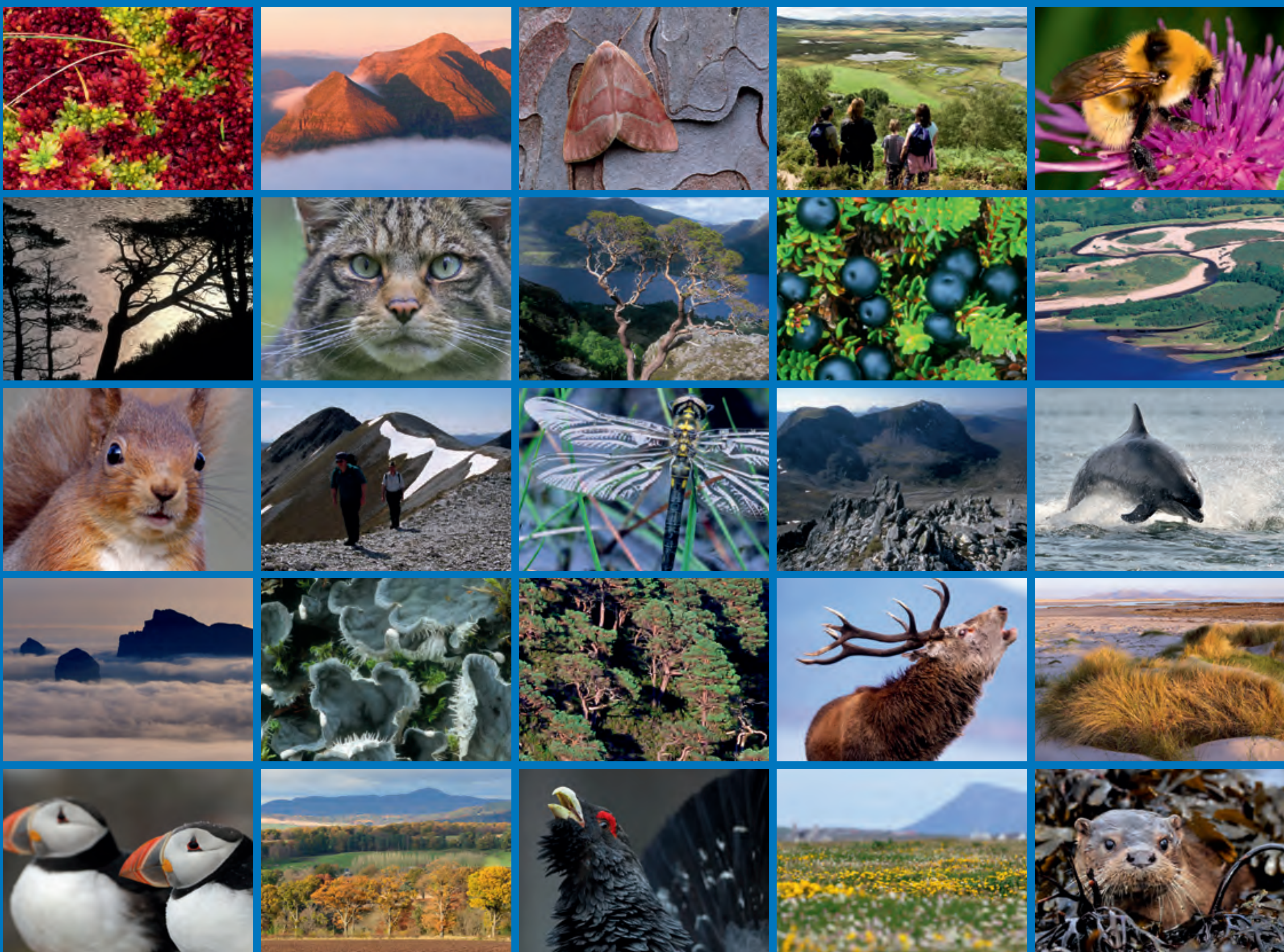
Scottish Natural Heritage
Commissioned Report No. 755

Data Supporting Site Condition Monitoring of Atlantic salmon SACs



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C O M M I S S I O N E D   R E P O R T

Commissioned Report No. 755

Data Supporting Site Condition Monitoring of Atlantic salmon SACs

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Summary

Data Supporting Site Condition Monitoring of Atlantic salmon SACs

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Background

In 2011, Rivers and Fisheries Trusts of Scotland (RAFTS) was commissioned by Scottish Natural Heritage (SNH) to coordinate the collection of juvenile and adult Atlantic salmon data and environmental information. This information will be used to allow SNH staff to carry out a process of site condition monitoring and condition assessments for the 17 Scottish Special Areas of Conservation (SACs) with Atlantic salmon (*Salmo salar* L.) as a primary or secondary qualifying feature.

The data collected during this contract included:

1. Juvenile salmon populations as determined by SFCC standard electro fishing surveys undertaken at representative sites;
2. Collation and analyses of adult rod catch abundance for the spring, summer and autumn run time components following application of the NASCO rod catch assessment tool to catches of the 20 year period 1991-2010; and
3. Environmental and fishery management information obtained by questionnaire from fishery managers. This provided information on the extent of additional surveys undertaken on juvenile and adult stocks, on the extent and impact of invasive non-native species and on hatchery and stocking information. Information on the condition of supporting habitats for Atlantic salmon was also obtained from a separate assessment of Water Framework Directive water body classifications.

Collation and reporting these data, and supporting information, was carried out by RAFTS and the River Forth Fisheries Trust (RFFT) with input from SNH, Marine Scotland Science, rivers and fisheries trusts and local District Salmon Fishery Board fishery interests in the SAC rivers. This report details the work completed, the data collected and collated and the process and suggested classifications for each of the site condition assessment components. The last site condition assessment for these 17 SAC sites took place in 2005. The results of these, and the current cycle, are compared.

Main findings

Individual status assessments are suggested for each river for juvenile populations from quantitative electro fishing surveys completed and for 0+ and 1++ age classes separately. From these a suggested 2011 assessment was generated which indicate that twelve sites (Berriedale and Langwell, Bladnoch, Borgie, Dee, Little Gruinard, Naver, North Harris, Oykel, Spey, South Esk, Tay and Tweed) should be assigned favourable and five (Endrick, Langavat, Moriston, Teith and Thurso) assigned unfavourable status.

Similarly, suggested status assessments were generated for each river based upon application of the NASCO rod catch assessment tool, and a simple trend analysis to the spring, summer and autumn run time components over the period 1991-2010. From these it is suggested that thirteen sites (Berriedale and Langwell, Borgie, Dee, Langavat, Little Gruinard, Moriston, Naver, North Harris, Oykel, Tay, Teith, Thurso and Tweed) should be assigned favourable status and four (Bladnoch, Endrick, South Esk and Spey) assigned unfavourable status.

These juvenile and adult assessments were then combined using a default system to generate a proposed overall assessment for each river where both juvenile and adult assessment elements must be at favourable status to generate an overall favourable status. This approach proposed that a total of nine SACs (Berriedale and Langwell, River Borgie, River Dee, Little Gruinard, River Naver, North Harris, River Oykel, River Tay, River Tweed) are achieving favourable status whilst the remaining eight (River Bladnoch, Endrick Water, Langavat, River Moriston, South Esk, River Spey, River Teith, River Thurso) retain "unfavourable - recovering" status.

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1. INTRODUCTION

Under the EC Habitats Directive (Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora), member states are required to protect and conserve species and habitats listed in Annex II. Atlantic salmon (*Salmo salar* L.) are included on this list. There are 17 Special Areas of Conservation (SACs) in Scotland that have Atlantic salmon as a primary or secondary qualifying interest feature (11 primary and six secondary). These are shown in Table 1.1 and in Map 1.1. SAC sites must be monitored with regard to key habitats and species so that the sites can be assigned to one of four condition categories: Favourable; Unfavourable (both with further subcategories of Declining, Maintained or Recovering); Partially Destroyed and Destroyed. This process is referred to as Site Condition Monitoring (SCM). SCM is carried out regularly, in a six-year cycle. The last cycle of SCM for salmon SACs was carried out in 2004/05 and reported by the Scottish Fisheries Coordination Centre (SFCC) with field work undertaken by the rivers and fisheries trusts and District Salmon FIshery Boards (DSFBs) across Scotland (Godfrey, 2005[1]).

In 2011, Rivers and Fisheries Trusts of Scotland (RAFTS) was commissioned by Scottish Natural Heritage (SNH) to carry out survey work and data analyses to inform site condition monitoring at each of the 17 Atlantic salmon SACs in Scotland. Field work was undertaken by RAFTS member fishery and river trusts and as appropriate to SAC locations and in areas where no such trust existed by arrangement with the local DSFB or other fishery interests.

The report was completed by RAFTS and the River Forth Fisheries Trust (RFFT) with input from SNH and with local consultation with the river and fisheries trusts, DSFBs and other fisheries interests associated with each designated site.

The data collection and analyses described in this report were undertaken in three component areas. These were:

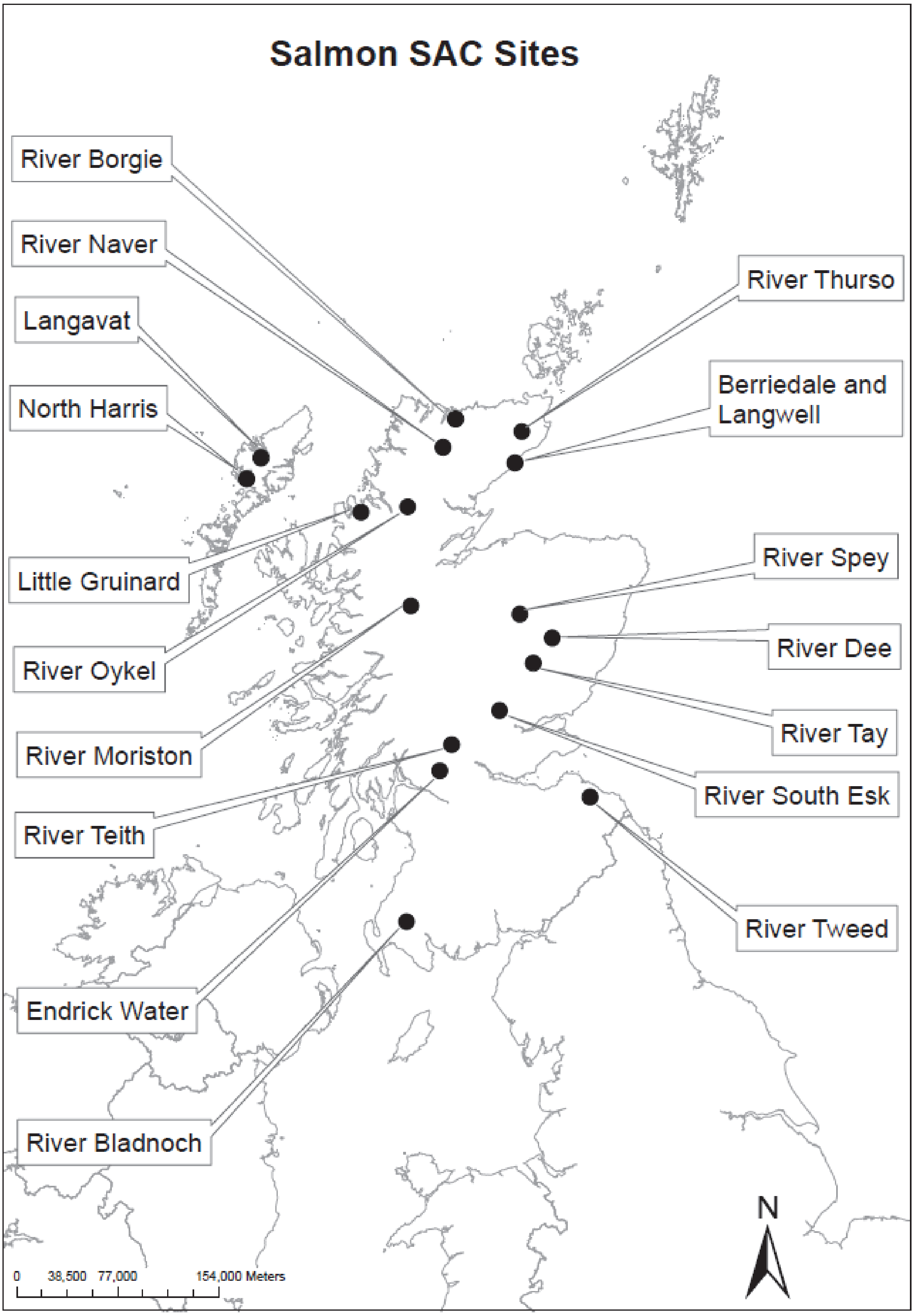
- Analysis of spawning success and juvenile production as determined by electro fishing survey;
- Adult catches as considered by application of the NASCO Rod Catch Assessment Tool and an overall assessment of catch records; and
- Environmental quality as described by WFD classifications of 2009 and questionnaire returns from each river to provide further local context of local issues, studies and data availability.

[1] http://www.scotland.gov.uk/Resource/Doc/295194/0096508.pdf

Table 1.1 – List of the 17 Scottish SAC sites with Atlantic salmon as a primary or secondary qualifying feature.

Special Area of Conservation	Atlantic salmon as primary or secondary qualifying feature?
Berriedale and Langwell Waters	Primary
River Bladnoch	Primary
River Borgie	Secondary
River Dee	Primary
Endrick Water	Secondary
Langavat	Primary
Little Gruinard River	Primary
River Moriston	Secondary
River Naver	Primary
North Harris	Secondary
River Oykel	Secondary
River South Esk	Primary
River Spey	Primary
River Tay	Primary
River Teith	Secondary
River Thurso	Primary
River Tweed	Primary

Map 1.1 - Locations of all 17 Atlantic salmon SAC sites.



a) Methods

1. Juvenile surveys

Spawning success and juvenile production was assessed at each site by the completion of a mixture of timed and depletion electrofishing surveys. As far as possible, the same sites were surveyed as in 2004/05, and as with the 2004/05 survey, SFCC electrofishing methods were employed (although a component of the 2004/05 survey that called for three flow types to be included at each timed site was dropped due to associated logistical difficulties).

Before sites were agreed participating trusts were able to propose revised site locations for consideration by SNH to better represent the catchment as a whole. This resulted in a slightly revised sample network being agreed in some instances but with the overall coverage and general distribution proposed retained.

Originally, depletion sites were selected to provide an appropriate spread of sites across each SAC, while at the same time setting the current juvenile salmon population levels based on historical knowledge of the locations of suitable, accessible habitats and juvenile populations. Strict adherence to the SFCC quantitative electrofishing protocol was required at all times, and when possible, the population density described using the maximum likelihood estimator described by Zippin (1956).

The timed sites (based on 5-minute electrofishing events) were selected to give a larger number of samples to assess the spatial status of salmon populations within the SACs. It is recognised that rather than determining fish density per unit area, sites surveyed during the timed electrofishing approach provide information on the number of fish caught regarded as an index of abundance (catch per unit of effort (time)).

The sampling for the current round of SCM took place between July and October 2011. A particularly wet late summer in 2011 led to the delay and disruption of sampling for some SACs, and in some cases, depletion surveys were replaced with timed surveys due to consistently higher than desired flows. In other instances the intended level of survey effort could not be achieved due to unsuitable flow conditions in some catchments across the sampling season.

2. Adult catch assessment

Although other data sources and methods exist which can provide information on adult salmon numbers and abundance, e.g. fish counters, fish traps and redd counts, fishery catch statistics have been utilised in the assessments completed in this study. In Scotland a long standing and systematically collected set of catch statistics is available for use for fishery districts and is held by Marine Scotland Science (MSS)[2]. These data allow analysis of catches since 1952 and, although additional long standing records do exist for individual fisheries, rivers or have been compiled independently by fishery managers e.g. on the River Tweed, the 1952 sequence has been used in a general catch analysis for each SAC analysis. In the majority of SACs catch records held by MSS represent those of the SAC catchment itself. However, in a number of instances the catch statistics available are not for the catchment itself e.g. Oykel SAC is included in the catch statistics for the Kyle of

[2] http://www.scotland.gov.uk/Topics/marine/science/Publications/stats/SalmonSeaTroutCatches

Sutherland District, and this is acknowledged where this is the case in the individual river chapters.

There are limitations to the use of catch statistics as a measure of abundance and these are well known, understood and acknowledged. In particular:

- Catch varies with exploitation which is dependent on effort expended:
  There are no effort data consistently available for Scottish rod fisheries that can be used systematically. Effort can vary with climatic conditions, angling prospects and angling efficiency and all can contribute to changes in exploitation. However, it is not possible to include such variability in any standard analysis of catch.

- Catches may be misreported by those submitting catch records:
  There are many reasons why rod catch may be either under or over reported and, again, it is not possible to recognise this factor in any standard analysis of catch.

As part of reporting obligations to the North Atlantic Salmon Conservation Organisation (NASCO)[3] Scotland submitted a Focus Area Report on the Management of Salmon Fisheries in 2008[4]. Within this submission, a tool for the assessment of rod catch as a measure of adult abundance is set out (see Figure 1.1) the methodology of which has been applied to the seasonal catch components in each SAC as advised by SNH. The NASCO assessment tool identifies whether conservation measures or local investigations are required for any of the spring, summer or autumn seasonal catch components based on catch records for each seasonal component over the last 20 years. These assessments of seasonal run components have been included to help inform the condition assessment proposed for each SAC and which are set out individually in each river chapter.

The application of the NASCO rod catch assessment tool provides a more robust and statistically safe tool for the assessment of rod catch as an index of stock abundance than compared to the adult catch analysis used in the 2005 assessments where categorisation as favourable or unfavourable condition was based on the following criteria:

Favourable
The average rod catch in the years since the site was designated as an SAC is greater than the catch in the year of designation.

Unfavourable
The average rod catch in the years since the site was designated as an SAC is less than the catch in the year of designation.

[3] http://www.nasco.int/

[4] http://www.nasco.int/pdf/far_fisheries/FisheriesFAR_Scotland.pdf

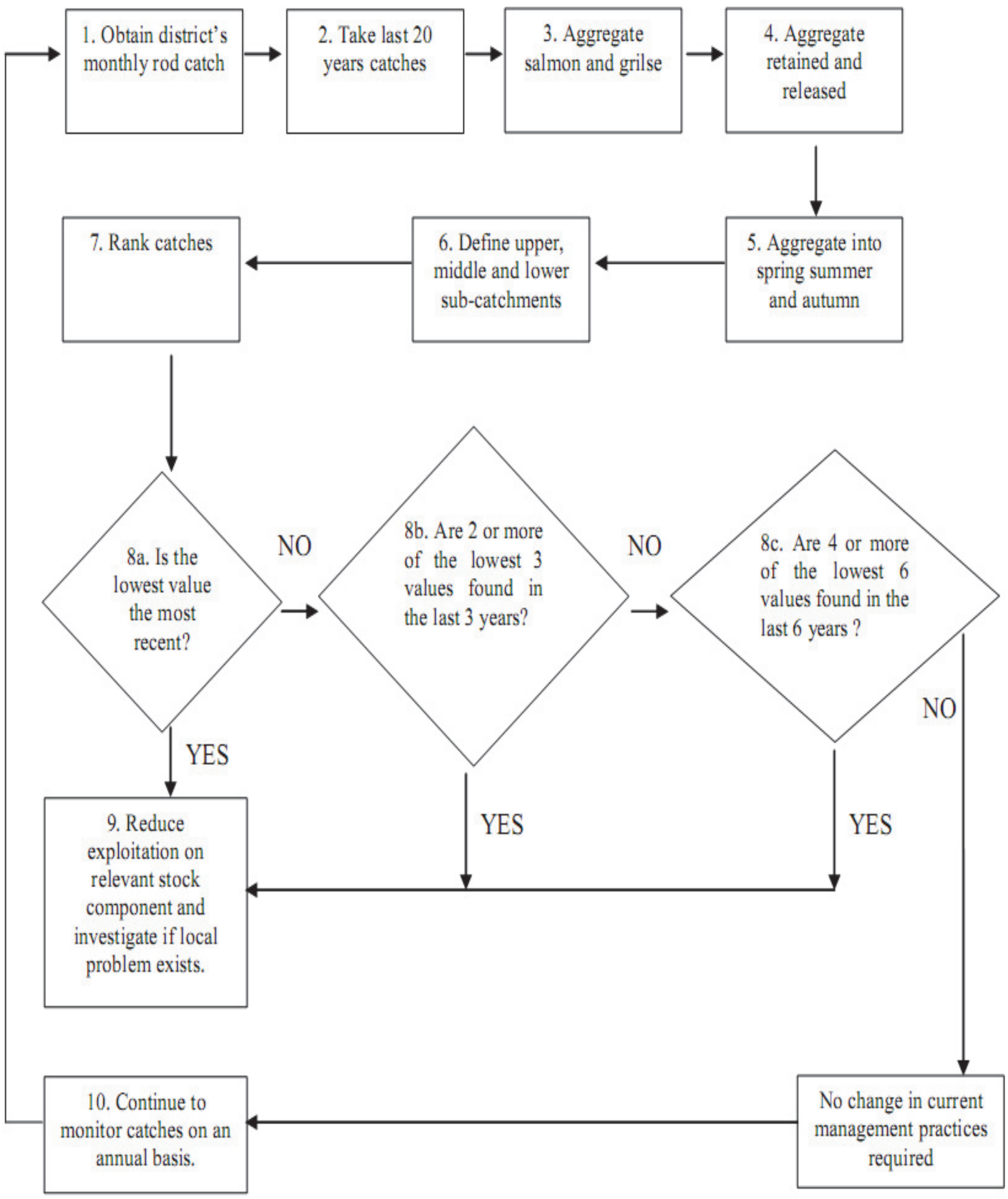


Figure 1.1 - Summary flow chart of the NASCO rod catch assessment tool process.

3. Environmental quality

Since the previous site condition assessments were carried out in 2005 the Water Framework Directive (WFD) has become fully operational in Scotland. The WFD now forms the basis of a national classification of the water environment based upon units of management (water bodies) in each freshwater catchment, standing water, transitional water, coastal water and body of groundwater. These classifications are reported by SEPA within the river basing management planning process and in the River Basin Management Plans for the Scotland River Basin District and Solway Tweed River Basin District respectively. Classifications are used to prioritise restoration activities for water bodies where target objectives are currently not being achieved and protect water bodies where target objectives are in place.

This study considered the freshwater catchment classifications for each SAC as a summary of the general condition of the environment by WFD standards. As such classifications were not available in the 2005 assessments a direct comparison of the environmental condition of catchments then and now is not possible.

In addition to WFD classifications, questionnaire information was gathered and summarised for each SAC to provide a local context to other studies, data and information which is available for more refined assessments if required and to capture local knowledge as to the pressures and trends present in each catchment.

Five categories of environmental data were summarised for each SAC with information gathered from WFD classification information and questionnaire responses completed by trust staff and local river representatives. These are:

- Extent of juvenile, smolt and adult survey work since year of designation,
- Water quality and quantity,
- Biosecurity issues,
- Stocking and fish movements since year of designation,
- Catchment trends, changes and activities since year of designation.

Water quality and quantity data were obtained from the SEPA river basin planning website[5], for every waterbody within each SAC. Other local information was collected and collated by completion and analysis of an agreed questionnaire local information request.

Data gathered from these sources provides useful context information for the site condition assessment in each SAC but has not been used directly to generate the overall assessment. This is, in summary, because:

- WFD Classifications available to this study were not in place in 2005 and so a direct comparison of environmental quality then and now is not possible;
- The SAC site condition assessment process is intended to assess the current condition of each site when compared to that in the year of designation. Again, WFD information is not available for any site from that point in time and so direct comparison is not possible;
- Local information provide represents helpful context information for each site and summarises additional relevant studies e.g. radio tracking of adult fish, stock assessment juvenile surveys or smolt mark-recapture studies which may be available

[5] http://www.sepa.org.uk/water/river_basin_planning.aspx

for further more detailed assessments. However, these data are inconsistently available across SAC sites and where present has often been collected for local management purposes or investigations;

- It was agreed that the collation of local knowledge of activities and perspectives on each site would be useful contextual information for SNH, who would then have better knowledge of this should it be required or be deemed to be beneficial or useful at a later stage in the provision of management advice for individual SACs.

b. Site condition assessment classifications

It should be remembered that the primary purpose of this report is to provide data and contextual information to allow SNH to determine condition status. The analysis of each attribute (juvenile, adult and environment) is considered and summarised individually in the following sections before a suggested overall assessment for each sites is discussed and proposed. The suggested overall assessment is generated by combining the juvenile and adult assessments whilst retaining the environmental information as context for the site. A "default" system is used in the overall assessment in that both the juvenile and adult assessments must achieve favourable status to allow an overall favourable status for the site to be proposed. If either of these elements does not achieve favourable status then an unfavourable assessment is proposed.

1. Juvenile populations

An absolute regional classification of juvenile Atlantic salmon population quality based on the density (Zippin) method developed in Godfrey (2005) was used to suggest whether juvenile populations should be in Favourable or Unfavourable condition status. Table 1.2 below shows the results for each SAC, separated into 0+ and 1++ age classes. In order for an SAC to achieve favourable status, a median grade of C or higher is required for 0+ **and** 1++ densities across the sites within that SAC.

Sites where there were no juvenile Atlantic salmon present, or there were insufficient numbers to calculate Zippin densities, were assigned to the lowest quintile band. Green fill denotes favourable status while red fill denotes unfavourable status.

Table 1.2 - Number of sites within each SAC falling within each quintile (according to absolute regional classification for 0+ and 1++ age classes) – and the resulting condition status.

SAC	Region	Age class	Number of sites within each quintile					Median grade	Favourable condition?
			0-20	21-40	41-60	61-80	81-100		
			E	D	C	B	A		
Berriedale	North	0+	1			2	3	B	Y

and Langwell		1++	2				4	A	Y
Bladnoch	Solway	0+	1	1		2	2	B	Y
		1++	1		1	3	1	B	Y
Borgie	North	0+				1	2	A	Y
		1++				2	1	B	Y
Dee	East	0+		1	2	4	1	B	Y
		1++	1				7	A	Y
Endrick	Clyde coast	0+	1		1	4		B	Y
		1++	3	1		1	1	D	N
Langavat	Outer Hebrides	0+	1			1	3	A	Y
		1++	3			1	1	E	N
Little Gruinard	North West	0+					7	A	Y
		1++	1	1			5	A	Y
Moriston	Moray Firth	0+	4	1			1	E	N
		1++	1	1	1		3	B	Y
Naver	North	0+				2	6	A	Y
		1++				1	7	A	Y
North Harris	Outer Hebrides	0+	2			1	5	A	Y
		1++	3			2	3	B	Y
Oykel	North west	0+	1	1	1		4	A	Y
		1++				1	6	A	Y
South Esk	East	0+	1	1	1	2	2	B	Y
		1++	1				6	A	Y
Spey	Moray Firth	0+	2	1	3	2	2	C	Y
		1++	1	2	4	1	2	C	Y
Tay	East	0+			1	6	3	B	Y

		1++	1			2	7	A	Y
Teith	East	0+	1			1		D	N
		1++				1	1	B	Y
Thurso	North	0+		1	1		3	A	Y
		1++	2	1	1		1	D	N
Tweed	East	0+				3	6	A	Y
		1++			1	2	6	A	Y

Table 1.3 compares data from the 2011 juvenile surveys with the assessment from 2004/05. Where juvenile Atlantic salmon density has deteriorated from favourable to unfavourable starus, or where it has remained unfavourable, red fill has been used to highlight this. Where sites have improved to favourable or remained in favourable condition, they have been highlighted in green.

Table 1.3 - Comparison of site condition status in 2004 and in 2011 for 0+ and 1++ age classes.

SAC	Age Class	2004	2011	Change
Berriedale and Langwell	0+	N	Y	+
	1++	Y	Y	=
Bladnoch	0+	Y	Y	=
	1++	Y	Y	=
Borgie	0+	n/a	Y	n/a
	1++	n/a	Y	n/a
Dee	0+	Y	Y	=
	1++	Y	Y	=
Endrick	0+	N	Y	+
	1++	N	N	=
Langavat	0+	N	Y	+
	1++	Y	N	-
Little Gruinard	0+	Y	Y	=

	1++	Y	Y	=
Moriston	0+	N	N	=
	1++	Y	Y	=
Naver	0+	N	Y	+
	1++	Y	Y	=
North Harris	0+	N	Y	+
	1++	Y	Y	=
Oykel	0+	N	Y	+
	1++	Y	Y	=
Spey	0+	N	Y	+
	1++	Y	Y	=
South Esk	0+	Y	Y	=
	1++	Y	Y	=
Tay	0+	Y	Y	=
	1++	Y	Y	=
Teith	0+	N	N	=
	1++	N	Y	+
Thurso	0+	Y	Y	=
	1++	Y	N	-
Tweed	0+	Y	Y	=
	1++	Y	Y	=

Based upon the juvenile populations summarised in Tables 1.2 and 1.3 the following site condition assessments are suggested:

- **Favourable**:
  Berriedale and Langwell, Bladnoch, Borgie, Dee, Little Gruinard, Naver, North Harris, Oykel, Spey, South Esk, Tay and Tweed.

- **Unfavourable**:
  Endrick, Langavat, Moriston, Teith and Thurso.

2. Adult assessments

The annual provision of rod catch data to Marine Scotland Science is now mandatory within Scotland. These data contribute to a dataset which extends from 1952-2010 and no measure of fishing effort is provided with catch returns. Significantly, these data are only available for analysis at the Fishery District, rather than individual river, level. Within each of the chapters provided for each SAC, the analyses utilised the monthly data for rod catch from each Fishery District and these were aggregated into spring, summer and autumn catches. Local changes in effort, accessibility and of the application of conservation measures such as catch and release are described as they apply to each river and recognition is made that, particularly in the larger catchments such as the Tweed, Tay and Spey individual seasonal fisheries may be masked in the whole river assessments made for the SAC.

Comparisons of average catch since designation are made in the two SAC assessment cycles i.e. from designation to 2005 and from designation to 2010. In the longer time series (to 2010) the majority of average catches are greater than that in the various years of designation and these are discussed.

However, as agreed with SNH it is the application of the NASCO rod catch assessment tool to the spring, summer and autumn catches over the 20 year period 1991-2010, and the assessment of catch trends which are most significant in supporting the suggested site condition assessment for this attribute. The data used in these analyses are presented in Appendix 1, and the results for each of the seasonal run-time components from application of the NASCO rod catch assessment tool tests are set out in Table 1.4 for each SAC.

A default system is used to determine the overall assessment for the site i.e. if any of the tests have been failed for any of the season run time components the site is considered to be at unfavourable status. This is supported by a simple analysis of rod catch trends.

Using this approach four SACs are proposed as being at unfavourable status (River Bladnoch, Endrick Water, South Esk and River Spey) due to a failure of the spring component of the catch.

Table 1.4 – Summary of current adult rod catch assessment of seasonal catch components.

Special Area of Conservation	Adult rod catch assessment [favourable (+) unfavourable (-)]			
	Spring	Summer	Autumn	Overall
Berriedale and Langwell Waters	+	+	+	+
River Bladnoch	-	+	+	-
River Borgie	+	+	+	+
River Dee	+	+	+	+
Endrick Water	-	+	+	-
Langavat	+	+	+	+

Little Gruinard River	+	+	+	+
River Moriston	+	+	+	+
River Naver	+	+	+	+
North Harris	+	+	+	+
River Oykel	+	+	+	+
River South Esk	-	+	+	-
River Spey	-	+	+	-
River Tay	+	+	+	+
River Teith	+	+	+	+
River Thurso	+	+	+	+
River Tweed	+	+	+	+

A different method of assessing adult catch was applied in the 2005 assessments to generate a site status for each SAC in that site condition monitoring period. However, the current NASCO rod catch assessment tool was also applied to the catch records available to the previous site condition monitoring assessment period (1985-2004). For context, these analyses of rod catch between SCM cycles, is provided in Appendix 2.

Based upon the adult rod catch assessments summarised in Table 1.4 and trend analyses the following site condition assessments are suggested:

- **Favourable**:
  Berriedale and Langwell, Borgie, Dee, Langavat, Little Gruinard, Moriston, Naver, North Harris, Oykel, Tay, Teith, Thurso and Tweed

- **Unfavourable**:
  Bladnoch, Endrick, South Esk and Spey

3. Environmental assessment results

A range of local information has been collated for each SAC in respect of additional survey and investigative data that is available having been gathered to support local management activities and monitoring. Local perspectives on new or current pressures and biosecurity, invasive non-native species and hatchery and stocking activities are also available and are presented in Appendix 3.

Notable is the significant concern in respect of the spread and impact of invasive non-native species in many sites and that increasingly, there are active programmes which seek to manage, control or remove these species from affected catchments. There are a number of the more northerly sites where invasive non-native species are not reported to be present and so the priority in these areas should be to prevent introductions.

There are also many catchments where significant local effort is made to better survey and understand particularly juvenile populations. Many sites have significant annual electro-fishing programmes to monitor stocks or to seek to quantify or assess restoration or hatchery activities for example. Fewer surveys and studies take place on smolts or adult fish.

A comprehensive classification of water bodies now in place through WFD that was not in place at the point of SAC designation, or during the last site condition assessment exercise in 2005. This makes comparison with the 2009 WFD classification information for each SAC with a historic position impossible. Prior to WFD implementation SEPA and River Purification Boards classified the water environment almost exclusively on water chemistry analysis informed by limited ecological information, often associated with invertebrate surveys. Current assessments of waterbody status are based on a more complex suite of chemical, biological and physical attributes.

Further, the site condition assessment data gathering exercise reported here is designed to allow SNH to determine the condition of the site when compared to the year of designation. This makes the use of the WFD classification information in the overall assessment difficult to justify as the condition determined now by WFD activities should not be worse than that at designation due to the additional protection afforded to SAC sites after designation, and also due to the range of activities now regulated by The Water Environment Controlled Activity Regulations (Scotland) 2011 (commonly known as CAR). Controlled and regulated activities now include water abstractions, impoundments and river engineering works which, largely, operated outside regulatory control before CAR.

However, WFD classification provides an opportunity to track environmental protection and improvement in SAC sites on an annual basis as SEPA issues a new classification on that frequency following consideration of new monitoring data and restorative actions in each water body. The classifications summarised for 2009 are shown in Table 1.6 which identify the number and river length of water bodies which are achieving high or good ecological status or potential objectives (and so are protected from deterioration) and the number and river length of water bodies which are classified as moderate, poor or bad ecological status or potential (and so are prioritised for improvement and restoration). From this assumed baseline annual environmental improvement or deterioration can be quantified and reported in future SAC site condition assessments.

Table 1.6 – Summary of 2009 WFD classification for Scottish Atlantic salmon SAC rivers.

Special Area of Conservation	Water Framework Directive Classification Summary				
	Number of High / Good Status (Potential) Waterbodies	Total River Length (km) of High /Good Status or Potential Waterbodies	Number of Moderate / Poor / Bad Status (Potential) Waterbodies	Total River Length (km) of Moderate / Poor / Bad Status or Potential Waterbodies	Total Number Waterbodies and HMWB and River Length (km)

Berriedale and Langwell Waters	2 (0)	21.3	1 (0)	40	3 (61.3)
River Bladnoch	14 (0)	119	1 (0)	18	15 (137)
River Borgie	3 (0)	26.2	0 (0)	0	3 (26.2)
River Dee	17 (0)	238	16 (0)	304	33 (546)
Endrick Water	0 (0)	0	2 (0)	50	2 (50)
Langavat	7 (0)	14	0 (0)	0	7 (14)
Little Gruinard	1 (0)	9	0 (0)	0	1 (9)
River Moriston	0 (3)	30	0 (0)	0	3 (30)
River Naver	9 (0)	81	1 (0)	28	10 (109)
North Harris	2 (0)	45	1 (1)	25	4 (69)
River Oykel	6 (0)	95	1 (0)	6	7 (101)
River South Esk	3 (1)	59	4 (1)	135	9 (194)
River Spey	25 (4)	369	20 (1)	357	50 (726)
River Tay	34 (9)	533	24 (8)	410	75 (943)
River Teith	9 (2)	113	7 (0)	57	18 (170)
River Thurso	9 (0)	143.8	2(1)	34.5	12 (178.3)
River Tweed	38 (4)	477	39 (6)	696	77 (1173)

Future SCM assessments will be able to make fuller use of WFD classifications reported for waterbodies in each SAC. At least two main options would seem to be available;

- Annual tracking of ecological classification

  Using the classifications reported by SEPA annual change in ecological quality within each SAC could be tracked and monitored. This would allow the extent of improvement, degradation or stability in each site to be identified annually to be reported and assessed.

- Relate ecological classification to specific site/species attributes of the SAC

WFD classifications could be considered in relation to required specific and relevant site attributes to the Atlantic salmon, as set out in the JNCC 2005[6]. When such attributes (such as dissolved oxygen concentration, pH, BOD, hydromorphology and hydrology) are identified and where they form part of WFD classification this would allow a more refined approach to restoration, regulatory or other protective activities within the site by regulators and others. Effectively, where WFD classification is less than good ecological status (as a minimum) or good ecological potential then targeted action could be identified and undertaken in SACs which is related to the species or habitat requirements of the designation. A summary of data available for site attributes within each SAC waterbody is provided in Appendix 4.

An agreed approach to the use of WFD classifications in future SCM assessment exercises would be desirable so that reporting requirements are clarified but, perhaps more importantly, to ensure that the SAC designation and the WFD classification and associated regulatory and restorative activities can be brought together to the benefit of the site.

[6] Common Standards Monitoring Guidance for Freshwater Fauna" JNCC 2005, JNCC, Peterborough

d) Determining overall site condition assessments

The status of each SAC assigned in cycle 1 (2005) is summarised in Table 1.7. At that time only two SACs (River Dee and River Spey) were assessed as being in ‘favourable’ status. All others were allocated a status of ‘unfavourable – recovering’, based upon the information available and analyses completed at that time. Since the 2005 assessment there has been a change in the method applied to assess adult catches although the juvenile assessment protocol remains largely unchanged save for some site revisions to refine the sampling network whilst retaining overall effort and representativeness of survey locations.

Table 1.7 – Scottish Atlantic salmon SAC sites condition assessments 2005.

Special Area of Conservation	Assessment in 2005
Berriedale and Langwell Waters	Unfavourable - recovering
River Bladnoch	Unfavourable - recovering
River Borgie	Unfavourable - recovering
River Dee	Favourable - maintained
Endrick Water	Unfavourable - recovering
Langavat	Unfavourable - recovering
Little Gruinard River	Unfavourable - recovering
River Moriston	Unfavourable - recovering
River Naver	Unfavourable - recovering
North Harris	Unfavourable - recovering
River Oykel	Unfavourable - recovering
River South Esk	Unfavourable - recovering
River Spey	Unfavourable - recovering
River Tay	Favourable - maintained
River Teith	Unfavourable - recovering
River Thurso	Unfavourable - recovering
River Tweed	Unfavourable - recovering

The suggested site assessments for 2011 are summarised in Table 1.8.

Table 1.8 – Proposed overall Scottish Atlantic salmon SAC sites condition assessment 2011

Special Area of Conservation	Juvenile	Adult	Proposed Overall
Berriedale and Langwell Waters	Favourable	Favourable	Favourable
River Bladnoch	Favourable	Unfavourable	Unfavourable - recovering
River Borgie	Favourable	Favourable	Favourable
River Dee	Favourable	Favourable	Favourable
Endrick Water	Unfavourable	Unfavourable	Unfavourable - recovering
Langavat	Unfavourable	Favourable	Unfavourable - recovering
Little Gruinard River	Favourable	Favourable	Favourable
River Moriston	Unfavourable	Favourable	Unfavourable - recovering
River Naver	Favourable	Favourable	Favourable
North Harris	Favourable	Favourable	Favourable
River Oykel	Favourable	Favourable	Favourable
River South Esk	Favourable	Unfavourable	Unfavourable - recovering
River Spey	Favourable	Unfavourable	Unfavourable - recovering
River Tay	Favourable	Favourable	Favourable
River Teith	Unfavourable	Favourable	Unfavourable - recovering
River Thurso	Unfavourable	Favourable	Unfavourable - recovering
River Tweed	Favourable	Favourable	Favourable

Based upon a status assignment using a default system considering juvenile densities and adult catch for each of the spring, summer and autumn run time components there is a marked change in the status of SACs across Scotland in 2011 from the 2005 assessment. This may be in significant part due to the change in the method applied to the adult rod catch assessment tool, as when the current method is applied to the catches used in the 2005 assessment (see Table 1.6 for summary) many of the unfavourable sites of 2005 generate a favourable condition assessment (see Appendix 2).

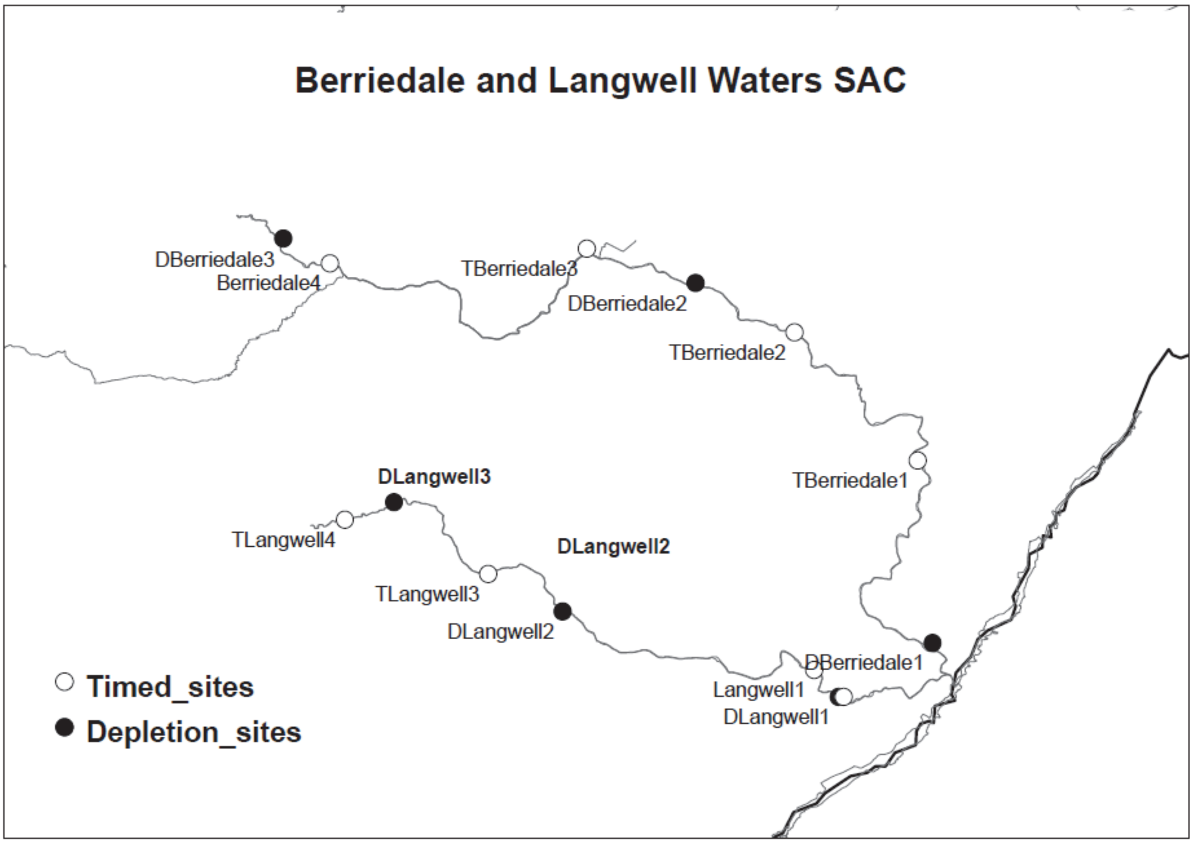
Overall, the data suggest that a total of nine SACs (Berriedale and Langwell, River Borgie, River Dee, Little Gruinard, River Naver, North Harris, River Oykel, River Tay, River Tweed) are could be considered to be in favourable condition whilst the remaining eight (River Bladnoch, Endrick Water, Langavat, River Moriston, South Esk, River Spey, River Teith, River Thurso) retain unfavourable - recovering status.

2. BERRIEDALE AND LANGWELL

a) Juvenile Assessment

Six sites were surveyed using the standard SFCC catch depletion electrofishing method. A further nine sites were sampled using a five-minute timed electrofishing approach. All sites were situated within the Berriedale and Langwell SAC (Map 2.1). The sites were surveyed by staff of the Cromarty Firth Fisheries Trust.

Map 2.1 - Distribution of depletion and timed electrofishing sites on the Berriedale and Langwell SAC.



Depletion sites

Site details and a summary of electrofishing results are shown in Tables 2.1 – 2.3. Zippin and Carl and Strube estimates for fry were calculable for all sites, confidence limits were generally wide. All sites were calculable for 1+ fish and three sites for 2+. For fry, Zippin densities ranged from 20-27 per 100 m^2 (mean 22.8) and Carl and Strube densities ranged from 20 - 27 per 100m^2 (mean 22.2). 0+ and 1+ fish were caught at all six sites and 2+ fish at four sites. 2+ fish were absent from the Berriedale 1 and 3. The largest 0+ fish was found at Langwell 3 (54 mm), largest 1+ at Berriedale 3 (Feith Gaineimh Mhor) (100 mm) and largest 2+ fish were found at Langwell 1. Trout were present at three sites.(Langwell 1 ,2 & 3). The highest densities of 0+ and 1+ was at Langwell 2 (17 and 24 per 100 m^2 respectively

– Zippin estimates) (Figure 2.1). The lowest densities of 0+ and 1+ fish were found at Berriedale 2 (20 and 20 per 100 m^2 respectively).

Table 2.1 - Details of depletion electrofishing sites, Berriedale and Langwell SAC.

Site code	Date	Easting	Northing	Altitude (m)	Channel name
SACQBerriedale1	05/10/2011	311600	923300	25	Berridale
SACQLangwell1	01/10/2011	309700	922200	50	Langwell
SACQLangwell2	01/10/2011	304100	924800	140	Langwell
SACQLangwell3	05/10/2011	300700	926150	210	Langwell
SACQBerriedale3	08/10/2011	298450	931500	255	Feith Gaineimh Mhor
SACQBerriedale2	03/10/2011	306800	930600	160	Berridale Water

Table 2.2 - Details of depletion electrofishing for 0+ and 1++ salmon, Berriedale and Langwell SAC.

Site code	Wetted area (m^2)	Zippin 0+	Carl & Strube 0+	Zippin 1+	Carl & Strube 1+	Zippin 2+	Carl & Strube 2+
SACQBerriedale1	176.8	n/a	n/a	n/a	n/a	0.0	0.0
SACQLangwell1	112.5	36.7	35.6	17.5	16.9	3.4	2.7
SACQLangwell2	169.2	48.2	47.3	43.9	43.1	8.9	8.9
SACQLangwell3	127.3	25.8	25.2	26.6	25.9	n/a	n/a
SACQBerriedale3	115.2	27.2	26.0	8.0	7.8	0.0	0.0
SACQBerriedale2	174.0	36.4	35.1	37.6	36.8	8.3	7.5

n/a denotes salmon present, but not in high enough densities to allow calculation of Zippin or Carl & Strube statistics. 0.0 denotes no salmon found at site.

Table 2.3 - Presence/absence of salmon year classes and of trout 0+ and 1++ at depletion sites, Berriedale and Langwell SAC.

Site code	Salmon age class present?				Trout present?	
	0+	1+	2+	3++	0+	1++
SACQBerriedale1	Y	Y	N	Y	N	Y
SACQLangwell1	Y	Y	Y	N	N	Y
SACQLangwell2	Y	Y	Y	N	Y	Y
SACQLangwell3	Y	Y	Y	N	Y	Y
SACQBerriedale3	Y	Y	N	N	Y	Y
SACQBerriedale2	Y	Y	Y	N	N	Y

Table 2.4 - Fork length of salmon of different age classes, Berriedale and Langwell SAC.

Site code	0+ mean fork length	No. 0+	1+ mean fork length	No. 1+	2+ mean fork length	No. 2+	3+ mean fork length	No. 3+
SACQBerriedale1	55	10	99	17	n/a	0	127	3
SACQLangwell1	46	39	91	19	128	3	n/a	0
SACQLangwell2	46	77	89	70	115	15	n/a	0
SACQLangwell3	54	32	86	33	113	4	n/a	0
SACQBerriedale3	50	30	100	9	n/a	0	n/a	0
SACQBerriedale2	49	55	88	60	113	13	n/a	0

n/a denotes means could not be calculated as no salmon of that age class were found at the site

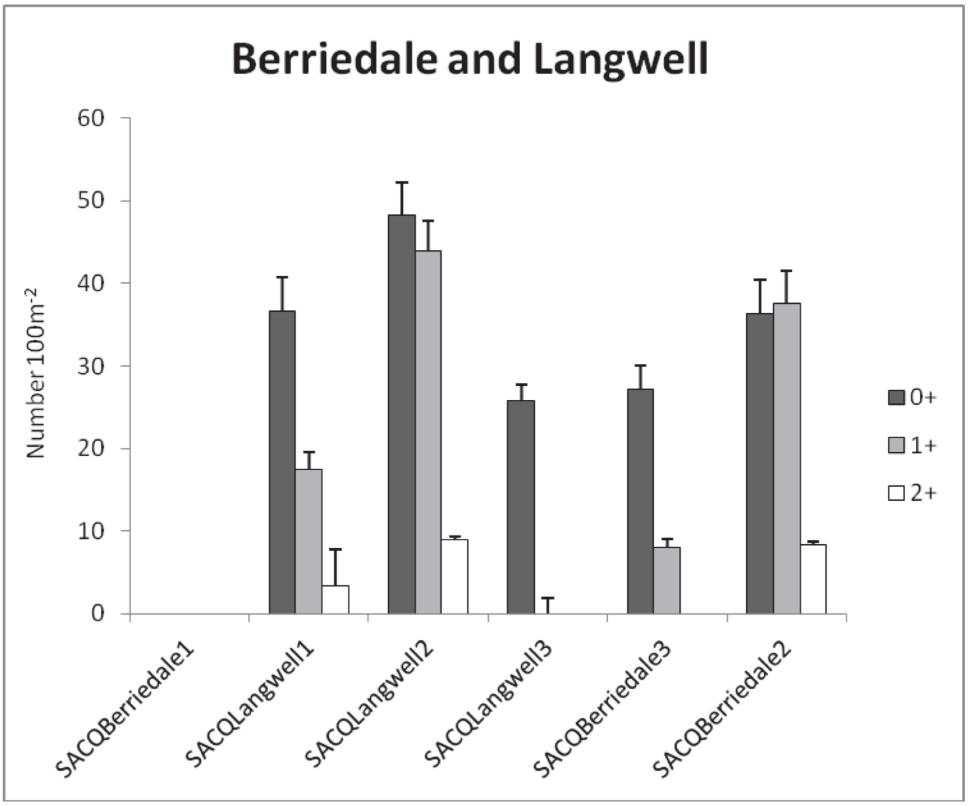


Figure 2.1 - Juvenile salmon population density estimated by the Zippin method for the SAC monitoring sites on the Berriedale and Langwell SAC.

Timed sites

Details of the nine timed sites are given in Table 2.5. CPUE for fry ranged from 0/ min to 3.2/min and for 1++ fish ranged from 0 per min to 2.6/min. 0+ salmon were caught at all of the timed sites, and 1+ fish at all but one on the main Berriedale channel. 2+ salmon were caught at six sites and trout were found at six sites.

Table 2.5 - Details of timed electrofishing sites, Berriedale and Langwell SAC.

Site code	Easting	Northing	River	Altitude (m)
SACTBerriedale/Langwell1	309800	922200	Berriedale B/L confluence	1
SACTBerriedale1	311300	927000	Berriedale	80
SACTBerriedale2	308800	929600	Berriedale	145
SACTBerriedale3	304600	931300	Berriedale	190
SACTLangwell2	306100	923000	Langwell	120
SACTLangwell3	302600	924700	Langwell	200
SACTLangwell4	299700	925800	Langwell	225
SACTBerriedale4	299400	931000	Berriedale	245
SACTLangwell1	309200	922750	Langwell	165

Table 2.6 - Salmon catch per unit effort (CPUE), Berriedale and Langwell SAC.

Site code	Survey date	Salmon 0+/min	Salmon 1++/min
SACTBerriedale/Langwell1	03/10/2011	3.0	0.6
SACTBerriedale1	03/10/2011	1.6	2.6
SACTBerriedale2	03/10/2011	0.8	2.0
SACTBerriedale3	08/10/2011	0.4	1.4
SACTLangwell2	01/10/2011	1.4	2.0
SACTLangwell3	05/10/2011	3.2	2.4
SACTLangwell4	05/10/2011	2.4	2.2
SACTBerriedale4	08/10/2011	1.6	0.8
SACTLangwell1	03/10/2011	1.8	2.2

Table 2.7 - Presence/absence of salmon year classes and of trout at timed sites, Berriedale and Langwell SAC.

Site code	Salmon age class present?				Trout present?
	0+	1+	2+	3+	
SACTBerriedale/Langwell1	Y	Y	N	Y	N
SACTBerriedale1	Y	Y	Y	N	N
SACTBerriedale2	Y	Y	Y	N	Y
SACTBerriedale3	Y	Y	Y	N	Y
SACTLangwell2	Y	Y	Y	N	N
SACTLangwell3	Y	Y	N	N	Y
SACTLangwell4	Y	Y	Y	N	Y
SACTBerriedale4	Y	N	Y	N	Y
SACTLangwell1	Y	Y	Y	N	Y

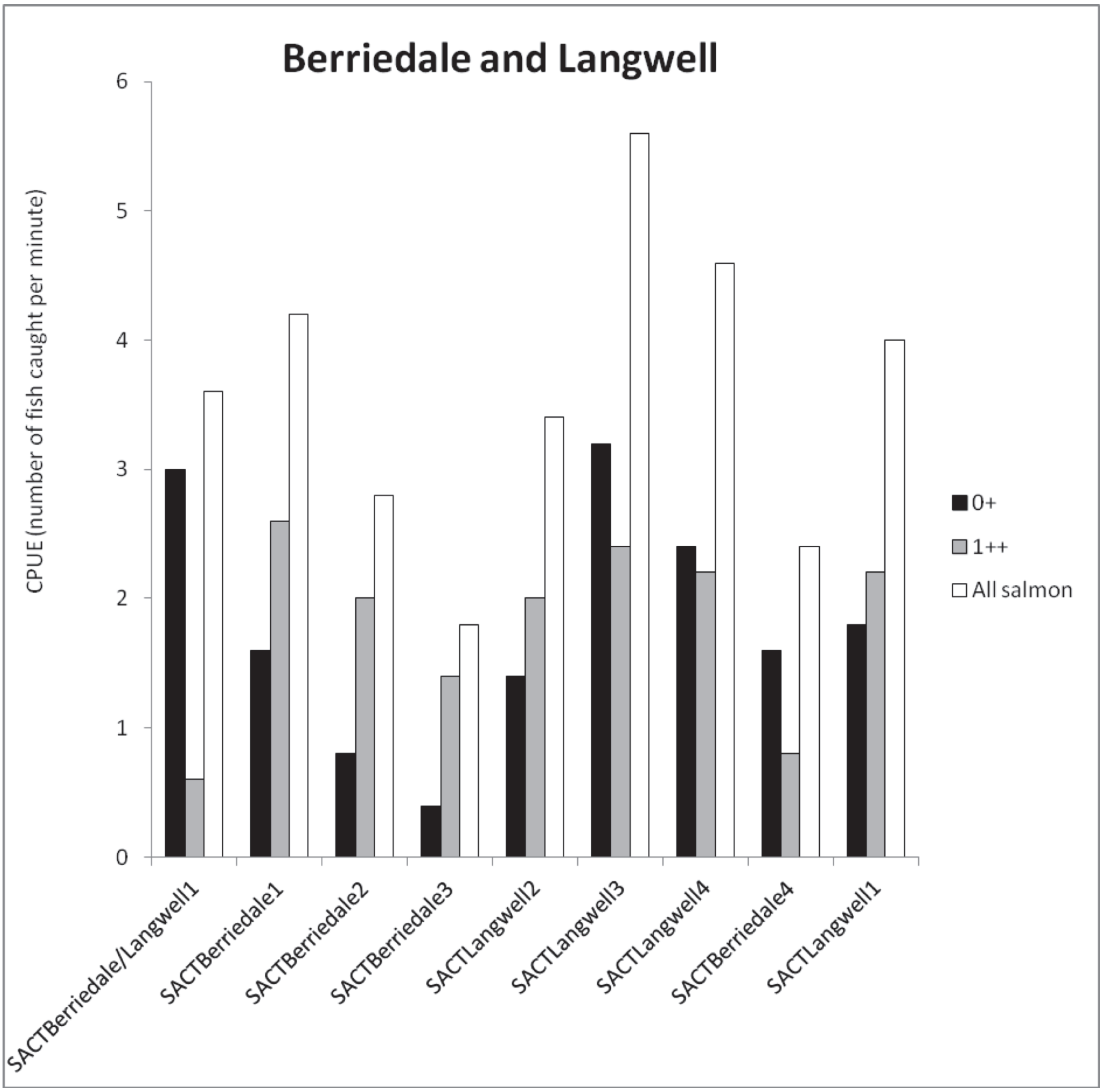


Figure 2.2 - Number of salmon (0+, 1++ and all salmon) caught per minute during 5 minutes of electrofishing at sites within the Berriedale and Langwell SAC.

Summary

When the densities of 0+ and 1++ juveniles are considered in quintile distributions of sites and in relation to regional juvenile densities developed by Godfrey (2005), the Berriedale and Langwell SAC sites lie mainly in the two highest quintile bands and a very small number in the lowest band (Table 2.8). This indicates that salmon densities are high across the catchment for both fry and parr reflecting good juvenile productivity. Both fry and parr are in favourable status and it is suggested that juvenile populations are in favourable status in the SAC (see Table 2.8).

Table 2.8 – Number of sites within the Berriedale and Langwell SAC falling within each quintile (according to absolute regional classification for 0+ and 1++ age classes) – and the resulting condition status.

SAC	Age class	Number of sites					Median grade	Favourable condition?
		0-20	21-40	41-60	61-80	81-100		
		E	D	C	B	A		
Berrie & Lang	0+	1			2	3	B	Y
	1++	2				4	A	Y

For the few sites where densities are low, they fall within the lowest band, indicating that there are areas of lower production where either natural production is low, or local management problems exist which may require active management to resolve.

A comparison of juvenile data from cycle 1 and cycle 2 indicate that the status of the Berriedale and Langwell SAC has improved for fry since the previous assessment (Table 2.9). The current analysis suggests that the status of fry should now be favourable, whereas in the previous assessment it was unfavourable. The data indicate that status of parr should remain unchanged.

Table 2.9 - Comparison of condition status in 2004[7] and in 2011 for 0+ and 1++ age classes.

SAC		2004	2011	Change
Berriedale & Langwell	0+	N	Y	+
	1++	Y	Y	=

[7] While the Godfrey report is dated 2005, the actual electrofishing survey took place in 2004, therefore when referring to the previous juvenile assessment, 2004 will be used throughout

b) Adult Assessment

Data for adult Atlantic salmon populations in the Berriedale and Langwell Waters were analysed using the NASCO Rod Catch Assessment Tool, introduced and described in Section 1. This analysis considers the rod catch in seasonal components (spring, summer and autumn) to provide an assessment of the adult population. In addition, a summary of Marine Scotland Science catch statistics (available from 1952) is provided for the overall catch, and the same run-time components.

Summary of 1952 Catch Statistics

The total published catch statistics for the Berriedale and Langwell Waters are shown in Figure 2.3 with this data presented also for the spring, summer and autumn run-time components in Figures 2.4, 2.5 and 2.6.

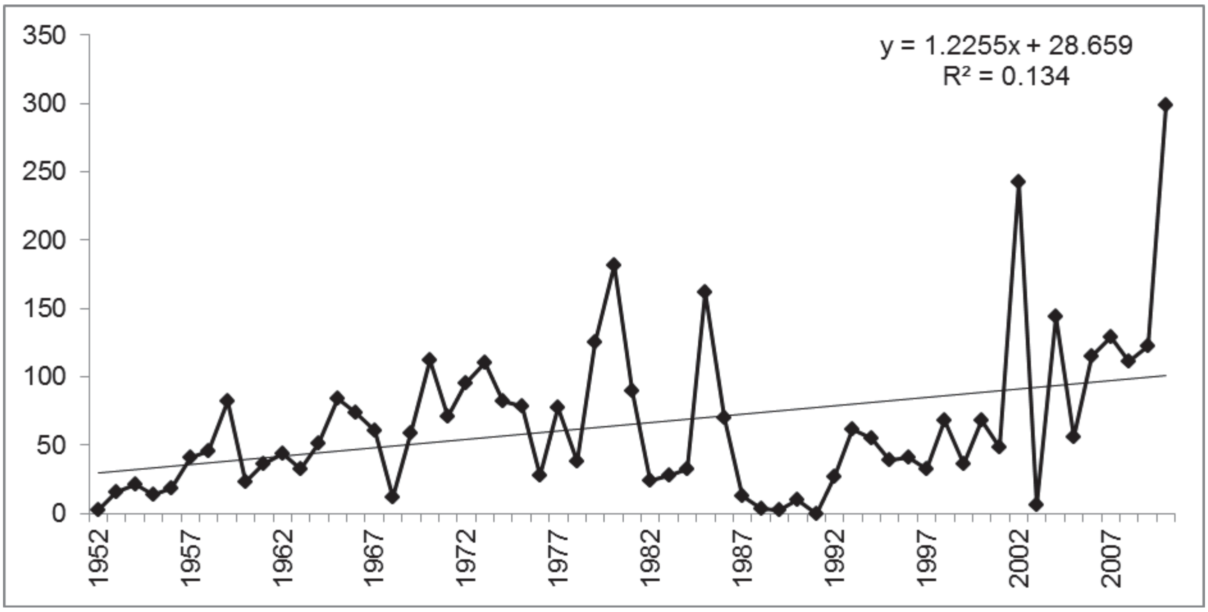


Figure 2.3 - Berriedale and Langwell Waters total rod catch 1952-2010 (salmon and grilse, retained and released)

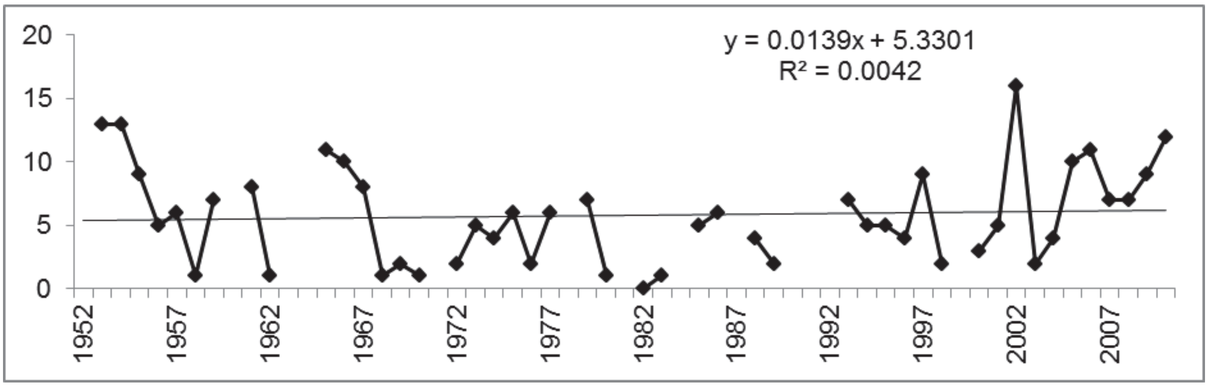


Figure 2.4 - Berriedale and Langwell Waters total spring rod catch 1952-2010 (salmon and grilse, retained and released)

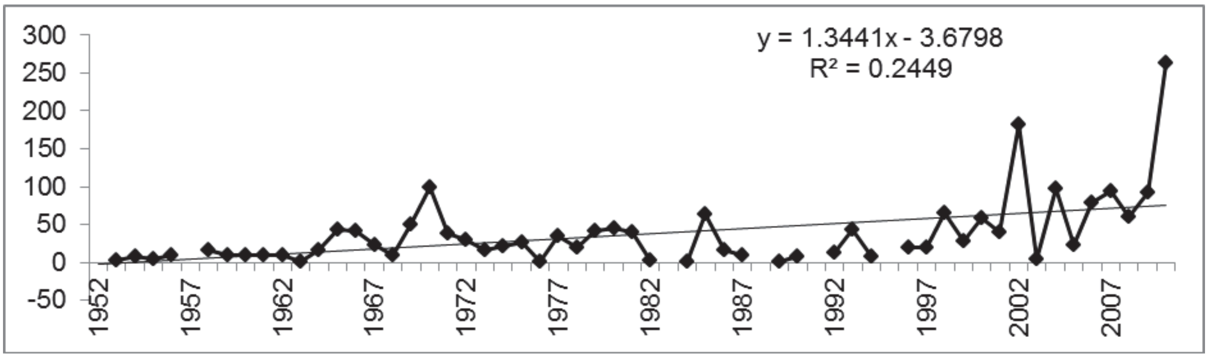


Figure 2.5 - Berriedale and Langwell Waters total summer rod catch 1952-2010 (salmon and grilse, retained and released)

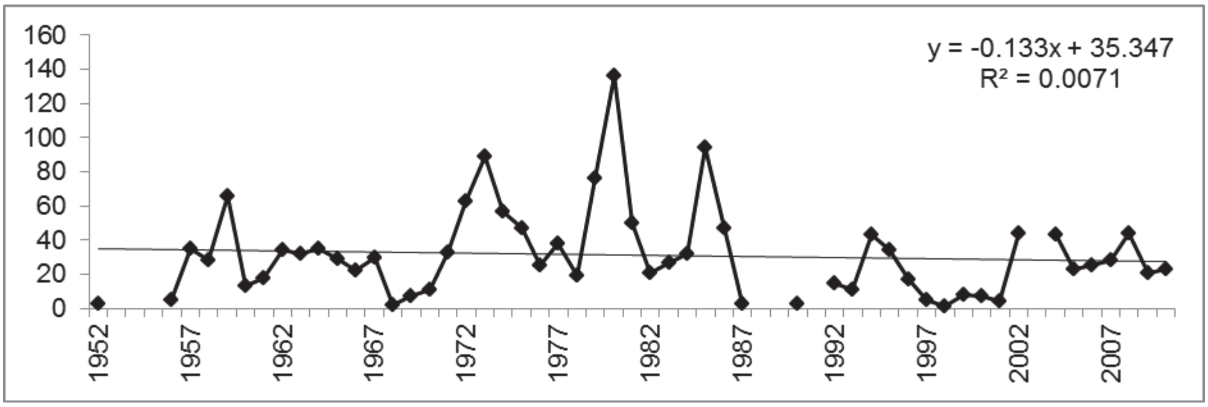


Figure 2.6 - Berriedale and Langwell Waters total Autumn rod catch 1952-2010 (salmon and grilse, retained and released)

Figure 2.3 shows an overall increasing trend of catch over the total period of records, but with fluctuating numbers throughout the period. There are particularly low catches recorded in the late1980s and early 1990s and again in 2003 when only six fish in total were recorded. Since 2003 total catches have been, generally, above the increasing trend line. Spring fish catches (Figure 2.4) have been low throughout the period but show a stable catch trend with slightly higher catches recorded since 2005. Summer catches (Figure 2.5) show a slight upward trend with a number of the higher catches over the period being recorded from 2003 to date. The autumn catch (Figure 2.6) shows a marginal decreasing trend over the total period with the largest catches recorded in the early 1970s and mid-1980s. Since then, catch has been variable with a number of years throughout the records showing very low, or zero, catches.

The reporting of rod catch over the period has been relatively consistent and there is no evidence that any trends summarised are attributable to a change in reporting accuracy or inconsistency in a quantifiable way. However, local information suggests that under reporting of rod catch was likely in the 1970s and 1980s, although accuracy has improved since that time.

Exploitation both in the river and in the net and coble and fixed engine salmon nets at the mouth have varied considerably over time. Netting with fixed engine bag nets (two double nets) took place until the late 1990's but has not taken place since. This netting may have intercepted fish destined for other rivers as well as the Berriedale. Sweep netting effort has been considerably reduced since 2006, both in terms of overall fish numbers, and length of operating season. In the period 2007 to 2011 salmon and grilse were only netted by sweep net at the river mouth in late July. A maximum catch estimated to be approximately 50 fish is understood to have been taken in any one year. Until the early 1980's fish were also netted in-river on the Berriedale water as far upstream as two miles from the river mouth. This netting took place as early as March and in these instances may have exploited perhaps a significant proportion of the very early running fish.

Angling effort has varied considerably over the period of records. In the 1970's and 1980's the river was let through one of the local hotels and the river was heavily fished. Catches are likely to have been under-reported or not reported at all and very few fish were ever returned. Much of the fishing at this time took place during the autumn period although many of the fish taken may have been coloured as there are no records of significant numbers of fresh fish entering the system in the Autumn period.

In more recent times (post-2006) fishing effort has probably been increased very slightly on the Berriedale Water due to the increased angling activities of Estate staff. Reporting accuracy has improved during that period and catch and release rates (especially in spring and autumn have increased dramatically). The Langwell Water now operates a 100% catch and release policy unless the fish is unable to be returned due to injury, or if the fish is the first taken by the angler. Angling effort on the Langwell has also been deliberately reduced considerably in recent years.

Application of Rod Catch Assessment Tool

The catches from the Berriedale and Langwell over the last 20 years (1991-2010) have been used and applied to the rod catch assessment tool to consider the current status of each run-time component.

Initially catch was considered in relation to three tests:

Test A: Is the 2010 catch the lowest in the sequence?

Test B: Do the 2 lowest catches occur within the last three years catches?

Test C: Do the 4 lowest catches occur within the last six years catches?

The results of these tests for the Berriedale and Langwell are shown in Table 2.10. The data used to complete these tests is available in Appendix 1. These tests confirm that no reduction in exploitation or investigation as to whether local problems exist is suggested as required for any of the stock components.

Table 2.10 - Summary of the Rod Catch Assessment Tool Tests for Berriedale and Langwell Waters.

Test	Spring	Summer	Autumn
A	No	No	No
B	No	No	No
C	No	No	No

The catches for the 20 year period considered (1991-2010) are presented for total catch in Figure 2.7 and for each seasonal component in Figures 2.8, 2.9 and 2.10. An F-Test could not be applied to each of the seasonal components to assess significance of changes in catches due to incomplete catch records for all run-time components (see Table 2.11).

A trend line is presented for the total, spring, summer and autumn catches which in each instance shows an increasing catch trend over the period 1991-2010. It should be noted that in the main the catches on the Berriedale appear to be driven by the summer catch as opposed to the spring or autumn components where numbers of fish caught are relatively small in comparison.

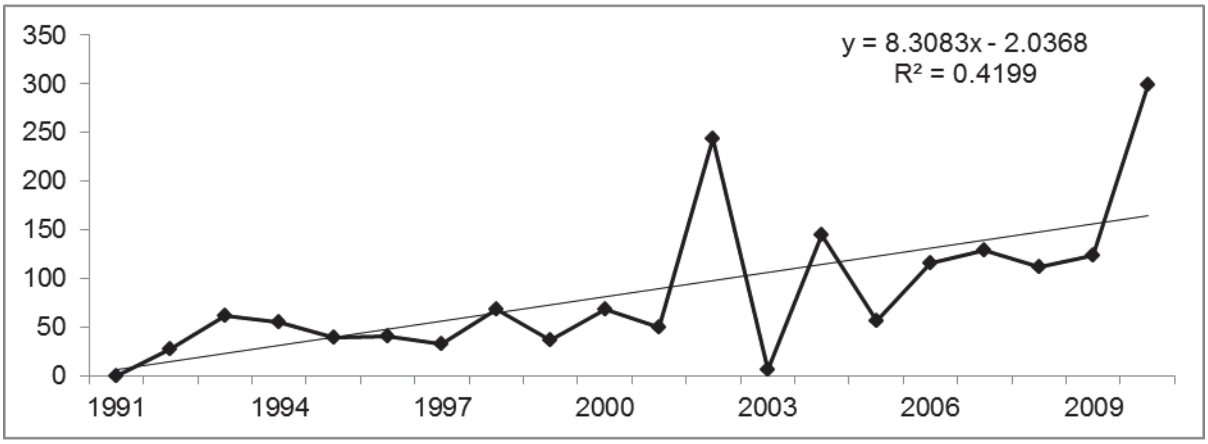


Figure 2.7 - Rivers Berriedale and Langwell total rod catch 1991-2010 (salmon and grilse, retained and released).

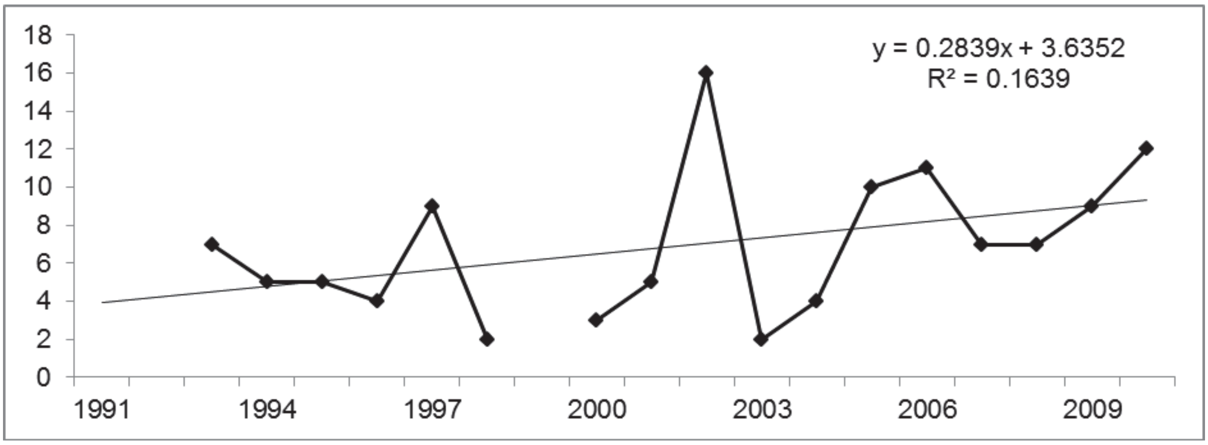


Figure 2.8 - Rivers Berriedale and Langwell Spring rod catch 1991-2010 (salmon and grilse, retained and released).

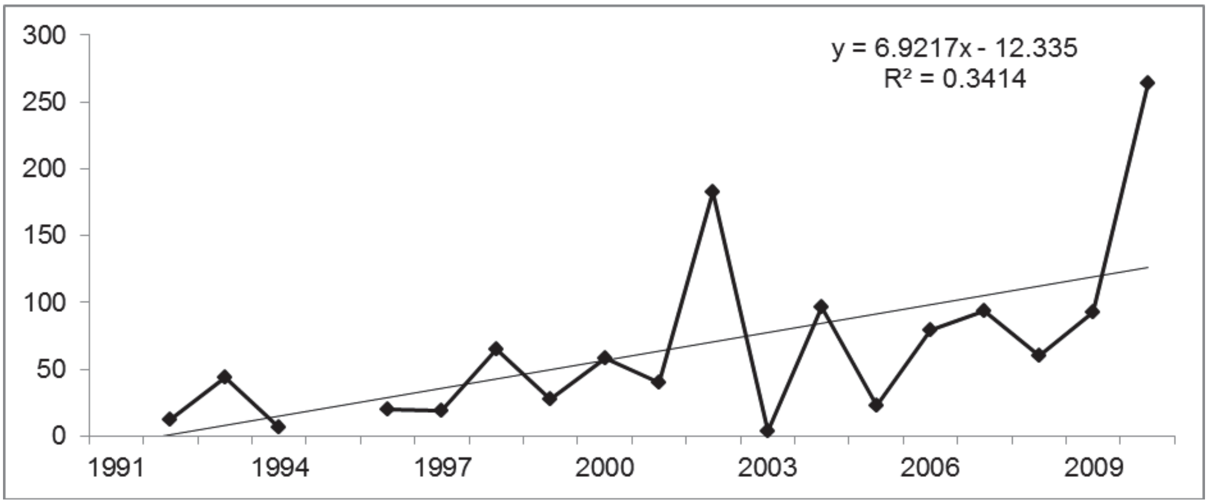


Figure 2.9 - Rivers Berriedale and Langwell Summer rod catch 1991-2010 (salmon and grilse, retained and released).

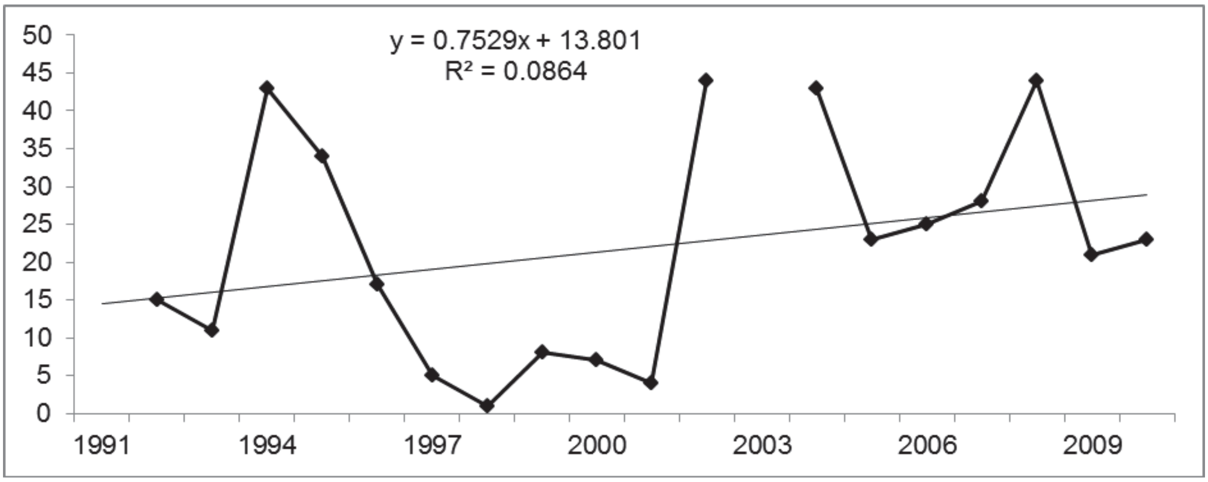


Figure 2.10 - Rivers Berriedale and Langwell Autumn rod catch 1991-2010 (salmon and grilse, retained and released).

Table 2.11 - Summary of F-Test Results on Rivers Berriedale and Langwell Seasonal Rod Catch (1991-2010).

Component	Observations	F-Value	F-Significance
Spring	Incomplete data	-	-
Summer	Incomplete data	-	-
Autumn	Incomplete data	-	-

Finally, the percentage change in the spring, summer and autumn rod catches were considered for the two SCM cycles undertaken since the year of designation (2001). The first assessment was undertaken during 2003-2004 and cycle 2 covers the period 2003-2010. In this review the rod catch is averaged for each cycle period and the increase or decrease in average rod catch expressed as a percentage of the rod catch in the year of designation.

This 'between-Cycle' comparison is shown in Figure 2.12, and indicates that, for all stock components on the Berriedale and Langwell, there has been an increase in average rod catch in the over each cycle period. The largest increase is apparent in the autumn catches although this is partly a consequence of the catch in the year of designation being the second lowest since designation and so averages compared against this low baseline value are more likely to show an increase in catch. Similarly, the summer catch in the year of designation was the third lowest since designation.

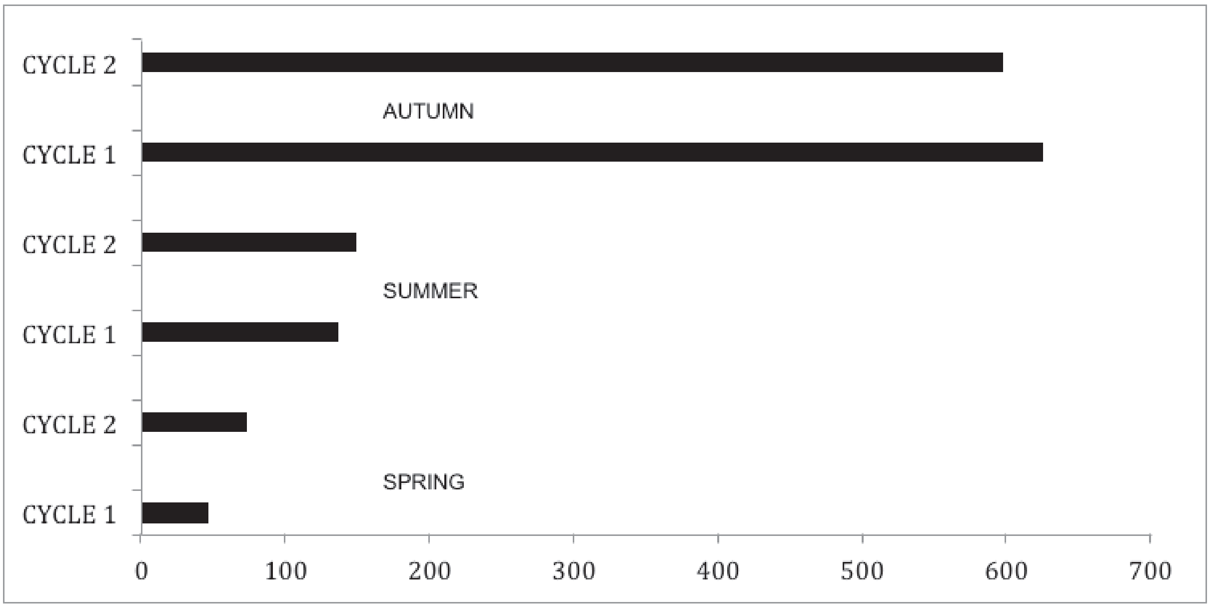


Figure 2.12 - Stock trend assessment since Rivers Berriedale and Langwell SAC Designation (2001) in cycle 1 (2002-2004) and cycle 2 (2002-2010).

Summary

The total rod catch for Atlantic salmon in the Berriedale and Langwell over the period 1952-2010, shows a small increase with spring rod catches remaining stable, summer rod catches increasing, and autumn rod catches showing a slight decline. Within the long-term dataset there are a number of years when very low total rod catches were declared. These occurred principally in the late-1980's and early-1990's, although there were a number of years where individual seasonal components have recorded low or even zero catches. Because of the nature of angling activity on these rivers, which rely on heavy rainfall to produce spates, it is not unknown for no fish to be caught for quite long periods of the season. By contrast, periods such as July and August 2010 or May and June 2011 saw higher water levels and the arrival of large numbers of multi-sea-winter fish. These periods of high water produced some of the best angling returns in living memory. Large numbers of fish have been seen spawning in the last four years. Observed, but un-quantified, smolt runs appear to be healthy.

Application of the NASCO rod catch assessment tool to the recorded catches over the last 20 years (1991-2010) suggest that no reduction in exploitation is required and no investigations into the existence of local problems are necessary for any of the spring, summer or autumn run-time components. Due to limitations in the data available statistical analysis of the catch in each seasonal component was not possible.

When the average catch for each of the two SCM cycles is compared to those recorded in the year of designation there is a large increase in both the autumn and summer rod catches in each cycle. This may be, at least in part, a function of the low autumn and summer rod catches recorded in the year of designation (autumn: second lowest since designation and summer: third lowest since designation). These low catches in the years of designation make it more likely that future average catches will show an increase in catch by comparison.

In combination these analyses of adult rod catch in the Berriedale and Langwell Waters indicate an improving situation since designation in 2001 within the longer term context of improvement since 1952 (but showing marked yearly fluctuations).

c) Habitats supporting the qualifying feature

1. Water quality and quantity

The status of each water body within the SAC, for which SEPA hold data, was obtained directly from the SEPA River Basin Planning interactive website.

A total of three WFD water bodies representing a river length of 61 km are recognised as being within the Berriedale and Langwell SAC. Of these, two are classified as being of good or high ecological status (total length 21.3 km) and are protected from deterioration. The remaining waterbody (river length 40 km) is classified as being at moderate ecological status and measures are required to bring it up to at least good ecological status. The cause of this waterbody classification being at less than good status is diffuse pollution from an unknown source. There are no Heavily Modified Water Bodies (HMWBs) within the Berriedale and Langwell SAC. Table 2.12 below summarises the number of water bodies and the length of channel within each status category.

Table 2.12 - Number of water bodies and length of channel within each WFD status category in the Berriedale and Langwell SAC.

WFD status (2009)	High	Good	Moderate	Poor	Bad	Total
Number of water bodies	1	1	1			3
Length of channel (km)	0.3	21	40			61

2. Trends, changes and activities

The Cromarty Firth Fisheries Trust suggest that grazing has a major negative impact on Atlantic salmon in the catchments of the SAC. Forestry activities are also considered to exert a negative influence on Atlantic salmon, and there is concern in respect of the affect that the extensive hill drainage schemes of the 1960’s and 1970’s may continue to have had upon the natural hydrology of the catchment.

The CFFT suggest that main activities having a negative impact on Atlantic salmon in the Berriedale and Langwell SAC are:

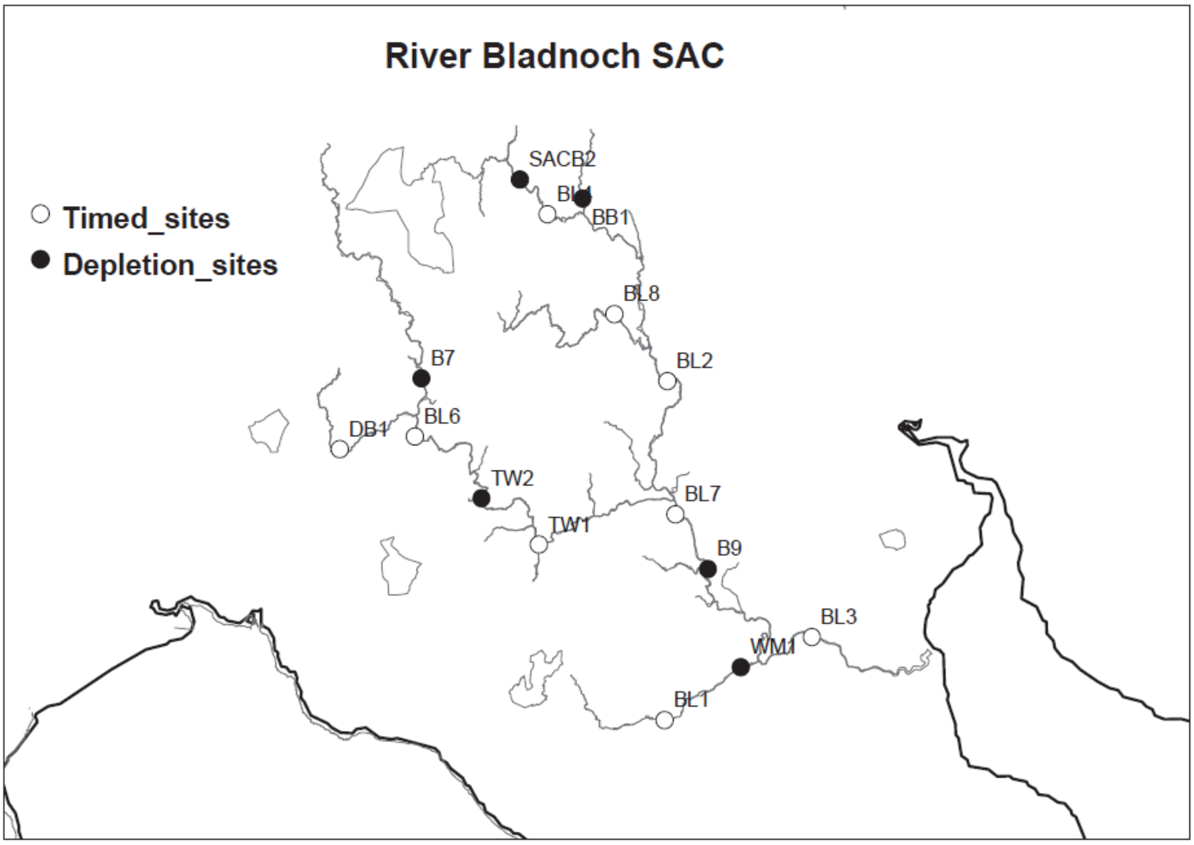
- Grazing;
- Forestry; and
- Historic hill drainage schemes affecting natural hydrology.

3. RIVER BLADNOCH

a) Juvenile Assessment

Six sites were surveyed using the standard SFCC catch depletion electrofishing method. A further nine sites were sampled using a five-minute timed electrofishing approach. All sites were situated within the River Bladnoch SAC (Map 3.1). The sites were surveyed by staff of the Galloway Fisheries Trust.

Map 3.1 - Distribution of depletion and timed electrofishing sites on the River Bladnoch SAC.



Depletion sites

Site details and a summary of electrofishing results are shown in Tables 3.1 – 3.4. One of the six depletion sites on the main Bladnoch channel did not have any salmon present. Zippin and Carl & Strube estimates for fry and 1+ fish were calculable for the remaining five that did have salmon present, and confidence limits were very narrow for three of those sites. For fry, Zippin densities ranged from 8 – 126 per 100 m^2 (mean 66) and Carl & Strube densities ranged from 8 - 125 per 100m^2 (mean 65). For 1+ fish, Zippin densities ranged from 9 - 66 per 100m^2 (mean 22) and Carl & Strube densities ranged from 6 - 65 per 100 m^2 (mean 21). The highest 1+ densities were found in the Water of Malzie and the lowest in the Tarf Water. 2+ salmon were found at one site on the main Bladnoch channel but were not found in high enough numbers to allow density estimates to be calculated. The largest 0+

fish were found in the main Bladnoch channel and the largest 1+ fish in the Tarf Water (mean 66 mm and 110 mm respectively).

Table 3.1 - Details of depletion electrofishing sites, River Bladnoch SAC.

Site code	Date	Easting	Northing	Altitude (m)	Channel name
SACB2	29/08/11	229100	572100	120	Bladnoch
B7	05/09/11	225500	564800	105	Bladnoch
BB1	05/09/11	231400	571400	80	Beoch Burn
WM1	05/09/11	237200	554200	20	Water of Malzie
TW2	15/11/11	227700	560400	80	Tarf Water
B9	16/11/11	236000	557800	20	Bladnoch

Table 3.2 - Details of depletion electrofishing for 0+ and 1++ salmon, River Bladnoch SAC.

Site code	Wetted area (m^2)	Zippin 0+	Carl & Strube 0+	Zippin 1+	Carl & Strube 1+	Zippin 2+	Carl & Strube 2+
SACB2	159.3	0.0	0.0	0.0	0.0	0.0	0.0
B7	130.4	7.7	7.7	12.3	11.5	n/a	n/a
BB1	80.9	40.3	39.6	10.3	6.2	n/a	n/a
WM1	75.3	121.6	120.8	66.0	65.1	0.0	0.0
TW2	119.2	33.7	30.2	9.0	8.4	n/a	n/a
B9	134.6	125.6	124.8	11.9	11.9	n/a	n/a

n/a denotes salmon present, but not in high enough densities to allow calculation of Zippin or Carl & Strube statistics. 0.0 denotes no salmon found at site.

Table 3.3 - Presence/absence of salmon year classes and of trout 0+ and 1++ at depletion sites, River Bladnoch SAC.

Site code	Salmon age class present?				Trout present?	
	0+	1+	2+	3++	0+	1++
SACB2	N	N	N	N	Y	N
B7	Y	Y	Y	N	Y	Y
BB1	Y	Y	Y	N	Y	Y
WM1	Y	Y	N	N	Y	Y
TW2	Y	Y	Y	N	N	N
B9	Y	Y	Y	N	N	N

Table 3.4 - Fork length of salmon of different age classes, River Bladnoch SAC.

Site code	0+ mean fork length	No. 0+	1+ mean fork length	No. 1+	2+ mean fork length	No. 2+	3+ mean fork length	No. 3+
SACB2	n/a	0	n/a	0	n/a	0	n/a	0
B7	63	10	109	14	130	1	n/a	0
BB1	66	31	108	5	125	1	n/a	0
WM1	61	91	95	48	n/a	0	n/a	0
TW2	65	31	110	10	124	2	n/a	0
B9	62	160	102	16	125	2	n/a	0

n/a denotes means could not be calculated as no salmon of that age class were found at the site.

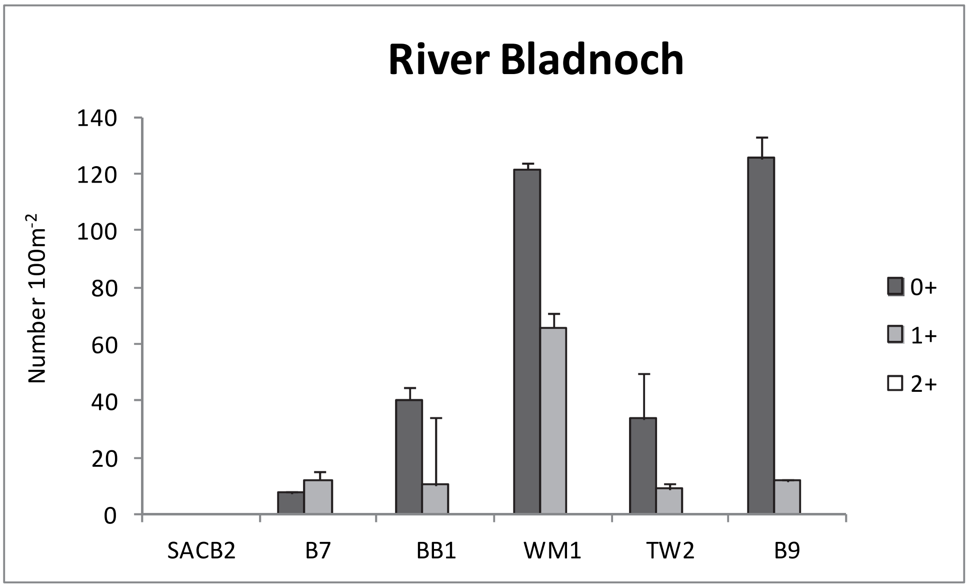


Figure 3.1 - Juvenile salmon population density estimated by the Zippin method for the SAC monitoring sites on the River Bladnoch SAC.

Timed sites

Details of the nine timed sites are given in Table 3.5. 0+ fish were caught at seven of the nine timed sites, while 1++ fish were caught at eight sites. CPUE for fry ranged from 0 – 8/min, and for 1+ fish ranged from 0 – 3/min (Table 3.6). 2+ salmon were caught at six sites. Trout were caught at seven of the sites.

Table 3.5 - Details of timed electrofishing sites, River Bladnoch SAC.

Site code	Easting	Northing	River	Altitude (m)
DB1	222500	562200	Drumpail Burn	110
BL1	234400	552250	Malzie Burn	65
TW1	229800	558700	Tarf Water	70
BL3	239800	555300	Bladnoch	15
BL7	234800	559800	Bladnoch	25
BL2	234500	564700	Bladnoch	50
BL6	225248	562660	Tarf Water	100
BL4	230117	570818	Bladnoch	100
BL8	232557	567155	Black Burn	75

Table 3.6 - Salmon catch per unit effort (CPUE), River Bladnoch SAC.

Site code	Survey date	Salmon 0+/min	Salmon 1++/min
DB1	05/09/11	0.0	1.0
BL1	09/11/11	4.2	2.6
TW1	09/11/11	6.2	1.4
BL3	09/11/11	1.4	1.8
BL7	09/11/11	7.8	0.8
BL2	15/11/11	4.0	1.2
BL6	15/11/11	5.8	1.2
BL4	15/11/11	0.0	0.0
BL8	15/11/11	7.4	2.2

Table 3.7 - Presence/absence of salmon year classes and of trout at timed sites, River Bladnoch SAC.

Site code	Salmon age class present?				Trout present?
	0+	1+	2+	3+	
DB1	N	Y	Y	N	N
BL1	Y	Y	N	N	N
TW1	Y	Y	N	N	N
BL3	Y	Y	Y	N	N
BL7	Y	Y	Y	N	N
BL2	Y	Y	Y	N	N
BL6	Y	Y	Y	N	N
BL4	N	N	N	N	Y
BL8	Y	Y	Y	N	Y

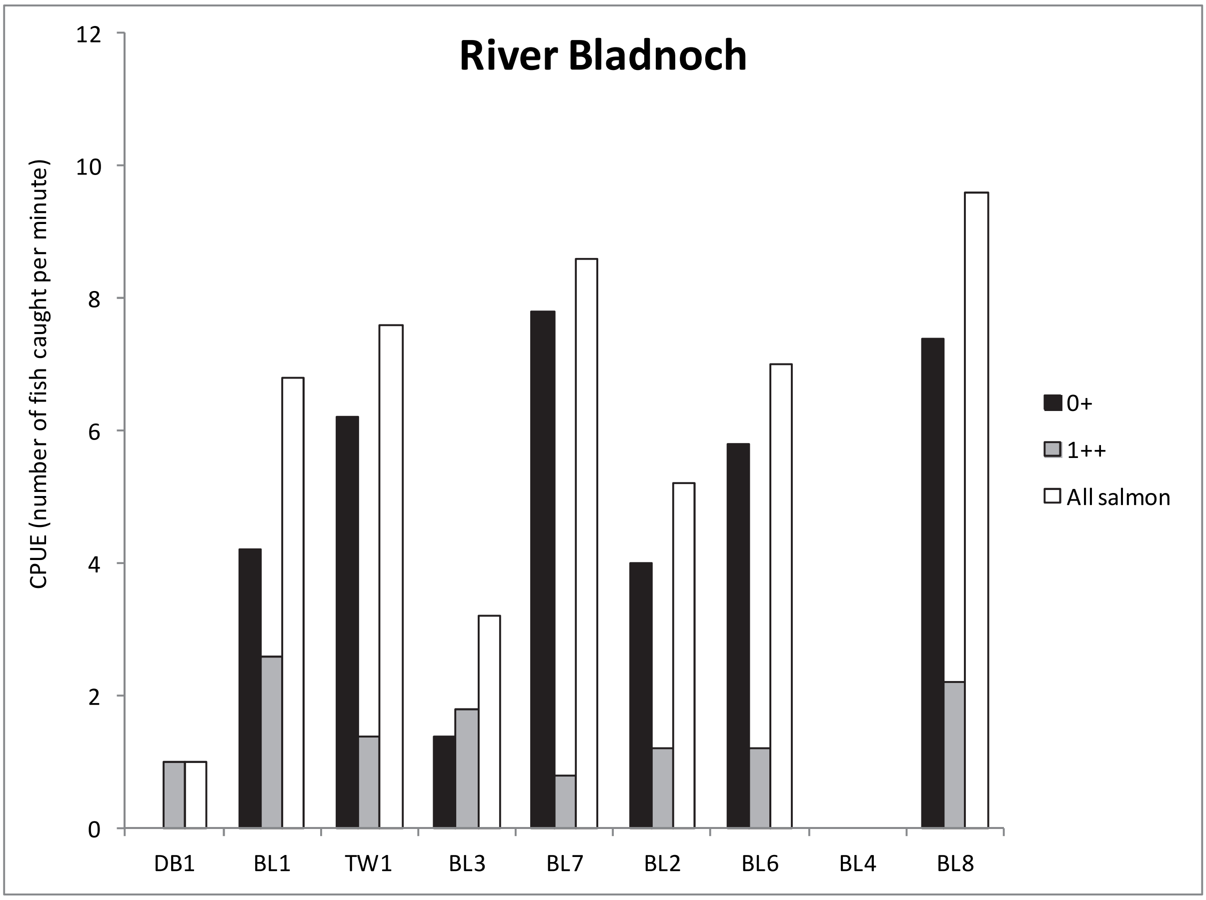


Figure 3.2 - Number of salmon (0+, 1++ and all salmon) caught per minute during five minutes of electrofishing at sites within the River Bladnoch SAC.

Summary

When the densities of 0+ and 1++ juveniles are considered in quintile distributions of sites and in relation to regional juvenile densities developed by Godfrey (2005), the Bladnoch has sites spread across all of the quintile bands, but there are twice as many sites in the top two bands than the lower bands, for both fry and parr (Table 3.8). This indicates that there is some variability in juvenile fish density across the catchment which, for both fry and parr, reflects local differences in juvenile productivity. These differences may be associated with natural production limits associated with, for example, habitat quality or nutrient levels, the number of spawning adults reaching survey locations or the impact of external pressures which limit natural production or juvenile survival. However, both fry and parr can be considered to be in favourable status. The overall assessment based upon the sites surveyed is therefore that juvenile populations are in favourable status within the SAC.

Table 3.8 – Number of sites within the River Bladnoch SAC falling within each quintile (according to absolute regional classification for 0+ and 1++ age classes) – and the resulting condition status.

SAC	Age class	Number of sites					Median grade	Favourable condition?
		0-20	21-40	41-60	61-80	81-100		
		E	D	C	B	A		
Bladnoch	0+	1	1		2	2	B	Y
	1++	1		1	3	1	B	Y

The variability in densities found confirms that, within the River Bladnoch catchment, there are areas of higher and lower production and areas where local management problems and issues exist which may require active management to resolve.

The methodology adopted for the juvenile assessment shows that the status of the River Bladnoch was the same in 2011 when compared to the previous assessment which also showed both fry and parr to be in favourable status (Table 3.9).

Table 3.9 - Comparison of condition status in 2004 and in 2011 for 0+ and 1++ age classes.

SAC		2004	2011	Change
Bladnoch	0+	Y	Y	=
	1++	Y	Y	=

b) Adult Assessment

An assessment of adult Atlantic salmon populations in the River Bladnoch was made using Rod Catch Assessment tool introduced and described in Section 1. This analysis considers the rod catch in seasonal components (spring, summer and autumn) to provide an assessment of the adult population. In addition, a summary of Marine Scotland Science catch statistics (available from 1952) is provided for the overall catch, and the same run-time components.

Summary of 1952 Catch Statistics

The published catch statistics for all Atlantic salmon captured in the River Bladnoch are shown in Figure 3.3. Data are also presented also for the spring, summer and autumn run-time components in Figures 3.4, 3.5 and 3.6.

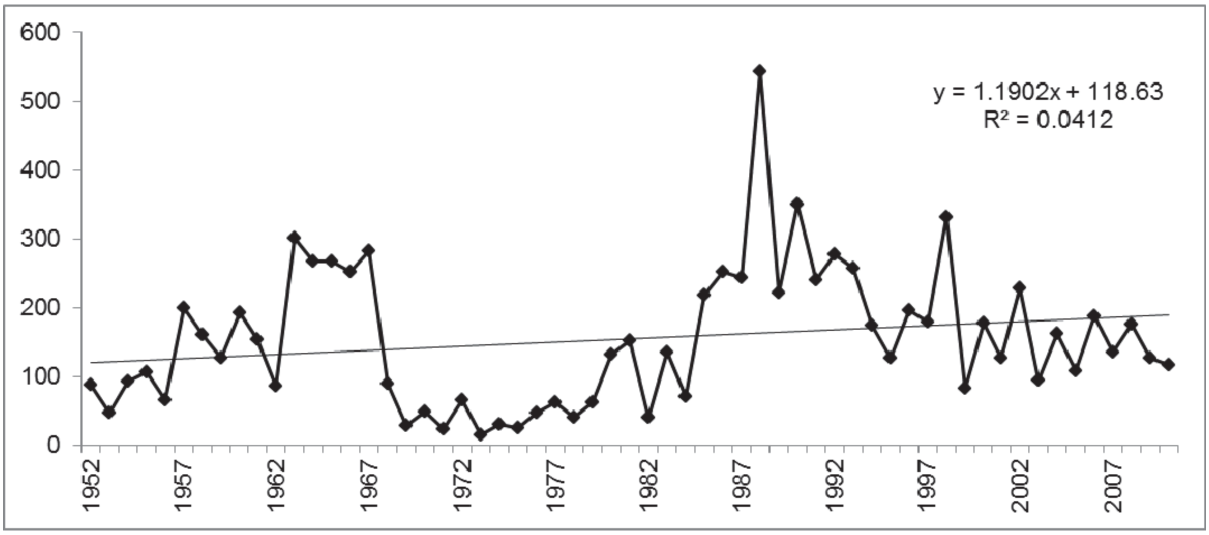


Figure 3.3 - River Bladnoch total rod catch 1952-2010 (salmon and grilse, retained and released).

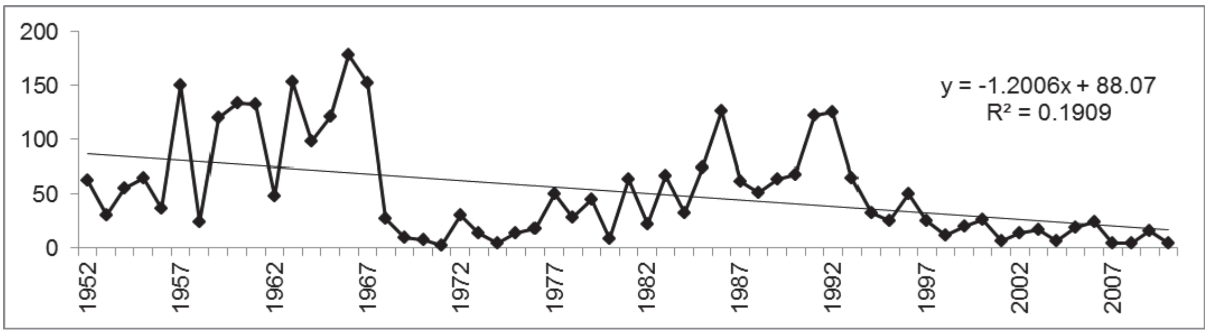


Figure 3.4 - River Bladnoch total spring rod catch 1952-2010 (salmon and grilse, retained and released)

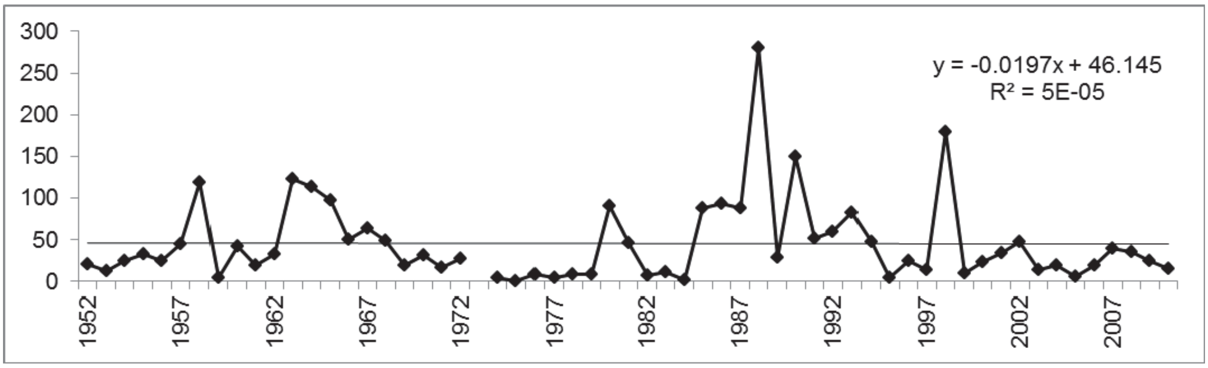


Figure 3.5 - River Bladnoch total summer rod catch 1952-2010 (salmon and grilse, retained and released).

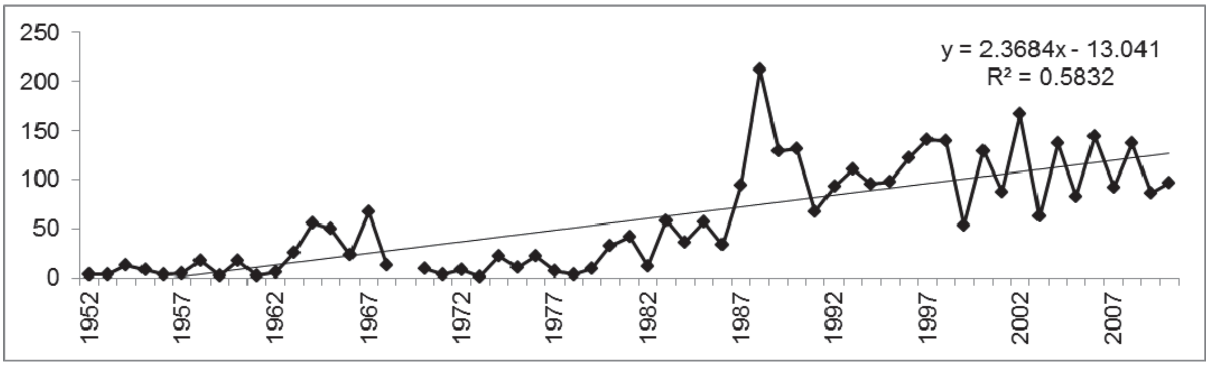


Figure 3.6 - River Bladnoch total autumn rod catch 1952-2010 (salmon and grilse, retained and released).

Figure 3.3 shows an overall increase over data series with particularly high total catches recorded in the mid-1950's – mid-1969's and again in the mid 1980s until the early 1990s.

However, within this overall increase, the spring catch (Figure 3.4) shows an overall decline over the same period. Peak spring catches were recorded in the mid 1950s - late 1960s with further individual years of higher catches in 1986, 1991 and 1992. Low spring catches were recorded from 1969-1979 and again from 1997 to date. The current period of low spring catch has coincided with the identification of surface water acidification in the headwaters of the catchment where spring fish were historically thought to have originated.

The summer catch (Figure 3.5) shows a stable overall trend line but with some yearly fluctuation. The autumn catch (Figure 3.6) shows an increasing trend over the 1952-present and this is the main driver of the overall increased catch shown in Figure 3.3.

It is likely that the reporting of rod catch over the period has been both consistent and representative, and there is no evidence that any trends summarised may be attributable to a change in reporting accuracy or inconsistency. However, Galloway Fisheries Trust suggest that whilst angling pressure, particularly in the spring, is now 'light' and in itself may contribute to low spring catches, they view the current low spring catch as indicative of real changes and trends in abundance of that stock component.

The Bladnoch DSFB have adopted a number of conservation measures to protect all Atlantic salmon stocks but, these are aimed primarily at the spring component of the fishery. These measures have sought to reduce, and then cease, net fishing effort and regulate the activities and methods of the rod and line fishery.

There is now no netting effort in the Fishery District. The net and coble fishery was removed under a 99 year lease and was last fished in 1995. The stake net fishery in the District is rented to prevent fishing on an annual basis. This arrangement has been in place since 1999 and the fishery has not been active since that time other than a single year of operation in 2004/05.

In addition to controlling netting activities, the Bladnoch DSFB have introduced conservation measures to manage the rod and line fishery and these are reviewed annually. These measures currently discourage the killing of spring salmon up the 1st June; require the return of all female salmon in the last month of the season; restrict methods such as worming to protect spring fish and fish close to spawning; and limit the number of hooks to be fished in spinning gear.

Despite the conservation measures above it is not clear that these have had any discernible impact on the numbers of spring fish taken (and which have continued to decline), or on the numbers of fish captured during the summer (where no increase in catch is apparent).

Application of Rod Catch Assessment Tool

Catches from the Bladnoch over the last 20 years (1991-2010) were applied to the rod catch assessment tool to consider the current status of each run-time component.

Conclusions from these tests for the River Bladnoch SAC are shown in Table 3.10. The data used to complete these tests is available in Appendix 1. These tests confirm that no reduction in exploitation or investigation as to whether local problems exist is required for the summer or autumn run-time components. However, Tests A and B for spring fish indicates that a reduction in exploitation of the spring stock and investigation into whether local problems exist may be justified due to the low catches recorded in 2010 (last year in the sequence) and as two of the lowest three catches in the sequence occur within the last three years.

Table 3.10 - Summary of the Rod Catch Assessment Tool Tests for River Bladnoch.

Test	Spring	Summer	Autumn
A	Yes	No	No
B	Yes	No	No
C	No	No	No

The catches for the 20 year period considered (1991-2010) are presented for total rod catch in Figure 3.7 for each seasonal component in Figures 3.8, 3.9 and 3.10. An F-Test was applied to each of the seasonal components to assess significance and the results these are summarised in Table 3.11. These confirm no significant trend in catch in either the summer or autumn catch but confirm a significant reduction (at the 95% confidence level) in catch from the spring component of the fishery over the 20-year period.

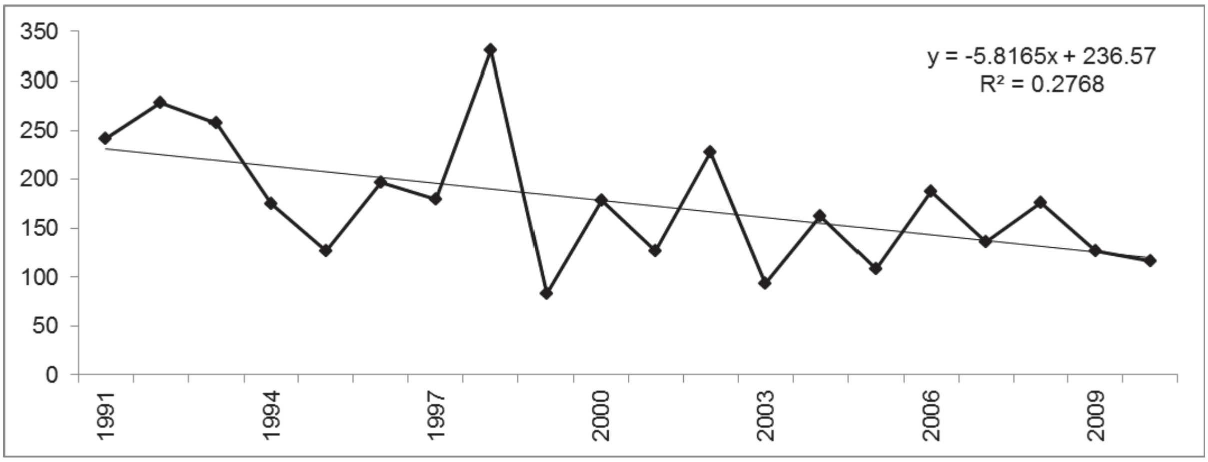


Figure 3.7 - River Bladnoch total rod catch 1991-2010 (salmon and grilse, retained and released).

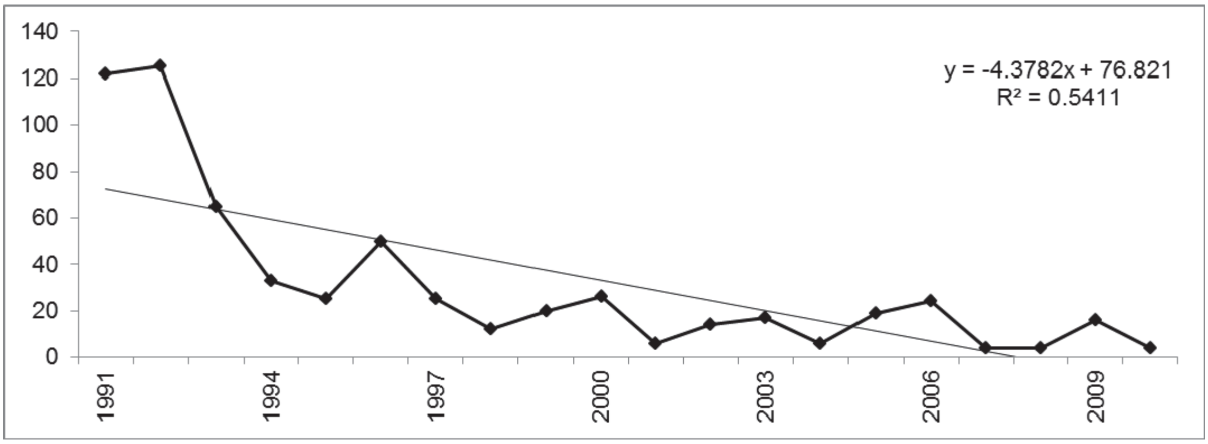


Figure 3.8 - River Bladnoch Spring rod catch 1991-2010 (salmon and grilse, retained and released).

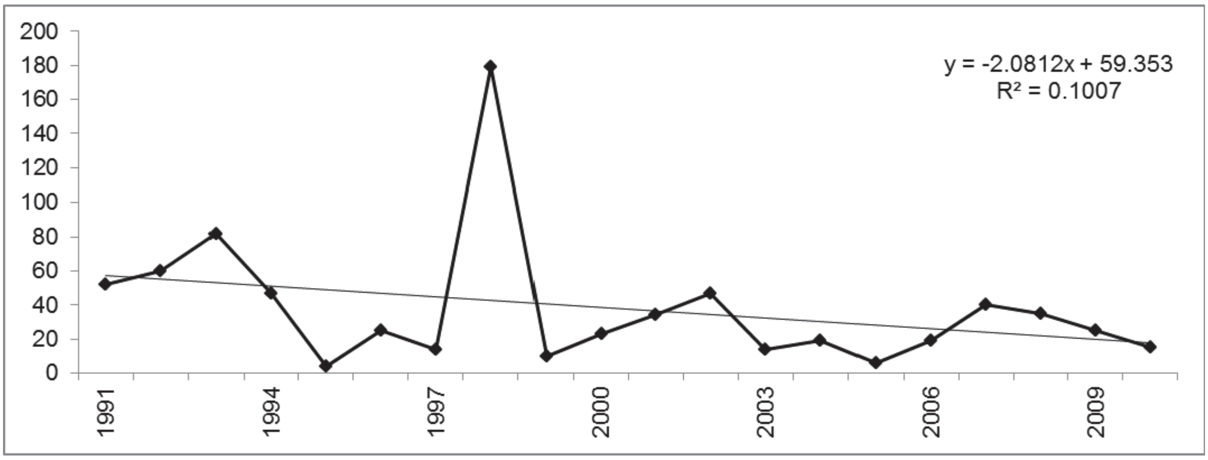


Figure 3.9 - River Bladnoch Summer rod catch 1991-2010 (salmon and grilse, retained and released).

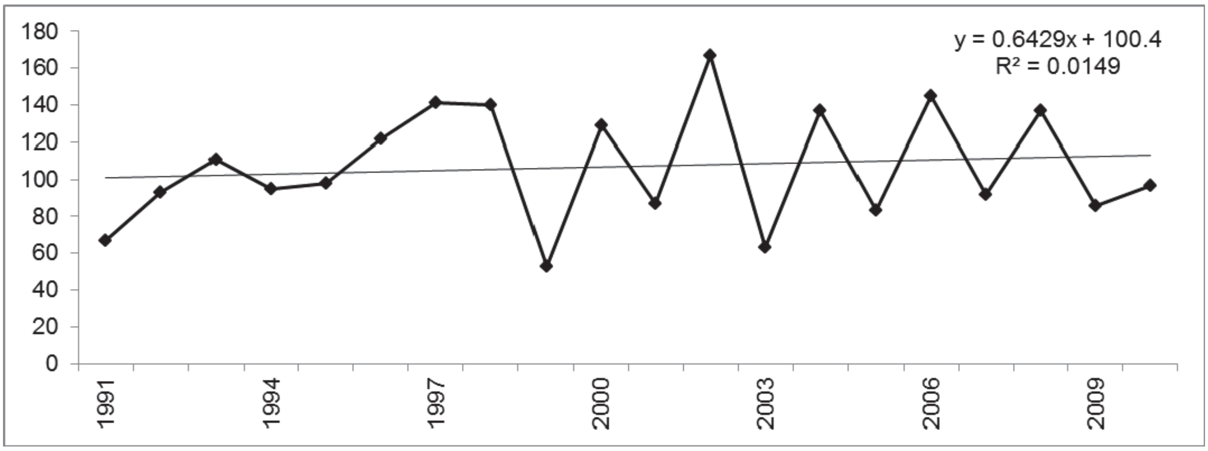


Figure 3.10 - River Bladnoch Autumn rod catch 1991-2010 (salmon and grilse, retained and released).

Table 3.11 - Summary of F-Test Results on River Bladnoch Seasonal Rod Catch (1991-2010).

Component	Observations	F-Value	F-Significance
Spring	20	21.22	0.0002
Summer	20	2.015	0.173
Autumn	20	0.272	0.608

Finally, the percentage change in the spring, summer and autumn rod catches were considered for the two SAC monitoring cycles since the year of designation (2001 in the case of the River Bladnoch). The first assessment was undertaken in 2004 and so the cycle 1 period covers the period 2002-2004. Cycle 2 covers the period 2002-2010 which, at the time of commencement of this work, represented the last year of published catch data. In this review the rod catch is averaged for each cycle period and the increase or decrease in average rod catch is expressed as a percentage of the rod catch in the year of designation presented.

This assessment is shown in Figure 3.11 (below), and indicates that for the summer stock components on the River Bladnoch has shown a decrease in average rod catch since the year of designation in each of the two cycles. However, the spring and autumn average catches in each period since designation have increased, with the average spring catch showing a particularly large increase. It must be noted and recognised, however, that the spring catch in particular in 2001 was very low (a total of six fish were caught) thus providing a low base figure to set these, more recent, values against. In addition, the spring catches now recorded on the River Bladnoch are at such low levels (ranging between four and 24 fish in each year since designation), that small increases in recorded catch can have a disproportionately large impact on the average catch in the period.

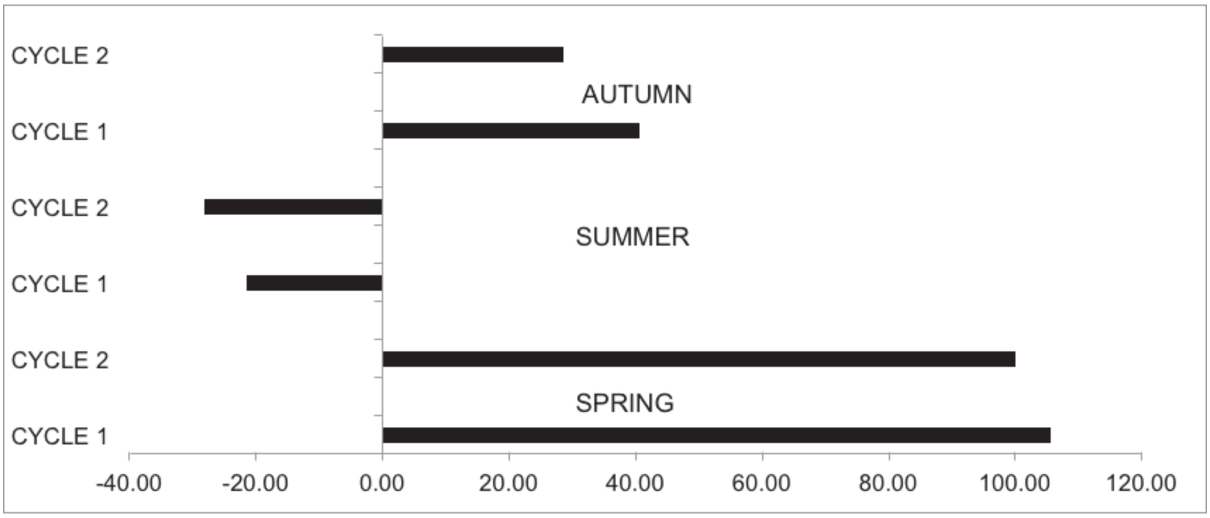


Figure 3.11 - Stock trend assessment since River Bladnoch SAC Designation (2001) in cycle 1 (2002-2004) and cycle 2 (2002-2010).

Summary

The overall trend in catch of the River Bladnoch over the period 1952-2010 shows a marginal increase but, within this, summer catches have remained stable, spring catches have declined and autumn catches increased. The increase in autumn catch is considered to be the driver behind the observed overall increase in total catch.

Application of the rod catch assessment tool to the recorded catches over the last 20 years (1991-2010) indicated that no reduction in exploitation was required and no investigations into the existence of local problems were necessary for the summer and autumn run-time components. However, a reduction in exploitation and commencement of investigations into local problems is suggested as necessary for the spring stock from the results of Tests A and B. When catches for each run-time component are considered individually over this period there was no significant change in either the summer or autumn catches, but a significant decline in the spring catch was confirmed.

When average catch is compared since designation in 2001 over SCM cycles one (2002-2004) and two (2002-2010), a decrease in summer catches and an increase in both the spring and autumn catches was evident. However, spring catches over the total period are now very low and small increases in catch in any given year can have a disproportionate impact upon calculated averages.

In combination, these assessments of adult rod catch in the River Bladnoch indicate a relatively static or improving situation in respect of the summer and autumn catches, but with spring in decline. There is evidence throughout the assessment, except the average catch in each cycle since 2001, of long term decline in the spring stock component over the period of available catch records (since 1952) and over the 20 year assessment period (since 1991) and with little or no evidence of recovery or improvement since designation in 2001.

c) Habitats supporting the qualifying feature

1. Water quality and quantity

The status of each water body within the SAC, for which SEPA hold data, was obtained from the SEPA River Basin Planning interactive website.

A total of 15 WFD water bodies representing a river length of 137 km are located within the River Bladnoch SAC. Of these four are classified as being of good or high ecological status (total length 25 km) and are protected from deterioration from that condition. The remaining 11 (river length 112 km) are classified as being of either moderate or poor ecological status and, therefore, require improvement to bring them up to at least good ecological status for parameters that affect Atlantic salmon (and high for pH). The most common cause of waterbody classification being less than good status is diffuse pollution from forestry/non-renewable energy generation and morphological alterations from forestry plantings close to river banks. Within the overall ecological status classification these pressures particularly influence the fish ecology and pH quality elements. These morphological alterations also give rise to fish passage issues. In addition, several sites are classified at less than good ecological status because of issues relating to water abstraction pressures. Two sites classified as being at less than good status because of issues relating to non-renewable energy generation, and diffuse pollution from forestry activities respectively. There are no Heavily Modified Water bodies (HMWBs) within the River Bladnoch SAC. Table 3.12 below summarises the number of water bodies and the length of channel within each status category.

Table 3.12 - Number of water bodies and length of channel within each WFD status category in the River Bladnoch SAC.

WFD status (2009)	High	Good	Moderate	Poor	Bad	Total
Number of water bodies		4	10	1		15
Length of channel (km)		25	94	18		137

2. Trends, changes and activities

The key issue affecting Atlantic salmon in the River Bladnoch SAC is water quality. The catchment has been subject to substantial surface water acidification, and in some areas fish have been lost from the catchment completely. Negative impacts associated with forestry, and in particular forestry-mediated impacts on gravel movements and resulting degraded in-channel habitats, are also a significant concern. In some areas this has led spawning areas being left with either insufficient, or compacted, gravels. Grazing and the introduction of non-native fish species are also considered to have a negative impact on the SAC. Despite these concerns, new forestry activities, and better forestry practices (such as the establishment of riparian buffer zones), will benefit river processes and water quality.

Whilst water is not a significant issue at the present time, the potential establishment of run-of-river hydro schemes may have a negative impact.

The GFT suggest that the main activities having a negative impact on Atlantic salmon in the River Bladnoch catchment are:

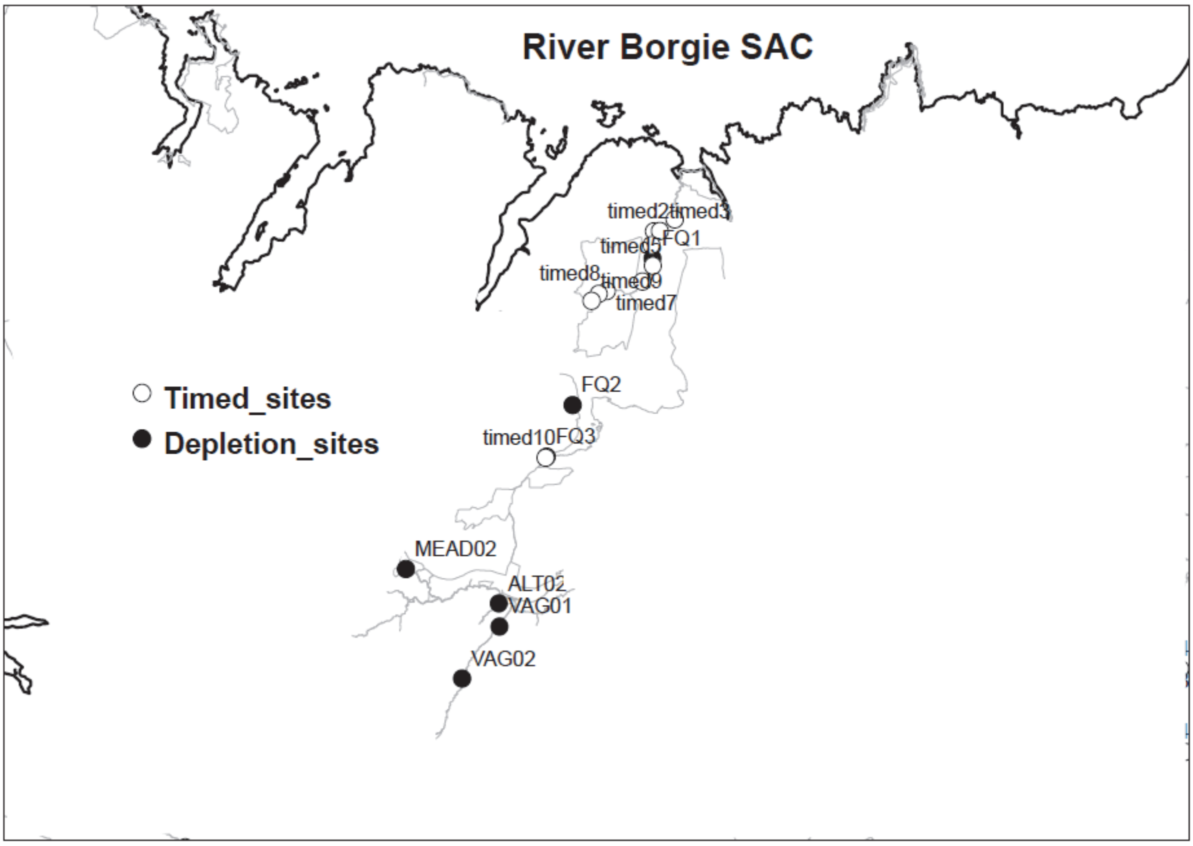
- Water quality (acidification);
- Lack of spawning gravels due to forestry; and
- Compaction of spawning gravels due to lack of movement and replacement.

4. RIVER BORGIE

a) Juvenile Assessment

Three sites were surveyed using the standard SFCC catch depletion electrofishing method. A further ten sites were sampled using a five-minute timed electrofishing approach. All sites were situated within the River Borgie SAC (Map 4.1). The sites were surveyed by staff of the Ness and Beauly Fisheries Trust and Lochaber Fisheries Trust.

Map 4.1 - Distribution of depletion and timed electrofishing sites on the River Borgie SAC.



Depletion sites

Site details and a summary of electrofishing results are shown in Tables 4.1 – 4.4. All three depletion sites contained 0+ and 1+ salmon, and Zippin densities were calculable for all. Confidence limits were very narrow in all cases. For fry, Zippin densities ranged from 22 - 53 per 100 m^2 (mean 37) and Carl & Strube densities ranged from 21 - 52 per 100 m^2 (mean 36). The highest 0+ densities were found in the main Borgie channel. For 1+ fish, Zippin densities ranged from 16 - 29 per 100 m^2 (mean 16) and Carl & Strube densities ranged from 15 - 27 per 100 m^2 (mean 21). The highest 1+ densities were found in the Allt Tor an Tairbh. The largest 0+ and 1+ fish were found in the Allt Tor an Tairbh (mean 55 mm and 129 mm respectively). No salmon older than 1+ were found in any of the sites.

Table 4.1 - Details of depletion electrofishing sites, River Borgie SAC.

Site code	Date	Easting	Northing	Altitude (m)	Channel name
sac/borgie/FQ1	11/10/2011	266429	956636	50	Borgie
sac/borgie/FQ2	12/10/2011	261413	947474	120	Allt Tor an Tairbh
sac/borgie/FQ3	12/10/2011	259801	944252	125	Lon Achadh na h-Aibhne

Table 4.2 - Details of depletion electrofishing for 0+ and 1++ salmon, River Borgie SAC.

Site code	Wetted area (m^2)	Zippin 0+	Carl & Strube 0+	Zippin 1+	Carl & Strube 1+	Zippin 2+	Carl & Strube 2+
sac/borgie/FQ1	153.6	52.9	51.5	15.6	15.0	0.0	0.0
sac/borgie/FQ2	107.0	59.9	49.5	n/a	n/a	10.8	10.3
sac/borgie/FQ3	191.2	22.3	20.9	17.9	16.7	n/a	n/a

n/a denotes salmon present, but not in high enough densities to allow calculation of Zippin or Carl & Strube statistics. 0.0 denotes no salmon found at site.

Table 4.3 - Presence/absence of salmon year classes and of trout 0+ and 1++ at depletion sites, River Borgie SAC.

Site code	Salmon age class present?				Trout present?	
	0+	1+	2+	3++	0+	1++
sac/borgie/FQ1	Y	Y	N	N	Y	Y
sac/borgie/FQ2	Y	Y	Y	N	Y	Y
sac/borgie/FQ3	Y	Y	Y	N	Y	Y

Table 4.4 - Fork length of salmon of different age classes, River Borgie SAC.

Site code	0+ mean fork length	No. 0+	1+ mean fork length	No. 1+	2+ mean fork length	No. 2+	3+ mean fork length	No. 3+
sac/borgie/FQ1	52	73	91	22	n/a	0	n/a	0
sac/borgie/FQ2	48	39	86	13	116	11	n/a	0
sac/borgie/FQ3	53	36	79	24	111	6	n/a	0

n/a denotes means could not be calculated as no salmon of that age class were found at the site.

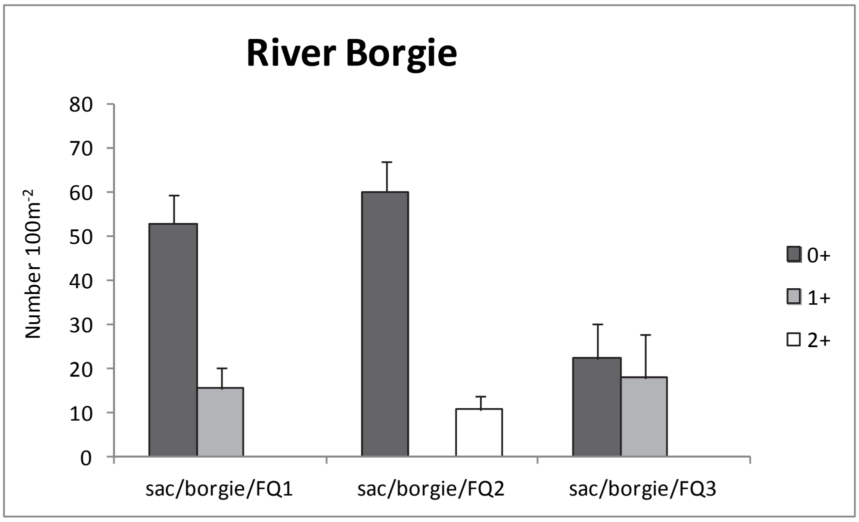


Figure 4.1 - Juvenile salmon population density estimated by the Zippin method for SAC monitoring sites on the River Borgie SAC.

Timed sites

Details of the ten timed sites are given in Table 4.5. 0+ and 1++ fish were caught at all ten of the times sites. CPUE for fry ranged from 0.2 – 4.2/ min, and for 1+ fish ranged from 0.2 – 2.4/ min (Table 4.6). No salmon older than 1+ were caught at any of the sites. Trout were caught at three of the sites.

Table 4.5 - Details of timed electrofishing sites, River Borgie SAC.

Site code	Easting	Northing	River	Altitude (m)
sac/borgie/timed1	267813	959073	Borgie	20
sac/borgie/timed2	266512	958329	Borgie	40
sac/borgie/timed3	266892	958364	Borgie	55
sac/borgie/timed4	266371	957484	Borgie	40
sac/borgie/timed5	266447	956189	Borgie	55
sac/borgie/timed6	265788	955194	Borgie	70
sac/borgie/timed7	263571	954613	Borgie	110
sac/borgie/timed8	263067	954428	Borgie	110
sac/borgie/timed9	262610	953984	Borgie	115
sac/borgie/timed10	259724	944191	Lon Achadh na h-Aibhne	120

Table 4.6 - Salmon catch per unit effort (CPUE), River Borgie SAC.

Site code	Survey date	Salmon 0+/min	Salmon 1++/min
sac/borgie/timed1	13/10/2011	2.0	0.8
sac/borgie/timed2	11/10/2011	2.2	1.8
sac/borgie/timed3	11/10/2011	2.0	2.4
sac/borgie/timed4	11/10/2011	2.8	1.4
sac/borgie/timed5	11/10/2011	2.0	1.0
sac/borgie/timed6	11/10/2011	4.2	0.8
sac/borgie/timed7	13/10/2011	1.8	0.8
sac/borgie/timed8	13/10/2011	3.0	2.0
sac/borgie/timed9	13/10/2011	2.6	0.2
sac/borgie/timed10	13/10/2011	0.2	0.6

Table 4.7 - Presence/absence of salmon year classes and of trout at timed sites, River Borgie SAC.

Site code	Salmon age class present?				Trout present?
	0+	1+	2+	3+	
sac/borgie/timed1	Y	Y	N	N	N
sac/borgie/timed2	Y	Y	N	N	N
sac/borgie/timed3	Y	Y	N	N	Y
sac/borgie/timed4	Y	Y	N	N	Y
sac/borgie/timed5	Y	Y	N	N	N
sac/borgie/timed6	Y	Y	N	N	Y
sac/borgie/timed7	Y	Y	N	N	N
sac/borgie/timed8	Y	Y	N	N	N
sac/borgie/timed9	Y	Y	N	N	N
sac/borgie/timed10	Y	Y	N	N	N

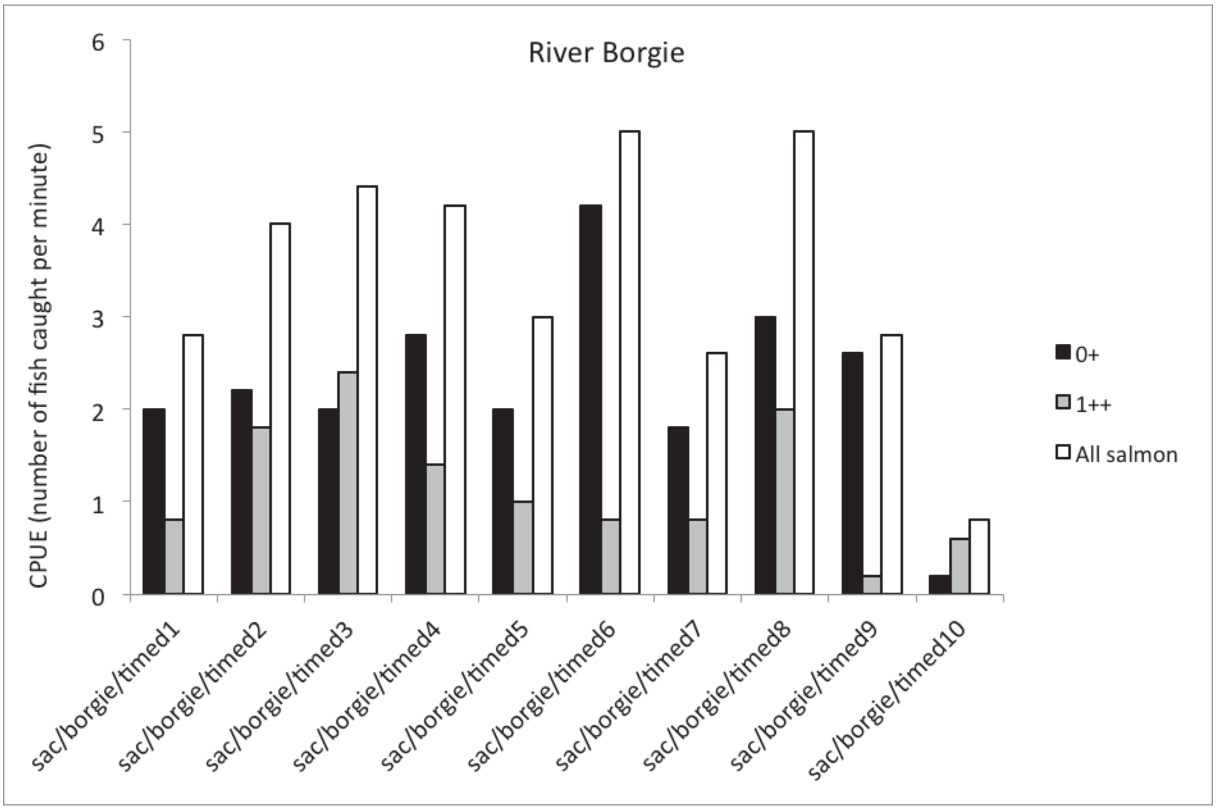


Figure 4.2 - Number of salmon (0+, 1++ and all salmon) caught per minute during five minutes of electrofishing at sites on the River Borgie.

Summary

The densities of 0+ and 1++ juveniles viewed as quintile distributions of sites, and in relation to regional juvenile densities developed by Godfrey (2005), show that juvenile numbers occupy the two highest quintile bands (Table 4.8). This indicates the presence of high juvenile fish densities across the sample sites for both fry and parr and reflects the high quality of good quality juvenile habitat available. Both fry and parr can be considered to be in favourable status and we recommend that the overall assessment, based upon the sites surveyed, is therefore that juvenile populations are in favourable status in the SAC (Table 4.8).

Table 4.8 – Number of sites within the River Borgie SAC falling within each quintile (according to absolute regional classification for 0+ and 1++ age classes) – and the resulting condition status.

SAC	Age class	Number of sites					Median grade	Favourable condition?
		0-20	21-40	41-60	61-80	81-100		
		E	D	C	B	A		
Borgie	0+				1	2	A	Y
	1++				2	1	B	Y

It is not possible to compare the 2011 assessment with the findings of the 2004 assessment as data is not available for 2004 (Table 4.9).

Table 4.9 - Comparison of condition status in 2004 and in 2011 for 0+ and 1++ age classes.

SAC		2004	2011	Change
Borgie	0+	n/a	Y	n/a
	1++	n/a	Y	n/a

b) Adult Assessment

Rod catch data for adult Atlantic salmon populations were analysed using the River Borgie using the Rod Catch Assessment tool introduced and described in Section 1. This tool utilised data for each of the rod catch seasonal components (spring, summer and autumn) to provide an assessment of adult population. In addition to this analysis, a summary presentation of catch, using Marine Scotland Science catch statistics available from 1952, is provided for the overall rod catch and the same seasonal run-time components.

Summary of 1952 Catch Statistics

Published total rod catch data for the River Borgie are shown in Figure 4.3. These data are also presented for the spring, summer and autumn run-time components in Figures 4.4, 4.5 and 4.6.

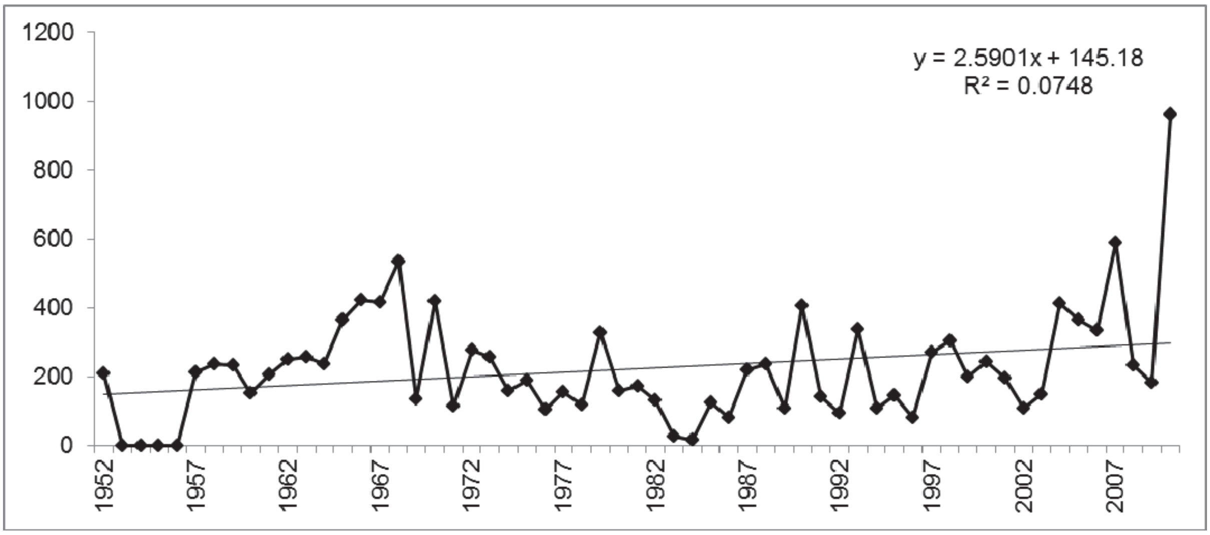


Figure 4.3 - River Borgie total rod catch 1952-2010 (salmon and grilse, retained and released).

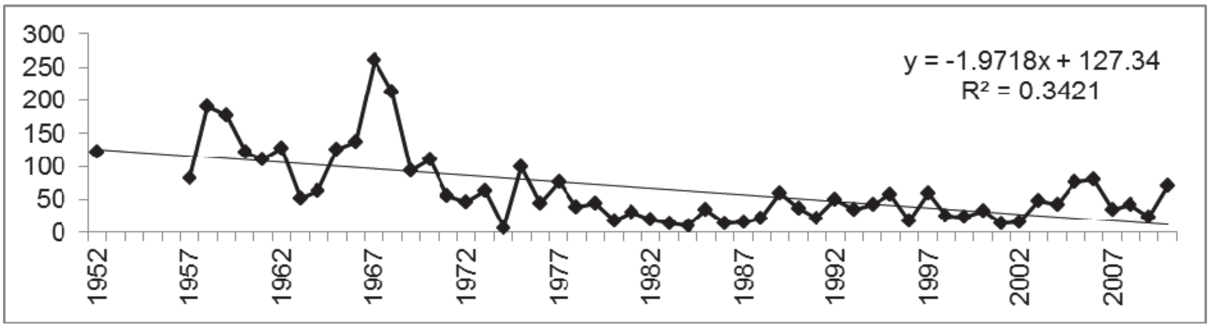


Figure 4.4 - River Borgie total Spring rod catch 1952-2010 (salmon and grilse, retained and released).

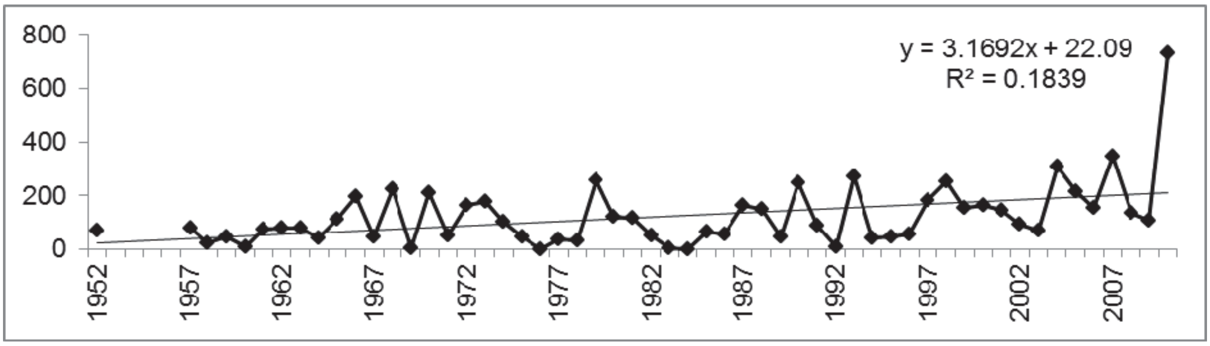


Figure 4.5 - River Borgie total Summer rod catch 1952-2010 (salmon and grilse, retained and released).

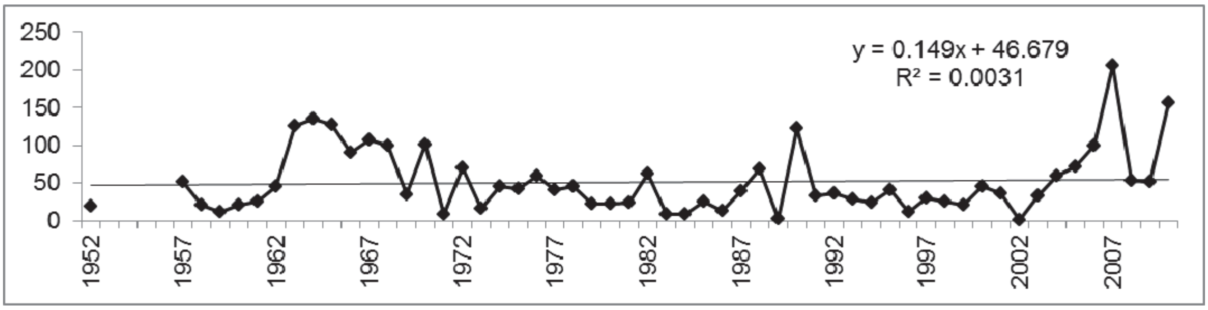


Figure 4.6 - River Borgie total Autumn rod catch 1952-2010 (salmon and grilse, retained and released).

Figure 4.3 shows an overall trend of increasing rod catch over the period when records are available. Catches were variable within this period. From 1953-1956 no rod caught fish were recorded from the Borgie. It is not clear whether this was actually the case, or whether it is an artefact of non-returned catch returns not being made; low or no fishing effort; extended periods of poor angling conditions in the year; a real absence of fish; or a combination of these factors. Since that time rod catch has been highly variable, but with clear periods of high rod catch in the mid 1960's and from 2004-2007 and in 2010. Low catches occurred throughout most of the 1980's and until the mid-1990's. The highest catch recorded was in 2010 which is almost double the next highest year and significantly higher than catches in most other years.

The spring rod catch (Figure 4.4) shows a general decline over the time series with the largest catches recorded early in the sequence and until the mid-1960's. Since the mid-1970's the spring rod catch has remained low although there is some evidence of improved catches from 2002. The summer rod catch (Figure 4.5) has, generally, increased over the period but from a low base level in 1952, with some years in the 1950's recording a zero catch. The rod catch of spring fish increased in the mid-1960's and relatively high numbers of spring fish appeared in catch records in 1989, 2007 and 2010.

The autumn catch (Figure 4.6) was stable over the data set with periods of high catch apparent in the mid 1960's and again from 2004-2007 and in 2010. Low catches are not uncommon and these are recorded in the early 1960's, 1980's and 1990's.

Despite concerns over the earliest data in the series (1953-56), it is likely that the reporting of rod catch over the period has been relatively consistent, there is no evidence to suggest that any of the trends summarised are attributable to a systematic change in reporting accuracy or inconsistency.

Active netting stations are present at Armadale and Port Skerra (Halladale District). These sites may harvest fish destined for the Borgie, but supporting data is unavailable. The extent of Borgie fish capture is, therefore, unknown.

Angling effort has remained relatively constant in the river, although angling conditions and variable flow levels exert a major influence on angling success. A total of six to ten rods are available on the river and fishing method is restricted to fly only at all times. There is a major natural waterfall below Loch Slaim, and no angling takes place above this until June. This is thought to protecting early running fish who pass the falls before then and reach the loch.

A catch and release policy is in place which is not voluntary. All fish captured before the end of May must be returned (this is a condition of permit purchase). After this date a limited number of, largely small male fish, can be retained at the discretion and advice of the local fishery manager. Using this scheme a return rate of 86% was achieved in 2012.

Application of Rod Catch Assessment Tool

Rod catches from the Borgie over the last 20 years (1991-2010) were applied to the rod catch assessment tool to consider the current status of each run-time component.

The results of these tests for the Borgie are shown in Table 4.10. The data used to complete these tests is available in Appendix 1. These tests confirm that no reduction in exploitation is currently required for any of the run-time components, and no investigation into local issues potentially affecting any of the seasonal catches is currently necessary.

Table 4.10 - Summary of the Rod Catch Assessment Tool Tests for River Borgie.

Test	Spring	Summer	Autumn
A	No	No	No
B	No	No	No
C	No	No	No

Rod catches for the 20 year period considered (1991-2010) for total catch and each seasonal component are provided in Figures 4.7, 4.8, 4.9 and 4.10. An F-test was applied to data for each of the seasonal components to assess whether the slope of the trend differs from horizontal. These analyses are summarised in Table 4.11, and confirm no significant trend in spring or summer catch. The analysis also confirms a significant increase (at the 95% confidence level) in autumn catch over this period.

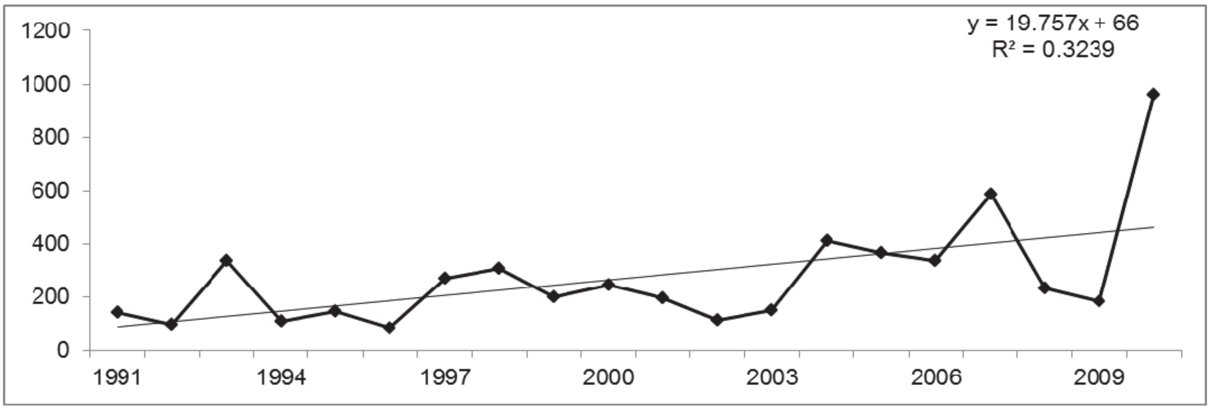


Figure 4.7 - River Borgie total rod catch 1991-2010 (salmon and grilse, retained and released).

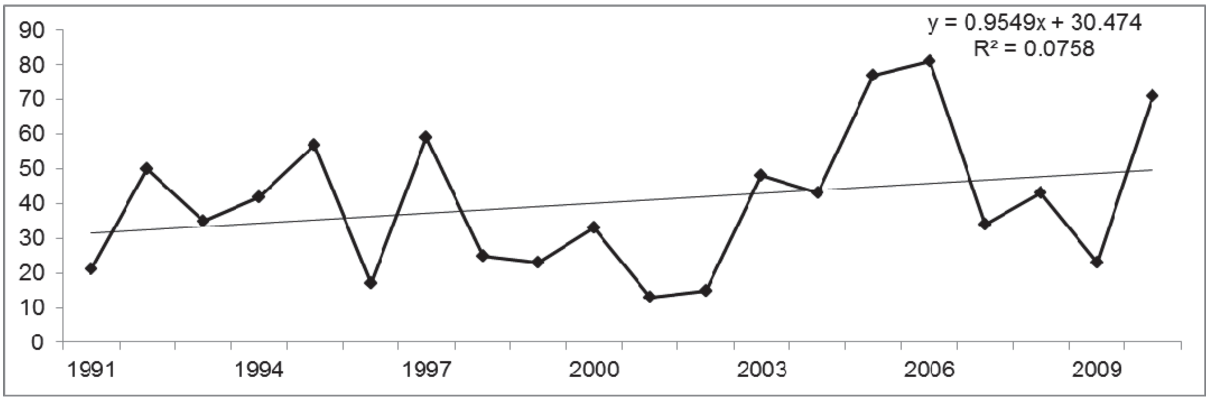


Figure 4.8 - River Borgie Spring rod catch 1991-2010 (salmon and grilse, retained and released).

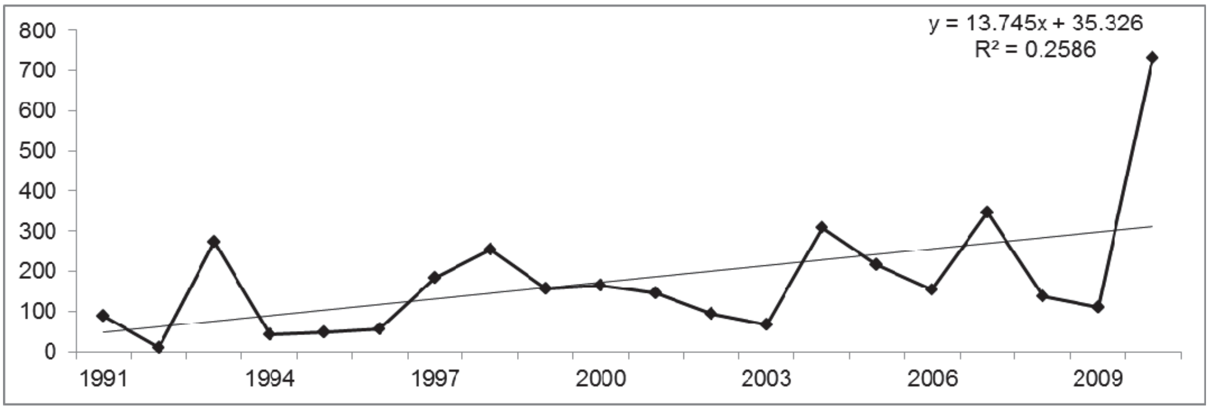


Figure 4.9 - River Borgie Summer rod catch 1991-2010 (salmon and grilse, retained and released).

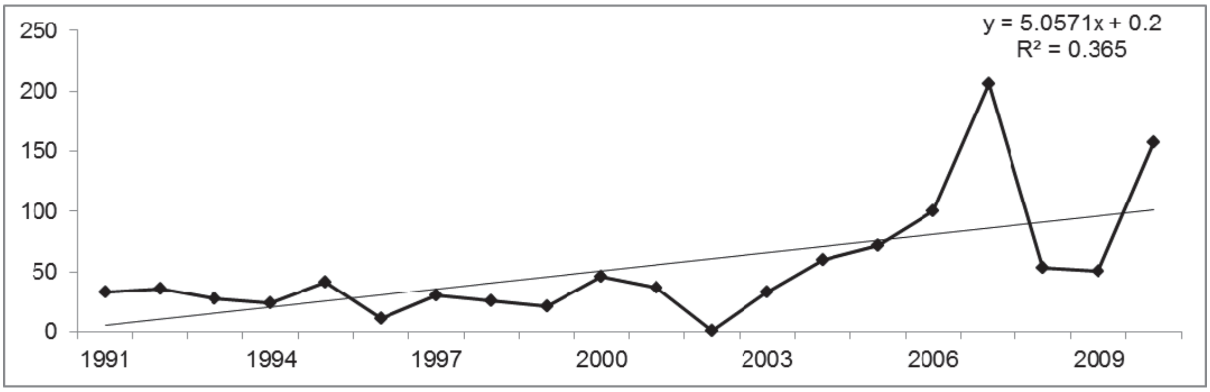


Figure 4.10 - River Borgie Autumn rod catch 1991-2010 (salmon and grilse, retained and released).

Table 4.11 - Summary of F-Test Results on River Borgie Seasonal Rod Catch (1991-2010).

Component	Observations	F-Value	F-Significance
Spring	20	1.476	0.240
Summer	20	6.278	0.220
Autumn	20	10.345	0.004

Finally, the percentage change in the spring, summer and autumn rod catches were considered for the two site condition monitoring cycles since the year of designation (1998). The data series considered in cycle 1 was 1999-2004, and cycle two 1999-2010. In this review, the rod catch is averaged for each cycle period and the increase or decrease in average rod catch expressed as a percentage of the rod catch in the year of designation.

This assessment is shown in Figure 4.11. When comparing the average rod catches in cycle one from those recorded in the year of designation, the data show increased rod catches for the spring and autumn stock components, and a decrease in the summer rod catch. When average rod catches in the cycle two period are compared with the 1998 catch the same pattern of increased spring and autumn rod catch but reduced summer rod catch is evident. The greatest change in rod catch is the increased autumn catch. This is in part due to the low ‘baseline’ autumn catch recorded in 1998, which has been exceeded ten times in the period 1999-2010. Significantly higher rod catches were recorded in the years 2004-2010, 2007 and 2010.

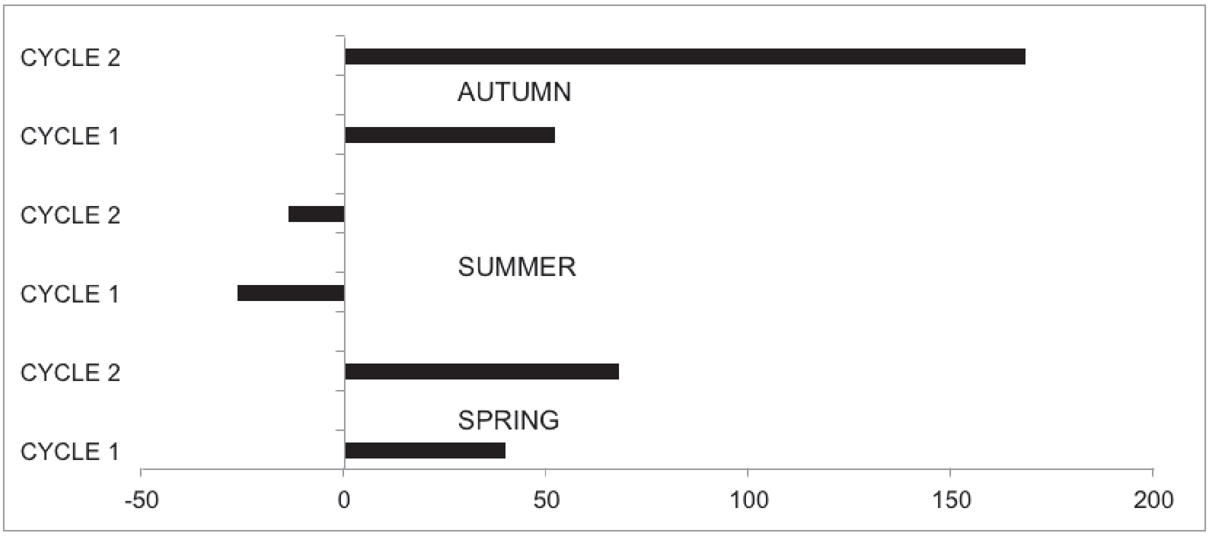


Figure 4.11 - Stock trend assessment since River Borgie SAC Designation (1998) in cycle 1 (1999-2004) and cycle 2 (1999-2010).

Summary

Rod catches show an overall increasing trend in River Borgie over the period 1952-2010 but catches are variable. The reason(s) behind the zero catch records from 1953-1956 are unknown and there are periods when total rod catches were high. This is true of the mid-1960's, 2004-2007 and 2010. Lower rod catches were reported throughout most of the 1980s and until the mid-1990's. Over the same period, the spring catch has shown an overall decline. The summer catch has increased from a low baseline highest rod catch records in 1989, 2007 and 2010. The autumn rod catch has remained stable with high rod catches being reported in the mid-1960's, f2004-2007 and 2010. The highest catch on record was made in 2010 which was almost double the previous highest catch in 2007.

Application of the rod catch assessment tool to the recorded catches over the last 20 years (1991-2010) indicates that no reduction in exploitation is required and no investigations into the existence of local problems are necessary for any of the spring, summer or autumn run-time components. When catches for each run-time component are considered individually over this period there is a significant increase in the autumn catch but no change in either the spring or summer run components.

When average catch is compared since designation in 1998 over cycle one (1999-2004) and cycle two (1999-2010) we can see an increase in both spring and autumn catch and a decrease in summer catch in each cycle.

In combination, these assessments of adult rod catch in the River Borgie indicate an improving situation since designation in 1998 within the longer term context of decline in the spring and autumn fishery since 1952. These assessments indicate, for the River Borgie, the catches over the 1952-2010 period are relatively stable and with generally high catches recorded since approximately 2000, there is no indication of a need for further conservation measures or investigations to any of the spring, summer or autumn run components.

Average catches since designation in 2001 are increasing for spring and autumn components.

c) Habitats supporting the qualifying feature

1. Water quality and quantity

The condition status of each water body within the River Borgie SAC, for which SEPA hold data, was obtained from the SEPA River Basin Planning website.

A total of three WFD water bodies representing a river length of 26.24 km occur within the boundary of the River Borgie SAC. All of these are classified as being of good or high ecological status and are protected from deterioration from that class. There are no Heavily Modified Water bodies (HMWBs) within the River Borgie SAC. WFD waterbody classification information is summarised in Table 4.12.

Table 4.12 - Number of water bodies and length of channel within each WFD status category in the River Borgie SAC.

WFD status (2009)	High	Good	Moderate	Poor	Bad	Total
Number of water bodies	1	2				3
Length of channel (km)	0.24	26				26.24

2. Trends, changes and activities

The key issues considered to have a negative impact on salmon in the River Borgie are activities associated with the forestry. Anecdotal reports suggest that run-off speeds have increased, and that water fluctuations become more intense as a result of forestry drainage operations. Concerns also exist about the input of fine material associated with ground disturbances caused by large scale forestry felling activities into surface waters. Disturbance by cattle, fish farm escapes and leachate from old landfill site are also considered locally to be issues of concern.

Fisheries management practices have improved within the Borgie, and these changes are considered to be making a positive contribution to the system. Specifically, these include a reduction of fish stocking activities, and the promotion of a catch and release policy to increase spawning stock.

The main activities or concerns locally in relation to Atlantic salmon in the River Borgie catchment are considered to be:

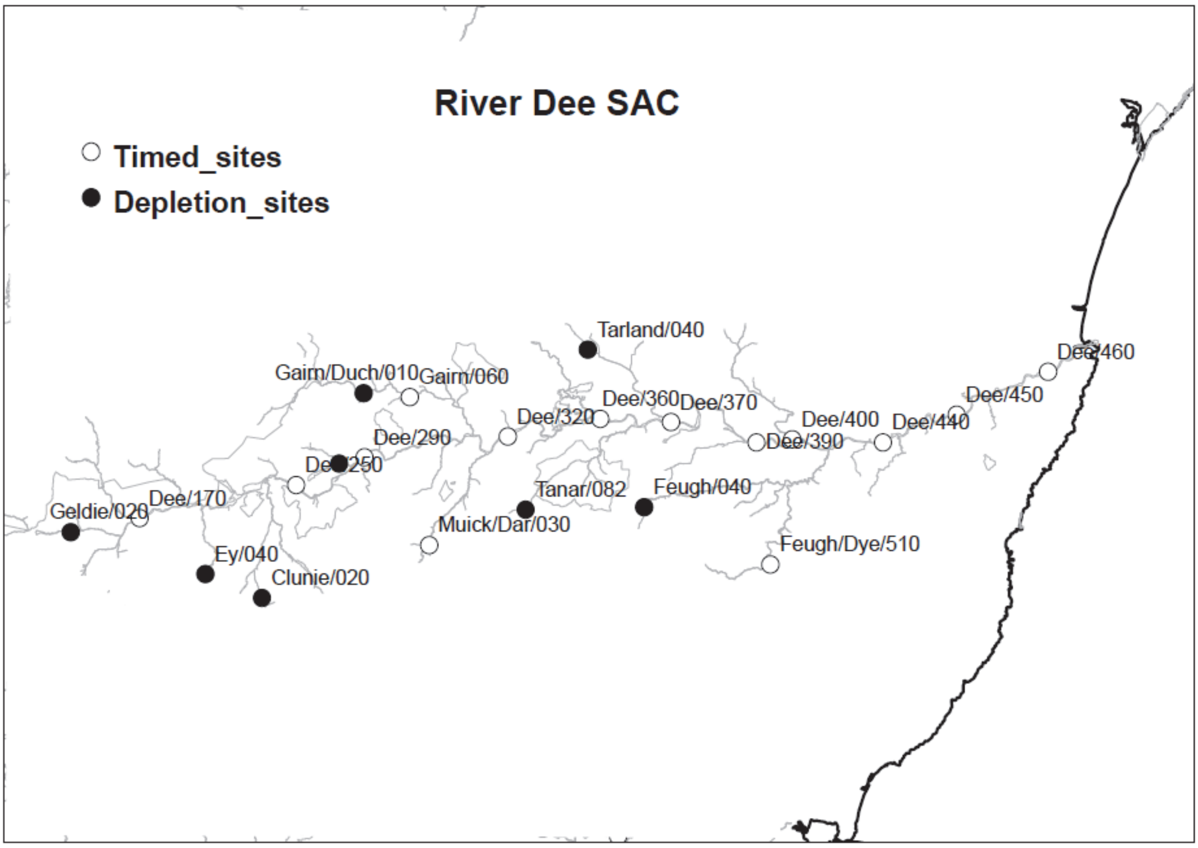
- Forestry drainage and increasing the speed of water run-off and altering water height fluctuations;
- Water quality issues due to sediment input caused by land drainage and disturbance activities; and
- Poaching of bankside areas by cattle.

5. RIVER DEE

a) Juvenile Assessment

Eight sites were surveyed using the standard SFCC catch depletion electrofishing method. A further 14 sites were sampled using a five-minute timed electrofishing approach. All sites were situated within the River Dee SAC. The depletion sites were located throughout the tributaries while the timed sites were focussed primarily on the main river channel which was too large for depletion electrofishing (Map 5.1). The sites were fished by staff of the River Dee Trust.

Map 5.1 - Distribution of depletion and timed electrofishing sites on the River Dee SAC.



Depletion sites

Site details and a summary of electrofishing results are shown in Tables 5.1 – 5.4. Zippin and Carl and Strube estimates for fry were calculable for all sites although confidence limits were wide in some cases. Seven sites were calculable for 1+ fish and five sites for 2+. For fry, Zippin densities ranged from 12-114 per 100 m^2 (mean 47) and Carl and Strube densities ranged from 11-111 per 100 m^2 (mean 44). 0+ and 1+ fish were caught at all eight sites and 2+ fish at six sites. 2+ fish were absent from the Tarland Burn and the Duchrie Burn. The largest 0+ and 2+ fish were found on the Ey Burn (51 and 147 mm respectively) while the Tarland Burn had the largest 1+ fish (93 mm) (Table 5.4). Trout were present at all eight sites. The highest densities of 0+ and 1+ fish were found in the Feardar Burn (114 and

81 per 100 m^2 respectively – Zippin estimates) (Figure 5.1). The lowest densities of 0+ and 1+ fish were found in the Ey Burn (12 and 18 per 100 m^2 respectively).

Table 5.1 - Details of depletion electrofishing sites, River Dee SAC.

Site code	Date	Easting	Northing	Altitude (m)	Channel name
Tanar/082	02/09/11	340439	789354	387	Water of Tanar
Feugh/040	03/09/11	352108	789592	262	Water of Feugh
Clunie/020	08/09/11	314517	780649	487	Clunie Water
Geldie/020	08/09/11	295685	787113	519	Geldie Burn
Gairn/Duch/010	01/08/11	324495	800825	418	Duchrie Burn
Feardar/020	04/08/11	322114	793871	316	Feardar Burn
Ey/040	24/08/11	308922	782992	471	Ey Burn
Tarland/040	21/07/11	346562	805108	159	Tarland Burn

Table 5.2 - Details of depletion electrofishing for 0+ and 1++ salmon, River Dee SAC.

Site code	Wetted area (m^2)	Zippin 0+	Carl & Strube 0+	Zippin 1+	Carl & Strube 1+	Zippin 2+	Carl & Strube 2+
Tanar/082	109	51.3	42.3	50.7	49.6	5.7	5.5
Feugh/040	99	52.1	44.5	61.0	59.7	4.1	4.1
Clunie/020	90	44.5	43.1	28.3	26.6	n/a	n/a
Geldie/020	137	32.4	31.5	18.1	16.9	17.0	16.1
Gairn/Duch/010	86	28.5	24.3	32.9	32.4	n/a	n/a
Feardar/020	94	113.7	111.0	81.3	80.0	15.0	10.7
Ey/040	151	11.8	11.3	17.6	15.2	2.7	2.7
Tarland/040	122	45.0	41.8	n/a	n/a	0.0	0.0

n/a denotes salmon present, but not in high enough densities to allow calculation of Zippin or Carl & Strube statistics. 0 denotes no salmon found at site.

Table 5.3 - Presence/absence of salmon year classes and of trout 0+ and 1++ at depletion sites, River Dee SAC.

Site code	Salmon age class present?				Trout present?	
	0+	1+	2+	3++	0+	1++
Tanar/082	Y	Y	Y	N	Y	Y
Feugh/040	Y	Y	Y	N	Y	Y
Clunie/020	Y	Y	Y	N	Y	Y
Geldie/020	Y	Y	Y	N	Y	Y
Gairn/Duch/010	Y	Y	N	N	Y	Y
Feardar/020	Y	Y	Y	N	Y	Y
Ey/040	Y	Y	Y	N	Y	Y
Tarland/040	Y	Y	N	N	Y	Y

Table 5.4 - Fork length of salmon of different age classes, River Dee SAC.

Site code	0+ mean fork length	No. 0+	1+ mean fork length	No. 1+	2+ mean fork length	No. 2+	3+ mean fork length	No. 3+
Tanar/082	36	34	73	50	111	6	n/a	0
Feugh/040	47	34	82	61	115	4	n/a	0
Clunie/020	46	39	89	24	123	1	n/a	0
Geldie/020	37	40	69	22	101	21	n/a	0
Gairn/Duch/010	37	19	80	28	n/a	0	n/a	0
Feardar/020	32	90	63	74	97	9	n/a	0
Ey/040	51	4	91	13	147	3	n/a	0
Tarland/040	39	43	93	1	n/a	0	n/a	0

n/a denotes means could not be calculated as no salmon of that age class were found at the site.

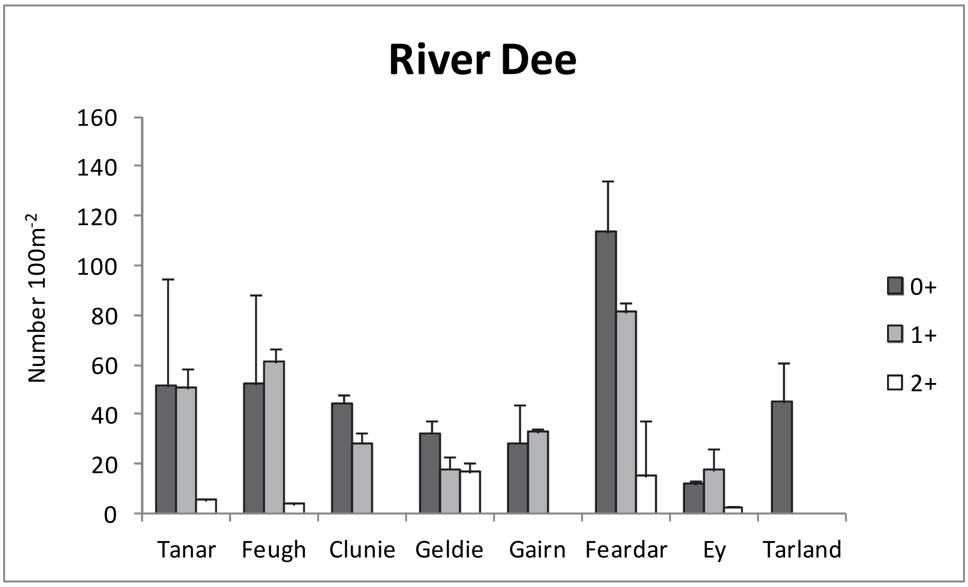


Figure 5.1 - Juvenile salmon population density estimated by the Zippin method for the SAC monitoring sites on the River Dee SAC.

Timed sites

Details of the 14 timed sites are given in Table 5.5. CPUE for fry ranged from 0/min to 3.8/min and for 1++ fish, ranged from 0/min to 1.8/min (Table 5.6, Figure 5.2). 0+ salmon were caught at 13 of the 14 timed sites, and 1+ fish at 11 sites (Table 5.7). No salmon of any age were caught at one site on the main channel and 2+ salmon were caught at only one site, also on the main channel. Trout were found at only two sites, one on the main channel and one on the Muick tributary.

Table 5.5 - Details of timed electrofishing sites, River Dee SAC.

Site code	Easting	Northing	River	Altitude (m)
Dee/390	363165	795971	River Dee	83
Dee/450	382837	798713	River Dee	19
Feugh/Dye/510	364514	783932	Water of Dye	195
Dee/360	347780	798303	River Dee	142
Dee/400	366672	796292	River Dee	22
Dee/440	375600	795980	River Dee	40
Dee/460	391829	802923	River Dee	4
Dee/370	354714	797962	River Dee	120
Dee/170	302469	788530	River Dee	397
Dee/290	324587	794518	River Dee	286
Dee/250	317861	791761	River Dee	308
Gairn/060	329046	800435	River Gairn	333
Dee/320	338663	796571	River Dee	196
Muick/Dar/030	330954	785834	River Muick	386

Table 5.6 - Salmon catch per unit effort (CPUE), River Dee SAC.

Site code	Survey date	Salmon 0+/min	Salmon 1++/min
Dee/390	31/08/11	2.0	0.4
Dee/450	31/08/11	5.0	0.0
Feugh/Dye/510	31/08/11	2.0	1.0
Dee/360	31/08/11	2.0	1.0
Dee/400	05/09/11	0.8	0.2
Dee/440	05/09/11	1.0	0.6
Dee/460	05/09/11	0.0	0.0
Dee/370	06/09/11	3.8	1.6
Dee/170	08/09/11	0.2	0.0
Dee/290	23/08/11	3.8	0.6
Dee/250	23/08/11	1.8	1.2
Gairn/060	23/08/11	1.4	0.4
Dee/320	24/08/11	2.6	1.8
Muick/Dar/030	24/08/11	3.0	0.4

Table 5.7 - Presence/absence of salmon year classes and of trout at timed sites, River Dee SAC.

Site code	Salmon age class present? 0+	1+	2+	3+	Trout present?
Dee/390	Y	Y	N	N	N
Dee/450	Y	N	N	N	Y
Feugh/Dye/510	Y	Y	N	N	N
Dee/360	Y	Y	N	N	N
Dee/400	Y	Y	N	N	N
Dee/440	Y	Y	N	N	N
Dee/460	N	N	N	N	N
Dee/370	Y	Y	N	N	N
Dee/170	Y	N	N	N	N
Dee/290	Y	Y	N	N	N
Dee/250	Y	Y	Y	N	N
Gairn/060	Y	Y	N	N	N
Dee/320	Y	Y	N	N	N
Muick/Dar/030	Y	Y	N	N	Y

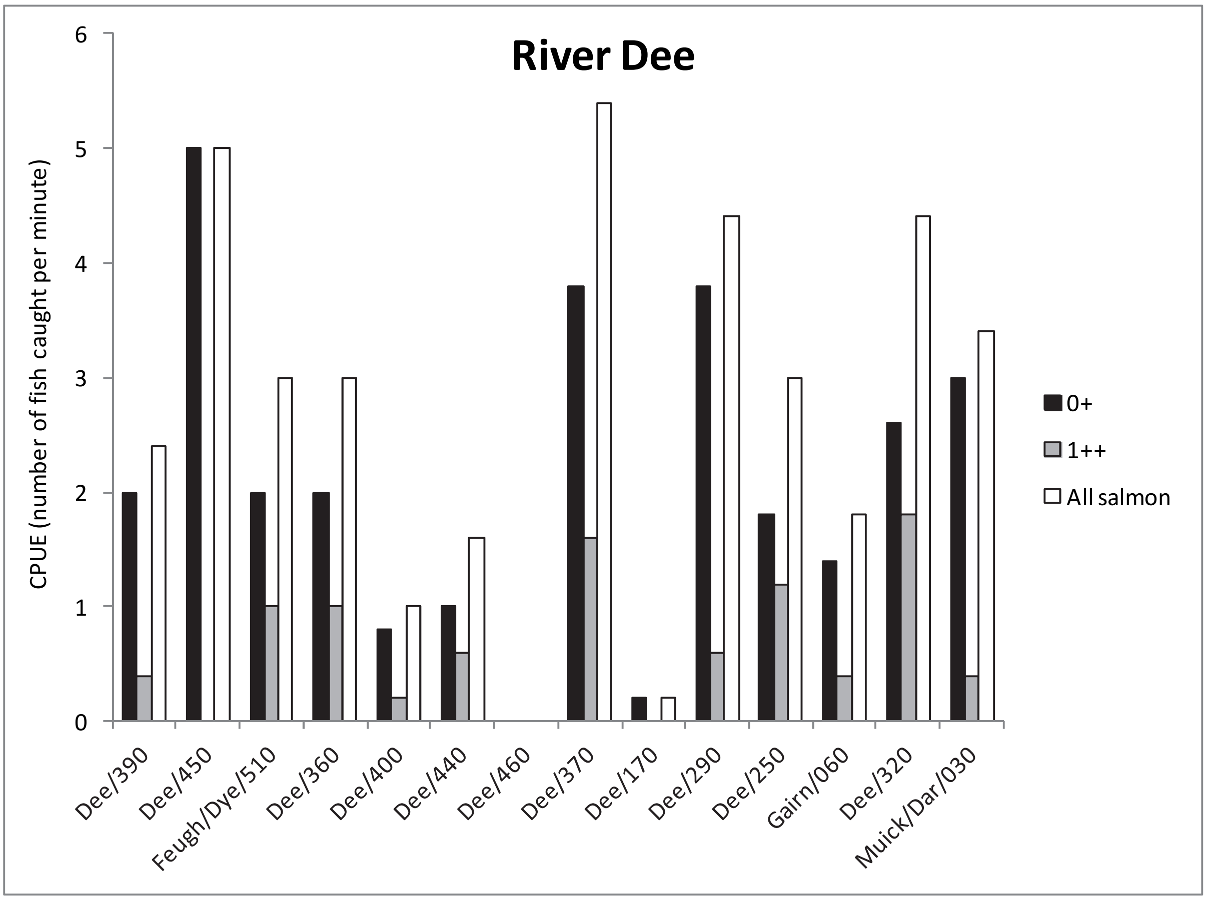


Figure 5.2 - Number of salmon (0+, 1++ and all salmon) caught per minute during five minutes of electrofishing at sites on the River Dee.

Summary

When the densities of 0+ and 1++ juveniles are considered in relation to the regional quintiles described by Godfrey (2005), they are spread across most bands for fry, and almost all parr sites are placed in the top band (Table 5.8). These data suggest a high variability in fry density across the catchment, possibly reflecting local differences in juvenile productivity. These differences may be associated with natural production limits associated with, for example, habitat quality, the number of spawning adults reaching survey locations or the impact of external pressures which limit natural production. Recruitment to the parr stage appears to be excellent given the high densities which are present in the majority of sites sampled. Despite differences in densities between fry and parr, it is suggested that both are in favourable status and therefore the overall assessment based upon the sites surveyed is that juvenile populations should be that they are in favourable status within the boundary of the SAC (see Table 5.8)

Table 5.8 – Number of sites within the River Dee SAC falling within each quintile (according to absolute regional classification for 0+ and 1++ age classes) – and the resulting condition status.

SAC	Age class	Number of sites					Median grade	Favourable condition?
		0-20	21-40	41-60	61-80	81-100		
		E	D	C	B	A		
Dee	0+		1	2	4	1	B	Y
	1++	1				7	A	Y

The variability in fry densities found confirms that within the River Dee catchment there are areas of higher and lower production and areas where local management problems and issues may exist, and which may require active management.

The methodology adopted for the juvenile assessment shows that the status of the River Dee was the same in 2011 compared to the previous assessment for both fry and parr (Table 5.9).

Table 5.9 - Comparison of condition status in 2004 and in 2011 for 0+ and 1++ age classes.

SAC		2004	2011	Change
Dee	0+	Y	Y	=

	1++	Y	Y	=

b) Adult Assessment

Data for adult Atlantic salmon populations in the River Dee were analysed using the NASCO Rod Catch Assessment tool introduced and described in Section 1. This analysis considers the declared rod catch in total and as seasonal components (spring, summer and autumn) to provide an assessment of adult population. In addition to this, Marine Scotland Science rod catch statistics (available from 1952 to the present) for the overall catch and the same run-time components are also examined.

Summary of 1952 Catch Statistics

The published rod catch statistics for all Atlantic salmon captured in the River Dee are shown in Figure 5.3. Data presented also for the spring, summer and autumn run-time components in Figures 5.4, 5.5 and 5.6.

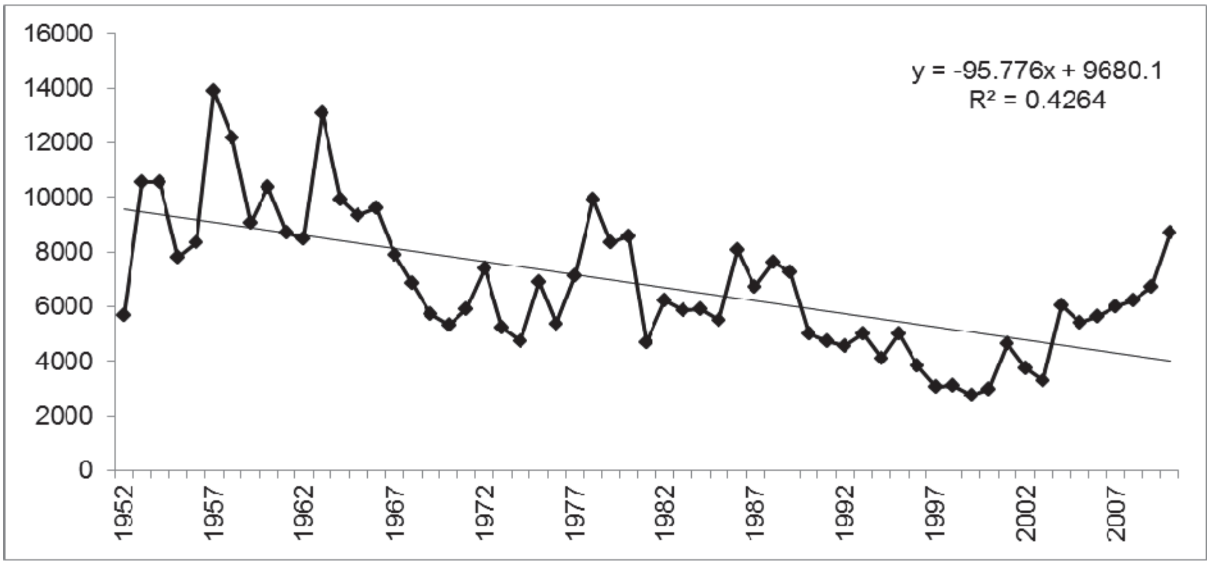


Figure 5.3 - River Dee total rod catch 1952-2010 (salmon and grilse, retained and released).

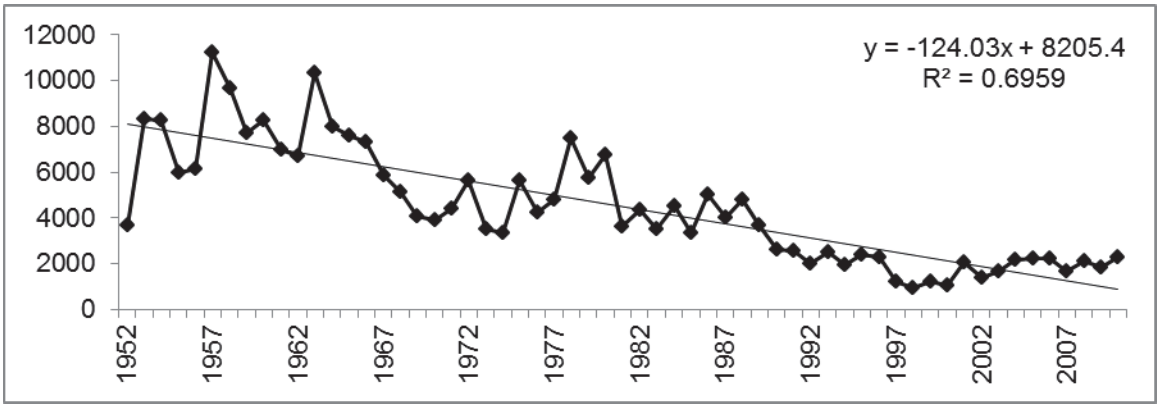


Figure 5.4 - River Dee total Spring rod catch 1952-2010 (salmon and grilse, retained and released).

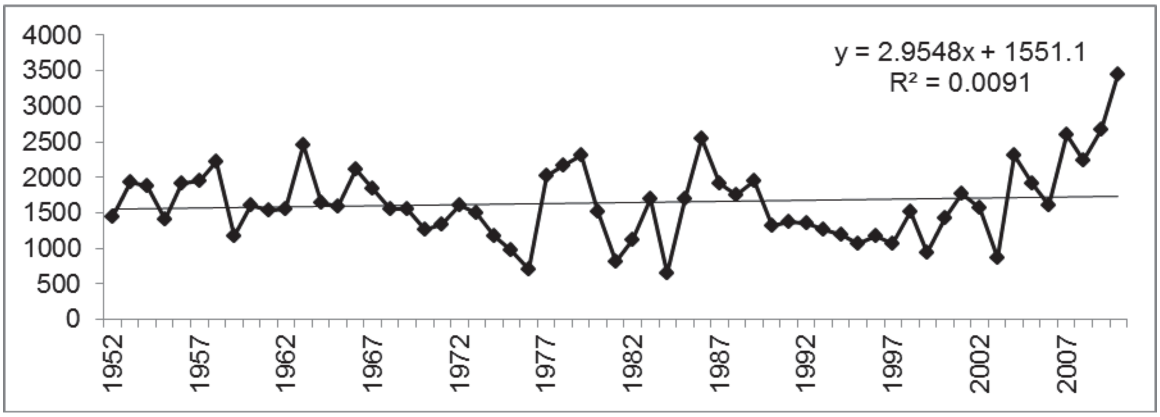


Figure 5.5 - River Dee total Summer rod catch 1952-2010 (salmon and grilse, retained and released).

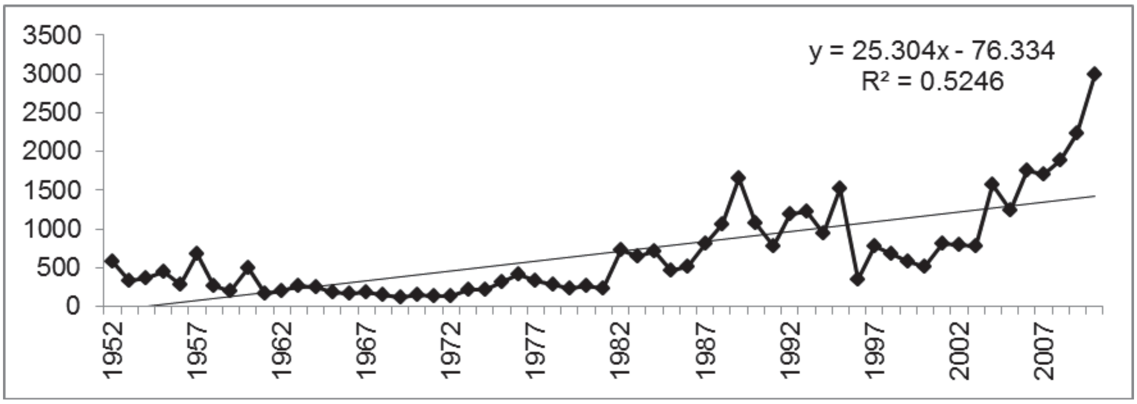


Figure 5.6 - River Dee total Autumn rod catch 1952-2010 (salmon and grilse, retained and released).

Figure 5.3 shows an overall decline in the rod catch over the period 1952-present, however a notable increase in total rod catch post-2000. The spring catch (Figure 5.4) shows a similar trend with again some evidence of recovery since around the year 2000. The summer catch (Figure 5.5) shows a stable overall trend line but with an increase in rod catch since 2004, with all years since then being above the overall trend line for the period. Autumn rod catches (Figure 5.6) show an increasing trend over the longer term, with this increase being particularly marked in the years post-2004.

The quality of reporting for rod catch has been consistent and there is no evidence that any trends summarised may be attributable to a change in reporting accuracy. In 1994 the Dee DSFB introduced a voluntary catch and release policy to the river. Although this was originally introduced to protect and conserve spring fish, this policy has now been extended more widely. Since 2000, an average of 93% of all fish have been returned after capture (River Dee Trust, *pers. comm.*). This policy may have made an important contribution to the improvement in catch in recent years, and particularly since 2000.

Prior to the introduction of the catch and release policy in 2000, the DSFB applied an alternative conservation measure to protect spring fish. During this period the start of the fishing season was delayed until 1st March from 1996-2000 from a previous start date of 1st February. This policy reduced fishing effort in the early part of the season and may also have contributed to reduced spring catches in each of these years.

Netting effort within the Fishery District has been in general decline since the 1970's and ceased completely in the late 1990s. This change in exploitation, in parallel with the establishment of the catch and release policy may also have contributed to recent catch recoveries.

Application of Rod Catch Assessment Tool

The catches from the Dee over the last 20 years (1991-2010) were applied to the NASCO rod catch assessment tool to consider the current status of each run-time component.

The summary outcome for these tests for the River Dee is shown in Table 5.10, and the data used to complete them is available in Appendix 1. These tests confirm that no reduction in exploitation or investigation as to whether local problems exist is required for any of the spring, summer or autumn run-time components.

Table 5.10 - Summary of the Rod Catch Assessment Tool Tests for River Dee.

Test	Spring	Summer	Autumn
A	No	No	No
B	No	No	No
C	No	No	No

Rod catch for the 20 year period (1991-2010) are presented for total rod catch and the seasonal components in Figures 5.7, 5.8, 5.9 and 5.10. An F-test was applied to each of the seasonal components to assess deviation from a horizontal trend. These are summarised in Table 5.11 and suggest no significant trend in spring catch and a significant upward trend (at the 95% confidence level) in summer and autumn catch over the period.

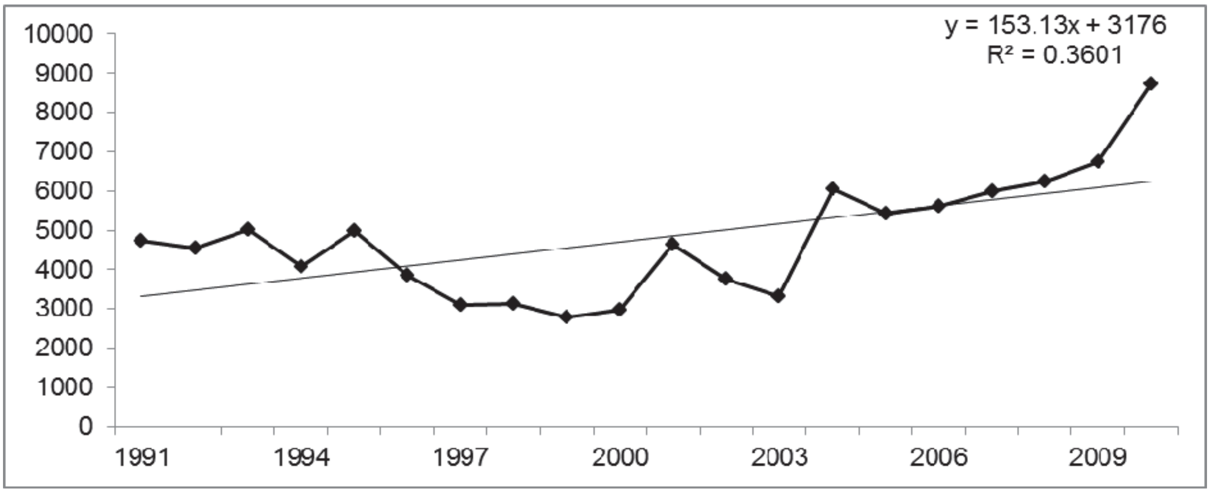


Figure 5.7 - River Dee total rod catch 1991-2010 (salmon and grilse, retained and released).

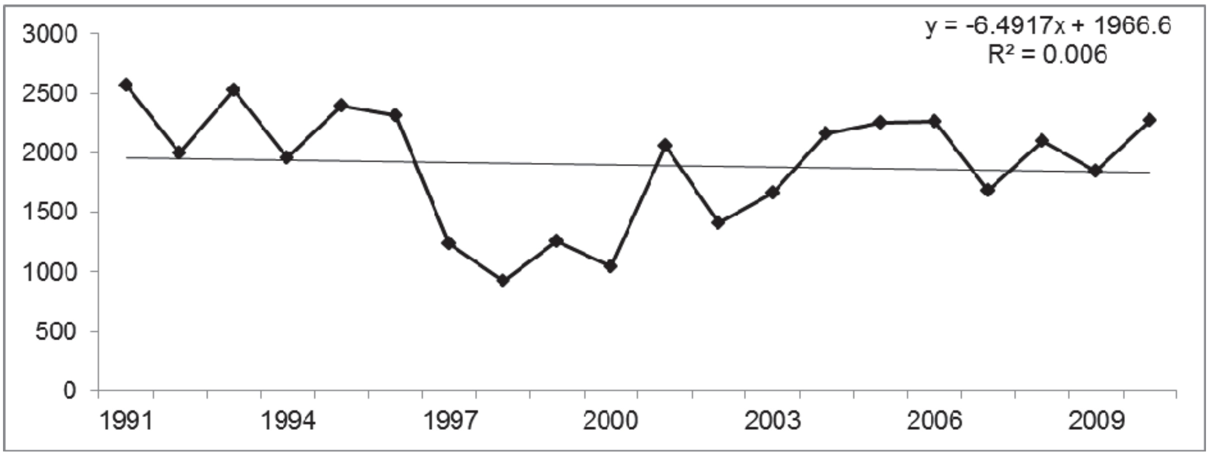


Figure 5.8 - River Dee Spring rod catch 1991-2010 (salmon and grilse, retained and released).

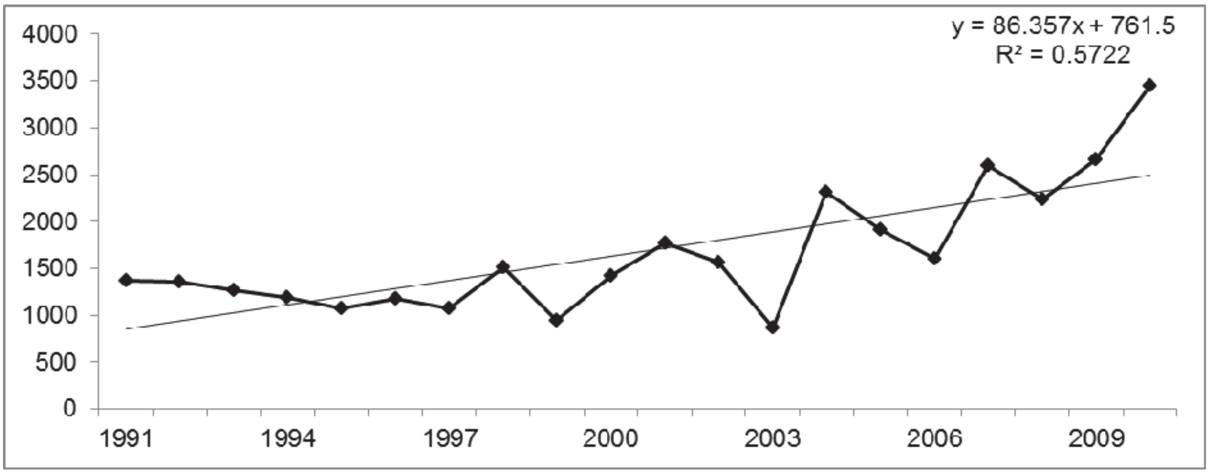


Figure 5.9 - River Dee Summer rod catch 1991-2010 (salmon and grilse, retained and released).

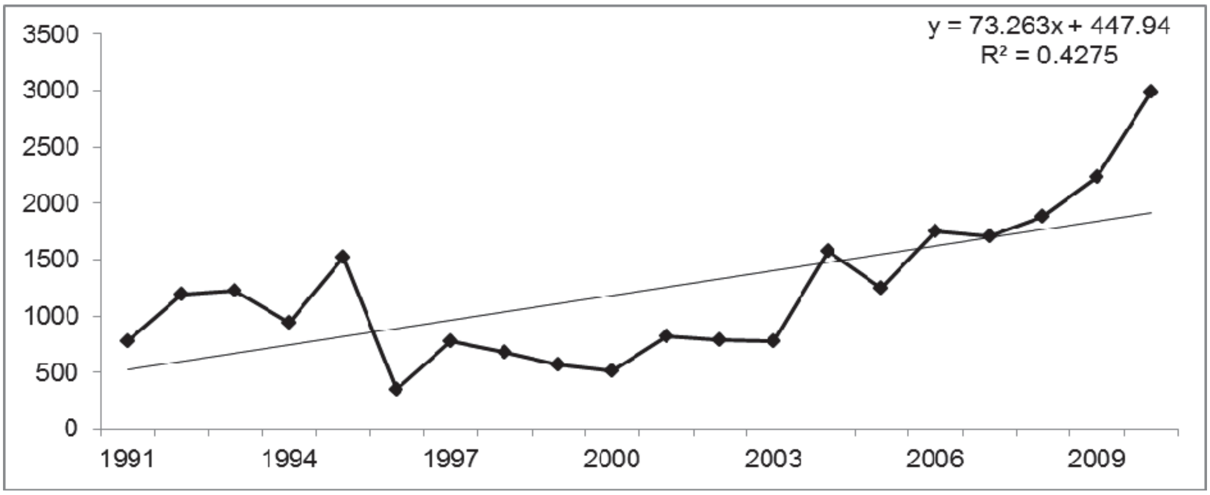


Figure 5.10 - River Dee Autumn rod catch 1991-2010 (salmon and grilse, retained and released).

Table 5.11 - Summary of F-Test Results on River Dee Seasonal Rod Catch (1991-2010).

Component	Observations	F-Value	F-Significance
Spring	20	0.1086	0.7454
Summer	20	24.0711	0.0001
Autumn	20	13.44	0.0017

Finally, the percentage change in the spring, summer and autumn rod catches were considered for the two SCM cycles undertaken since the year of designation (2002). The first assessment was undertaken during 2003-2004 and cycle 2 covers the period 2003-2010. In this review the rod catch is averaged for each cycle period and the increase or decrease in average rod catch expressed as a percentage of the rod catch in the year of designation.

This assessment is shown in Figure 5.11, and indicates that, for all stock components on the River Dee, there has been an increase in average rod catch since the year of designation. This increase is most prominent in the autumn catch but the increase is greater over the longer cycle two period for each component.

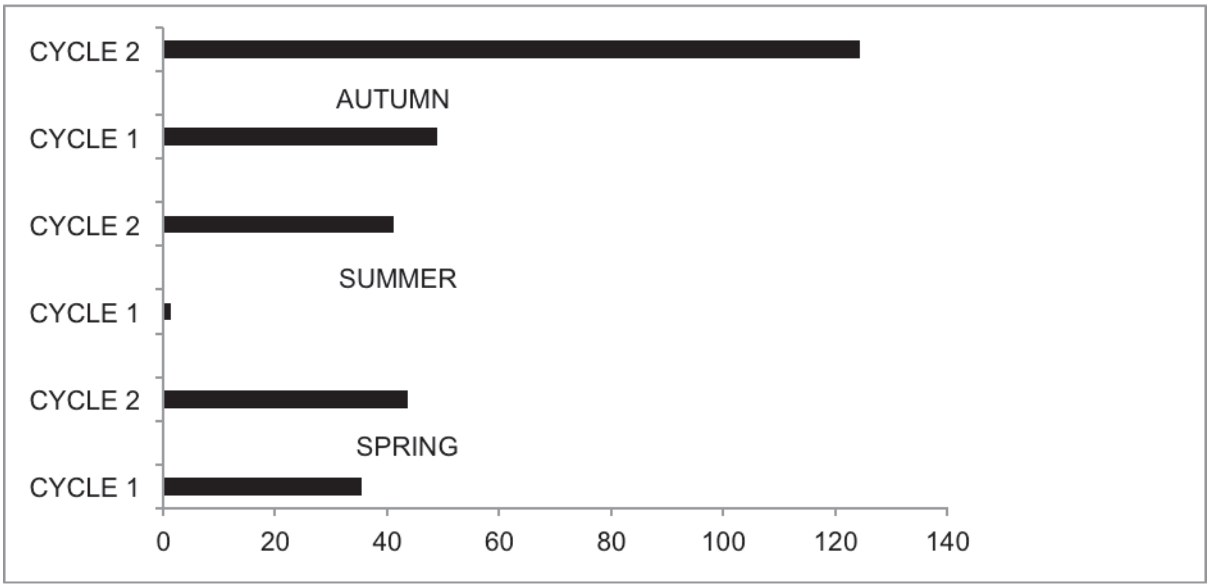


Figure 5.11 - Stock trend assessment since River Dee SAC Designation (2002) in cycle 1 (2003-2004) and cycle 2 (2003-2010).

Summary

The overall trend in rod catch within the River Dee over the period 1952-2010 shows a decline and this is particularly prominent in the spring catch. The summer rod catch has been relatively stable over the data series and the autumn rod catch has exhibited an increasing trend. In recent years, both the summer and autumn fishery components have recorded rod catches above the long-term trend and the spring fishery has also reported rod catches above the downward trend line, indicating signs of recovery.

The application of the rod catch assessment tool to the recorded catches over the last 20 years (1991-2010) indicate that no reduction in exploitation is required and no investigations into the existence of local problems are necessary for any of the seasonal run-time components. When catches for each run-time component are considered individually there is no significant change in spring catch, but significant increases in both the summer and autumn catch components.

When average catch for each SCM reporting cycle is compared to those reported in the year of designation in 2002 there is an increase in the reported rod catch of all run-time components. This is particularly true of the autumn rod catch, and particularly in the cycle two assessment period.

In combination these assessments of adult rod catch in the River Dee indicate an improving situation since designation in 2002 within the longer term context of decline in the spring fishery since 1952.

c) Habitats supporting the qualifying feature

1. Water quality and quantity

The WFD status of each water body within the River Dee SAC, for which SEPA hold data, was obtained from the SEPA River Basin Planning interactive website.

A total of 33 WFD water bodies representing a river length of 546 km are recognised within the River Dee SAC. Of these 17 are classified as being of good or high ecological status (total length 238 km) and are protected from deterioration from that class. The remaining 16 (river length 300 km) are classified as being at moderate, poor or bad ecological status and, therefore, require improvement to bring them up to at least good status. The most common cause of a waterbody classification being less than good status in the River Dee SAC is morphological alteration that give rise to fish passage issues. Several sites are classified as being at less than good ecological status due to water abstraction pressures, and one site has been impacted by non-renewable energy generation and diffuse pollution from forestry activities. There are no Heavily Modified Water bodies (HMWBs) within the River Dee SAC.

Table 5.12, below, summarises the number of water bodies and the length of channel within each status category.

Table 5.12 - Number of water bodies and length of channel within each WFD status category in the River Dee SAC.

WFD status (2009)	High	Good	Moderate	Poor	Bad	Total
Number of water bodies	3	14	10	5	1	33
Length of channel (km)	51	187	202	91	11	546

2. Trends, changes and activities

Agricultural operations (e.g. ploughing, the use of fertiliser and pesticides) were identified as being the primary negative pressure on Atlantic salmon within the River Dee catchment. Water management for agriculture, such as the abstraction of water for irrigation purposes, is also considered to be a significant pressure.

Other negative factors were identified and include: grazing, burning, forestry operations, freshwater fish farm escapes, dumping, construction and INNS. Fisheries management activities such as barrier removal and habitat restoration were identified as having a positive impact on Atlantic salmon within the Dee catchment.

The main activities considered to have a negative impact on Atlantic salmon within the River Dee catchment are:

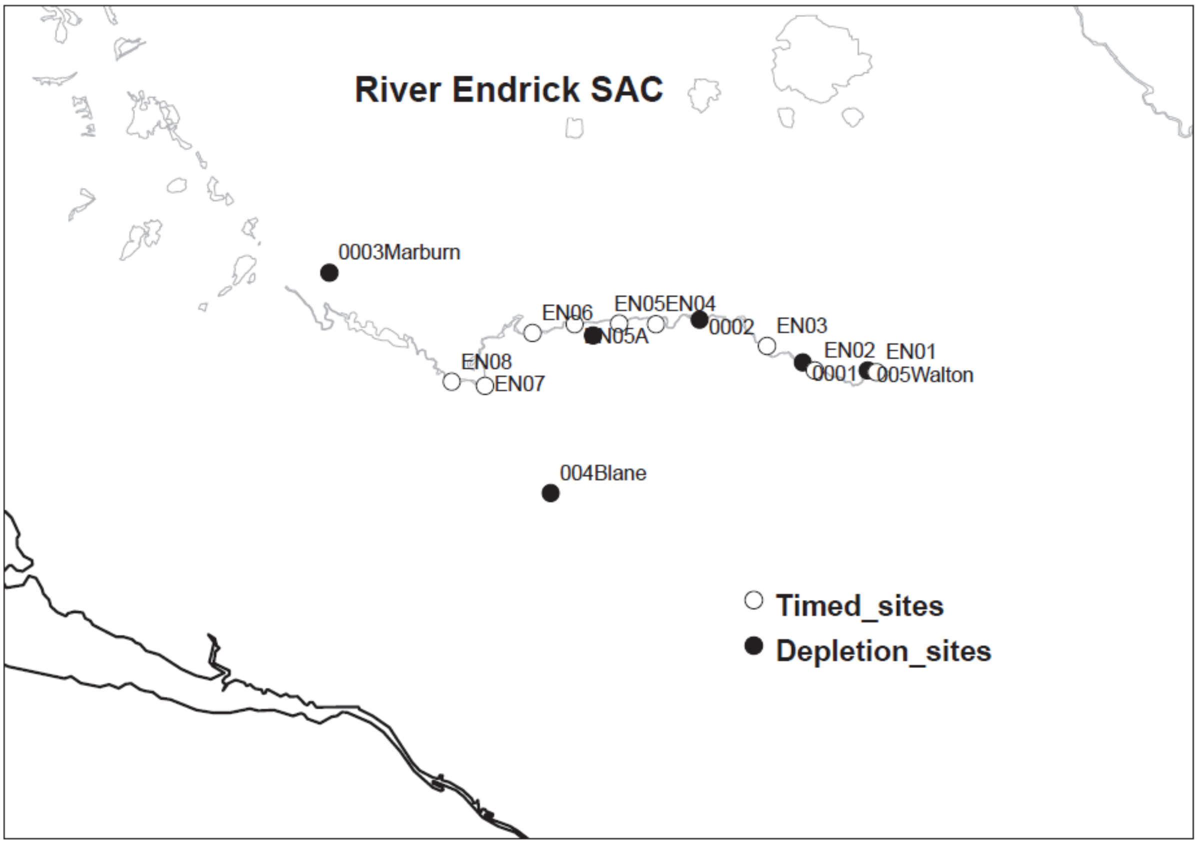
- Agricultural operations;
- Water quality (point and diffuse pollution); and
- Water management for agriculture.

6. ENDRICK WATER

a) Juvenile Assessment

Six sites were surveyed using the standard SFCC catch depletion electrofishing method. A further nine sites were sampled using a five-minute timed electrofishing approach. All sites were situated within the Endrick Water SAC (Map 6.1. The sites were surveyed by staff of the Loch Lomond Fisheries Trust.

Map 6.1 - Distribution of depletion and timed electrofishing sites on the Endrick Water SAC.



Depletion sites

Site details and a summary of electrofishing results are shown in Tables 6.1 – 6.4. Five of the six depletion sites had 0+ and 1+ salmon present. The Burn of Mar was the only site without 0+ and 1+ fish (although 2+ salmon were present). For 0+ salmon, Zippin densities were calculable for the five sites were they were present. For 1+ salmon, densities were only calculable for three sites. Confidence limits were wide for two of the sites. For fry, Zippin densities ranged from 0 - 31 per 100 m^2 (mean 21) and Carl & Strube densities ranged from 0 - 24 per 100 m^2 (mean 19). The highest 0+ densities were found in the main Endrick channel. For 1+ fish, Zippin densities ranged from 0 - 17 per 100 m^2 (mean 8) and Carl & Strube densities ranged from 0 - 16 per 100 m^2 (mean 8). The highest 1+ densities were found in the main Endrick channel as were the largest 0+ and 1+ fish (mean 69 mm and 116 mm respectively). 0+ and 1++ trout were present at all sites.

Table 6.1 - Details of depletion electrofishing sites, Endrick Water SAC.

Site code	Date	Easting	Northing	Altitude (m)	Channel name
LT12 Boquhan	15/08/11	254570	687660	50	Boquhan Burn
0001	24/08/11	262732	686604	100	Endrick
0002	30/08/11	258720	688270	70	Endrick
004Blane	31/08/11	252931	681498	25	Blane Water
005Walton	05/09/11	265252	686294	155	Walton Burn
0003Marburn	27/10/11	244329	690107	20	Burn of Mar

Table 6.2 - Details of depletion electrofishing for 0+ and 1++ salmon, Endrick Water SAC.

Site code	Wetted area (m^2)	Zippin 0+	Carl & Strube 0+	Zippin 1+	Carl & Strube 1+	Zippin 2+	Carl & Strube 2+
LT12 Boquhan	137.5	22.1	19.6	0.0	0.0	0.0	0.0
0001	306.8	23.7	23.1	5.6	5.5	0.0	0.0
0002	200.0	30.9	24.0	16.5	15.5	n/a	n/a
004Blane	243.0	19.3	18.5	2.7	2.5	0.0	0.0
005Walton	93.7	11.1	10.7	n/a	n/a	0.0	0.0
0003Marburn	123.9	0.0	0.0	0.0	0.0	0.0	0.0

n/a denotes salmon present, but not in high enough densities to allow calculation of Zippin or Carl & Strube statistics. 0 denotes no salmon found at site.

Table 6.3 - Presence/absence of salmon year classes and of trout 0+ and 1++ at depletion sites, Endrick Water SAC.

Site code	Salmon age class present?				Trout present?	
	0+	1+	2+	3++	0+	1++
LT12 Boquhan	Y	N	N	Y	Y	Y
0001	Y	Y	N	N	Y	Y
0002	Y	Y	Y	N	Y	Y
004Blane	Y	Y	N	N	Y	Y
005Walton	Y	Y	N	N	Y	Y
0003Marburn	N	N	N	Y	Y	Y

Table 6.4 - Fork length of salmon of different age classes, Endrick Water SAC.

Site code	0+ mean fork length	No. 0+	1+ mean fork length	No. 1+	2+ mean fork length	No. 2+	3+ mean fork length	No. 3+
LT12 Boquhan	56	23	n/a	0	n/a	0	117	2
0001	61	67	105	17	n/a	0	n/a	0
0002	69	34	116	28	140	1	n/a	0
004Blane	63	40	104	6	n/a	0	n/a	0
005Walton	60	10	107	9	n/a	0	n/a	0
0003Marburn	n/a	0	n/a	0	n/a	0	128	1

n/a denotes means could not be calculated as no salmon of that age class were found at the site.

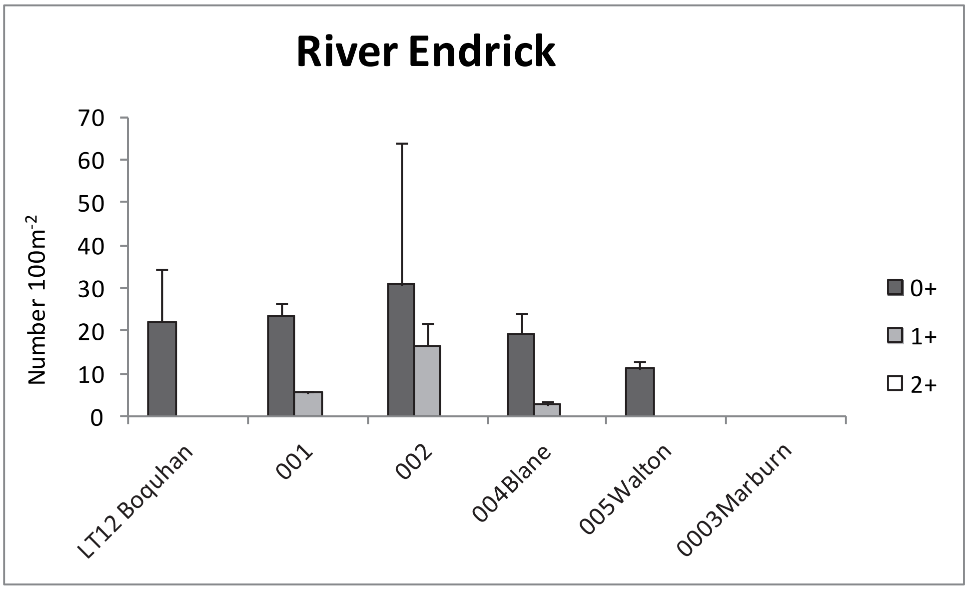


Figure 6.1 - Juvenile salmon population density estimated by the Zippin method for the SAC monitoring sites on the Endrick Water SAC.

Timed sites

Details of the nine timed sites are given in Table 6.5. CPUE for fry ranged from 0 per min to 3/min and for 1++ fish, ranged from 0/min to 2/min. 0+ salmon were caught at eight of the nine timed sites, and 1++ fish at six sites. No salmon of any age were caught at one site on the main channel. Trout were caught at six of the nine sites.

Table 6.5 - Details of timed electrofishing sites, Endrick Water SAC.

Site code	Easting	Northing	River	Altitude (m)
EN05	255592	688120	Endrick Water	45
EN05A	253860	688100	Endrick Water	40
EN04	257032	688093	Endrick Water	60
EN01	265600	686220	Endrick Water	155
EN02	263200	686294	Endrick Water	95
EN03	261332	687250	Endrick Water	80
EN06	252222	687750	Endrick Water	50
EN07	250376	685680	Endrick Water	15
EN08	249090	685855	Endrick Water	30

Table 6.6 - Salmon catch per unit effort (CPUE), Endrick Water SAC.

Site code	Survey date	Salmon 0+/min	Salmon 1++/min
EN05	27/07/11	1.0	1.2
EN05A	27/07/11	0.2	0.2
EN04	03/08/11	1.2	0.8
EN01	03/08/11	1.0	1.4
EN02	09/08/11	0.8	1.0
EN03	09/08/11	3.0	2.0
EN06	23/08/11	0.6	0.4
EN07	23/08/11	0.4	0.0
EN08	23/08/11	0.0	0.0

Table 6.7 - Presence/absence of salmon year classes and of trout at timed sites, Endrick Water SAC.

Site code	Salmon age class present?				Trout present?
	0+	1+	2+	3+	
EN05	Y	Y	Y	N	N
EN05A	Y	Y	N	N	N
EN04	Y	Y	N	N	Y
EN01	Y	Y	Y	N	Y
EN02	Y	Y	N	N	Y
EN03	Y	Y	Y	N	Y
EN06	Y	N	Y	N	Y
EN07	Y	N	N	N	Y
EN08	N	N	N	N	N

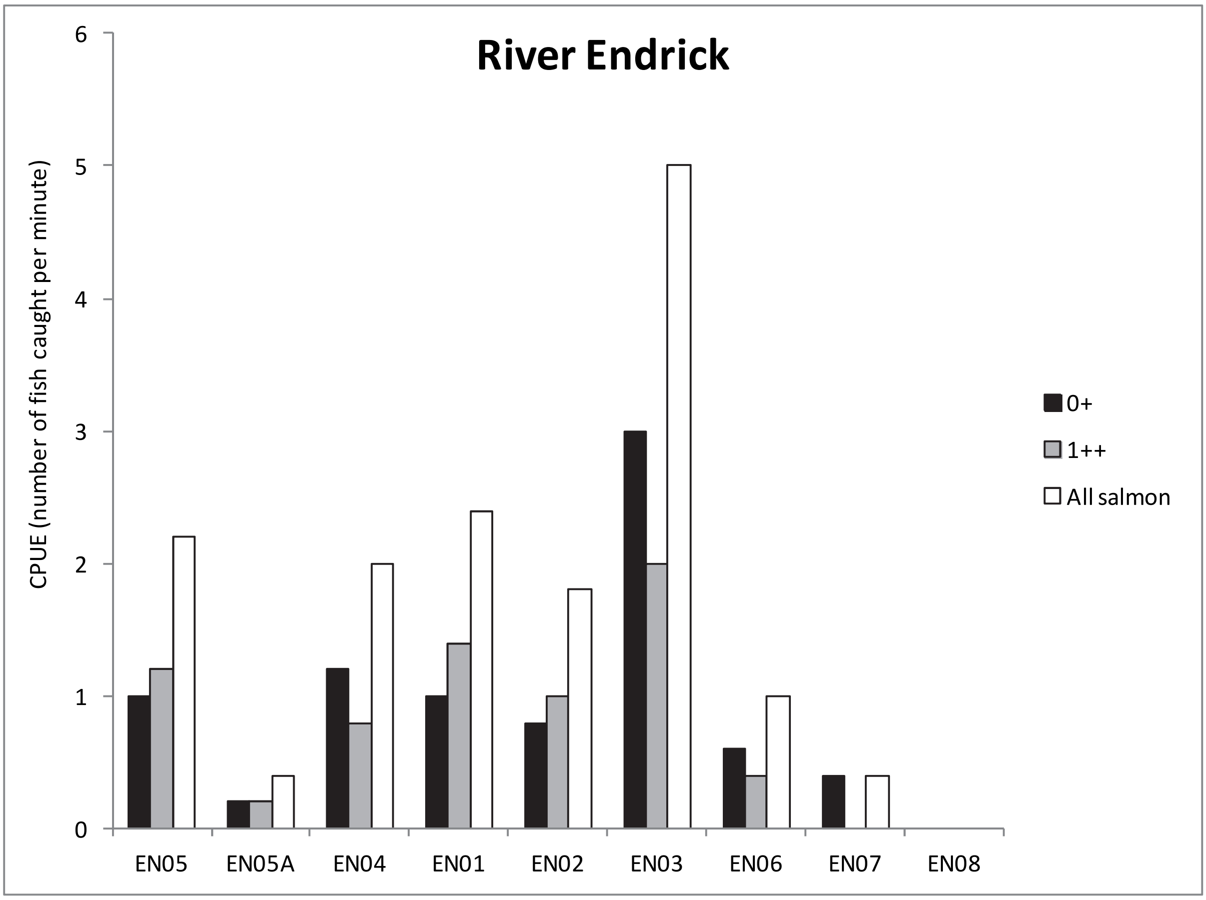


Figure 6.2 - Number of salmon (0+, 1++ and all salmon) caught per minute during five minutes of electrofishing at sites within the Endrick Water SAC.

Summary

When the densities of 0+ and 1++ juvenile Atlantic salmon are considered against quintile distributions for regional juvenile densities developed by Godfrey (2005), for both fry and parr in the Endrick Water SAC had sites spread across most of the quintile bands (Table 6.8). Assessed separately, fry can be considered to be in favourable status while parr are in unfavourable status. Based on these data, it is suggested that the overall assessment is that juvenile populations are in unfavourable status within the SAC (see Table 6.8).

Table 6.8 – Number of sites within the Endrick Water SAC falling within each quintile (according to absolute regional classification for 0+ and 1++ age classes) – and the resulting condition status.

SAC	Age class	Number of sites					Median grade	Favourable condition?
		0-20	21-40	41-60	61-80	81-100		
		E	D	C	B	A		
Endrick	0+	1		1	4		B	Y
	1++	3	1		1	1	D	N

The variability in densities found suggests that, within the Endrick Water SAC, there are areas of higher and lower production, and areas where local management problems may require active management to resolve.

The methodology adopted for the juvenile assessment shows that the status of the Endrick Water SAC was higher in 2011 compared to the previous assessment (Table 6.9). This is based on an improved performance in relation to fry densities.

Table 6.9 - Comparison of condition status in 2004 and in 2011 for 0+ and 1++ age classes.

SAC		2004	2011	Change
Endrick	0+	N	Y	+
	1++	N	N	=

b) Adult Assessment

Adult Atlantic salmon rod catch for the Endrick Water were analysed using the NASCO Rod Catch Assessment tool introduced and described in Section 1. This analysis considers the rod catch both in total, and as seasonal components (spring, summer and autumn). In addition to this, day rod catch data extending from 1952-present (obtained from Marine Scotland Science) were also examined.

Due to the methods of rod catch reporting to Marine Scotland Science the catch statistics used in the following assessments are those for the Clyde Fisheries District as a whole and not those of the Endrick Water SAC. These data are readily available. For the purposes of these assessments the analyses of the catches from the District is assumed to be representative of the Endrick Water. This has not been demonstrated to be the case, howver, and no definite relationship between the catch of the Endrick Water and the Clyde District has been established.

Summary of 1952 Catch Statistics

The published Atlantic salmon rod catch statistics for the Clyde District (including the Endrick Water) for all fish and for each of the spring, summer and autumn run-time components are shown in Figures 6.2, 6.3, 6.4 and 6.5.

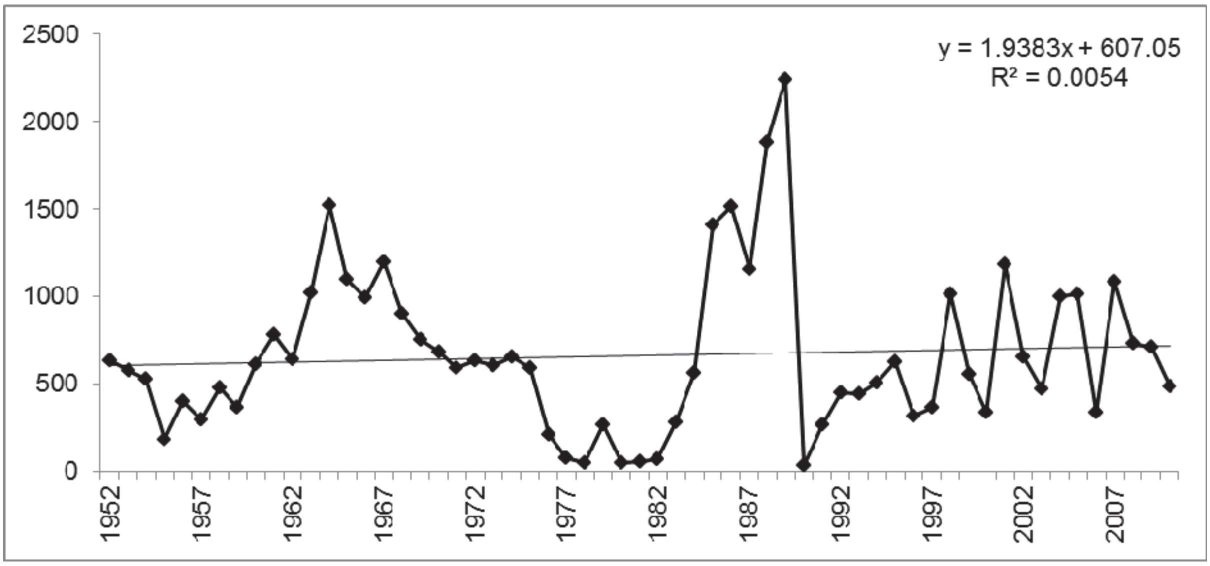


Figure 6.2 - Clyde District (for the Endrick Water) total rod catch 1952-2010 (salmon and grilse, retained and released).

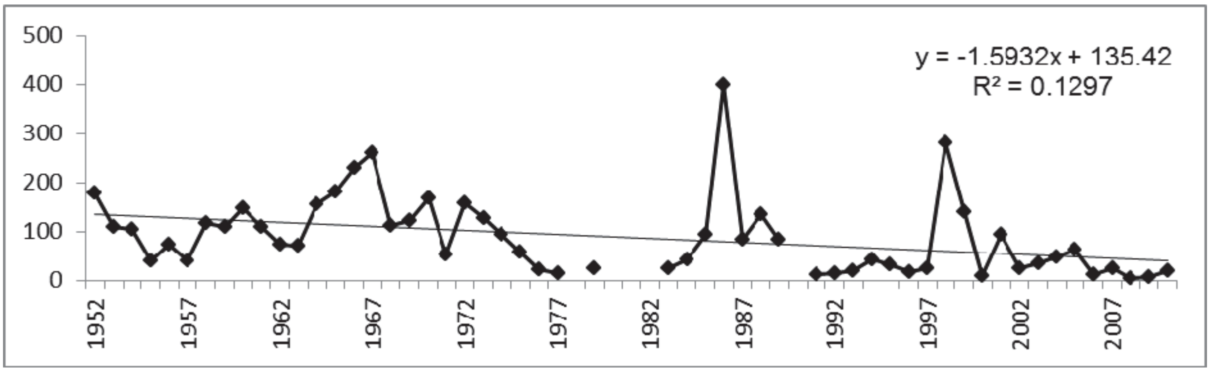


Figure 6.3 - Clyde District (for the Endrick Water) total spring rod catch 1952-2010 (salmon and grilse, retained and released).

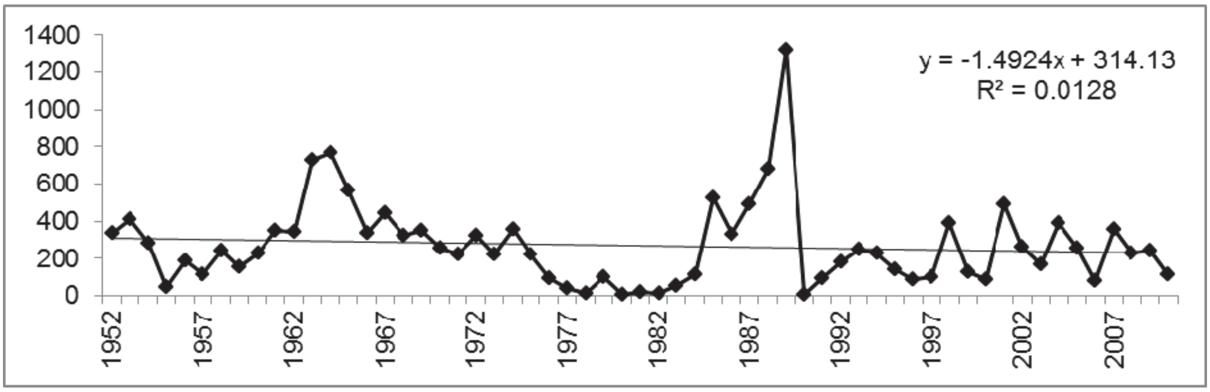


Figure 6.4 - Clyde District (for the Endrick Water) total summer rod catch 1952-2010 (salmon and grilse, retained and released).

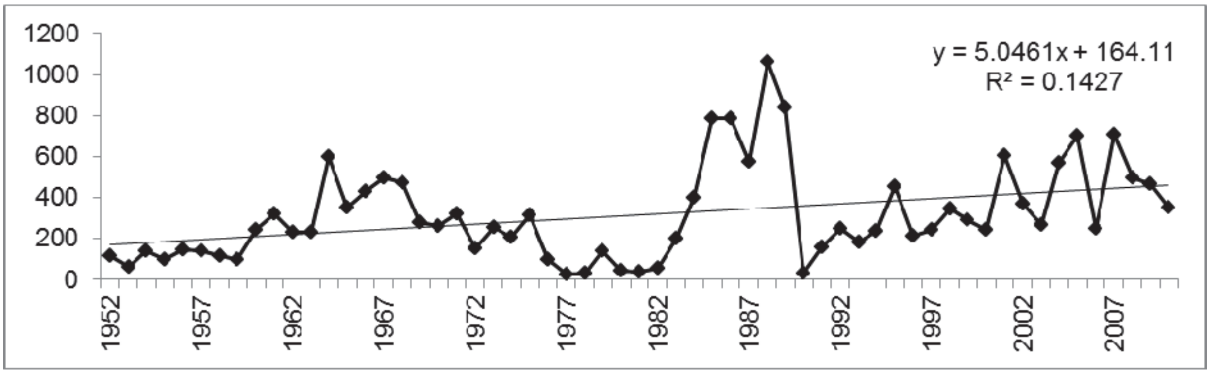


Figure 6.5 - Clyde District (for the Endrick Water) total Autumn rod catch 1952-2010 (salmon and grilse, retained and released).

Figure 6.2 shows the total declared Atlantic salmon rod catch for the Clyde District since 1952. These data show a period of particularly high catches in the mid-late 1980's which followed a period of low catches in the mid-1970's to early 1980's. The spring and summer catch (Figure 6.3 and 6.4) show slight decline in catch trends, although the autumn rod catch (Figure 6.5) shows an improving trend over the same period. In each of the stock components a period of low catch in the mid-1970's to the early 1980's was followed by a period of high catch in the mid-late 1980's.

Many areas in the Clyde District were significantly impacted during the industrialisation of Central Scotland. This left a legacy of poor water quality and barriers to fish migration. Whilst recovery is ongoing, and Atlantic salmon are now returning in significant numbers to parts of their former range, these past activities are likely to have restricted the success of this species in many catchments within the Clyde District. This adds to the difficulty in interpreting the published catch statistics for this site.

The Clyde District has no District Salmon Fishery Board (DSFB) in place and there is a strong culture and history of the rivers and fisheries being owned or leased and managed by an extensive network of angling clubs and associations. These associations have made consistent and robust efforts to improve the Clyde and have undoubtedly provided a catalyst to help stimulate many of the environmental and water quality improvements that are now apparent.

There must be significant doubt about the robustness of the catch statistics published for the Clyde District as a whole particularly at times when the catchments are increasingly healthy and stocks are publicised as being strong. It is not clear how many catch returns are provided by members to angling associations and clubs who are charged with submitting returns for each fishery and the suspicion must be that the much of the rod catch is unreported.

In respect of the Endrick Water itself this is managed in the main by the Loch Lomond Angling Improvement Association who are the major proprietor or lessee of the fisheries. Over the period to 2010 there was no catch and release policy in operation within the system, although individual anglers may return fish on an individual basis.

Application of Rod Catch Assessment Tool

The rod catches from the Clyde District (for the Endrick Water) over the last 20 years (1991-2010) have been used and applied to the NASCO rod catch assessment tool.

The test results for the Clyde District (for the Endrick Water) are shown in Table 6.10, and the data used to complete these tests is available in Appendix 1. These tests confirm that no reduction in exploitation or investigation as to whether local problems exist is required for the summer or autumn run-time components. However, Test B for spring fish indicates that a reduction in exploitation of the spring stock, and investigation into whether local problems exist may be justified due to two of the lowest three catches in the sequence occurring within the last three years.

It must be noted here that these tests have been applied to the catch of the River Clyde District and not specifically the Endrick Water where no robust catch records are available. Local fisheries managers advise that they currently encourage conservation measures across all seasonal components of the catch.

Table 6.10 - Summary of the Rod Catch Assessment Tool Tests Clyde District (for the Endrick Water).

Test	Spring	Summer	Autumn
A	No	No	No
B	Yes	No	No
C	No	No	No

The catches for the 20 year period considered (1991-2010) are presented for total catch in Figure 6.6 for each seasonal component in Figures 6.7, 6.8 and 6.9. An F-test was applied to each of the seasonal components to assess deviation from a horizontal trend and the results of these are summarised in Table 6.11. These confirm no significant trend in spring or summer catch but do confirm a significant upward trend (at the 95% confidence level) in autumn catch over the period.

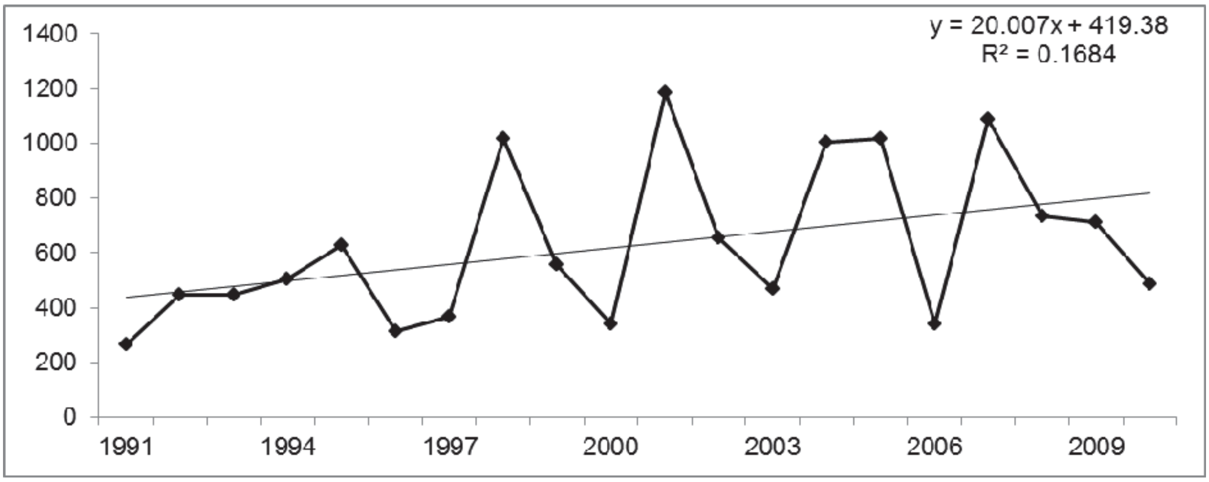


Figure 6.6 - Clyde District (for the Endrick Water) total rod catch 1991-2010 (salmon and grilse, retained and released).

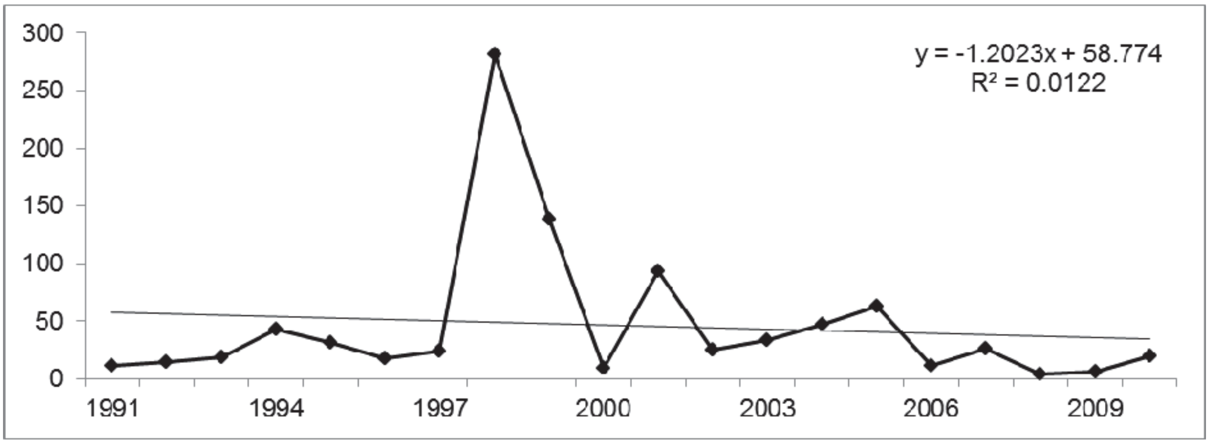


Figure 6.7 - Clyde District (for the Endrick Water) spring rod catch 1991-2010 (salmon and grilse, retained and released).

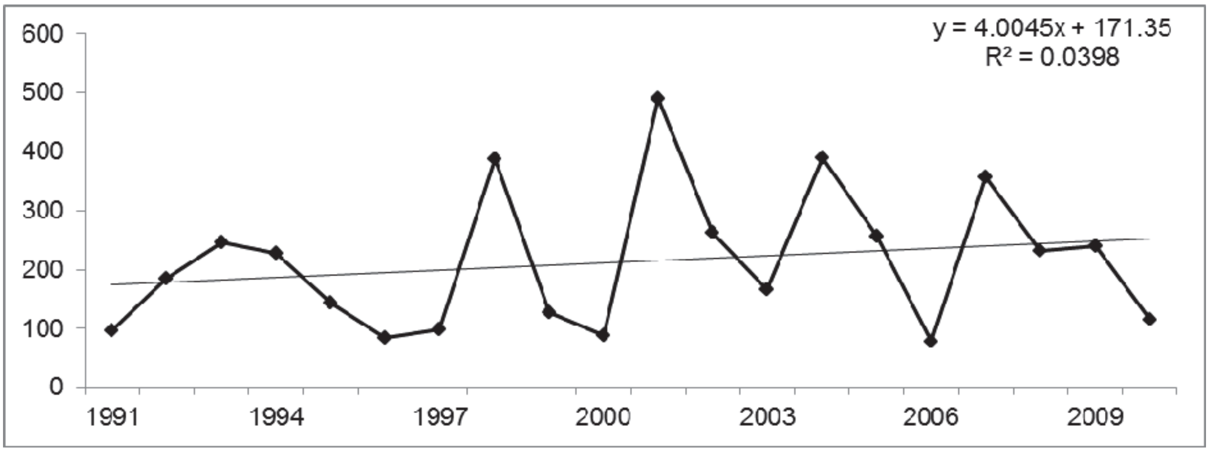


Figure 6.8 - Clyde District (for the Endrick Water) summer rod catch 1991-2010 (salmon and grilse, retained and released).

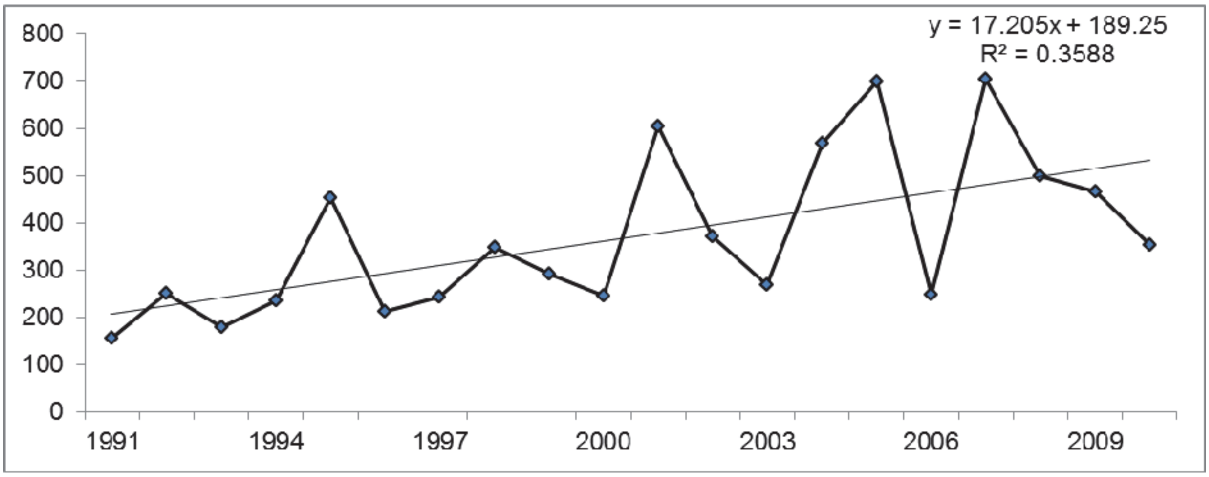


Figure 6.9 - Clyde District (for the Endrick Water) autumn rod catch 1991-2010 (salmon and grilse, retained and released).

Table 6.11 - Summary of F-Test Results on Clyde District (for Endrick Water) Seasonal Rod Catch (1991-2010).

Component	Observations	F-Value	F-Significance
Spring	20	0.222	0.642
Summer	20	0.747	0.398
Autumn	20	10.073	0.005

Finally, the percentage change in the spring, summer and autumn rod catches were considered for the two SCM cycles against the year of designation (2001). Period covered by cycle one is 2002-2004 and 2002-2010 for cycle two. In this review rod catch is averaged for each cycle period and the increase or decrease in average rod catch expressed as a percentage of the rod catch in the year of designation presented.

This assessment is shown in Figure 6.10 (below). This indicates that, for the autumn component in the Clyde District there has been an increase in average rod catch since the year of designation in each assessment cycle. However, both the summer and spring and rod catches show a decrease in average catch when compared to the rod catch in the year of designation in both cycle one and cycle two. The spring catch shows a particularly large decrease over both cycles. These apparent declines may have been inevitable in that the spring rod catch in 2001, the year of designation, was the highest recorded during the time series.

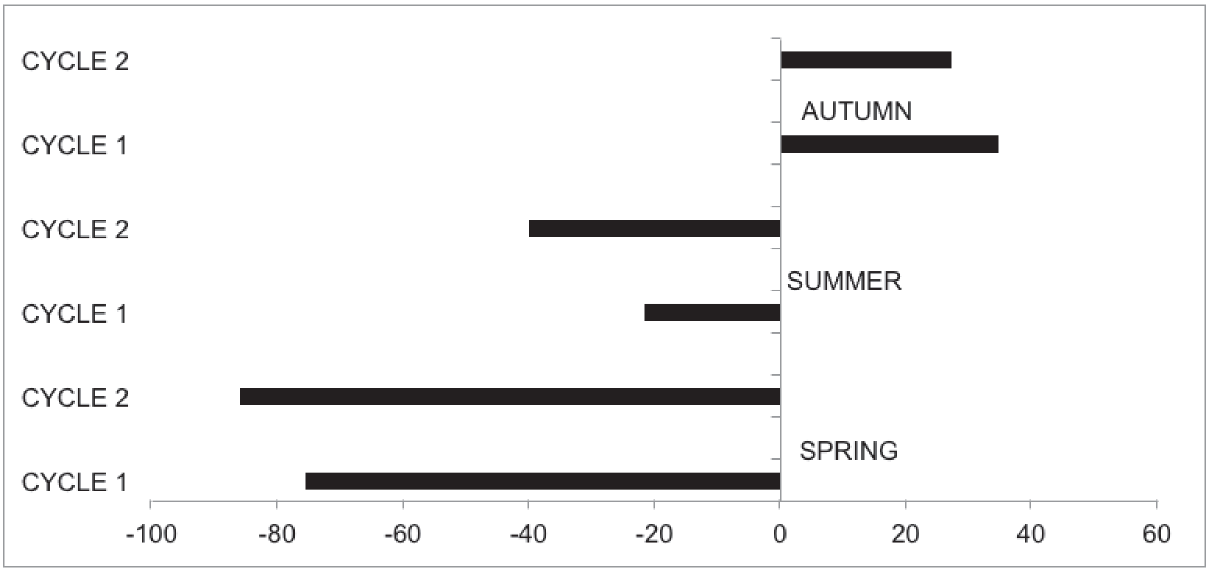


Figure 6.10 - Stock trend assessment Clyde District (for the Endrick Water) since River Endrick SAC Designation (2001) in cycle 1 (2002-2004) and cycle 2 (2002-2010).

Summary

The overall picture for Atlantic salmon rod total catch within the Clyde District (for the Endrick Water) over the period 1952-2010 shows a small, increasing, trend. This is driven by an improving autumn rod catch against a backdrop of marginal declines in spring and summer catches over the same period. Reported rod catches for the Clyde District should, however, be considered with caution given concerns about the suspected level of under-reporting. In addition, it should be noted that the adult rod catch assessments and analyses have used records for the River Clyde District as a whole, because robust records for the Endrick Water SAC are not available. Rod catches from the Clyde District are assumed to be representative of the Endrick Water, though this has not been demonstrated to be the case and no definite relationship between the catch of the Endrick and the Clyde District has been established.

Application of the NASCO rod catch assessment tool to the recorded catches over the last 20 years (1991-2010) indicate that no reduction in exploitation is required and no investigations into the existence of local problems are necessary for the summer and autumn run-time components. However, a reduction in exploitation and commencement of investigations into local problems is suggested as necessary for the spring stock from the results of Test B (does two of the lowest catches in the series occur in the last three years). When rod catch trends for each run-time component are considered individually over the same period, no significant changes are detected in either the spring or summer rod catches. A significant increase in the autumn catch is evident.

When average rod catch in each of the two SCM reporting cycles is compared against that reported in the year of designation in 2001, there is an increase in the autumn average catch in each cycle when compared to the 2001 catch. Both spring and summer average rod catches in both cycles are less than that recorded in the year of designation. However, as the 2001 catch is the highest in the period for both spring and summer catches, a decrease from this high point is inevitable when average catches are calculated in subsequent years.

In combination, the assessments of adult rod catch in the Clyde District (for the Endrick Water) indicate a long-term improvement in total and autumn rod catch from 1952. Application of the rod catch assessment tool suggests that a reduction in exploitation and further investigations may be required for spring stocks. The absence of river specific catch records for the Endrick Water means, however, that these conclusions should be considered with the qualification that the records for the River Clyde District may not represent those of the SAC itself.

c) Habitats supporting the qualifying feature

1. Water quality and quantity

The WFD status of each water body within the Endrick Water SAC, for which SEPA hold data, was obtained from the SEPA River Basin Planning interactive website].

A total of two WFD water bodies representing a river length of 50 km are identified within the River Endrick SAC. Both of these are classified as being of moderate ecological status and, therefore, require a package of measures to bring them up to at least good status by 2015. The cause of waterbody classification being less than good status is point source pollution from sewage disposal, flow regulation and abstraction in the upper catchment. In the lower catchment point source pollution from sewage disposal and diffuse pollution from livestock farming and recreation are key issues. There are no Heavily Modified Water bodies (HMWBs) within the River Endrick SAC.

Table 6.12, below, summarises the number of water bodies and the length of channel within each status category.

Table 6.12 - Number of water bodies and length of channel within each WFD status category in the Endrick Water SAC.

WFD status (2009)	High	Good	Moderate	Poor	Bad	Total
Number of water bodies			2			2
Length of channel (km)			50			50

2. Trends, changes and activities

Water quality was identified as being the primary negative pressure within the Endrick Water SAC. Agricultural diffuse pollution and point source sewage discharges have resulted in significant levels of organic enrichment within the south basin of Loch Lomond. Physical habitat degradation is identified as the second most important pressure and includes bank erosion, channel widening and braiding and sedimentation of the lower river. Many of these features are related to the third most important factor, riparian grazing pressure on lowland pasture which can result in geomorphic instability and cause the physical changes in watercourses. Heavy fertilisation and ploughing of the floodplain for improved pasture is also an important pressure. Water management, lack of remedial action and invasive species were also identified as having a negative impact.

The LLFT suggest that the main activities which have a negative impact on Atlantic salmon within the Endrick Water catchment are:

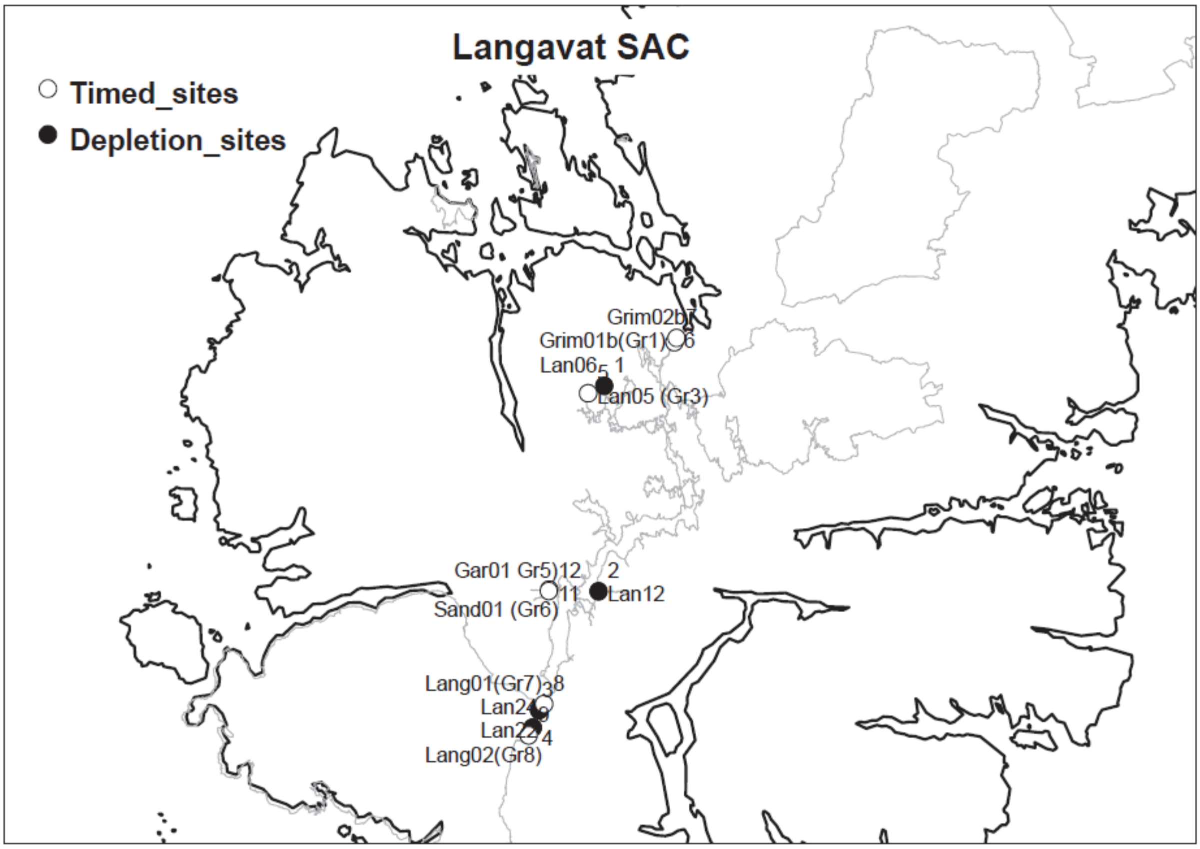
- Point and agricultural diffuse/sedimentation pollution;
- Physical habitat degradation; and
- Riparian grazing pressure.

7. LANGAVAT SAC

a) Juvenile Assessment

Five sites were surveyed using the standard SFCC catch depletion electrofishing method. A further seven sites were sampled using a five-minute timed electrofishing approach. All sites were situated within the Langavat SAC (Map 7.1). The sites were surveyed by staff of the Outer Hebrides Fisheries Trust.

Map 7.1 - Distribution of depletion and timed electrofishing sites on the Langavat SAC.



Depletion sites

Site details and a summary of electrofishing results are shown in Tables 7.1 – 7.4. All five depletion sites were located on the main river channel. Zippin and Carl & Strube estimates for fry were calculable for four sites although confidence limits were wide in some cases. Two sites were calculable for 1+ fish and one site for 2+. For fry, Zippin densities ranged from 11 - 61 per 100 m^2 (mean 37) and Carl & Strube densities ranged from 11 - 59 per 100 m^2 (mean 36). 0+ and 1+ fish were caught at all five sites and 2+ at four sites. The largest 0+ fish were found at two sites (mean 42 mm) while the mean largest 1+ fish was 87 mm. Trout were present at all five sites.

Table 7.1 - Details of depletion electrofishing sites, Langavat SAC.

Site code	Date	Easting	Northing	Altitude (m)	Channel name
SACQ-L-Lan06	10/08/2011	117872	927209	60	Abhainn Ghriomarstaidh
SACQ-L-Lan04	22/08/2011	118782	926689	50	Abhainn Ghriomarstaidh
SACQ-L-Lan12	23/08/2011	117599	917472	35	Abhainn Ghriomarstaidh
SACQ-L-Lan22	25/08/2011	114773	911847	56	Abhainn Ghriomarstaidh
SACQ-L-Lan24	25/08/2011	114473	911016	65	Abhainn Ghriomarstaidh

Table 7.2 - Details of depletion electrofishing for 0+ and 1++ salmon, Langavat SAC.

Site code	Wetted area (m^2)	Zippin 0+	Carl & Strube 0+	Zippin 1+	Carl & Strube 1+	Zippin 2+	Carl & Strube 2+
SACQ-L-Lan06	54.0	60.5	59.3	n/a	n/a	0	0
SACQ-L-Lan04	66.4	10.6	10.5	n/a	n/a	n/a	n/a
SACQ-L-Lan12	77.7	49.4	46.3	12.1	11.6	n/a	n/a
SACQ-L-Lan22	177.6	28.5	27.0	20.1	18.0	6.2	5.6
SACQ-L-Lan24	23.5	n/a	n/a	n/a	n/a	n/a	n/a

n/a denotes salmon present, but not in high enough densities to allow calculation of Zippin or Carl & Strube statistics. 0 denotes no salmon found at site.

Table 7.3 - Presence/absence of salmon year classes and of trout 0+ and 1++ at depletion sites, Langavat SAC.

Site code	Salmon age class present?				Trout present?	
	0+	1+	2+	3++	0+	1++
SACQ-L-Lan06	Y	Y	N	N	Y	Y
SACQ-L-Lan04	Y	Y	Y	N	Y	N
SACQ-L-Lan12	Y	Y	Y	Y	Y	Y
SACQ-L-Lan22	Y	Y	Y	N	Y	N
SACQ-L-Lan24	Y	Y	Y	N	Y	Y

Table 7.4 - Fork length of salmon of different age classes, Langavat SAC.

Site code	0+ mean fork length	No. 0+	1+ mean fork length	No. 1+	2+ mean fork length	No. 2+	3+ mean fork length	No. 3+
SACQ-L-Lan06	35	32	84	8	n/a	0	n/a	0
SACQ-L-Lan04	51	7	87	2	103	2	n/a	0
SACQ-L-Lan12	35	32	84	9	111	2	135	1
SACQ-L-Lan22	42	42	73	27	97	10	n/a	0
SACQ-L-Lan24	42	2	79	2	101	3	n/a	0

n/a denotes means could not be calculated as no salmon of that age class were found at the site.

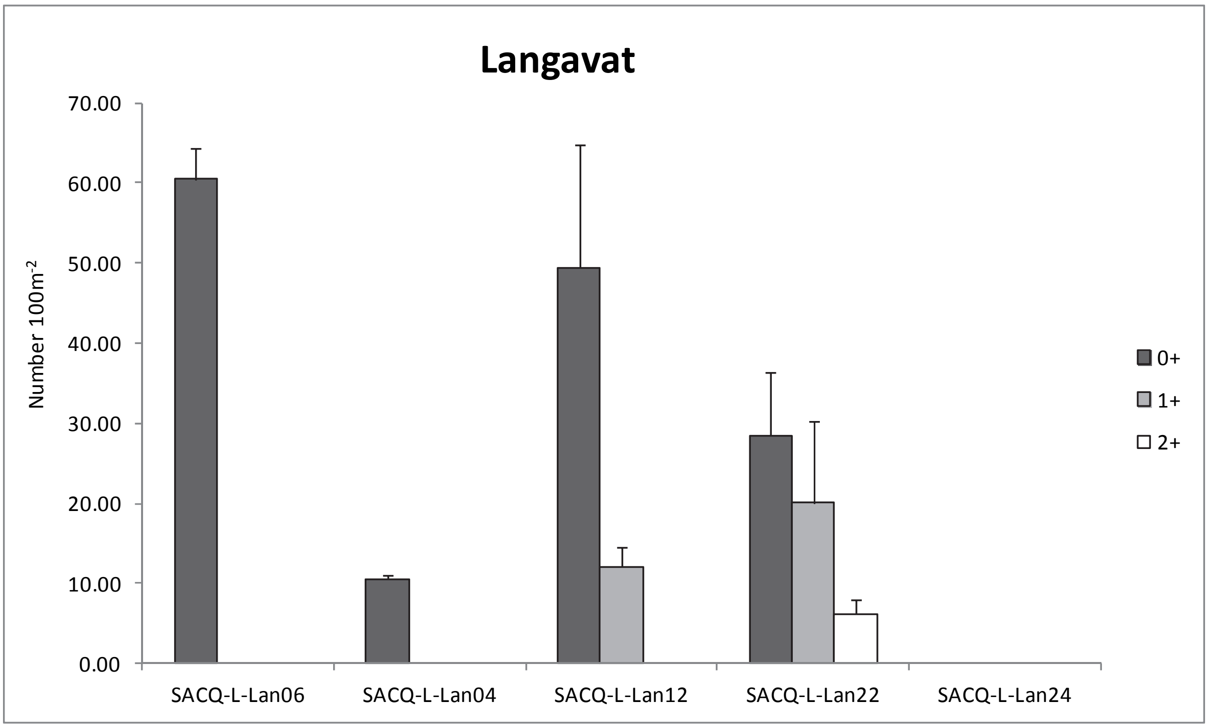


Figure 7.1 - Juvenile salmon population density estimated by the Zippin method for the SAC monitoring sites on the Langavat SAC.

Timed sites

Details of the seven timed sites are given in Table 7.5. CPUE for fry ranged from 0/ min to 2.6/ min and for 1++ fish ranged from 0/ min to 1.6/ min. 0+ and 1+ salmon were caught at six of the seven timed sites. No salmon of any age were caught at one site (tributary of Loch Mohal Beag) and no 2++ salmon were caught at any of the sites. Trout were found at four sites.

Table 7.5 - Details of timed electrofishing sites, Langavat SAC.

Site code	Easting	Northing	River	Altitude (m)
SACT - L - Lan05 (Gr3)	117100	926866	Loch Mohal Beag	75
SACT - L Grim 01b (Gr1)	121190	929290	Abhainn Ghriomarstaidh	10
SACT - L Grim 02b	121285	929479	Burn at old hatchery	6
SACT-L-Lang01 (Gr7)	115006	912132	Abhainn Ghriomarstaidh	44
SACT-L-Lang02 (Gr8)	114285	910640	Abhainn Ghriomarstaidh	70
SACT-L-Sand01 (Gr6)	115258	917560	Abhainn Ghriomarstaidh	36
SACT-L-Gar01 Gr5)	115251	917494	Garry burn	37

Table 7.6 - Salmon catch per unit effort (CPUE), Langavat SAC.

Site code	Survey date	Salmon 0+/min	Salmon 1++/min
SACT - L - Lan05	10/08/2011	0.0	0.0
SACT - L Grim 01b	22/08/2011	2.6	1.6
SACT - L Grim 02b	22/08/2011	1.2	0.4
SACT-L-Lang01	25/08/2011	0.8	0.4
SACT-L-Lang02	25/08/2011	1.8	0.4
SACT-L-Sand01	18/10/2011	0.8	0.2
SACT-L-Gar01	18/10/2011	0.6	1.4

Table 7.7 - Presence/absence of salmon year classes and of trout at timed sites, Langavat SAC.

Site code	Salmon age class present?				Trout present?
	0+	1+	2+	3+	
SACT - L - Lan05	N	N	N	N	Y
SACT - L Grim 01b	Y	Y	N	N	N
SACT - L Grim 02b	Y	Y	N	N	Y
SACT-L-Lang01	Y	Y	N	N	N
SACT-L-Lang02	Y	Y	N	N	Y
SACT-L-Sand01	Y	Y	N	N	Y
SACT-L-Gar01	Y	Y	N	N	N

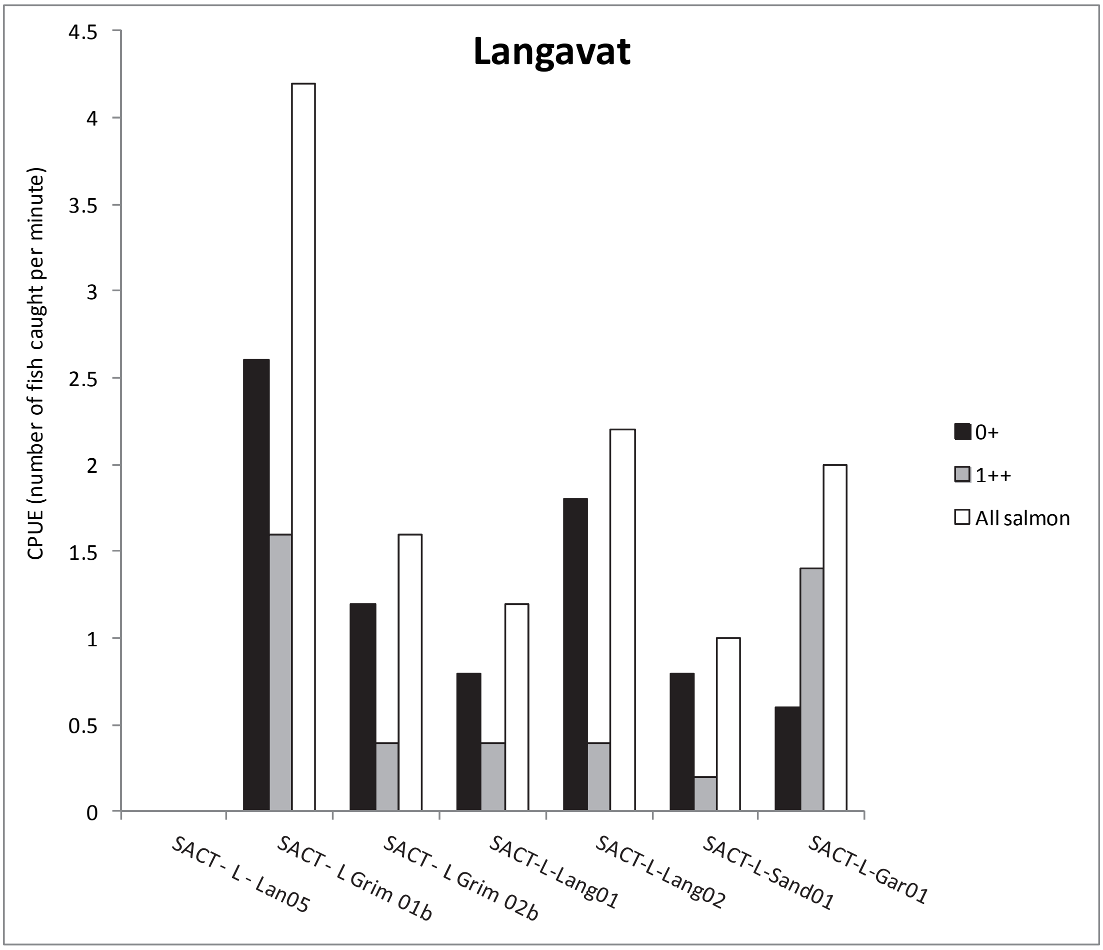


Figure 7.2 - Number of salmon (0+, 1++ and all salmon) caught per minute during five minutes of electrofishing at sites on the Langavat SAC.

Summary

When the densities of 0+ and 1++ juveniles are considered against regional juvenile densities developed by Godfrey (2005), the Langavat Atlantic salmon densities lie mainly in the highest quintile band for fry and the lowest band for parr (Table 7.8). This indicates good juvenile productivity but weaker recruitment to the parr stage. Assessed separately, we suggest that fry can be considered to be in favourable status, and parr in unfavourable status. Taken together, we suggest that the overall assessment, based upon the sites surveyed, is therefore that the juvenile populations are in unfavourable status within the SAC.

Table 7.8 – *Number of sites within the Langavat SAC falling within each quintile (according to absolute regional classification for 0+ and 1++ age classes) – and the resulting condition status.*

SAC	Age class	Number of sites					Median grade	Favourable condition?
		0-20	21-40	41-60	61-80	81-100		
		E	D	C	B	A		
Langavat	0+	1			1	3	A	Y
	1++	3			1	1	E	N

The variability in densities found confirms that within the Langavat catchment there are areas of higher and lower production, and areas where local management problems may exist.

Data obtained for the juvenile assessment shows that the status of the Langavat SAC was lower in 2011 compared to the previous assessment (Table 7.9). The mean salmon parr densities recorded in 2011 at the SAC monitoring sites were considerably lower than those recorded in 2004. However, the sub-optimal electrofishing fishing conditions encountered in 2011 may have contributed to the reduced densities captured in that year when compared to those seen in 2004.

Table 7.9 - Comparison of condition status in 2004 and in 2011 for 0+ and 1++ age classes.

SAC		2004	2011	Change
Langavat	0+	Y	Y	=
	1++	Y	N	-

b) Adult Assessment

Adult Atlantic salmon rod catch for the Langavat SAC was assessed using the NASCO Rod Catch Assessment tool introduced and described in Section 1. This analysis uses the rod catch in seasonal components (spring, summer and autumn) to provide an assessment of adult population. In addition to this, Marine Scotland Science rod catch statistics (available from 1952 for the overall catch and the same run-time components) were also examined.

A result of the way in which these data are gathered by Marine Scotland Science, the catch statistics used in the following assessments are those of the Loch Roag Fisheries District as a whole and not those of the Langavat SAC area itself (which is a complex of small, mostly low-gradient lochans and channels dominated by Loch Langavat itself and its short outfall, the Grimersta). Rod catches for the Langavat SAC area itself are not specifically available. For the purpose of this analysis the catches from the Loch Roag District is assumed to be representative of the Langavat SAC though this has not been demonstrated to be the case.

Recognising the limitations of using rod catch records only from the Loch Roag Fisheries District to assess the Langavat SAC, rod catch records from the Grimersta Estate, which is the only access point between the sea and the SAC, have been secured and included in part of the analysis of adult rod catch. In particular these catch records from 1991 have been replicated using the NASCO Rod Catch Assessment tool process for the spring, summer and autumn catches from this system. The output of this analysis is considered alongside the same test carried for the Loch Roag District using Marine Scotland Science data.

Summary of 1952 Catch Statistics

The published rod catch statistics for all Atlantic salmon within the Langavat SAC are shown in Figure 7.3, and information is also data presented for the spring, summer and autumn run-time components (Figures 7.4, 7.5 and 7.6).

It should be noted that there is significant uncertainty associated with the 1967 rod catch reported for the District and used in these analyses. The catch in this year (highlighted in Figures 7.3, 7.4, 7.5 and 7.6) is approximately 2.5 times greater than the next highest rod catch reported in the time sequence. [The figures presented have been checked as having been used in the first site condition monitoring assessment undertaken by Godfrey (2005) and match those provided by Marine Scotland Science]. However, by way of some context it is confirmed that the Grimersta (the largest fishery in the district) reported a rod catch of 977 in 1967 against a 100 year average of 730 fish per year, and with a highest total catch of 2225 in 1925. The other estates and fisheries in the District are generally less productive than the Grimersta but, for the available figures to be correct, would have needed to contribute in excess of 4000 fish to the rod catch in 1967 when the Grimersta catch was less than 1000. This is not thought likely but the source of this error, if one exists, has not been determined (Outer Hebrides Fisheries Trust *pers. comm*,).

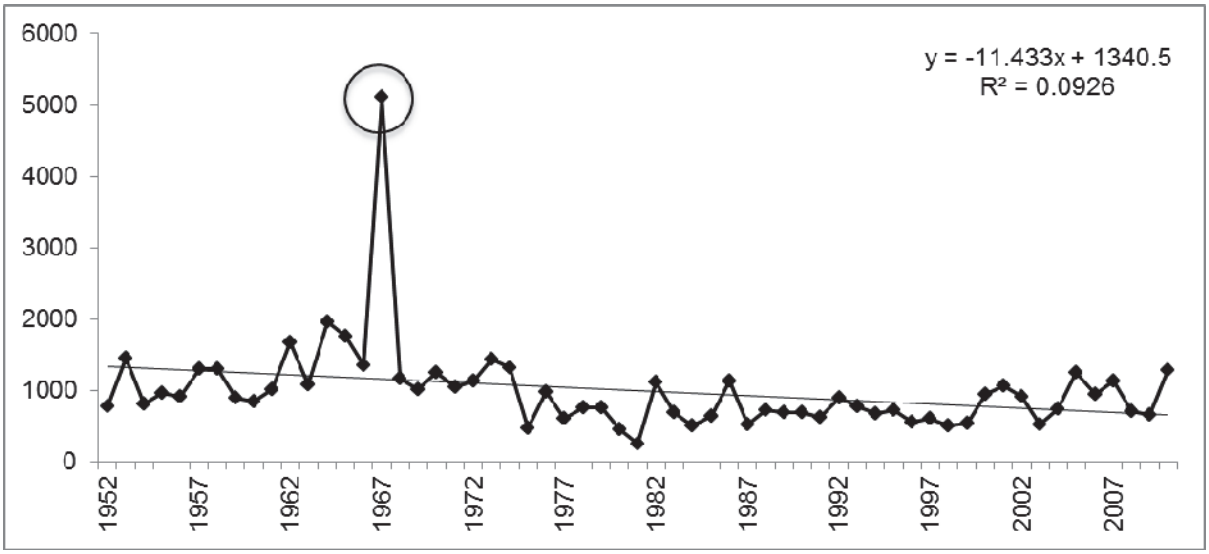


Figure 7.3 - Loch Roag District (for Langavat SAC) total rod catch 1952-2010 (salmon and grilse, retained and released).

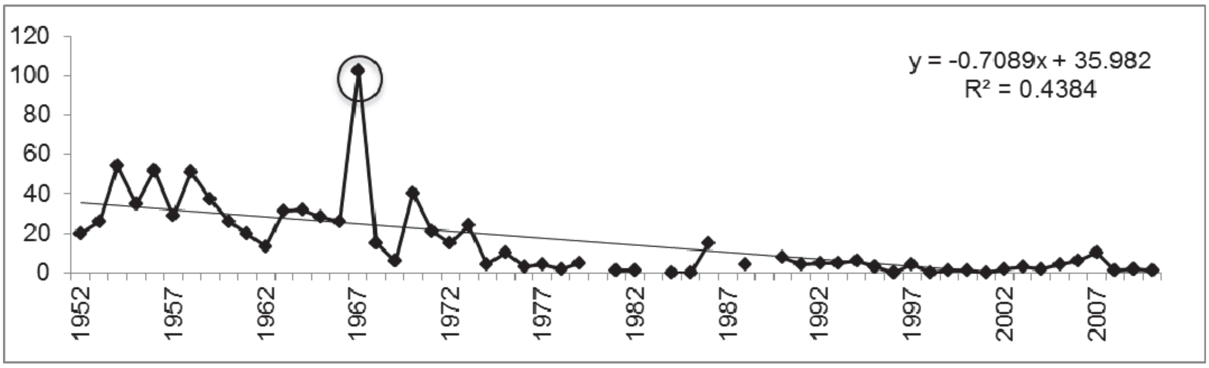


Figure 7.4 – Loch Roag District (for Langavat SAC) total spring rod catch 1952-2010 (salmon and grilse, retained and released).

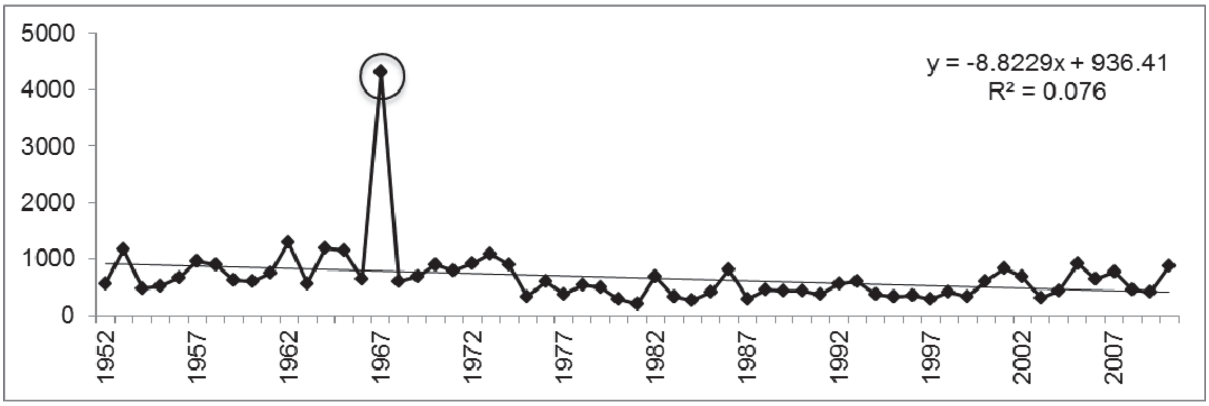


Figure 7.5 - Loch Roag District (for Langavat SAC) total summer rod catch 1952-2010 (salmon and grilse, retained and released).

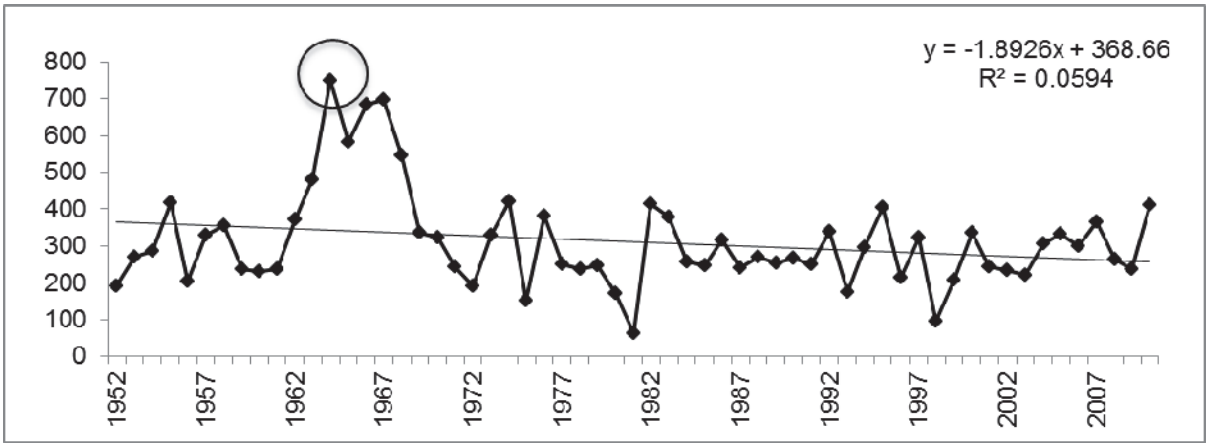


Figure 7.6 - Loch Roag District (for Langavat SAC) total autumn rod catch 1952-2010 (salmon and grilse, retained and released).

The total rod catch in the District (Figure 7.3) shows a marginal decline over the period 1952-present. However, rod catch is relatively stable over the whole period (with the exception of 1967 where a catch of approximately 5000 is stated against a more normal catch of around 1000). From 1974- 1999 all but two of the recorded catches were below the trend line, and represent an extended period of lower catch. Over the period 2000-2010 all but one year has recorded a catch above or on the trend line which may indicate a recent period of recovery.

The spring, summer and autumn catches (Figures 7.4, 7.5 and 7.6) all show slight downward trends. However, the spring catch has remained generally low throughout and a rod catch of more than 50 is considered infrequent. Very few rod caught spring fish were recorded during the period 1974-2010. Summer rod catches (with the exception of 1967) have remained relatively stable over data series. The autumn rod catch is more variable annually but, other than over the period 1964-1968 when high catches were recorded, it has been relatively stable overall.

It is considered that the reporting of rod catch over the period has been consistent and there is no evidence that any trends summarised may be attributable to a change in reporting accuracy or inconsistency.

Although the reporting of rod catch in the District is considered to be relatively consistent it is less certain that this fully reflects the true catch from the Langavat and Grimersta systems due to non-permitted angling or poaching activities. The relatively unrestricted access to Loch Langavat and its extensive shoreline means that, at present, it is difficult to monitor true catch effort and there is certainly a non-permitted, unreported and un-quantified additional catch made from the system. Currently the Western Isles DSFB are understood to be taking steps to more thoroughly police these activities and to ensure that only permitted angling takes place.

Catch and release, on a voluntary basis, is increasingly common within the District as a conservation measure. A ‘Langavat Code of Practice’, which covers brown trout, sea trout and Atlantic salmon, is now in place, which limits anglers to a one fish limit for salmon/grilse and the mandatory catch and release of all spring fish is required. The release of all female fish throughout the season is also strongly recommended. Currently, through voluntary catch and release, the large majority of fish are returned, and for Grimersta 85% and 100% return rates are being achieved for Atlantic salmon and sea trout respectively.

Application of Rod Catch Assessment Tool

Rod catch data from the Loch Roag District (for Langavat SAC) were applied to the NASCO rod catch assessment tool to consider the current status of each run-time component. The tool was then re-run with data from the Grimersta Estate for comparative purposes.

The results of these tests for the Loch Roag District (for Langavat SAC) are shown in Table 7.10 and for Grimersta in Table 7.11. The rod catch data used to complete the tests is available in Appendix 1. The output of these analyses suggest that no reduction in exploitation or investigation is required as to whether local problems exist for any of the spring, summer or autumn run-time components for either the Loch Roag District as a whole, or for the Grimersta.

Table 7.10 - Summary of the Rod Catch Assessment Tool Tests for Loch Roag District (for Langavat SAC).

Test	Spring	Summer	Autumn
A	No	No	No
B	No	No	No
C	No	No	No

Table 7.11 - Summary of the Rod Catch Assessment Tool Tests for Grimersta Estate.

Test	Spring	Summer	Autumn
A	No	No	No
B	No	No	No
C	No	No	No

Rod catches for the 20 year period considered (1991-2010) are presented for the Loch Roag District in Figures 7.7, 7.8, 7.9 and 7.10. An F-test was applied to each of the seasonal components to assess their deviation from a horizontal trend, and are summarised in Table 7.12. These tests suggest no significant trend in spring catch, and indicate the presence of a significant increase in both summer and autumn rod catch (at the 95% confidence level) over the 1991-2000 dataset.

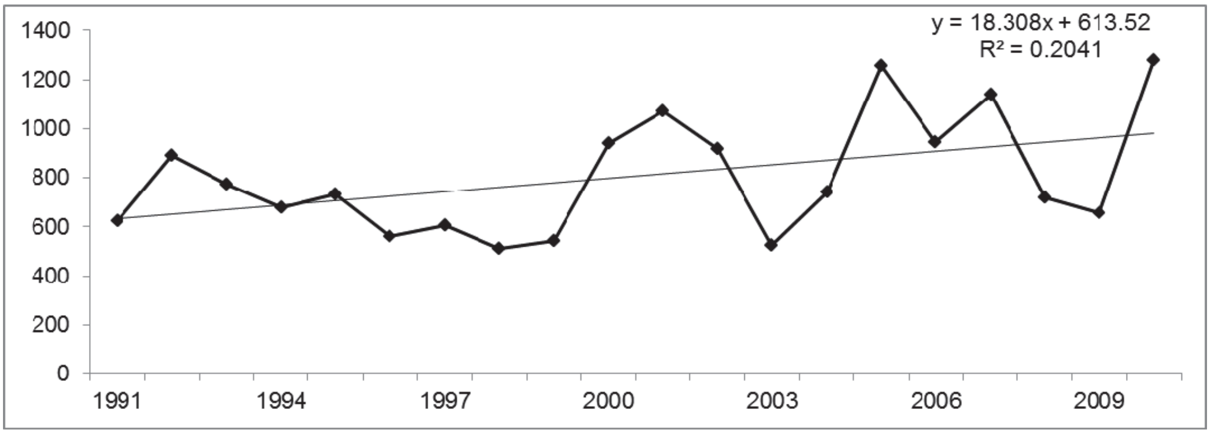


Figure 7.7 - Loch Roag District (for Langavat SAC) total rod catch 1991-2010 (salmon and grilse, retained and released).

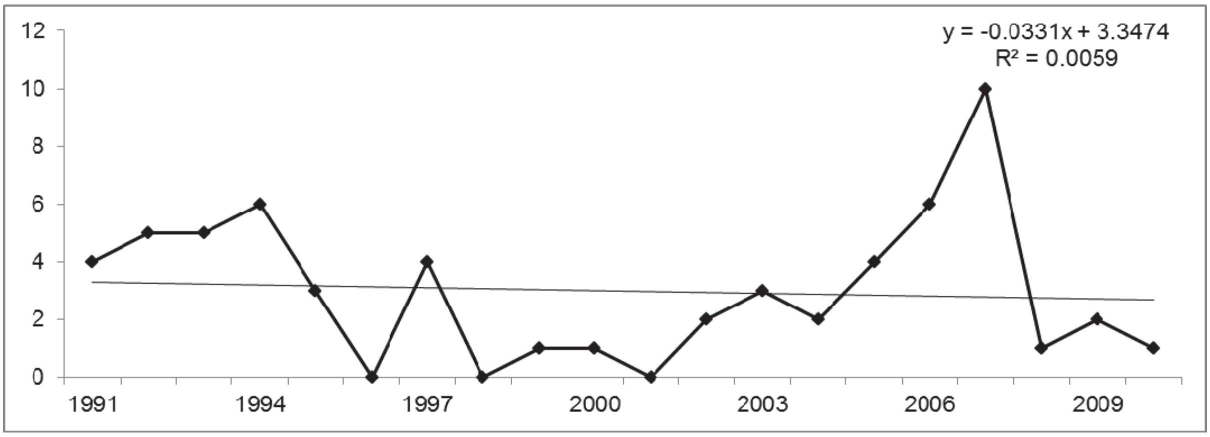


Figure 7.8 - Loch Roag District (for Langavat SAC) spring rod catch 1991-2010 (salmon and grilse, retained and released).

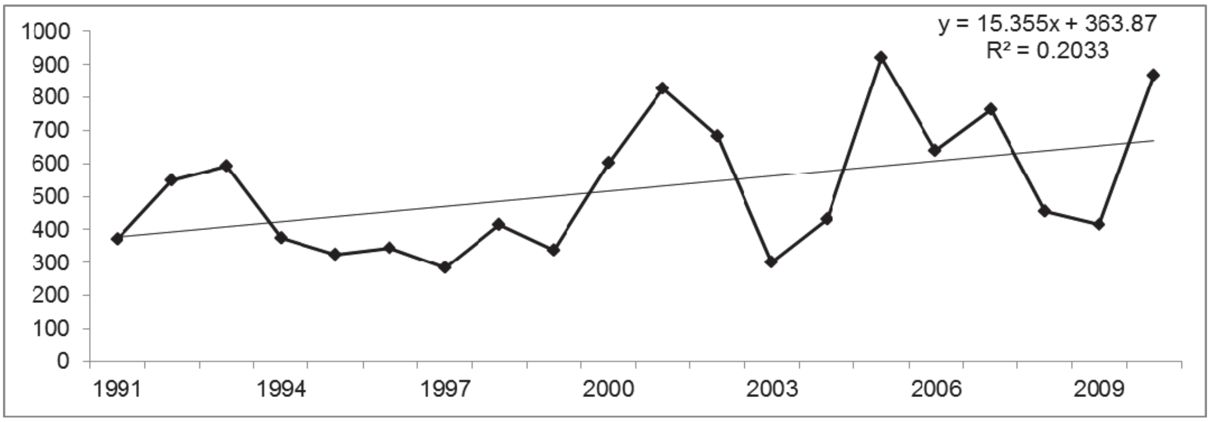


Figure 7.9 - Loch Roag District (for Langavat SAC) summer rod catch 1991-2010 (salmon and grilse, retained and released).

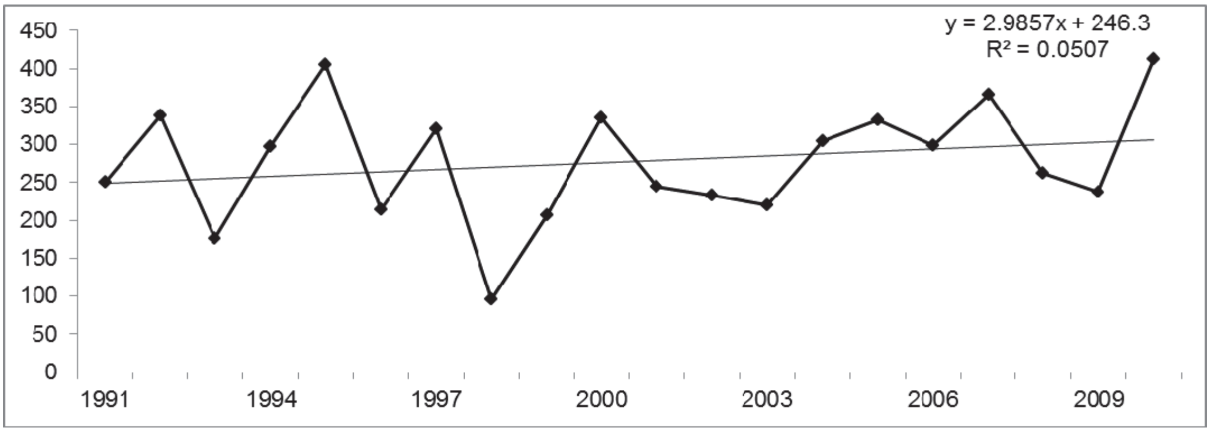


Figure 7.10 - Loch Roag District (for Langavat SAC) autumn rod catch 1991-2010 (salmon and grilse, retained and released).

Table 7.12 - Summary of F-Test Results on Loch Roag District (for Langavat SAC) Seasonal Rod Catch (1991-2010).

Component	Observations	F-Value	F-Significance
Spring	20	0.106	0.748
Summer	20	4.590	0.046
Autumn	20	4.617	0.046

Rod catches for the 20 year period considered (1991-2010) are presented for the Grimersta dataset over the same period in Figures 7.11, 7.12, 7.13 and 7.14. F-test was applied to each of the seasonal components to deviation from horizontal and these are summarised in Table 7.13. These suggest that no significant positive or negative trend exists for the spring, summer or autumn rod catch.

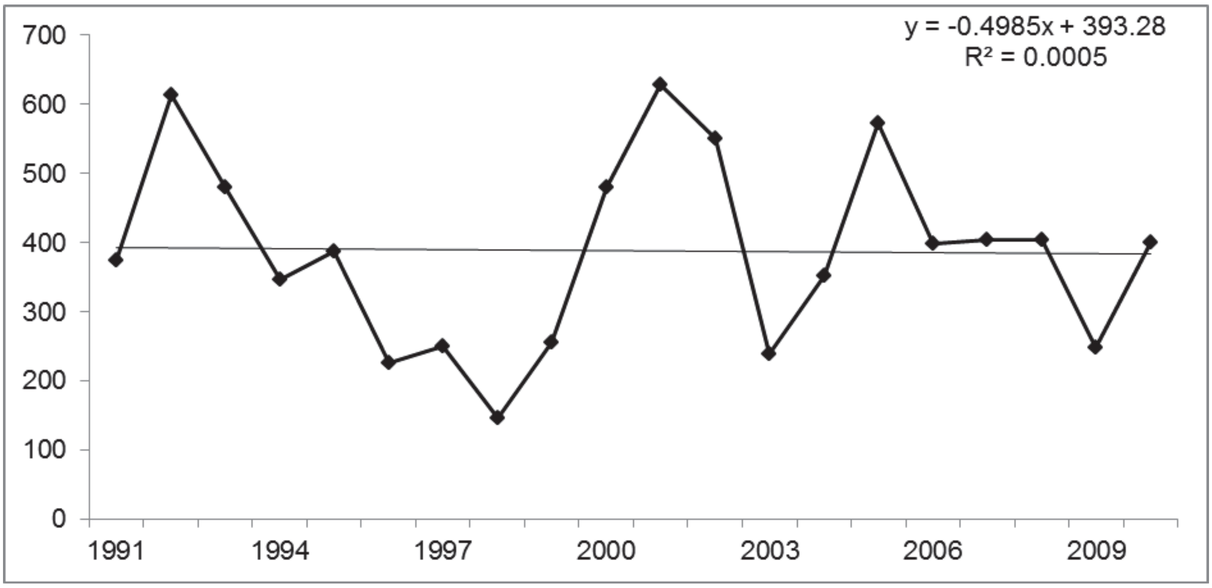


Figure 7.11 - Grimersta total rod catch 1991-2010 (salmon and grilse, retained and released).

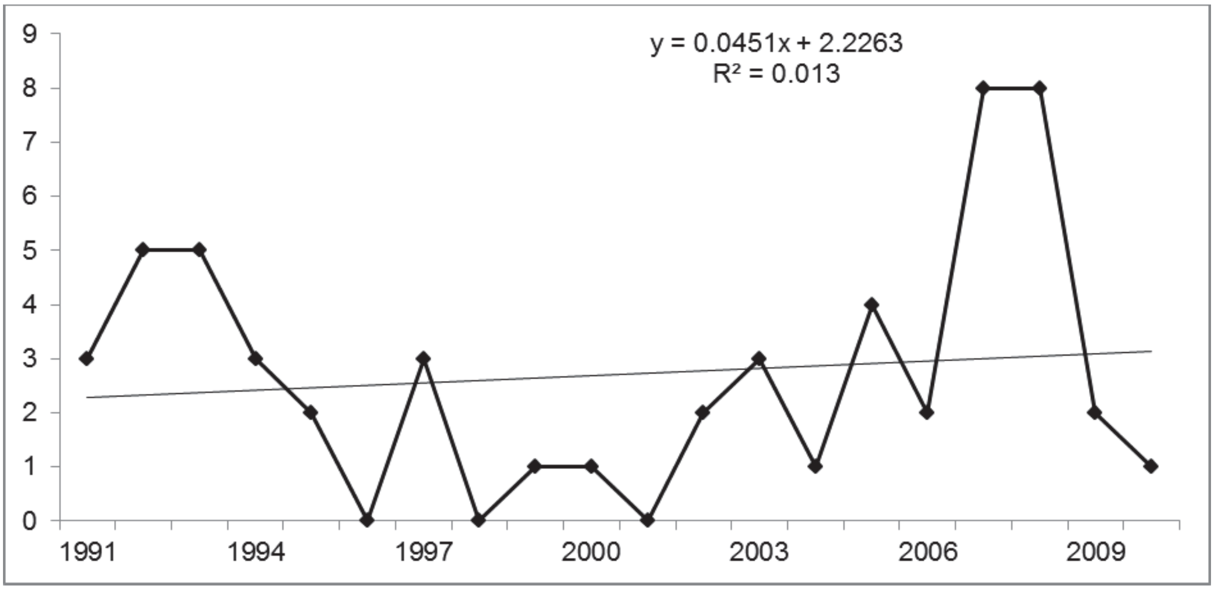


Figure 7.12 - Grimersta spring rod catch 1991-2010 (salmon and grilse, retained and released).

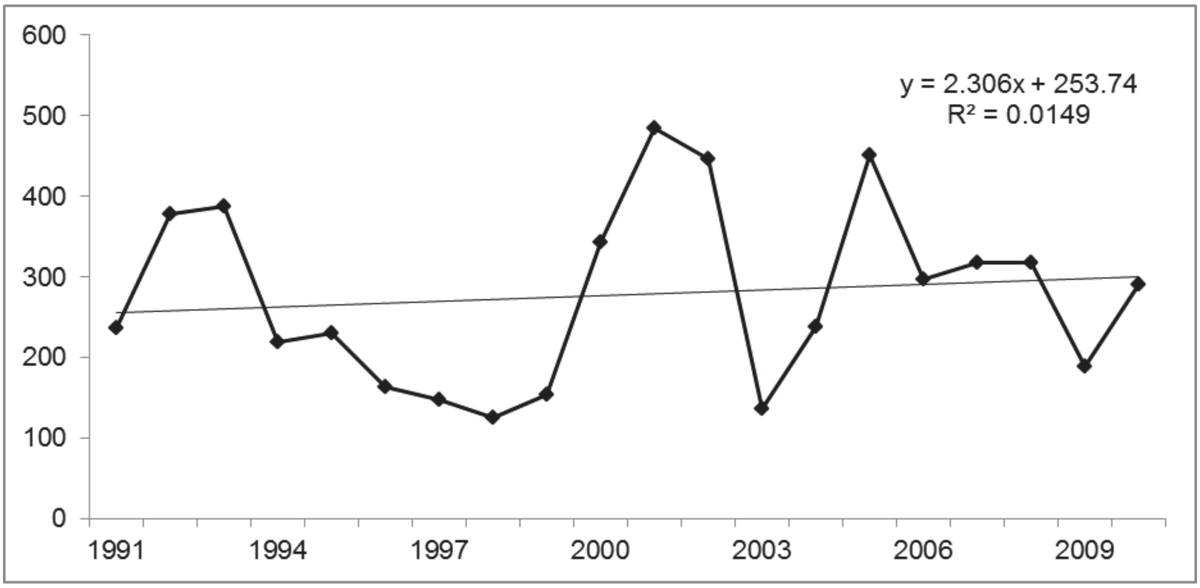


Figure 7.13 - Grimersta summer rod catch 1991-2010 (salmon and grilse, retained and released).

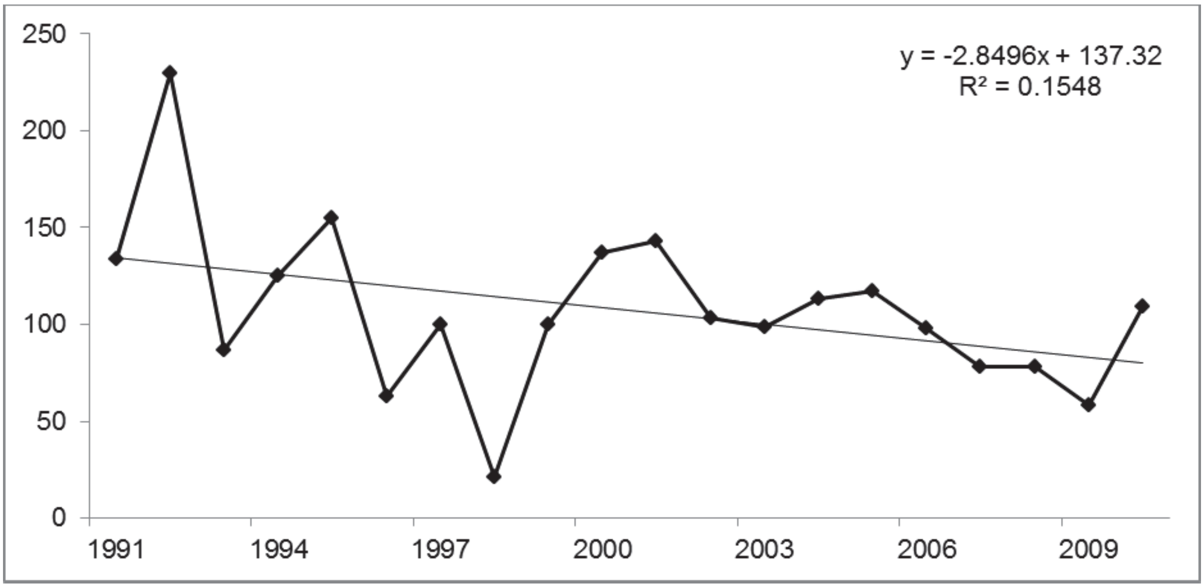


Figure 7.14 - Grimersta autumn rod catch 1991-2010 (salmon and grilse, retained and released).

Table 7.13 - Summary of F-Test Results on Grimersta Seasonal Rod Catch (1991-2010).

Component	Observations	F-Value	F-Significance
Spring	20	0.237	0.632
Summer	20	0.273	0.608
Autumn	20	3.296	0.086

Finally, changes which may have occurred between the two SCM monitoring cycles carried out since the year of designation (2001), were examined. Again, this analysis was carried out using data obtained for the Loch Roag District rod catches, and those provided by the Grimersta Estate. The first SCM assessment was undertaken in 2002 and so the dataset used for that analysis extended over 2002-2004. The cycle two dataset covers the period 2002-2010. In comparing Atlantic salmon catches over the two cycles, the rod catch is averaged for each cycle period and the increase or decrease in average rod catch expressed as a percentage of the rod catch in the year of designation.

This analysis is shown in Figures 7.11 and 7.12 for the Loch Roag District and Grimersta catches respectively.

For the catches in Loch Roag this indicates that the average autumn catch in each cycle is greater than that in the year of designation (2001) with the increase being greater in the longer cycle two period. The average summer catch in each cycle is less than that in the year of designation. However, the 2001 summer catch is the third highest in the period 2001-2010 and so provides a high base level against which to compare later averages and making it more likely that any calculated average will be less than that in the designation year.

There is insufficient data available to enable the the comparison of spring rod catches over either of the cycles within in the Loch Roag District dataset to allow for a comparison to be made against the catch in the year of designation.

For the Grimersta rod catches, the average rod catch in both summer and autumn in each assessment cycle is less than that in the year of designation. This largely due to both the summer (485 fish in total) and autumn (143 fish in total) catches in 2001. There is insufficient data for the spring catch over either of the cycles in the Grimersta to allow a comparison against the catch in the designation year.

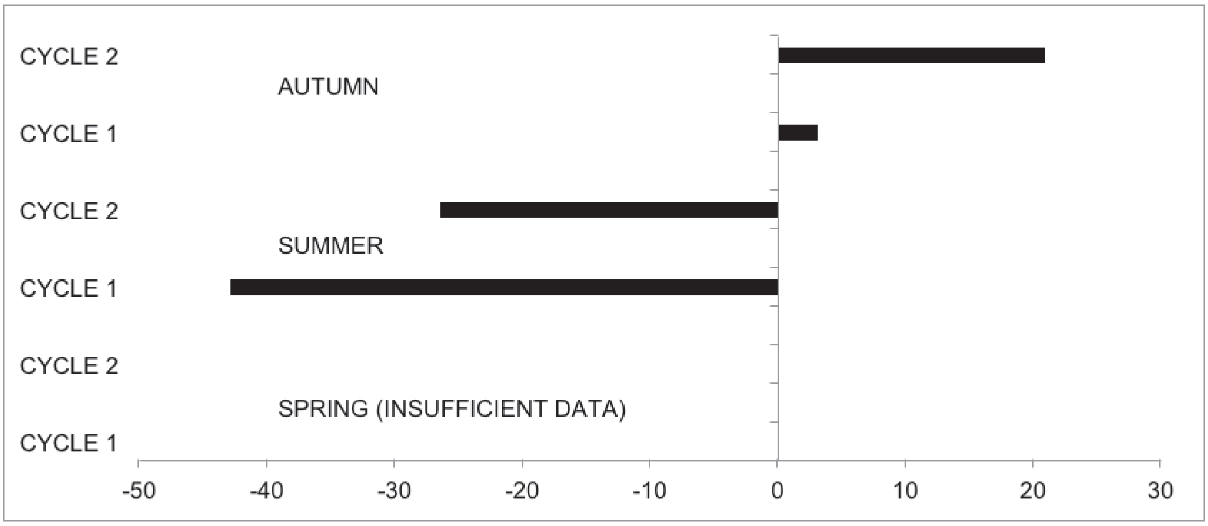


Figure 7.11 - Stock trend assessment since Langavat SAC Designation (2001) in cycle 1 (2002-2004) and cycle 2 (2002-2010) using catches from the Loch Roag Fisheries District.

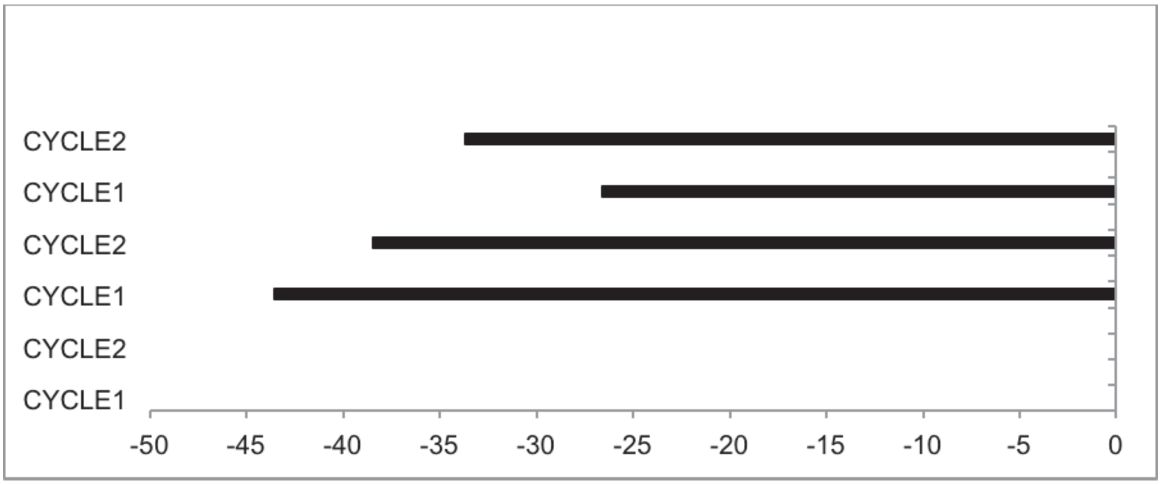


Figure 7.12 - Stock trend assessment since Langavat SAC Designation (2001) in cycle 1 (2002-2004) and cycle 2 (2002-2010) using catches from the Grimersta catchment.

Summary

The overall trend in rod catch within the Loch Roag District (for Langavat SAC) over the period 1952-2010 shows a decline. However, this decline is largely due to the exceptionally high 1967 declared rod catch, which at 5000 is significantly greater than the more regularly declared rod catch of around 1000 fish. Spring rod catches remain low over the period for which records exist. Although showing a decline largely as a function of the 1967 record catch, the summer component remains the largest proportion of the rod catch and the overall trend can be described as being relatively stable throughout. The autumn catch is also relatively stable outside a period of high catches in the mid-late 1960s. The validity of the 1967 catch is questioned and appears to be so significantly different from the catch in all other years and for the Grimersta catchment (historically the most productive fishery in the district) to be likely to be an erroneous record.

In addition to the rod catch records used for the Loch Road District, additional rod catch records from Grimersta Estate were used to provide a more local consideration of rod catch which may be more representative of the Langavat SAC itself. The application of the NASCO rod catch assessment tool to the recorded catches over the last 20 years (1991-2010) to both the Loch Roag District and the Grimersta catchment suggested that no reduction in exploitation is required for any run-time components. When rod catch catch trends for each run-time component were considered individually for the Loch Roag District no significant change in spring catch was identified although significant increases in both summer and autumn rod catches were evident. When catches for each run-time component were considered individually for the Grimersta rod catches no significant change in spring or summer catch was identified, although there was a significant decline in autumn catch over the same period.

The average catch was compared for the Loch Roag District since designation in 2001 over cycle one (2002-2004) and cycle two (2002-2010). This showed that the average autumn rod catch in each cycle was greater than in 2001. The average summer catch in each cycle is less than that in the designation year but this is largely explained by the 2001 catch being the third highest in the dataset since designation, making it less likely that any calculated average will exceed that individual year.

The average rod catch was also compared for the Grimersta dataset since the 2001 designation over cycle one (2002-2004) and cycle two (2002-2010). This showed that both the summer and autumn catches are less than that recorded in the year of designation. The Grimersta summer and autumn catches in 2001 were also the highest for each run component over the cycle period, making any average rod catch calculated from years after 2001 difficult to exceed that recorded in the year of designation.

In combination, these analyses of adult rod catch in the Loch Roag District (for Langavat SAC) indicate that although there is a small downward trend in rod catch since 1952 this is largely a function of the unusually high catches of 1967 specifically, and the years from 1967-1968. Over the past 20 years (1991-2010) there is an upward trend in rod catch which is largely being driven by an increase in the summer and autumn rod catches. Spring rod catch is a very small part of the total catch in the District. There is no indication that further conservation measures are required from application of the NASCO rod catch assessment tool.

Analysis of local data from the Grimersta Estate also suggests that there is no significant change in spring or summer rod catches, but indicates that the autumn rod catch has declined. However, application of the NASCO rod catch assessment tool suggests that further conservation measures or investigations are not required.

c) Habitats supporting the qualifying feature

1. Water quality and quantity

The status of each water body within the SAC, for which SEPA hold data, was obtained from the SEPA River Basin Planning interactive website.

A total of seven WFD water bodies representing a river length of 14km are recognised within the Langavat SAC. All of these are classified as being at good ecological status and will be protected from deterioration from that class. There are no Heavily Modified Water bodies (HMWBs) within the Langavat SAC. Table 7.14 below summarises the number of water bodies and the length of channel within each status category.

Table 7.14 - Number of water bodies and length of channel within each WFD status category in the Langavat SAC

WFD status (2009)	High	Good	Moderate	Poor	Bad	Total
Number of water bodies		7				7
Length of channel (km)		14				14

2. Trends, changes and activities

The Outer Hebrides Fishery Trust suggest that fish farms have the largest negative impact upon Atlantic salmon within the Langavat catchment, but that the last four years have seen improvements in management. Invasive species, and a lack of coherent catchment-wide management, are also cited as having a negative impact on Atlantic salmon. Reduction in grazing pressure, and improved forestry operations (involving fencing and planting) are considered to be having a positive impact on Atlantic salmon within the site.

The OHFT suggest that the main activities having a negative impact on Atlantic salmon in the Langavat catchment are:

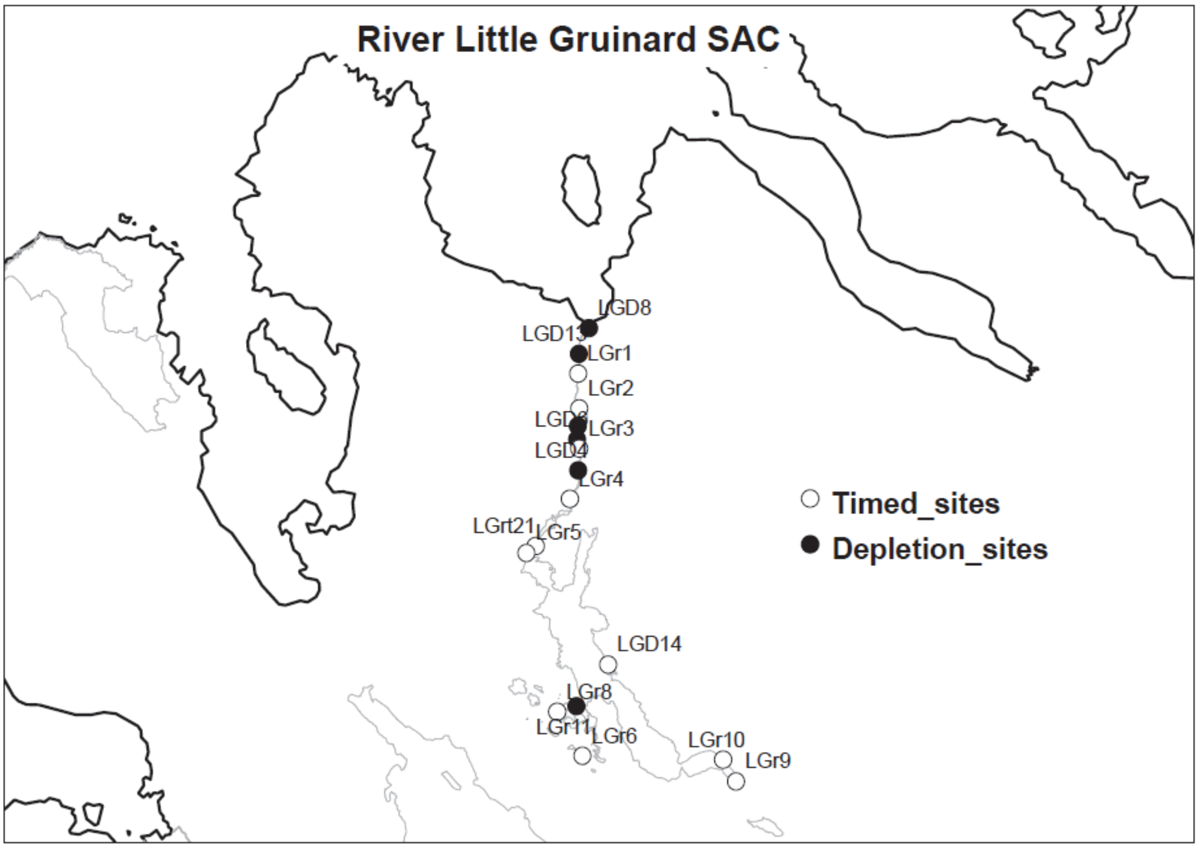
- Fish farms (escapes/disease/parasites);
- Lack of catchment-wide management planning;and
- Invasive non-native species.

8. RIVER LITTLE GRUINARD

a) Juvenile Assessment

Seven sites were surveyed using the standard SFCC catch depletion electrofishing method. A further 12 sites were sampled using a five-minute timed electrofishing approach. All sites were situated within the River Little Gruinard SAC (Map 8.1). The sites were surveyed by staff of the Wester Ross Fisheries Trust.

Map 8.1 - Distribution of depletion and timed electrofishing sites on the River Little Gruinard SAC.



Depletion sites

Site details and a summary of electrofishing results are shown in Tables 8.1 – 8.4. Zippin and Carl & Strube estimates for fry were calculable for all sites although confidence limits were wide in some cases. Five sites were calculable for 1+ fish and one site for 2+. For fry, Zippin densities ranged from 33 - 130 per 100 m^2 (mean 79) and Carl & Strube densities ranged from 32 -127 per 100 m^2 (mean 73). 0+ fish were caught on all sites, 1+ fish were caught at five sites and 2+ fish at only one site (Sand Bay Burn above Fionn Loch). The largest 0+ and 1+ fish were found in the main channel (50 and 79 mm respectively) while the largest 2+ fish (82 mm) was found in the Sand Bay Burn above Fionn Loch. Trout were present at all but one site. The highest densities of 0+ and 1+ fish were found in the Sand

Bay Burn above Fionn Loch (130 and 46 per 100 m^2 respectively). The lowest densities of 0+ and 1+ fish were found in the Main channel (33 and 0 per 100 m^2 respectively).

Table 8.1 - Details of depletion electrofishing sites, River Little Gruinard SAC.

Site code	Date	Easting	Northing	Altitude (m)	Channel name
LGD4	18/08/2011	194236	885417	120	Little Gruinard River
LGD6	18/08/2011	194200	886400	105	Little Gruinard River
LGr11	19/09/2011	194182	877896	95	Sand Bay Burn above Fionn Loch
LGD15	19/09/2011	194475	877847	170	Little Gruinard River
LGD8	03/10/2011	194570	889950	5	Little Gruinard River
LGD11	04/10/2011	194222	886835	90	Little Gruinard River
LGD13	04/10/2011	194254	889129	50	Little Gruinard River

Table 8.2 - Details of depletion electrofishing for 0+ and 1++ salmon, River Little Gruinard SAC.

Site code	Wetted area (m^2)	Zippin 0+	Carl & Strube 0+	Zippin 1+	Carl & Strube 1+	Zippin 2+	Carl & Strube 2+
LGD4	154.9	156.7	143.3	27.7	26.5	0.0	0.0
LGD6	107.3	42.5	39.2	37.9	36.4	0.0	0.0
LGr11	93.6	30.6	29.9	n/a	n/a	4.3	4.3
LGD15	177.6	90.7	64.8	28.9	22.2	0.0	0.0
LGD8	111.7	132.5	128.1	17.9	17.0	0.0	0.0
LGD11	70.6	91.6	89.3	32.2	31.2	0.0	0.0
LGD13	80.0	71.6	70.0	0.0	0.0	0.0	0.0

n/a denotes salmon present, but not in high enough densities to allow calculation of Zippin or Carl & Strube statistics. 0 denotes no salmon found at site

Table 8.3 - Presence/absence of salmon year classes and of trout 0+ and 1++ at depletion sites, River Little Gruinard SAC.

Site code	Salmon age class present?				Trout present?	
	0+	1+	2+	3++	0+	1++
LGD4	Y	Y	N	N	N	Y
LGD6	Y	Y	N	N	N	N
LGr11	Y	Y	Y	N	Y	N
LGD15	Y	Y	N	N	Y	N
LGD8	Y	Y	N	N	Y	Y
LGD11	Y	Y	N	N	N	Y
LGD13	Y	N	N	N	N	Y

Table 8.4 - Fork length of salmon of different age classes, River Little Gruinard SAC.

Site code	0+ mean fork length	No. 0+	1+ mean fork length	No. 1+	2+ mean fork length	No. 2+	3+ mean fork length	No. 3+
LGD4	38	137	69	38	n/a	0	n/a	0
LGD6	35	32	n/a	0	n/a	0	n/a	0
LGr11	42	27	73	2	82	4	n/a	0
LGD15	50	35	79	16	n/a	0	n/a	0
LGD8	45	113	72	19	n/a	0	n/a	0
LGD11	41	57	61	22	n/a	0	n/a	0
LGD13	47	56	n/a	0	n/a	0	n/a	0

n/a denotes means could not be calculated as no salmon of that age class were found at the site

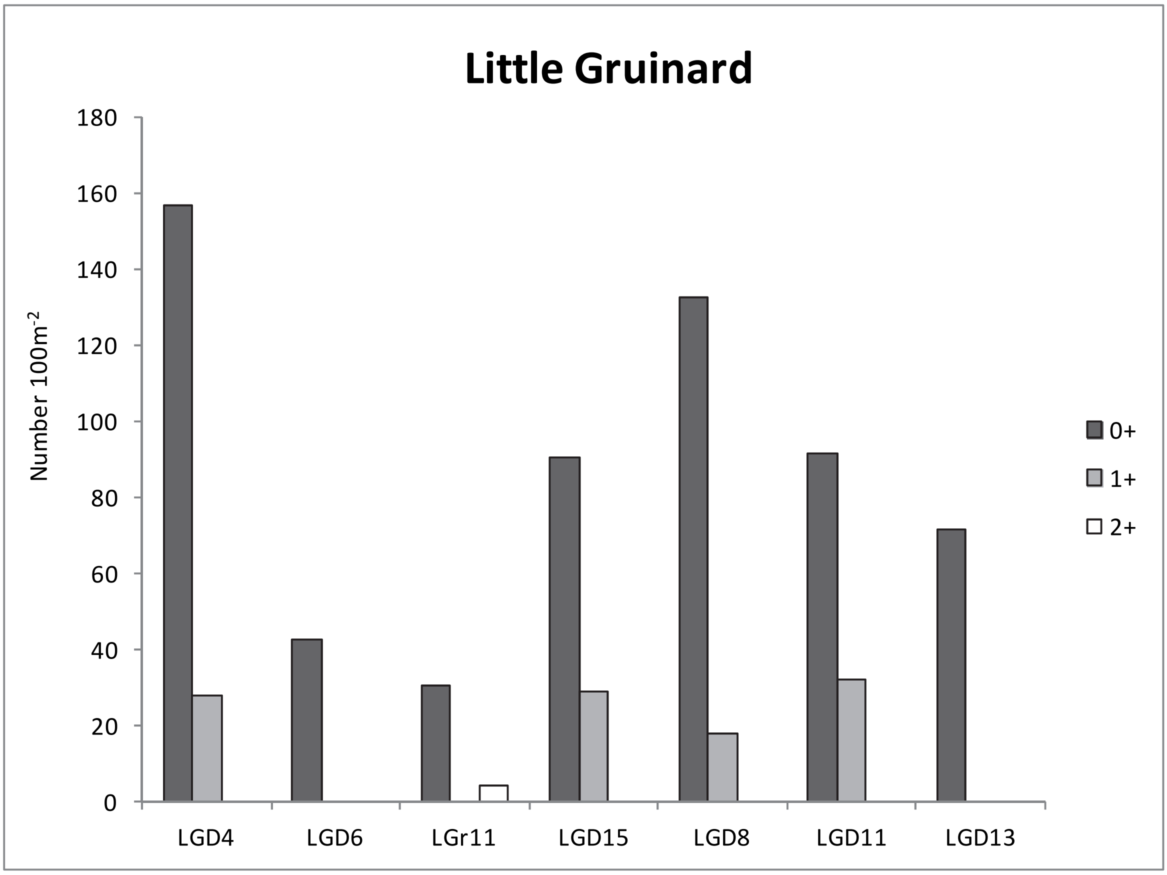


Figure 8.1 - Juvenile salmon population density estimated by the Zippin method for the SAC monitoring sites on the River Little Gruinard SAC.

Timed sites

Details of the 12 timed sites are given in Table 8.5. CPUE for fry ranged from 0/ min to 3/min and for 1++ fish, ranged from 0/ min to 2/min. 0+ salmon were caught at 10 of the 12 timed sites, and 1+ fish at 8 sites. No salmon of any age were caught at two sites - Loch na

Moine Buige Burn and Garbh Allt Burn. 2+ salmon were caught at only two sites (Allt Bruthach an Easain and the main channel). Trout were found at only five sites.

Table 8.5 - Details of timed electrofishing sites, River Little Gruinard SAC.

Site code	Easting	Northing	River	Altitude (m)
LGr3	194271	886114	Little Gruinard River	115
LGr4	193959	884505	Little Gruinard River	149
LGD14	195186	879222	Garbh Allt	
LGr10	198844	876190	Allt Bruthach an Easain	173
LGr6	194365	876307	Little Gruinard River	
LGr8	193561	877713	Loch an Doire Crionaich Burn above Beannach lochs	5
LGr7	193516	877808	Loch nan Clach Dubha burn above loch	185
LGrt21	192872	883000	Little Gruinard River at Stepping Stones	37
LGr5	192582	882775	Loch na Moine Buige burn	177
LGr9	199265	875494	Allt a' Chladhain above Dubh Loch	174
LGr1	194227	888504	Little Gruinard River	65
LGr2	194262	887397	Little Gruinard River	100

Table 8.6 - Salmon catch per unit effort (CPUE), River Little Gruinard SAC.

Site code	Survey date	Salmon 0+/min	Salmon 1++/min
LGr3	18/08/2011	1.1	0.8
LGr4	18/08/2011	0.8	1.7
LGD14	23/08/2011	0.0	0.0
LGr10	23/08/2011	2.7	1.8
LGr6	23/08/2011	0.4	1.7
LGr8	23/08/2011	2.1	1.1
LGr7	23/08/2011	0.4	0.1
LGrt21	19/09/2011	0.3	0.1
LGr5	19/09/2011	0.0	0.0
LGr9	23/09/2011	1.7	1.4
LGr1	04/10/2011	3.3	0.9
LGr2	04/10/2011	1.6	1.2

Table 8.7 - Presence/absence of salmon year classes and of trout at timed sites, River Little Gruinard SAC.

Site code	Salmon age class present?				Trout present?
	0+	1+	2+	3+	
LGr3	Y	Y	N	N	N
LGr4	Y	Y	N	N	N
LGD14	N	N	N	N	N
LGr10	Y	Y	Y	N	N
LGr6	Y	Y	Y	N	Y
LGr8	Y	Y	N	N	Y
LGr7	Y	N	N	N	Y
LGrt21	Y	N	N	N	N
LGr5	N	N	N	N	Y
LGr9	Y	Y	N	N	N
LGr1	Y	Y	N	N	Y
LGr2	Y	Y	N	N	N

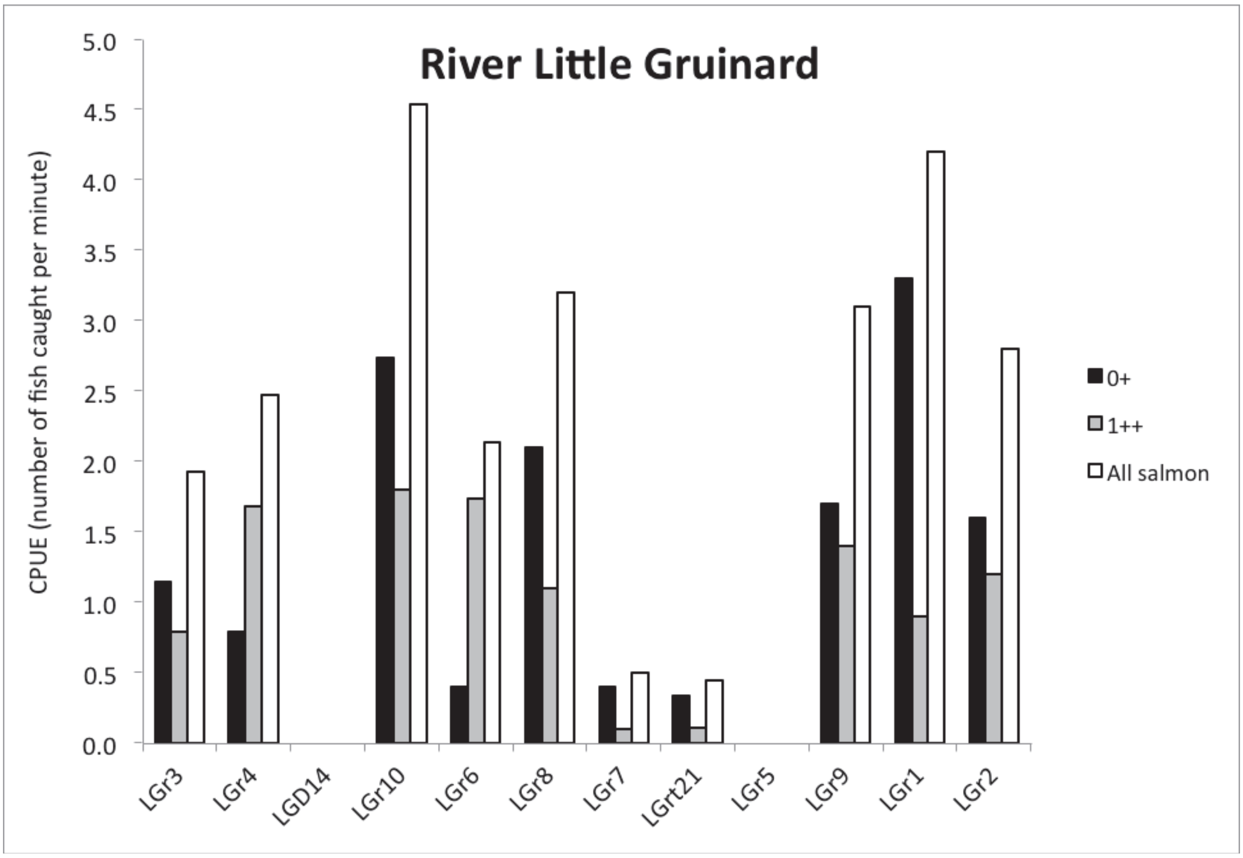


Figure 8.2 - Number of salmon (0+, 1++ and all salmon) caught per minute during 5 minutes of electrofishing at sites on the River Little Gruinard.

Summary

When the quintile densities of 0+ and 1++ juveniles are compared against the regional juvenile densities developed by Godfrey (2005), the Little Gruinard sites are concentrated in the top band (Table 8.8). This indicates the presence of high fry and parr densities across the catchment which, in turn, reflects good quality habitat and spawning success. These data strongly suggest that juvenile populations are in favourable status within the SAC.

Table 8.8 – *Number of sites within the River Little Gruinard SAC falling within each quintile (according to absolute regional classification for 0+ and 1++ age classes) – and the resulting condition status.*

SAC	Age class	Number of sites					Median grade	Favourable condition?
		0-20	21-40	41-60	61-80	81-100		
		E	D	C	B	A		
Little Gruinard	0+					7	A	Y
	1++	1	1			5	A	Y

A comparison of data obtained for each SCM shows that the juvenile numbers within the River Little Gruinard are similar to those seen in the previous assessment i.e. no change (Table 8.9).

Table 8.9 - Comparison of condition status in 2004 and in 2011 for 0+ and 1++ age classes.

SAC		2004	2011	Change
Little Gruinard	0+	Y	Y	=
	1++	Y	Y	=

b) Adult Assessment

An assessment of adult Atlantic salmon populations within the River Little Gruinard was carried out using the Rod Catch Assessment tool introduced and described in Section 1. This analysis uses the rod catch in seasonal components (spring, summer and autumn) to provide an assessment of adult population. In addition to this, Marine Scotland Science rod catch data (available from 1952-present) is interrogated to examine trends in overall rod catch and the same seasonal run-time components.

The Marine Scotland Science rod catch statistics used are those of the Gruinard Fisheries District as a whole and not those of the Little Gruinard SAC itself. Catches for the Little Gruinard SAC area itself are not specifically available. For the purposes of these analyses rod catch from the Gruinard District is assumed to be representative of the Little Gruinard SAC although this has not specifically been demonstrated to be the case.

Summary of 1952 Catch Statistics

Published rod catch statistics for the Gruinard District (for Little Gruinard SAC) for total catch, and each of the seasonal run-time components, are shown in Figures 8.3, 8.4, 8.5 and 8.6.

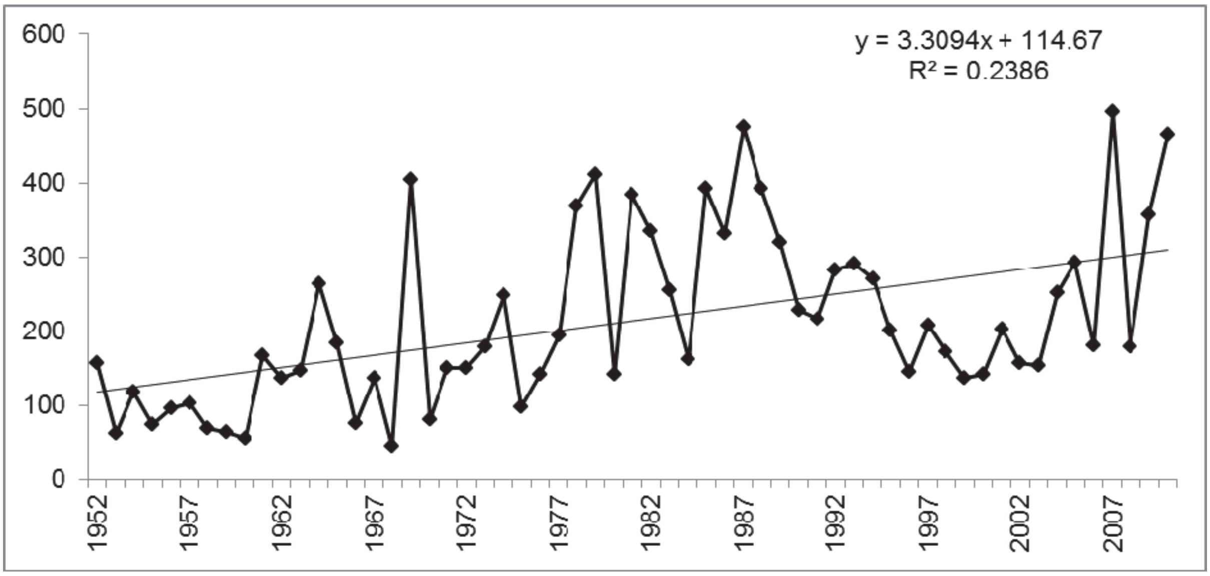


Figure 8.3 - Gruinard District (for Little Gruinard SAC) total rod catch 1952-2010 (salmon and grilse, retained and released).

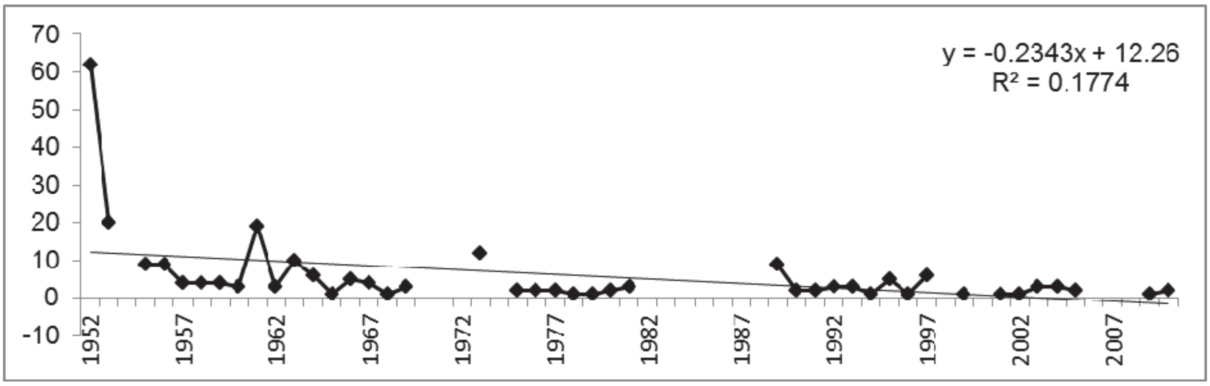


Figure 8.4 - Gruinard District (for Little Gruinard SAC) total spring rod catch 1952-2010 (salmon and grilse, retained and released).

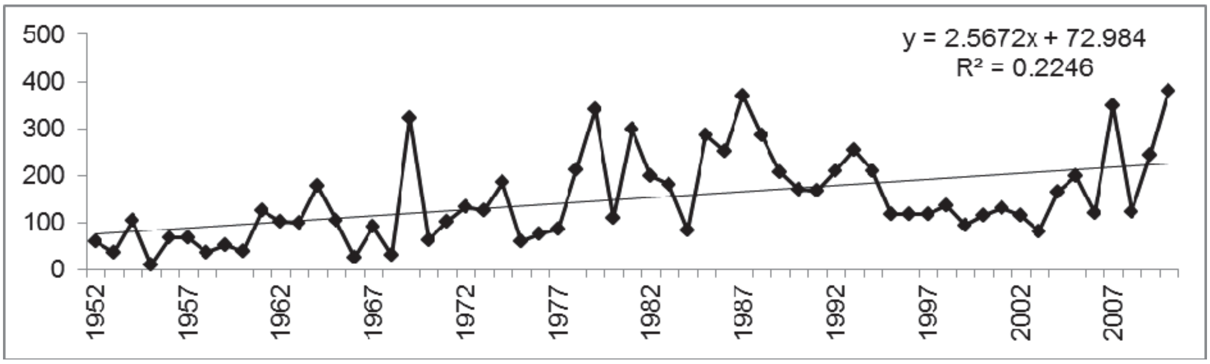


Figure 8.5 - Gruinard District (for Little Gruinard SAC) total summer rod catch 1952-2010 (salmon and grilse, retained and released).

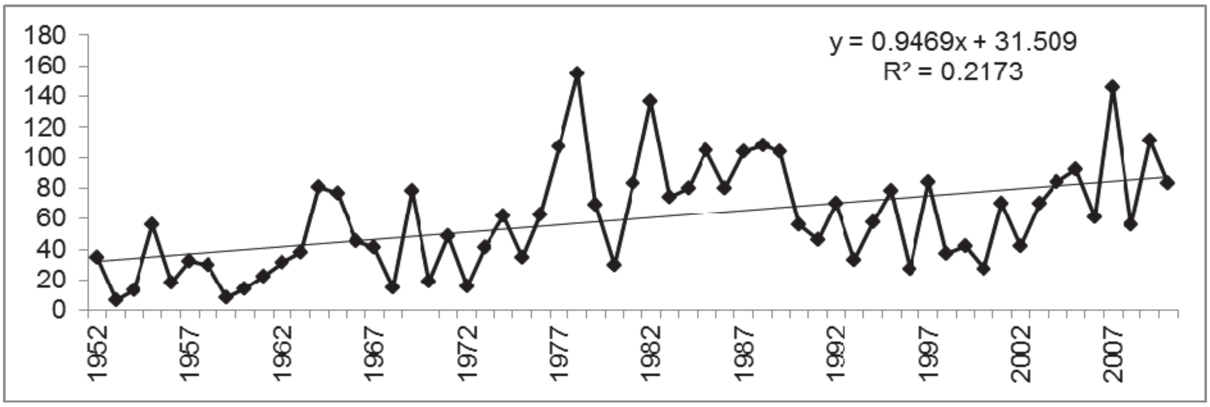


Figure 8.6 - Gruinard District (for Little Gruinard SAC) total autumn rod catch 1952-2010 (salmon and grilse, retained and released).

Figure 8.3 indicates an overall increase in total rod catch since 1952, but with some variation between years. In such a small catchment this is likely to reflect to a significant degree the angling conditions and fishing effort. The summer and autumn rod catches (Figure 8.5 and 8.6) show a corresponding improving trend which matches that recorded in the total rod catch. The spring rod catch (Figure 8.4) shows a slight declining trend but catches of this run-time component are low throughout the dataset, possibly reflecting the fact that the Little Gruinard is largely recognised as a summer and autumn fishing river. Some exceptions exist however, where the spring rod catches in 1952 and 1953 greater than any of the others in the time series.

It is considered that the reporting of rod catch over the period has been consistent and there is no evidence that any trends summarised may be attributable to a change in reporting accuracy or inconsistency.

A conservation code is in place within the Little Gruinard and a 100% catch and release policy is in place. Good record keeping is maintained and there is no history of stocking activities which may be seen to compromise and assessment of natural production or fishery performance.

Application of Rod Catch Assessment Tool

Rod catches from the Gruinard District (for Little Gruinard SAC) over the last 20 years (1991-2010) were applied to the rod catch assessment tool to consider the status of each run-time component.

Initially catch was considered in relation to three tests:

Test A: Is the 2010 catch the lowest in the sequence?

Test B: Do the two lowest catches occur within the last three years catches?

Test C: Do the four lowest catches occur within the last six years catches?

The results of these analyses for the Gruinard District (for Little Gruinard SAC) are shown in Table 8.10. The data used to complete each test is available in Appendix 1. These tests suggest that no reduction in exploitation is currently required for any of the run-time components.

Table 8.10 - Summary of the Rod Catch Assessment Tool Tests for Gruinard District (for Little Gruinard SAC).

Test	Spring	Summer	Autumn
A	No	No	No
B	No	No	No
C	No	No	No

The catches for the 20 year period considered (1991-2010) are presented for total rod catch and each of the seasonal components is shown in Figures 8.7, 8.8, 8.9 and 8.10. An F-test was applied to each of the seasonal components to assess the level of deviation from horizontal. These results are summarised in Table 8.11, and suggest no significant change in summer rod catch and a significant increase (at the 95% confidence level) in the autumn catch over the period examined. A full analysis of spring rod catch over the same period was not possible due to the paucity of data.

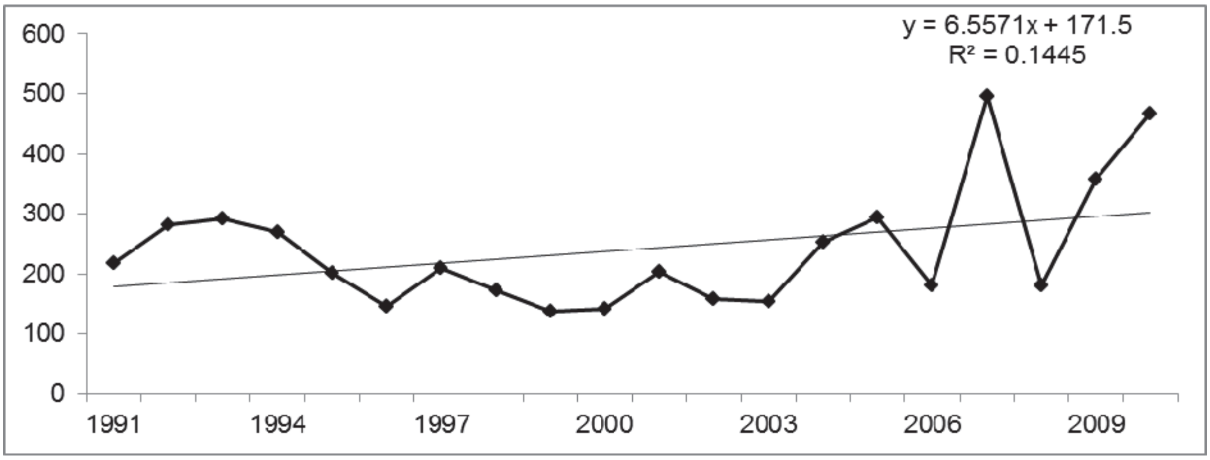


Figure 8.7 - Gruinard District (for Little Gruinard SAC) total rod catch 1991-2010 (salmon and grilse, retained and released).

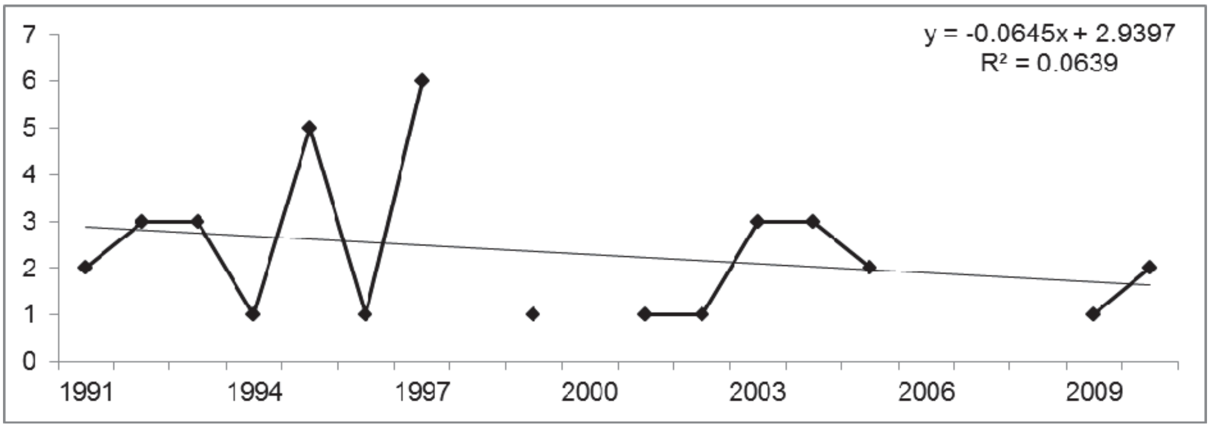


Figure 8.8 - Gruinard District (for Little Gruinard SAC) spring rod catch 1991-2010 (salmon and grilse, retained and released).

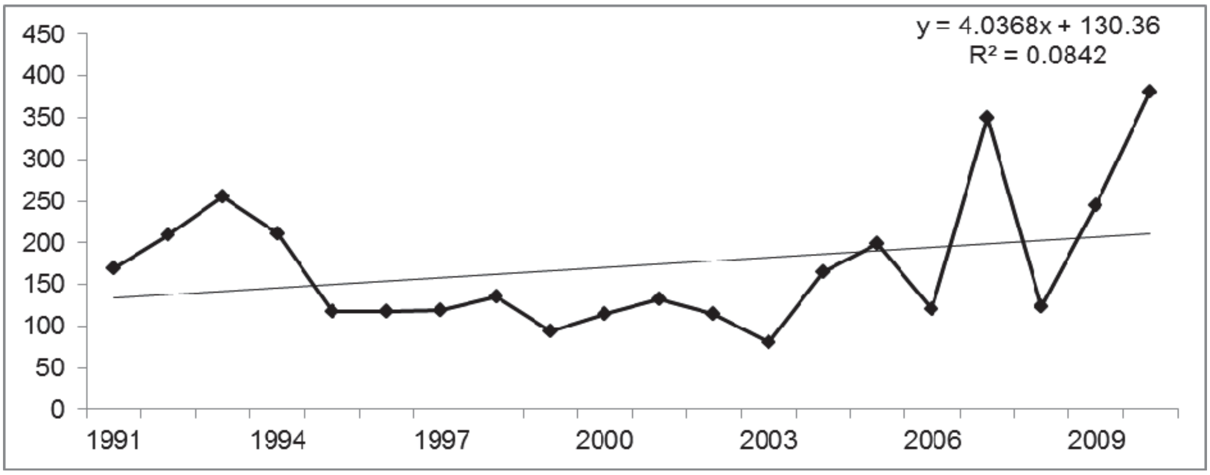


Figure 8.9 - Gruinard District (for Little Gruinard SAC) summer rod catch 1991-2010 (salmon and grilse, retained and released).

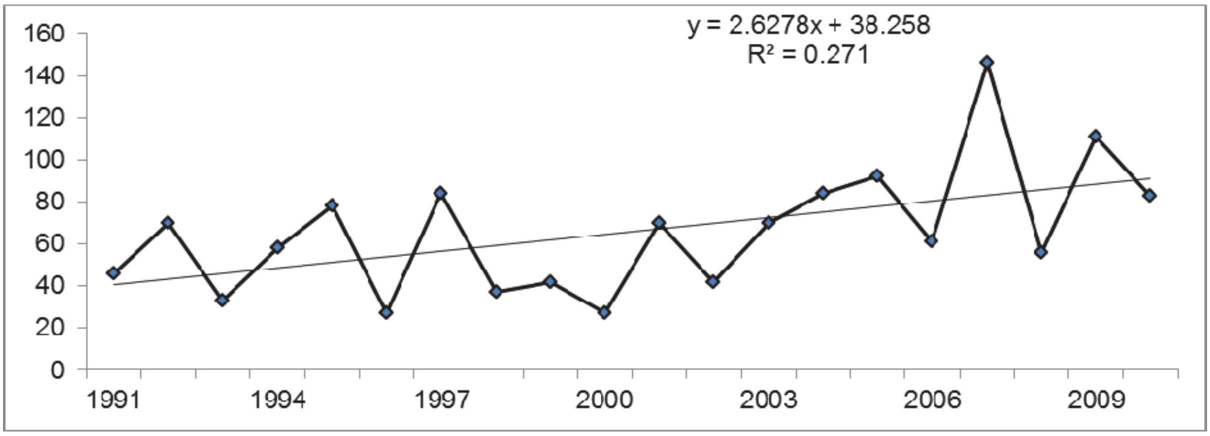


Figure 8.10 - Gruinard District (for Little Gruinard SAC) autumn rod catch 1991-2010 (salmon and grilse, retained and released).

Table 8.11 - Summary of F-Test Results on Gruinard District (for Little Gruinard SAC) Seasonal Rod Catch (1991-2010)

Component	Observations	F-Value	F-Significance
Spring	Insufficient data	-	-
Summer	20	1.654	0.215
Autumn	20	6.693	0.019

The percentage change in the spring, summer and autumn rod catches SCM cycles against the year of designation (2001) was also undertaken. The first SCM assessment covered the period 2002-2004, whilst the second includes data extending from 2002-2010. In this review the rod catch is averaged for each cycle period and the increase or decrease in average rod catch expressed as a percentage of the rod catch in the year of designation.

This comparison is shown in Figure 8.11, and indicates that for the summer and autumn stock components there has been an increase in average rod catch since the year of designation in cycle two. By contrast, there was a small reduction in average catch when each run-time component is compared to the rod catch in the year of designation at cycle one. The declared rod catch for the spring component is generally low and so average catch in each cycle period is more likely to be disproportionately influenced by small changes in catch over each cycle period. However, for each cycle the average spring catch was higher than that recorded since designation in 2001.

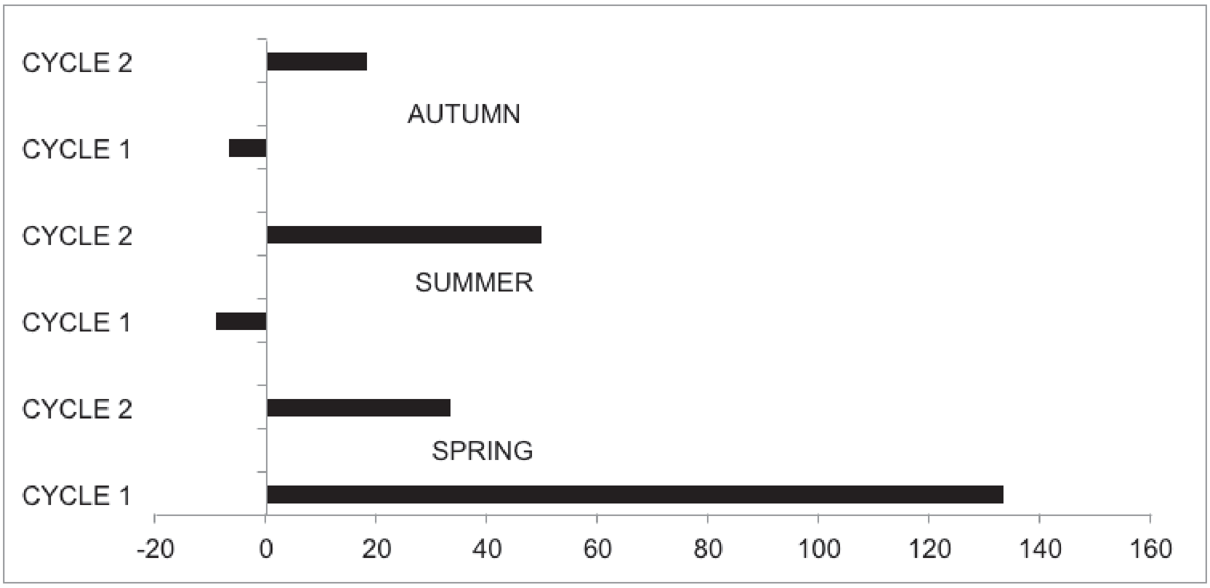


Figure 8.11 - Stock trend assessment since River Little Gruinard SAC Designation (2001) in cycle 1 (2002-2004) and cycle 2 (2002-2010).

Summary

Overall, total rod catch trends within the Gruinard District (for Little Gruinard SAC) over the period 1952-2010 shows an overall improvement. This is mirrored by the summer and autumn rod catches which comprise the main elements of the fishery. There has been a small downward trend in spring rod catches but this is set against consistently low catches in all of the years within the dataset (except 1952 and 1953 where significant larger spring catches were recorded).

Application of the NASCO rod catch assessment tool to data collated over the 20 year period (1991-2010), suggest that no reduction in exploitation is required. When rod catch trends for each run-time component were considered individually there appeared to be no significant change in summer rod catch, but a significant increase in the autumn rod catch components was evident. Statistical analysis of the spring rod catch was not possible.

When the average rod catch is compared since designation in 2001 there is a decrease in average catch when compared to those obtained for both summer and autumn rod catches over cycle one (2001-2004) and an increase in average catches in cycle two (2001-2010). In each cycle the average spring catch is greater than that recorded in the year of designation.

In combination, these assessments of adult Atlantic salmon rod catch in the Gruinard District (for Little Gruinard SAC) indicate an improving situation since designation in 2001 for summer and autumn catches, with spring rod catches being maintained at low levels. A similar pattern of improvement is shown for catches over the 1952-2010 period. The NASCO rod catch assessment tool supports this and indicate that there is no need for any reduction in exploitation (a 100% catch and release policy is in place in any case).

c) Habitats supporting the qualifying feature

1. Water quality and quantity

The status of each water body within the SAC, for which SEPA hold data, was obtained from the SEPA River Basin Planning interactive website.

There is only one WFD water body representing a river length of 9 km within the Little Gruinard SAC. This waterbody is classified as being of good ecological status (total length 238 km) and is protected from deterioration from that class. Table 8.12 summarises the water body channel length and classification.

Table 8.12 - Number of water bodies and length of channel within each WFD status category in the Little Gruinard SAC.

WFD status (2009)	High	Good	Moderate	Poor	Bad	Total
Number of water bodies		1				1
Length of channel (km)		9				9

2. Trends, changes and activities

The Wester Ross Fisheries Trust suggest that the Little Gruinard SAC is unproductive and ‘a loss of fertility and juvenile salmon food production within the catchment’ are the primary concerns. This is considered by the WRFT to be associated with grazing pressures and export of livestock and nutrients over many decades or centuries. More recently pressures, according to the WRFT, include nutrient losses associated with grazing by deer. There has been little change in grazing pressure since the site was designated, but the long-term impacts on vegetation and catchment fertility is thought, by the WRFT, to be significant, despite recent efforts to contain and manage grazing pressure.

The WRFT also consider that marine fish farms are also a concern for the Little Gruinard. This is based on the occurrence lice infested post-smolt sea trout in the area (within 20 km of the mouth). Post-smolt Atlantic salmon have, crucially, not been sampled. WRFT also suggest that food availability for post-smolts and predation in coastal waters may also be an issue, although the magnitude of any impact is not currently known. The presence of non-native European minnows in the Beannach Burn is also considered to be a cause of concern. Water quality is good within the Little Gruinard, however, there may be a tendency for minor acid episodes in the upper catchment.

The most positive impact on Atlantic salmon in the catchment has, according to the WRFT, arisen from improvements in wild salmon conservation management. There is a 100% catch and release policy in place, with good record keeping, and no stocking is allowed.

Improvements in woodland management practices is also considered to have had a positive impact, as large woody debris has been left along the riparian channel, especially along the lower river.

The main activities considered by the WRFT to have a negative impact on Atlantic salmon in the Little Gruinard catchment are:

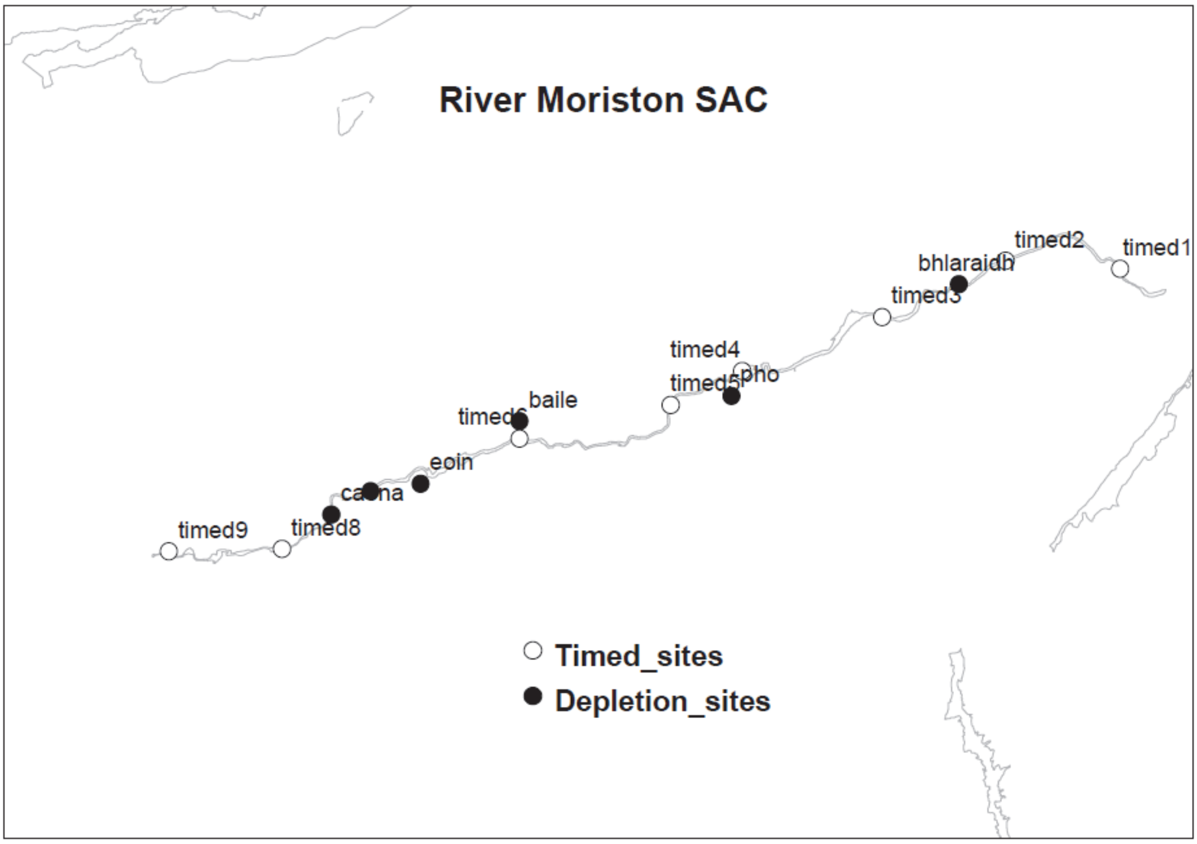
- Limited juvenile salmon food supply associated with low catchment fertility and long term grazing and export of animal carcasses;
- Fish farm parasites; and
- Food availability in coastal waters.

9. RIVER MORISTON

a) Juvenile Assessment

Six sites were surveyed using the standard SFCC catch depletion electrofishing method. A further nine sites were sampled using a five-minute timed electrofishing approach. All sites were situated within the River Moriston SAC (Map 9.1). The sites were surveyed by staff of the Ness and Beauly Fisheries Trust.

Map 9.1 - Distribution of depletion and timed electrofishing sites on the River Moriston SAC.



Depletion sites

Site details and a summary of electrofishing results are shown in Tables 9.1 – 9.4. Zippin and Carl & Strube estimates for fry were calculable for only three of the six depletion sites, for which confidence limits were generally narrow. Four sites were calculable for 1+ fish and one site for 2+. For fry, Zippin densities ranged from 4 - 170 per 100 m^2 (mean 87) and Carl & Strube densities ranged from 3 - 167 per 100 m^2 (mean 85). For 1+ fish, Zippin densities ranged from 14 – 50 (mean 36) and Carl & Strube densities from 13 – 47 (mean 34). 0+, 1+ and 2+ fish were caught at four sites. The mean largest 0+ fish were found in the main channel and the largest 1+ in Allt Bhlaraidh (48 and 89 mm respectively). Trout were present at all sites.

Table 9.1 - Details of depletion electrofishing sites, River Moriston SAC.

Site code	Date	Easting	Northing	Altitude (m)	Channel name
sac/mor/pho	05/07/2011	232492	813684	115	Allt Phocaihain
sac/mor/eoin	12/07/2011	224975	811550	130	Allt an Eoin
sac/mor/caena	22/07/2011	222810	810798	140	Moriston
sac/mor/baile	12/08/11	227362	813069	130	Allt Baile nan Carn
sac/mor/bhlaraidh	22/08/2011	238000	816400	170	Allt Bhlaraidh
sac/mor/mackenzie	26/08/2011	223765	811368	120	Moriston

Table 9.2 - Details of depletion electrofishing for 0+ and 1++ salmon, River Moriston SAC.

Site code	Wetted area (m^2)	Zippin 0+	Carl & Strube 0+	Zippin 1+	Carl & Strube 1+	Zippin 2+	Carl & Strube 2+
sac/mor/pho	124.7	3.5	3.2	14.1	12.8	0.0	0.0
sac/mor/eoin	107.3	n/a	n/a	44.4	41.0	0.0	0.0
sac/mor/caena	70.4	7.4	7.1	34.0	32.7	n/a	n/a
sac/mor/baile	121.6	0.0	0.0	0.0	0.0	4.3	4.1
sac/mor/bhlaraidh	140.8	0.0	0.0	0.0	0.0	n/a	n/a
sac/mor/mackenzie	122.0	170.2	167.2	49.8	46.7	n/a	n/a

n/a denotes salmon present, but not in high enough densities to allow calculation of Zippin or Carl & Strube statistics. 0 denotes no salmon found at site.

Table 9.3 - Presence/absence of salmon year classes and of trout 0+ and 1++ at depletion sites, River Moriston SAC.

Site code	Salmon age class present?				Trout present?	
	0+	1+	2+	3++	0+	1++
sac/mor/pho	Y	Y	N	Y	Y	N
sac/mor/eoin	Y	Y	N	N	Y	Y
sac/mor/caena	Y	Y	Y	N	Y	Y
sac/mor/baile	N	N	Y	Y	Y	Y
sac/mor/bhlaraidh	N	N	Y	N	N	Y
sac/mor/mackenzie	Y	Y	Y	Y	Y	Y

Table 9.4 - Fork length of salmon of different age classes, River Moriston SAC.

Site code	0+ mean fork length	No. 0+	1+ mean fork length	No. 1+	2+ mean fork length	No. 2+	3+ mean fork length	No. 3+
sac/mor/pho	37	4	85	15	n/a	0	124	1
sac/mor/eoin	43	1	83	42	n/a	0	n/a	0
sac/mor/caena	43	5	89	23	113	4	n/a	0
sac/mor/baile	n/a	0	n/a	0	101	4	125	1
sac/mor/bhlaraidh	n/a	0	n/a	0	110	4	n/a	0
sac/mor/mackenzie	48	168	90	48	104	3	127	2

n/a denotes means could not be calculated as no salmon of that age class were found at the site.

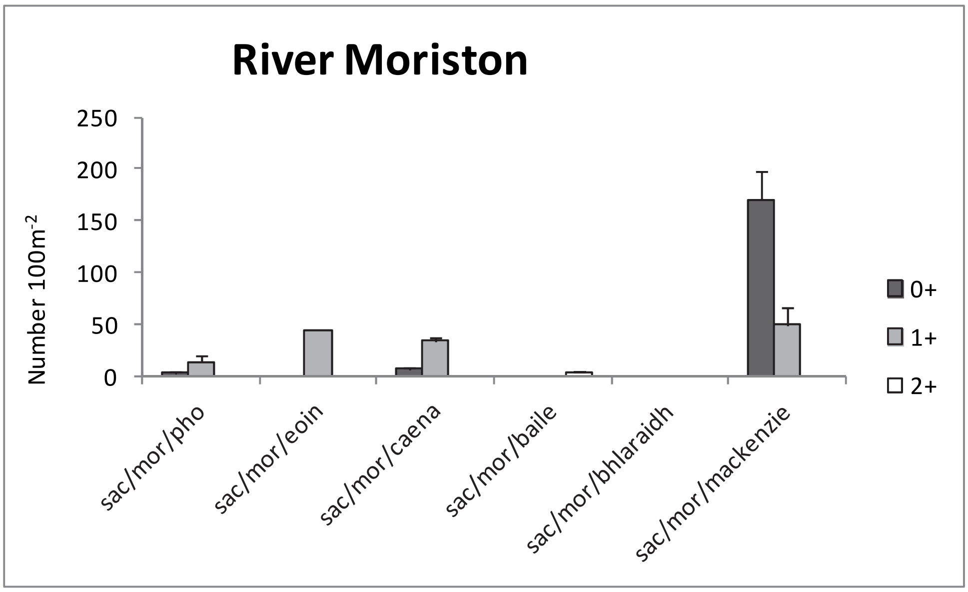


Figure 9.1 - Juvenile salmon population density estimated by the Zippin method for the SAC monitoring sites on the River Moriston SAC.

Timed sites

Details of the nine timed sites are given in Table 9.5. 0+ salmon were caught at all nine timed sites, and 1+ fish at seven sites. CPUE for fry ranged from 0.2/min to 5.4/min and for 1++ fish, ranged from 0/min to 2/min. No salmon older than 1+ were caught at any of the sites. Trout were recorded at only four sites.

.Table 9.5 - Details of timed electrofishing sites, River Moriston SAC.

Site code	Easting	Northing	River	Altitude (m)
sac/mor/timed2	239122	816974	Moriston	50
sac/mor/timed1	241901	816775	Moriston	30
sac/mor/timed3	236139	815601	Moriston	90
sac/mor/timed4	232750	814286	Moriston	115
sac/mor/timed5	231017	813464	Moriston	120
sac/mor/timed6	227364	812646	Moriston	121
sac/mor/timed7	225300	811800	Moriston	130
sac/mor/timed8	221614	809962	Moriston	140
sac/mor/timed9	218884	809905	Moriston	170

Table 9.6 - Salmon catch per unit effort (CPUE), River Moriston SAC.

Site code	Survey date	Salmon 0+/min	Salmon 1++/min
sac/mor/timed2	18/08/2011	0.8	1.6
sac/mor/timed1	18/08/2011	2.6	2.0
sac/mor/timed3	18/08/2011	0.2	0.8
sac/mor/timed4	26/08/2011	5.4	1.0
sac/mor/timed5	15/09/2011	1.2	1.8
sac/mor/timed6	15/09/2011	5.2	0.4
sac/mor/timed7	15/09/2011	2.6	0.2
sac/mor/timed8	25/07/2011	0.4	0.0
sac/mor/timed9	25/07/2011	1.2	0.0

Table 9.7 - Presence/absence of salmon year classes and of trout at timed sites, River Moriston SAC.

Site code	Salmon age class present?				Trout present?
	0+	1+	2+	3+	
sac/mor/timed2	Y	Y	N	N	N
sac/mor/timed1	Y	Y	N	N	Y
sac/mor/timed3	Y	Y	N	N	N
sac/mor/timed4	Y	Y	N	N	N
sac/mor/timed5	Y	Y	N	N	Y
sac/mor/timed6	Y	Y	N	N	N
sac/mor/timed7	Y	Y	N	N	N
sac/mor/timed8	Y	N	N	N	Y
sac/mor/timed9	Y	N	N	N	Y

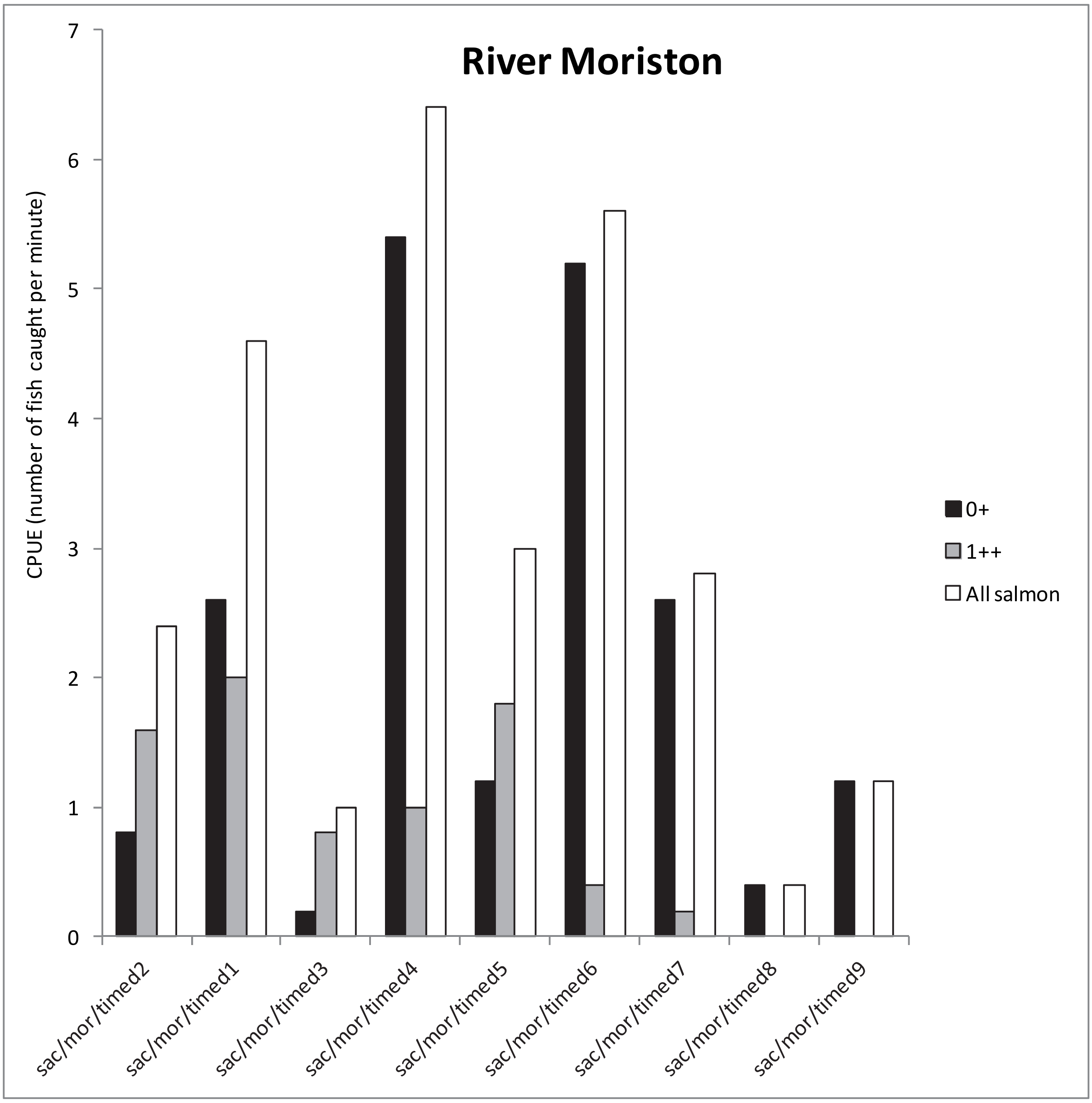


Figure 9.2 - Number of salmon (0+, 1++ and all salmon) caught per minute during five minutes of electrofishing at sites on the River Moriston.

Summary

When the densities of 0+ and 1++ juveniles are considered in relation to regional juvenile densities developed by Godfrey (2005) the majority of sites in River Moriston SAC occupy the lowest quintile bands for fry. Parr densities are spread across all the quintiles and several occupy the highest banding (Table 9.8). Assessed separately, fry may be considered to be in unfavourable status, whilst parr can be considered to be are in favourable status. Survey data, based upon the sites surveyed, suggest that juvenile populations are in unfavourable status in the SAC.

Table 9.8 – *Number of sites within the River Moriston SAC falling within each quintile (according to absolute regional classification for 0+ and 1++ age classes) – and the resulting condition status.*

SAC	Age class	Number of sites					Median grade	Favourable condition?
		0-20	21-40	41-60	61-80	81-100		
		E	D	C	B	A		
Moriston	0+	4	1			1	E	N
	1++	1	1	1		3	B	Y

The variability in juvenile densities suggests that, within the River Moriston catchment, there are areas of higher and lower production and areas where local management problems require active management to resolve.

A comparison of data collected for the cycle 1 SCM assessment shows that this population attribute mirrors that seen in the current survey (Table 9.9).

Table 9.9 - Comparison of condition status in 2004 and in 2011 for 0+ and 1++ age classes.

SAC		2004	2011	Change
Moriston	0+	N	N	=
	1++	Y	Y	=

b) Adult Assessment

Data for adult Atlantic salmon rod catch within the River Moriston was analysed using the NASCO Rod Catch Assessment tool introduced and described in Section 1. This analysis considers exploitation of seasonal stock components (spring, summer and autumn) and suggests whether management is required. Trends in long-term rod catch data from Marine Scotland Science (1952-present) for the overall catch and the same seasonal run-time components is also interrogated.

The Marine Scotland Science catch statistics used in the following analyses are those of the Ness Fisheries District as a whole and not those of the River Moriston itself. These are not specifically available at the scale required. For the purposes of these analyses the analyses of the catches from the District is assumed to be representative of the River Moriston.

Summary of 1952 Catch Statistics

The published rod catch statistics for the Ness District (for the River Moriston SAC) are shown in Figures 9.3, 9.4, 9.5 and 9.6.

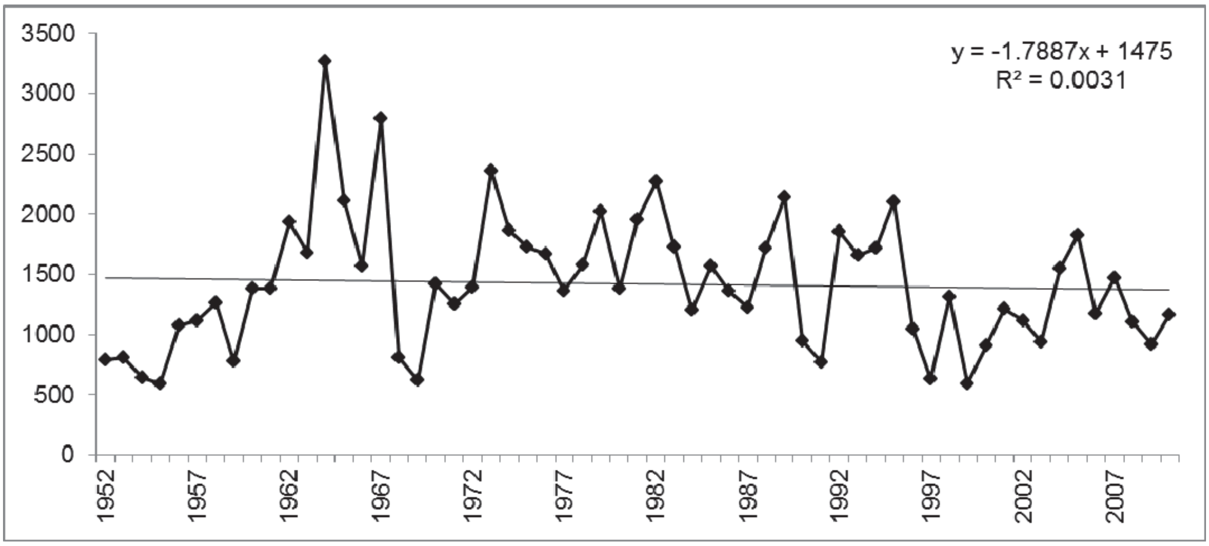


Figure 9.3 - Ness District (for River Moriston) total rod catch 1952-2010 (salmon and grilse, retained and released).

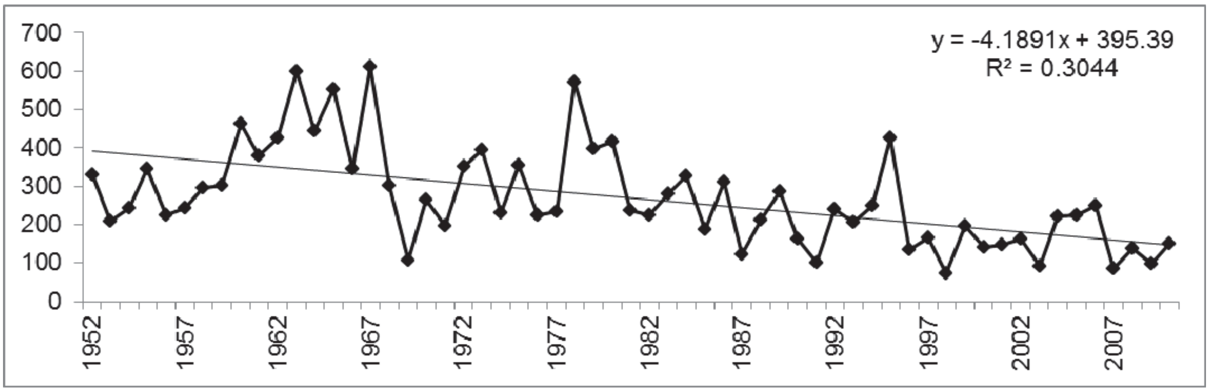


Figure 9.4 - Ness District (for River Moriston) total spring rod catch 1952-2010 (salmon and grilse, retained and released).

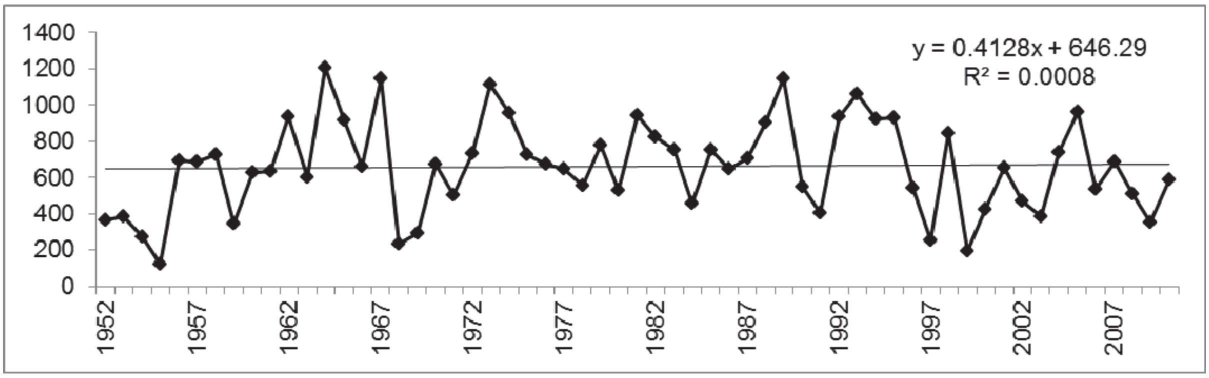


Figure 9.5 - Ness District (for River Moriston) total summer rod catch 1952-2010 (salmon and grilse, retained and released).

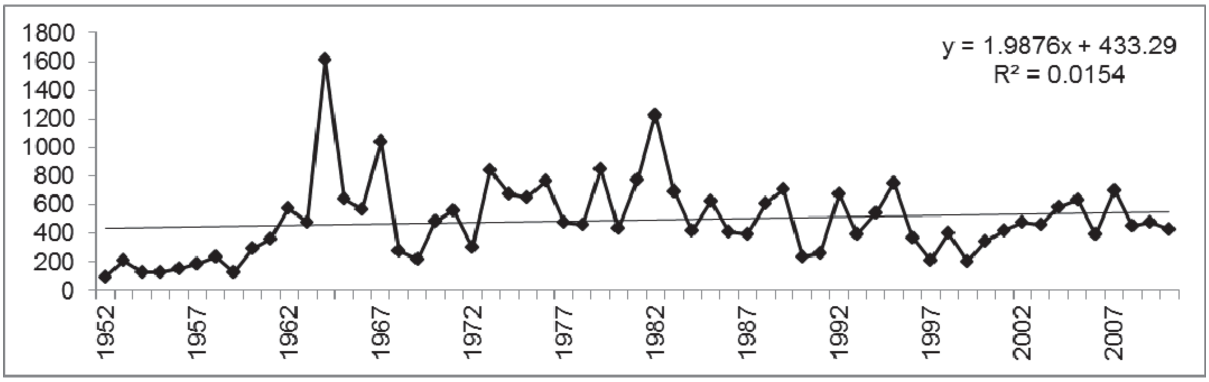


Figure 9.6 - Ness District (for River Moriston) total autumn rod catch 1952-2010 (salmon and grilse, retained and released).

Figure 9.3 shows a slight decline in total rod catch since 1952. Rod catch within the system are extremely variable. Lowest rod catches were declared in the early records of the 1950s, 1968-69. Despite increases in 1996-2004 catches have largely declined from 2005. The highest catches were recorded in the mid-1960s and catches were variable from 1973-1995.

Over the long-term, the spring rod catch (Figure 9.4) shows a declining trend with many of the lowest catches recorded in the mid/late-1980's, mid-1990's-2003 and again from 2007 to 2010. Summer rod catches (Figure 9.5) show a stable overall trend with variable annual catches. The lowest summer rod catches were recorded in the mid/late-1950's, late-1960's and from mid/late-1990's. Autumn rod catches (Figure 9.6) show a stable trend over the long-term with the lowest rod catches occurring in the early-1950's–early-1960's and again mid/late-1990's.

Reporting of rod catch over the period has been relatively consistent and although there is a general view (locally) that catches were, historically, under-reported. There is little or no information to quantify or demonstrate this. Within this context there is no evidence that any trends summarised may be attributable to a change in reporting accuracy or inconsistency.

Given the complex nature of the Ness and Moriston catchments particular care must be taken when applying the catches of Ness District to the River Moriston; although currently this is unavoidable due to the structure of the records available. The rod fishery of the River Moriston is largely restricted to the first few hundred metres of the estuary, to the point where the River Moriston joins Loch Ness, and fishing there often ceases by the end of May. Records from the Dundreggan fish counter may provide an additional measure of adult abundance. but these do not form part of this data gathering exercise. Given this marked reduction in fishing effort from June it is clear that the most important part of the Ness District rod catch contributed by the River Moriston is to the spring catch records. The summer and autumn catches are, in the main, generated by the River Ness itself

Netting effort has decreased substantially within the District and a number of netting operations were bought out by the Atlantic Salmon Conservation Trust in the mid-1980's. The Ness DSFB, until recently, leased a further a netting station in an attempt to reduce netting effort. Currently, those nets that remain operational, typically and voluntarily, do not start to fish until July. This protects the spring run-time component from exploitation.

Catch and release has become more prominent as a voluntary conservation measure, particularly for the spring component of the stock. Uptake of this measure has increased since 2006. In 2011 the Glenmoriston Lodge Estate operated a 100% release policy for all spring salmon. Elsewhere on the system a voluntary release policy successfully operates, and achieves a high release rate for spring salmon. The effect of these measures on the spring stock component and fishing effort in Loch Ness, the Ness District or the Moriston itself has not been quantified.

Application of Rod Catch Assessment Tool

Rod catch from the Ness District (River Moriston) covering the last 20 years (1991-2010) were applied to the NASCO rod catch assessment tool to assess whether exploitation of each run time component required management action.

The results of these analyses for the River Moriston are shown in Table 9.10, and the data used for this task is available in Appendix 1. These tests suggest that no reduction in exploitation is required for any of the seasonal components.

Table 9.10 - Summary of the Rod Catch Assessment Tool Tests of Ness District (for River Moriston).

Test	Spring	Summer	Autumn
A	No	No	No
B	No	No	No
C	No	No	No

The rod catches for the 20 year period (1991-2010) are shown in Figures 9.7, 9.8, 9.9 and 9.10. An F-test was applied to each of the seasonal components to assess the size and direction of the overall trend. The results of these tests are summarised in Table 9.11 and confirm that no significant trend exists in spring, summer or autumn rod catches.

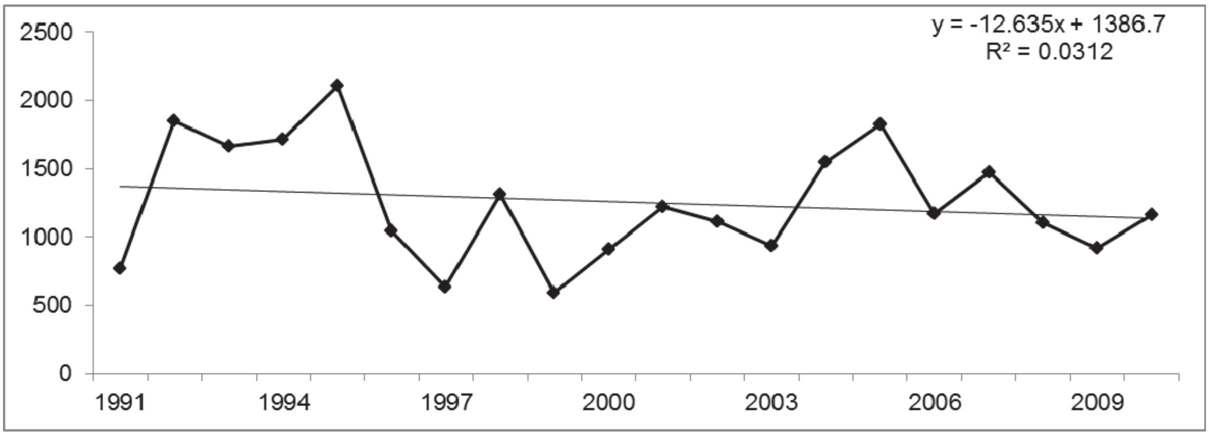


Figure 9.7 - Ness District (for River Moriston) total rod catch 1991-2010 (salmon and grilse, retained and released).

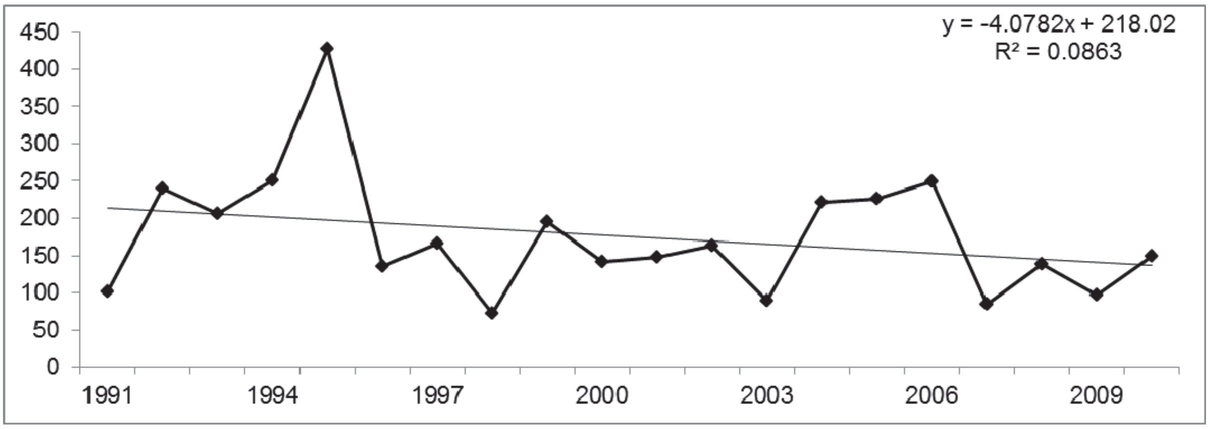


Figure 9.8 - Ness District (for River Moriston) spring rod catch 1991-2010 (salmon and grilse, retained and released).

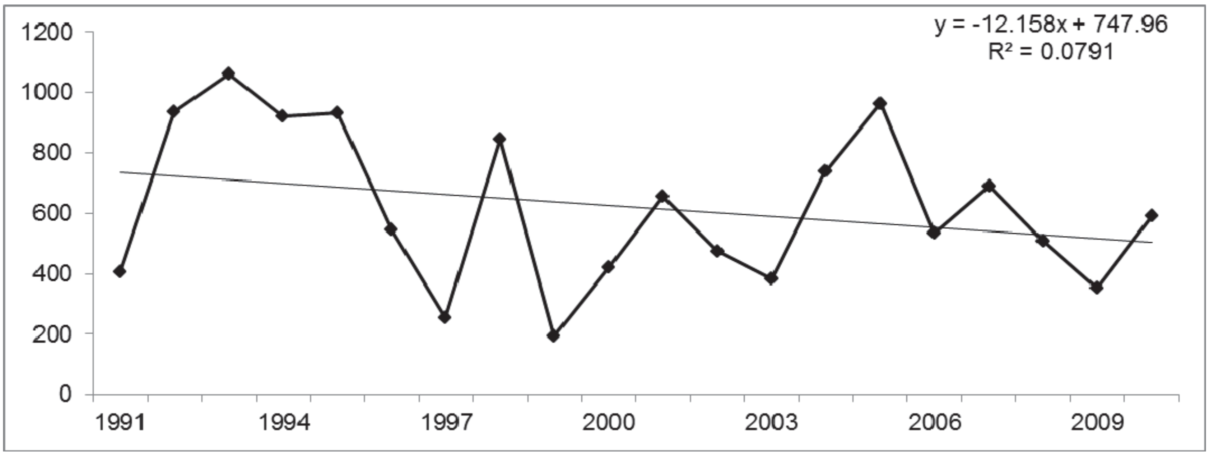


Figure 9.9 - Ness District (for River Moriston) summer rod catch 1991-2010 (salmon and grilse, retained and released).

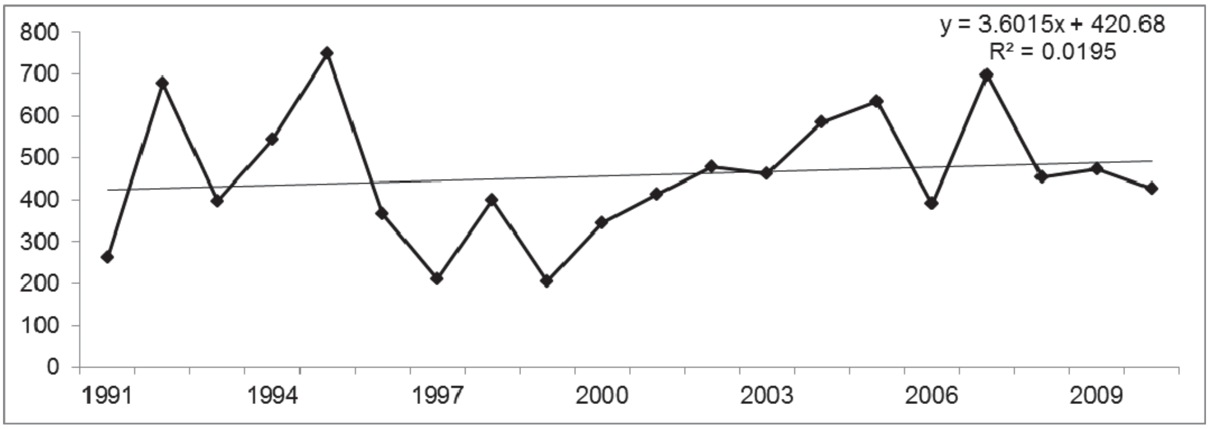


Figure 9.10 - Ness District (for River Moriston) autumn rod catch 1991-2010 (salmon and grilse, retained and released).

Table 9.11 - Summary of F-Test Results on River Moriston Seasonal Rod Catch (1991-2010).

Component	Observations	F-Value	F-Significance
Spring	20	1.701	0.209
Summer	20	1.547	0.230
Autumn	20	0.357	0.557

The percentage change in the spring, summer and autumn rod catches SCM cycles against the year of designation (2001) was also undertaken. The first SCM assessment covered the period 2002-2004, whilst the second includes data extending from 2002-2010. In this review

the rod catch is averaged for each cycle period and the increase or decrease in average rod catch expressed as a percentage of the rod catch in the year of designation.

This comparison is shown in Figure 9.11 and indicates that, for the spring stock component, the average rod catch in both cycle one and cycle two is slightly higher (<10%) than in the year of designation. This is also the case for the autumn component, but with the average rod catch being greater than the year of designation to a larger degree (20-30%) in each instance. The average summer rod catch in each cycle is less than in the year of designation.

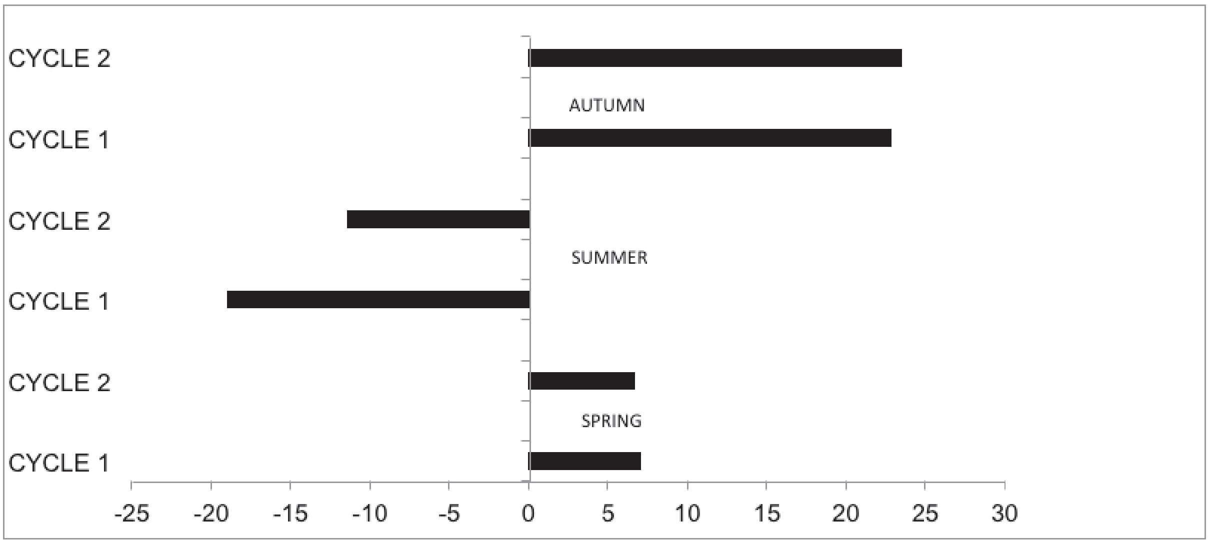


Figure 9.11 - Stock trend assessment since River Moriston SAC Designation (2001) in cycle 1 (2002-2004) and cycle 2 (2002-2010).

Summary

The overall trend in rod catch in the River Moriston over the period 1952-2010 shows a very marginal decline in total rod catches, and a more marked corresponding decline in the spring component. Individual records within the long-term dataset show marked inter-annual variability. The rod catch of the summer and autumn seasonal components has remained stable over the same period.

Application of the NASCO rod catch assessment tool to the recorded catches over the last 20 years (1991-2010) suggested that no reduction in exploitation is required for any of the seasonal components.

When the 2001 average rod catch (at designation) is compared against those used in SCM cycle one (2001-2004) and cycle two (2001-2010), there was an increase in the spring (<10%) and autumn (20-30%) rod catches, but a decrease in the summer run-time component on both occasions.

When viewed together, these analyses of adult rod catch in the Ness District, which in this instance is assumed to be representative of the River Moriston SAC, indicates a small decline in total rod catch since 1952, with a more marked reduction in the spring component.

Over the shorter 20 year period used to carry out the NASCO rod catch assessment tool tests, there appeared to be no significant changes in the rod catch of any of the seasonal components and no evidence to suggest further reductions in exploitation are required.

However, due to the structure of the Ness and Moriston catchments it may not be reasonable to assume that rod catches of the Ness District adequately represent the River Moriston. The River Moriston fishery is, historically, based around the spring run time component and an insignificant decline in the Ness District catch over the past 20 years, may or may not be more significant for the River Moriston.

c) Habitats supporting the qualifying feature

1. Water quality and quantity

The status of each water body within the SAC, for which SEPA hold data, was obtained from the SEPA River Basin Planning website.

Three WFD water bodies representing a river length of 30 km are recognised as being present within the River Moriston SAC. All of these are heavily modified and classified as being at good ecological potential for Heavily Modified Waterbodies (HMWB). All of the River Moriston water bodies are identified as such because of the presence of hydro power generation schemes. These are owned and managed by Scottish and Southern Energy. Table 9.12 below summarises the number of water bodies and the length of channel within each status category.

Table 9.12 - Number of water bodies and length of channel within each WFD status category in the River Moriston SAC.

WFD status (2009)	High	Good Ecological Potential	Moderate	Poor	Bad	Total
Number of water bodies		3				3
Length of channel (km)		30				30

2. Trends, changes and activities

The Ness and Beauly Fisheries Trust identify the key negative impact within the River Moriston catchment as being a lack of sediment/gravel transport. This is due to the presence of dams put in place to support hydroelectric power generation. Non-native invasive species and effects from freshwater fish farms were also considered to be important issues. The NBFT also identified agriculture, grazing, water management, water quality, forestry and lack of remedial management as having negative impacts in the catchment. Improvement in fisheries management within the catchment, including the easement of man-made barriers for fish passage, was considered to be the main positive impact.

The main activities considered by the NBFT as having a negative impact on Atlantic salmon within the River Moriston catchment:

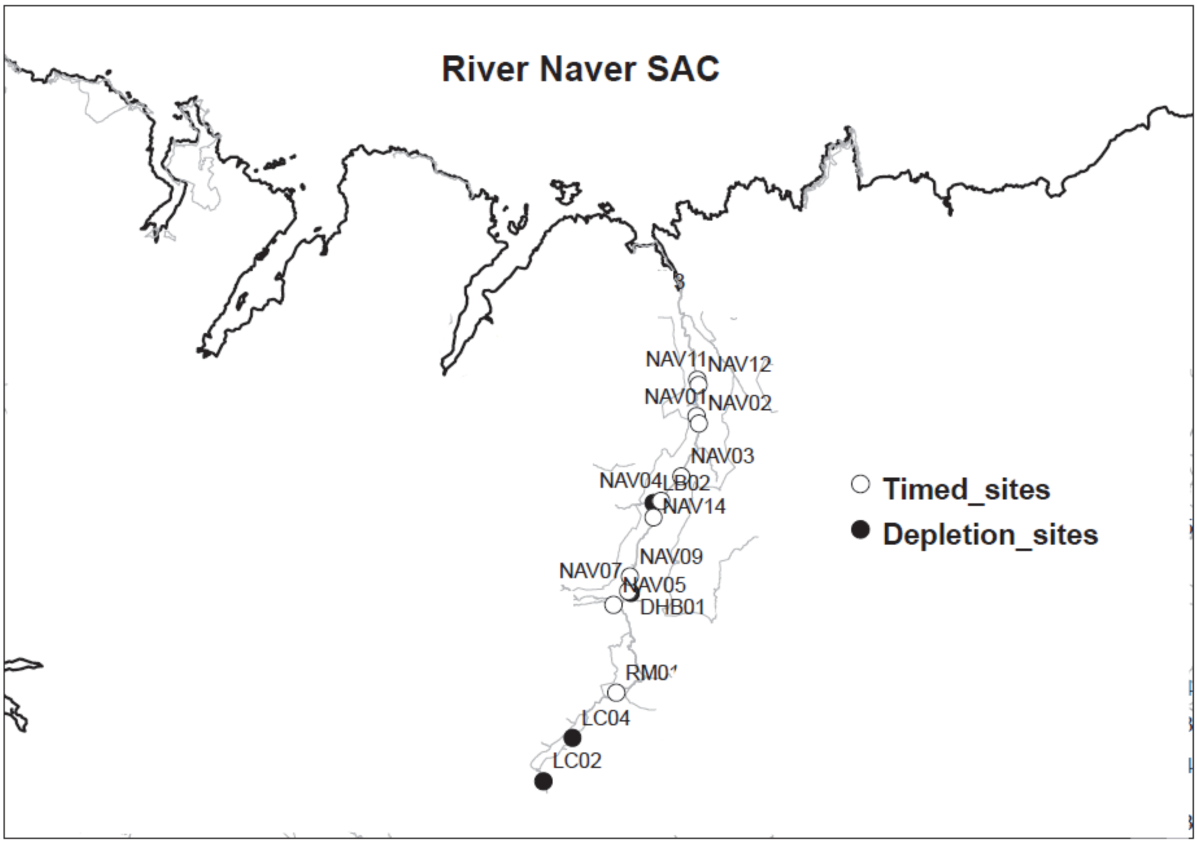
- Lack of sediment transfer due to dams;
- Invasive non-native species; and
- Fish farm effects (freshwater).

10. RIVER NAVER

a) Juvenile Assessment

Eight sites were surveyed using the standard SFCC catch depletion electrofishing method. A further 11 sites were sampled using a five-minute timed electrofishing approach. All sites were situated within the River Naver SAC (Map 10.1). The sites were surveyed by staff of the River Naver Fisheries.

Map 10.1 - Distribution of depletion and timed electrofishing sites on the River Naver SAC.



Depletion sites

Site details and a summary of electrofishing results are shown in Tables 10.1 – 10.4. 0+ and 1+ salmon were found at all eight depletion sites. 2+ fish were caught at six sites. Zippin and Carl & Strube estimates for fry and 1+ fish were calculable for all of the depletion sites. Confidence limits were occasionally wide. For fry, Zippin densities ranged from 21 - 195 per 100 m^2 (mean 74) and Carl & Strube densities ranged from 11 - 192 per 100 m^2 (mean 70). The highest 0+ Zippin densities were found in Allt Corrie na Fearna and the lowest in Langdale Burn. For 1+ fish, Zippin densities ranged from 16 - 102 (mean 41) and Carl & Strube densities from 15 - 87 (mean 37). The highest 1+ Zippin densities were found in the Altnaharra Burn and the lowest in the River Vagastie. The largest 0+ fish (mean fork length) were caught in the Dal Harrold and Langdale Burns (56mm at each site). The largest 1+ fish were caught in the Dal Harrold Burn (95mm). Trout were present at seven of the eight sites.

Table 10.1 - Details of depletion electrofishing sites, River Naver SAC.

Site code	Date	Easting	Northing	Altitude (m)	Channel name
ALT02(SCM)	02/08/11	256814	935075	89	River Mudale
DHB01(SCM)	03/08/11	267978	938756	74	Dal Harraild Burn
VAG01(SCM)	16/08/11	256848	933617	101	Vagastie
VAG02(SCM)	16/08/11	254510	930367	177	Vagastie
LB02(SCM)	17/08/11	269488	944785	54	Langdale Burn
MEAD02(SCM)	19/08/11	250995	937227	135	Meadie Burn
LC02(SCM)	23/08/11	262115	926092	180	Allt Corrie na Fearna
LC04(SCM)	23/08/11	264058	929011	177	Allt a' Chuilinn Beag

Table 10.2 - Details of depletion electrofishing for 0+ and 1++ salmon, River Naver SAC.

Site code	Wetted area (m^2)	Zippin 0+	Carl & Strube 0+	Zippin 1+	Carl & Strube 1+	Zippin 2+	Carl & Strube 2+
ALT02(SCM)	92.8	34.7	31.3	102.0	87.3	n/a	n/a
DHB01(SCM)	169.7	67.8	66.0	37.1	36.6	n/a	n/a
VAG01(SCM)	120.4	58.9	54.0	42.8	39.9	0.0	0.0
VAG02(SCM)	91.1	25.1	11.0	16.2	15.4	n/a	n/a
LB02(SCM)	119.1	21.1	20.1	17.7	16.8	0.0	0.0
MEAD02(SCM)	98.0	83.9	82.7	42.5	40.8	n/a	n/a
LC02(SCM)	101.4	194.9	192.3	27.2	25.6	n/a	n/a
LC04(SCM)	102.3	106.7	100.7	39.5	39.1	n/a	n/a

n/a denotes salmon present, but not in high enough densities to allow calculation of Zippin or Carl & Strube statistics. 0 denotes no salmon found at site.

Table 10.3 - Presence/absence of salmon year classes and of trout 0+ and 1++ at depletion sites, River Naver SAC.

Site code	Salmon age class present?				Trout present?	
	0+	1+	2+	3++	0+	1++
ALT02(SCM)	Y	Y	Y	N	N	Y
DHB01(SCM)	Y	Y	Y	N	Y	Y
VAG01(SCM)	Y	Y	N	N	N	N
VAG02(SCM)	Y	Y	Y	N	Y	N
LB02(SCM)	Y	Y	N	N	Y	Y
MEAD02(SCM)	Y	Y	Y	N	Y	N
LC02(SCM)	Y	Y	Y	N	Y	Y
LC04(SCM)	Y	Y	Y	N	Y	Y

Table 10.4 - Fork length of salmon of different age classes, River Naver SAC.

Site code	0+ mean fork length	No. 0+	1+ mean fork length	No. 1+	2+ mean fork length	No. 2+	3+ mean fork length	No. 3+
ALT02(SCM)	42	25	71	56	113	1	n/a	0
DHB01(SCM)	56	95	95	59	116	1	n/a	0
VAG01(SCM)	45	51	75	42	n/a	0	n/a	0

VAG02(SCM)	44	9	75	14	110	1	n/a	0
LB02(SCM)	56	24	86	19	n/a	0	n/a	0
MEAD02(SCM)	51	76	84	39	114	5	n/a	0
LC02(SCM)	43	171	84	25	114	1	n/a	0
LC04(SCM)	44	79	82	40	115	5	n/a	0

n/a denotes means could not be calculated as no salmon of that age class were found at the site.

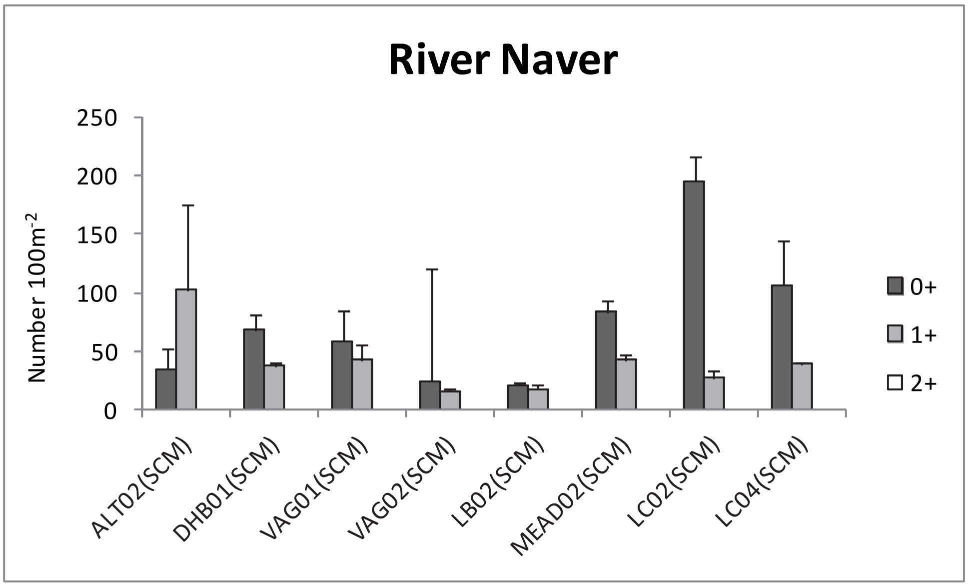


Figure 10.1 - Juvenile salmon population density estimated by the Zippin method for the SAC monitoring sites on the River Naver SAC.

Timed sites

Details of the 11 timed sites are given in Table 10.5. 0+ salmon were caught at ten of the timed sites, and 1+ fish at nine sites. CPUE for fry ranged from 0/min to seven/min and for 1++ fish, ranged from 0/min to 1.8/min. 2+ salmon were caught at only two of the sites. Trout were found at only one site.

Table 10.5 - Details of timed electrofishing sites, River Naver SAC.

Site code	Easting	Northing	River	Altitude (m)
NAV07(SCM)	267791	938859	Naver	68
NAV09(SCM)	267916	939861	Naver	68
NAV14(SCM)	269483	943822	Naver	49
NAV11(SCM)	272393	953080	Naver	20
NAV01(SCM)	272361	950637	Naver	26
NAV02(SCM)	272512	950129	Naver	30
NAV12(SCM)	272491	952722	Naver	20
NAV05(SCM)	266803	937952	Naver	75
NAV03(SCM)	271351	946585	Naver	39
NAV04(SCM)	269968	944937	Naver	49
RM01(SCM)	266999	932028	Mallart	156

Table 10.6 - Salmon catch per unit effort (CPUE), River Naver SAC.

Site code	Survey date	Salmon 0+/min	Salmon 1++/min
NAV07(SCM)	03/08/11	7.0	0.2
NAV09(SCM)	03/08/11	1.4	1.8
NAV14(SCM)	03/08/11	1.0	1.0
NAV11(SCM)	19/08/11	1.8	0.0
NAV01(SCM)	22/08/11	2.8	1.8
NAV02(SCM)	22/08/11	1.8	0.8
NAV12(SCM)	22/08/11	2.0	1.0
NAV05(SCM)	24/08/11	0.0	1.6
NAV03(SCM)	26/08/11	1.2	0.0
NAV04(SCM)	26/08/11	2.8	1.6
RM01(SCM)	18/08/11	5.2	0.2

Table 10.7 - Presence/absence of salmon year classes and of trout at timed sites, River Naver SAC.

Site code	Salmon age class present?				Trout present?
	0+	1+	2+	3+	
NAV07(SCM)	Y	Y	N	N	Y
NAV09(SCM)	Y	Y	Y	N	N
NAV14(SCM)	Y	Y	N	N	N
NAV11(SCM)	Y	N	N	N	N
NAV01(SCM)	Y	Y	N	N	N
NAV02(SCM)	Y	Y	N	N	N
NAV12(SCM)	Y	Y	N	N	N
NAV05(SCM)	N	Y	Y	N	N
NAV03(SCM)	Y	N	N	N	N
NAV04(SCM)	Y	Y	N	N	N
RM01(SCM)	Y	Y	N	N	N

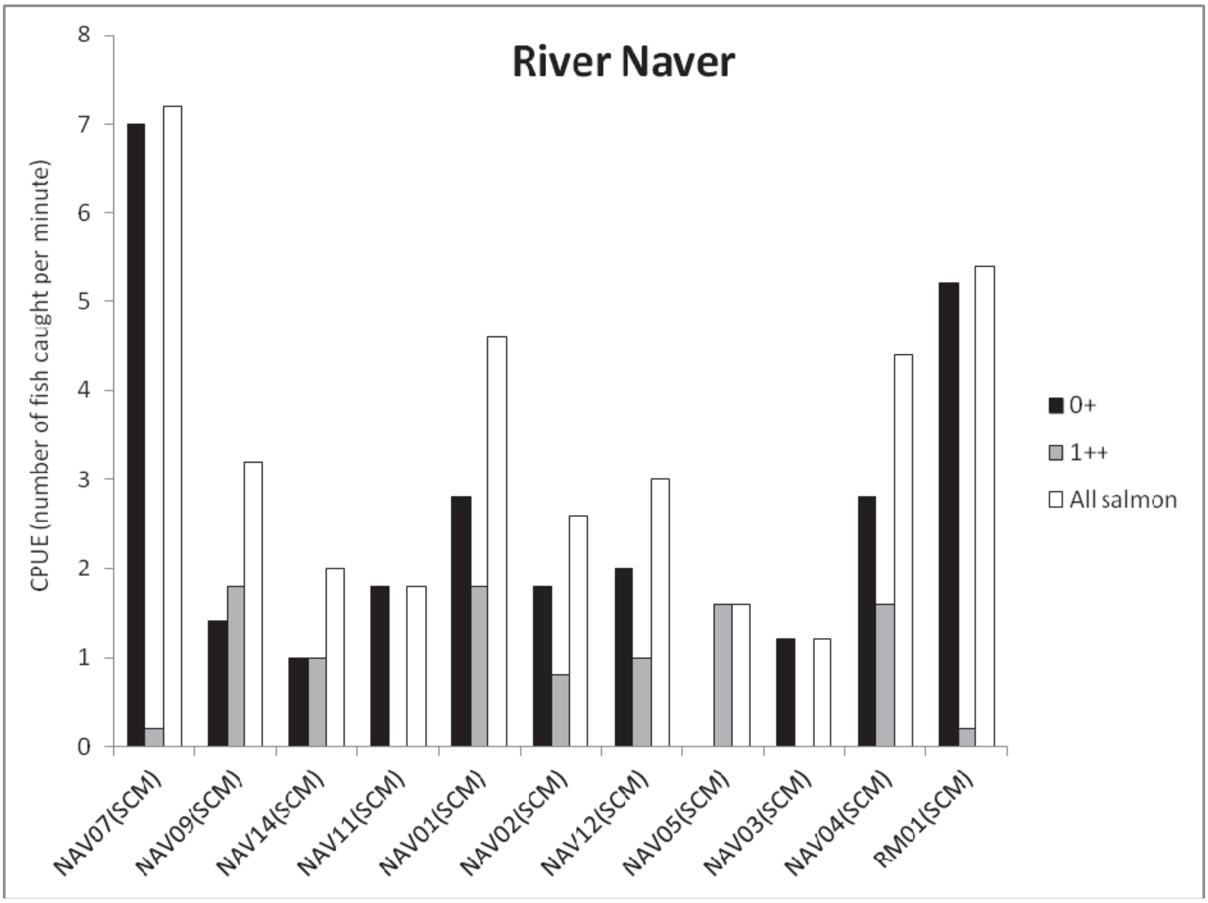


Figure 10.2 - Number of salmon (0+, 1++ and all salmon) caught per minute during five minutes of electrofishing at sites on the River Naver.

Summary

When the densities of 0+ and 1++ juveniles are considered against the regional juvenile densities developed by Godfrey (2005) all sites in the River Naver occupy the two highest quintile bands (Table 10.8). This indicates consistently high juvenile fish densities across the catchment for both fry and parr, reflecting a high standard of juvenile productivity. This could be the result of good habitat quality, a high number of spawning adults reaching survey locations, or the absence of external pressures which limit natural production or juvenile survival. Assessed separately, it is suggested that both fry and parr are in favourable status within the SAC.

Table 10.8 – *Number of sites within the River Naver SAC falling within each quintile (according to absolute regional classification for 0+ and 1++ age classes) – and the resulting condition status.*

SAC	Age class	Number of sites					Median grade	Favourable condition?
		0-20	21-40	41-60	61-80	81-100		
		E	D	C	B	A		
Naver	0+				2	6	A	Y
	1++				1	7	A	Y

A comparison of juvenile data from cycle 1 and cycle 2 indicate that the status of the River Naver has improved in 2011 compared to the previous assessment (Table 10.9). Previously, mean salmon fry densities were insufficient to achieve favourable status, the current assessment suggests that the condition of the juvenile population is upgraded to favourable.

Table 10.9 - Comparison of condition status in 2004 and in 2011 for 0+ and 1++ age classes.

SAC		2004	2011	Change
Naver	0+	N	Y	+
	1++	Y	Y	=

b) Adult Assessment

Data for adult Atlantic salmon rod catch within the River Naver was analysed using the NASCO Rod Catch Assessment tool introduced and described in Section 1. This analysis considers exploitation of seasonal stock components (spring, summer and autumn) and suggests whether management is required. Trends in long-term rod catch data from Marine Scotland Science (1952-present) for the overall catch and the same seasonal run-time components is also interrogated.

Summary of 1952 Catch Statistics

Rod catch statistics for the River Naver, covering the period 1952-2010, for the total catch and each of the seasonal run time components, are shown in Figures 10.3, 10.4, 10.5 and 10.6.

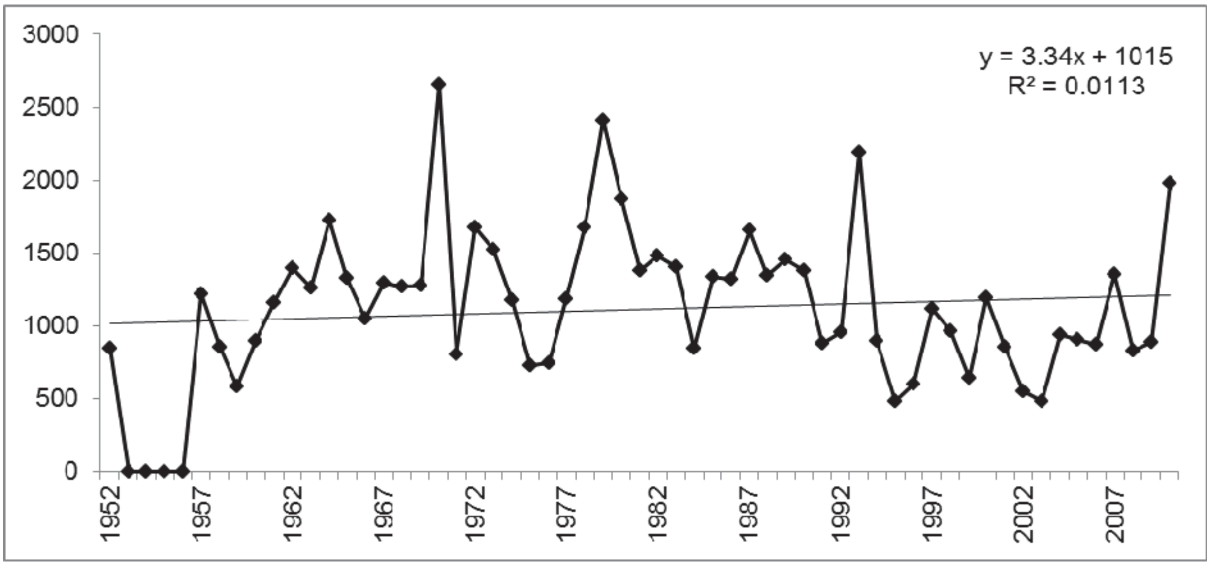


Figure 10.3 - River Naver total rod catch 1952-2010 (salmon and grilse, retained and released).

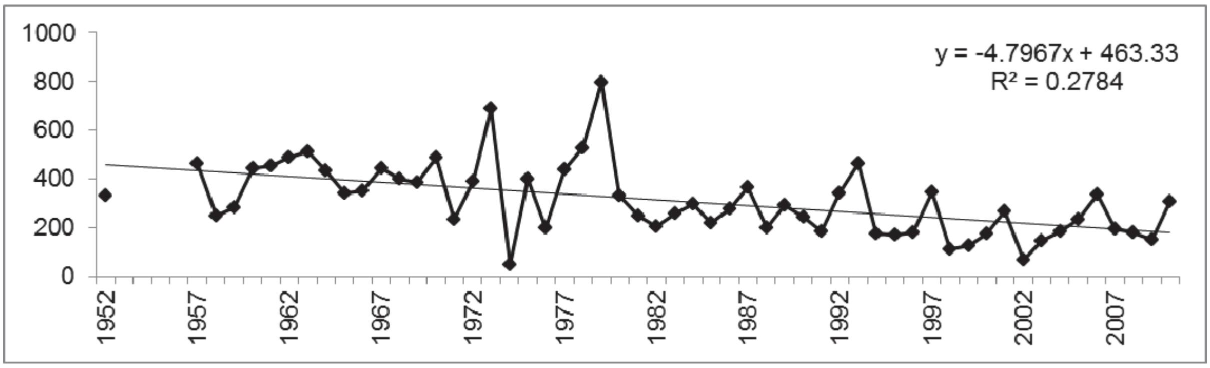


Figure 10.4 - River Naver total spring rod catch 1952-2010 (salmon and grilse, retained and released).

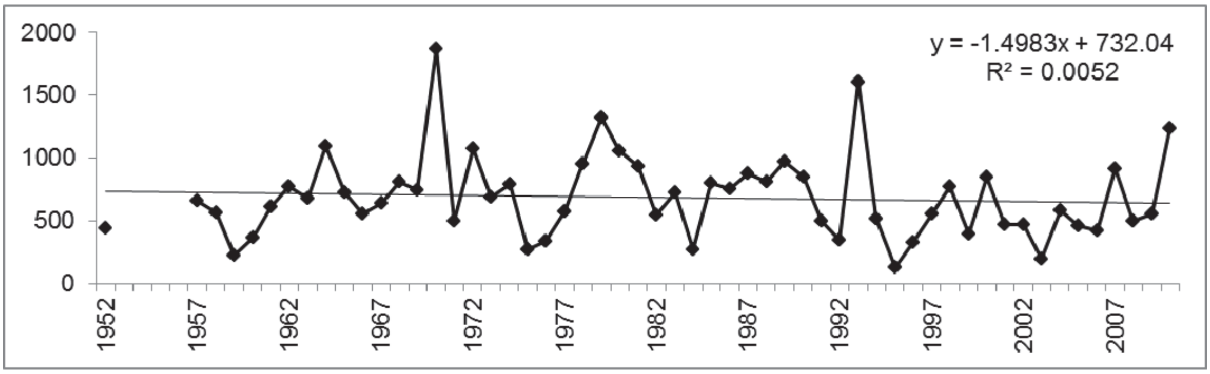


Figure 10.5 - River Naver total summer rod catch 1952-2010 (salmon and grilse, retained and released).

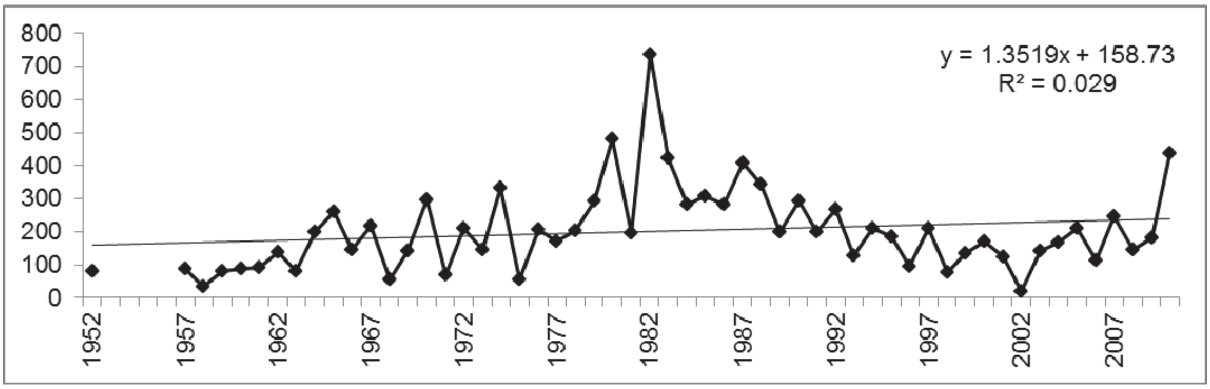


Figure 10.6 - River Naver total autumn rod catch 1952-2010 (salmon and grilse, retained and released).

The total rod catch for Atlantic salmon in the River Naver (Figure 10.3) shows an increasing trend, but with significant variability, over the period 1952-2010. Catch returns for the period 1953-1956 are not available. From 1961 to 1990 all but four of the catch records were above the overall trend line and indicate a period of, generally, high catches. Lower catches were reported from 1993 to 2009 but the 2010 catch was markedly higher than any other since 1993 and was the fourth highest on record.

Data for the spring rod catch (Figure 10.4) indicate a relatively constant decline over the time series, although higher numbers were reported in some years during the 1960’s and 1970’s. The summer rod catch (Figure 10.5) shows a relatively stable trend over the time series although rod catches below the trend line are more frequent from 1992 to the present. Autumn rod catches (Figure 10.6) show a slightly increasing trend with peak catches in the early 1980’s and periods of lowest catch from 1952–mid-1970’s and from mid-1990’s to mid-2000’s.

It is considered that (outwith the period 1953-1956) the reporting of rod catch over the time series has been consistent and there is no evidence that any trends summarised may be attributable to a change in reporting accuracy or inconsistency. The reason for zero returns during 1953-1956 is not known but is unlikely that adult Atlantic salmon were not present.

Within the vicinity of the River Naver a reduction in estuary and coastal netting in the past 20 years, and this may have allowed greater numbers of adult Atlantic salmon to return to the Naver itself. Netting ceased at the Bettyhill station in 1992 and the Strathy station was closed in 2007; these closures together may have resulted in a greater number of adults entering the River Naver. There was a marked increase in adult catches on the Naver in 2010, four years after the closure of the Strathy netting station although it is not possible to attribute this increase to the removal of the netting effort given that 2010 was a year of high rod catches in rivers across much of Scotland.

In addition to the reduction of netting effort, further conservation and management activities are in place on the River Naver and these are reviewed on an annual basis. The introduction of a catch and release policy on the River Naver Fisheries has increased return rates there from 54% in 2003 to 87% in 2010 across the season, following the introduction of enhanced measures in 2007.

Stocking activities on the River Naver, principally the introduction of unfed fry above impassable falls, has been shown by electro fishing survey to increase the density and distribution of juvenile Atlantic salmon in stocked areas. Having been suspended in 2010, stocking recommenced in 2011 following the development of a new stocking strategy to inform and direct these activities. Fishery protection work is undertaken by an active bailiff team and through regular land/river and coastal patrols are considered to have significantly decreased poaching activities within the system.

Application of Rod Catch Assessment Tool

Rod catch from the River Naver covering the last 20 years (1991-2010) were applied to the NASCO rod catch assessment tool to assess whether exploitation of each run time component required management action. Initially catch was considered in relation to three tests:

The results of these tests for the River Naver rod catch are shown in Table 10.10, and the data used to carry these out are available in Appendix 1. The output of these analyses suggest that no reduction in exploitation of any component is currently required for any of the seasonal run time components.

Table 10.10 - Summary of the Rod Catch Assessment Tool Tests for the River Naver.

Test	Spring	Summer	Autumn
A	No	No	No
B	No	No	No
C	No	No	No

Rod catches for the 20 year period used in this assessment (1991-2010) in are shown in Figures 10.7, 10.8, 10.9 and 10.10. An F-test was applied to each of the seasonal components to assess whether they deviated from horizontal and the results for these are shown in Table 10.11. These suggest that no significant change in the rod catch of any of the seasonal run-time components has taken place over this period.

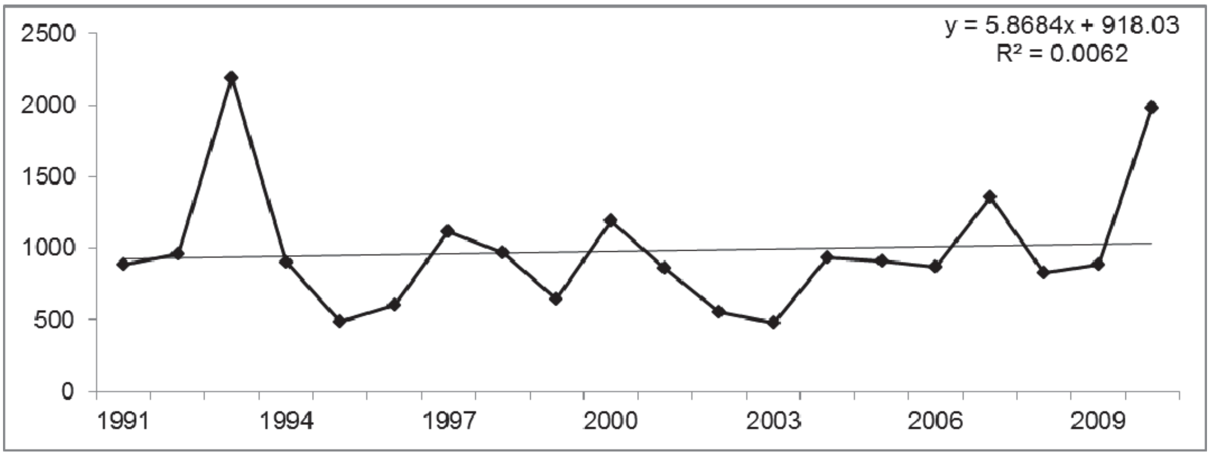


Figure 10.7 - River Naver total rod catch 1991-2010 (salmon and grilse, retained and released).

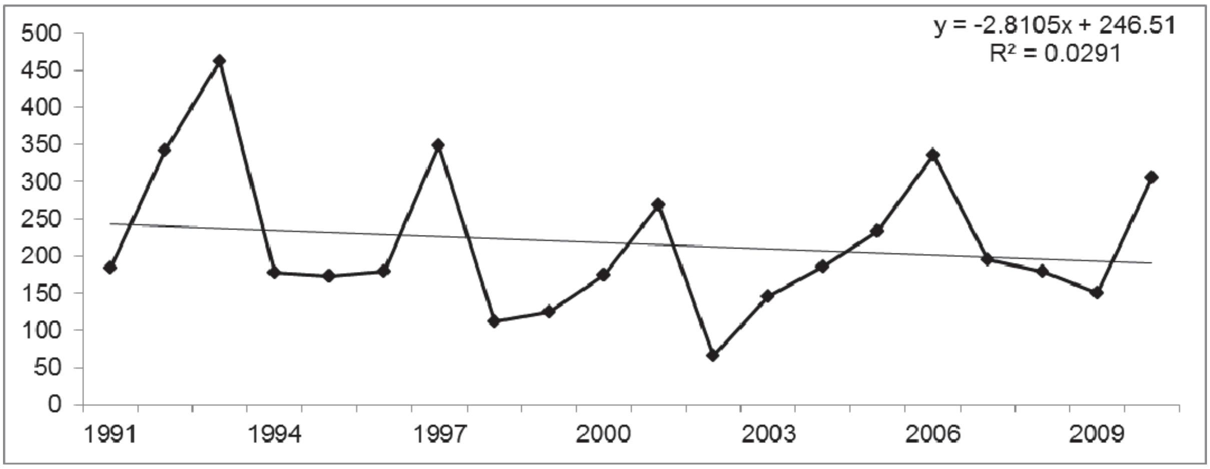


Figure 10.8 - River Naver spring rod catch 1991-2010 (salmon and grilse, retained and released).

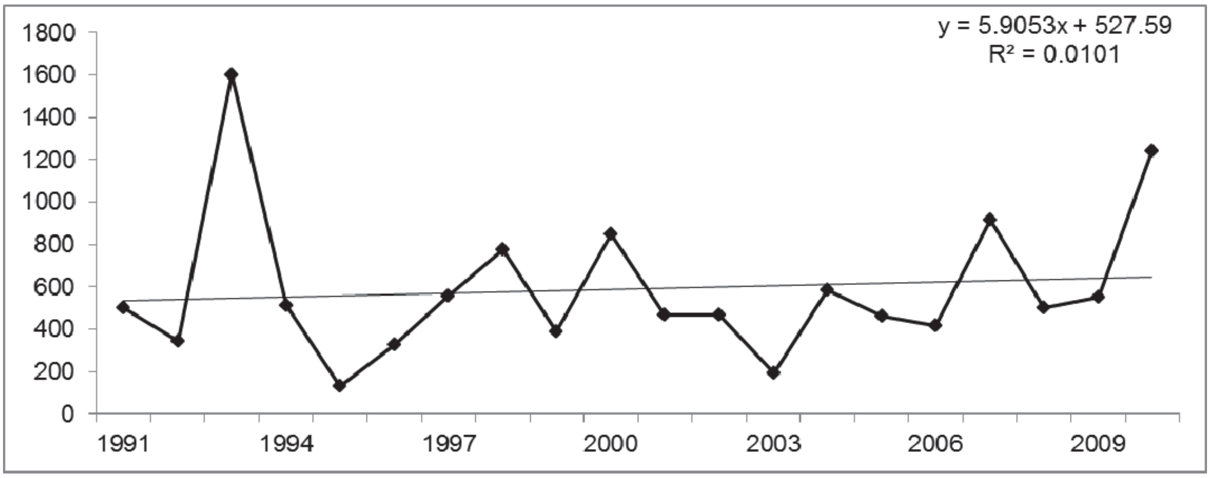


Figure 10.9 - River Naver summer rod catch 1991-2010 (salmon and grilse, retained and released).

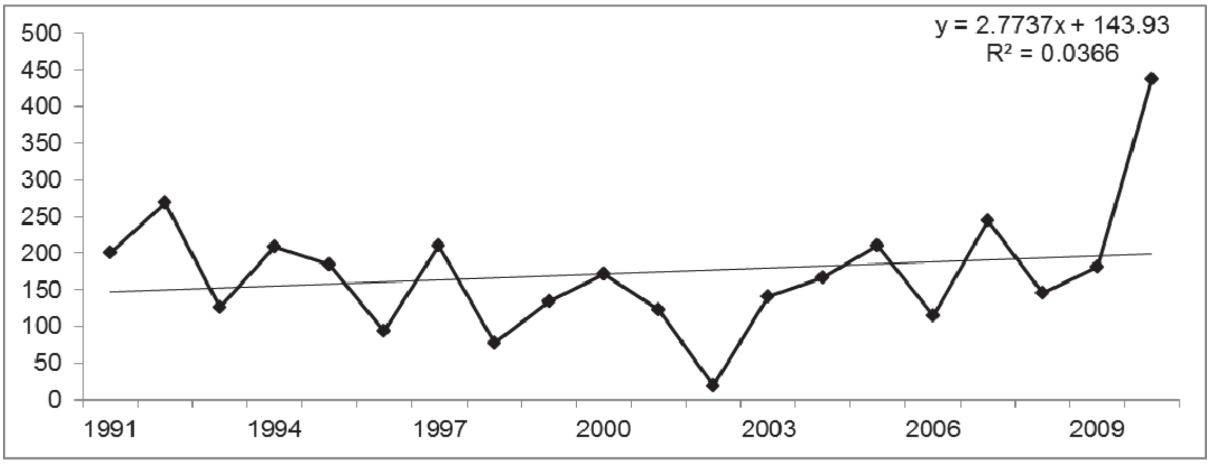


Figure 10.10 - River Naver autumn rod catch 1991-2010 (salmon and grilse, retained and released).

Table 10.11 - Summary of F-Test Results on River Naver Seasonal Rod Catch (1991-2010).

Component	Observations	F-Value	F-Significance
Spring	20	0.539	0.472
Summer	20	0.184	0.673
Autumn	20	0.684	0.419

The percentage change in the spring, summer and autumn rod catches SCM cycles against the year of designation (2001) was also undertaken. The first SCM assessment covered the period 2002-2004, whilst the second includes data extending from 2002-2010. In this review

the rod catch is averaged for each cycle period and the increase or decrease in average rod catch expressed as a percentage of the rod catch in the year of designation.

This comparison is shown graphically in Figure 10.11 and indicates that for both the summer and autumn there was a small decrease in average rod catch in cycle one but an increase in average catch over cycle two when compared to catch statistics for 2001. For both these components, record low rod catches in the 2002-2004 (immediately after designation of the site in 2001) largely explains the 'unfavourable' outcome in cycle one (i.e. summer catch in 2003 was the second lowest and autumn catch 2002 the lowest in the last 20 years). The average spring rod catch in each cycle is less than that in the year of designation, with low catches in 2002 and 2003 largely explaining the failure of this stock component in cycle one. The spring rod catch in the 2001 designation year was the sixth highest in the last 20 years, making comparisons against this relatively high baseline figure more likely to show an overall decline.

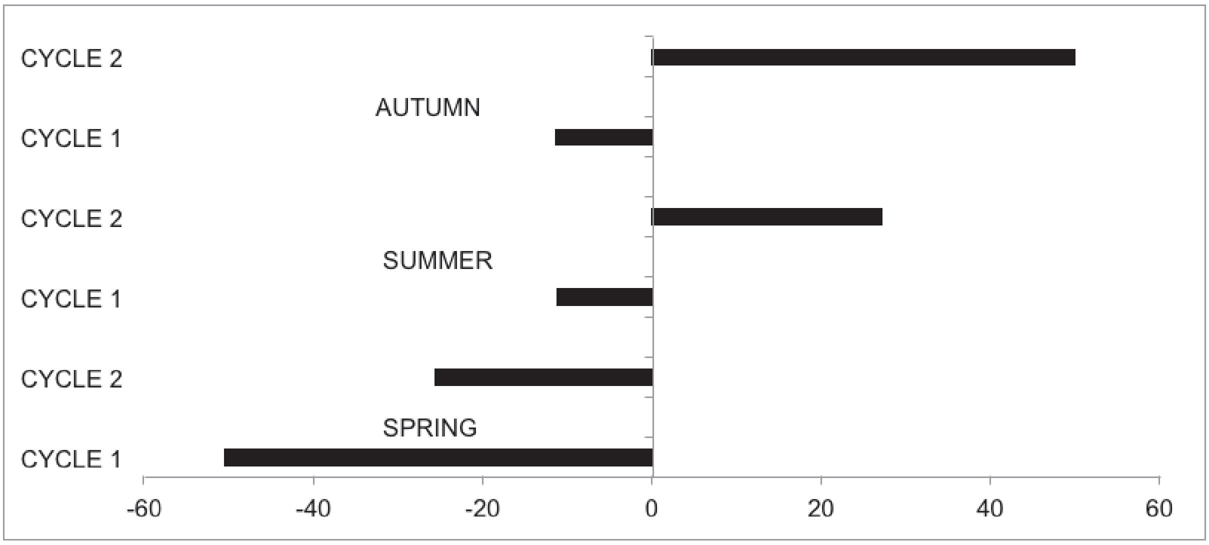


Figure 10.11 - Stock trend assessment since River Naver SAC Designation (2001) in cycle 1 (2002-2004) and cycle 2 (2002-2010).

Summary

The overall rod catch for Atlantic salmon in the River Naver over the period 1952-2010 shows a small, increasing, trend. Within this, however, there is a decreasing trend in spring rod catch. Catches of Atlantic salmon in the summer have remained stable and autimn rod catches have increased.

Application of the NASCO rod catch assessment tool to declared rod catches over the last 20 years (1991-2010) suggest, despite the decreasing spring catch, that no reduction in exploitation is required for any of the seasonal components. Application of the data to F-tests suggest that there has been no significant change in rod catch in any of the spring, summer or autumn components over this period.

When average catch for each of the two SCM cycles is compared to those recorded in the year of designation, both summer and autumn components show a reduced average catch in cycle one and increased average catch in cycle two. The average spring catch is less than that in the designation year in each cycle.

There has been a reduction in netting effort associated with the Naver since 1992 with stations closing at Bettyhill (1992) and Strathy (2007). In addition an effective catch and release policy, a salmon stocking programme in line with a strategy prepared in 2010 and an active fishery protection system all support the management and protection of salmon in the River Naver.

c) Habitats supporting the qualifying feature

1. Water quality and quantity

The status of each water body within the SAC, for which SEPA hold data, was obtained from the SEPA River Basin Planning interactive website.

A total of ten WFD water bodies representing a river length of 109 km are identified within the River Naver SAC. Of these, nine are classified as being of good ecological status (total length 81 km) and are protected from deterioration from that class. The remaining waterbody (river length 28 km) is classified as being at moderate ecological status and, therefore, required improvement to bring it up to at least good status within the next RBMP. There are no Heavily Modified Water bodies within the River Naver SAC. Table 10.12 summarises the number of water bodies and the length of channel within each status category.

Table 10.12 - Number of water bodies and length of channel within each WFD status category in the River Naver SAC.

WFD status (2009)	High	Good	Moderate	Poor	Bad	Total
Number of water bodies		9	1			10
Length of channel (km)		81	28			109

Since the 2009 classification (summarised above) the number of waterbodies within the River Naver catchment has been revised. It now contains 20 water bodies, of which only one is considered to be heavily modified. Of the 19 natural water bodies within the SAC two are classified as being at high ecological status and 17 are at good ecological status. The River Vagastie is heavily modified; water from the Vagastie is transferred to the River Shin catchment for the Shin Hydro Power Scheme operated by Scottish and Southern Energy. The River Vagastie is currently at moderate ecological potential as the impacts on flows and fish passage have not yet been adequately mitigated. Improvements to the flows and fish passage are scheduled to take place in the third planning cycle (2022 – 2027).

2. Trends, changes and activities

Naver Fisheries suggest that the main negative impact on Atlantic salmon within the catchment relates to extreme flow events which may be associated with climate change. The River Naver has experienced extreme high and low flow events in recent years and high flows are known to move large volumes of gravel substrate river bed material has been deposited on the surrounding floodplain. Low flows reduce the wetted perimeter of the river channel and can result in the drying out of some areas and the formation of shallow pools. Combined with potentially high temperatures that can occur during these events in summer, unfavourable habitat conditions for both juvenile and adult salmon can be created. It is anticipated that the Naver system will experience an increased frequency of high flow events causing changes to river dynamics and subsequent knock-on effects to the habitats that are reliant upon them.

Water management is also regarded as an important issue. During the 1950's a structure was built across the upper River Vagastie catchment to divert flow into the neighbouring River Shin catchment as part of the Loch Shin Hydropower Scheme. This is thought to present a physical barrier which prevents upstream and downstream migration, reduces downstream flows (particularly low and moderate flows) and degrades the wetted habitat available to fish (in terms of length and area of river which is covered in water to a minimum depth). It is also thought to change the high flow characteristics of the river (in terms of potential impacts on migration trigger flows and an overall reduction in energy). Initial results of investigative surveys on the River Vagastie by Naver Fisheries appear to support this.

Forestry is also thought to have a major impact on the catchment. Coniferous forestry plantations comprise a significant land use in the upper reaches of the River Naver and the lower to middle reaches of the River Mallart. Clear felling has occurred within the catchment in the past five to ten years and this activity is known to cause impacts to river systems - such as the release of fine sediment and nutrients, faster surface runoff after rainfall events and an increase in acidity. The catchment as a whole could benefit from drain blocking to reduce the rate of runoff. Some tributaries could also benefit from fencing to encourage natural regeneration of riparian habitat. The resulting shading of the river channel will help to stabilise and reduce water temperatures during low flow periods.

Negative impacts that are considered by Naver Fisheries to be of smaller magnitude include; small scale gravel extraction that has been undertaken recently in the more mobile sections of the River Naver. The act of removing gravel releases fine sediment into the watercourse that is deposited elsewhere downstream and could potentially smother spawning beds. Low intensity grazing by sheep and cattle takes place in the lower catchment and by deer in the mid to upper catchment. Although not deemed to be a major issue on the Naver, fenced areas indicate exclusion of deer/livestock can result in significant regeneration and improvement of riparian habitats, particularly on tributaries.

Several positive activities were also identified for the River Naver including the closure of the Bettyhill and Strathy netting stations in 1992 and 2007 respectively, the introduction of a catch and release policy which has increased return rates from 54% in 2003 to 87% in 2010, the reduction in poaching activity through greater river and coastal bailiff patrols and the success of juvenile salmon stocking as shown by electro-fishing surveys confirming increased distribution and juvenile densities at stocked sites.

Large scale planting of native tree species in riparian areas of upper Mallart and Mudale catchments (on both moorland health and cleared forestry areas) will provide a positive impact, and fenced areas are expected to encourage natural regeneration.

The NFT suggest that the main activities having a negative impact on Atlantic salmon in the River Naver catchment are:

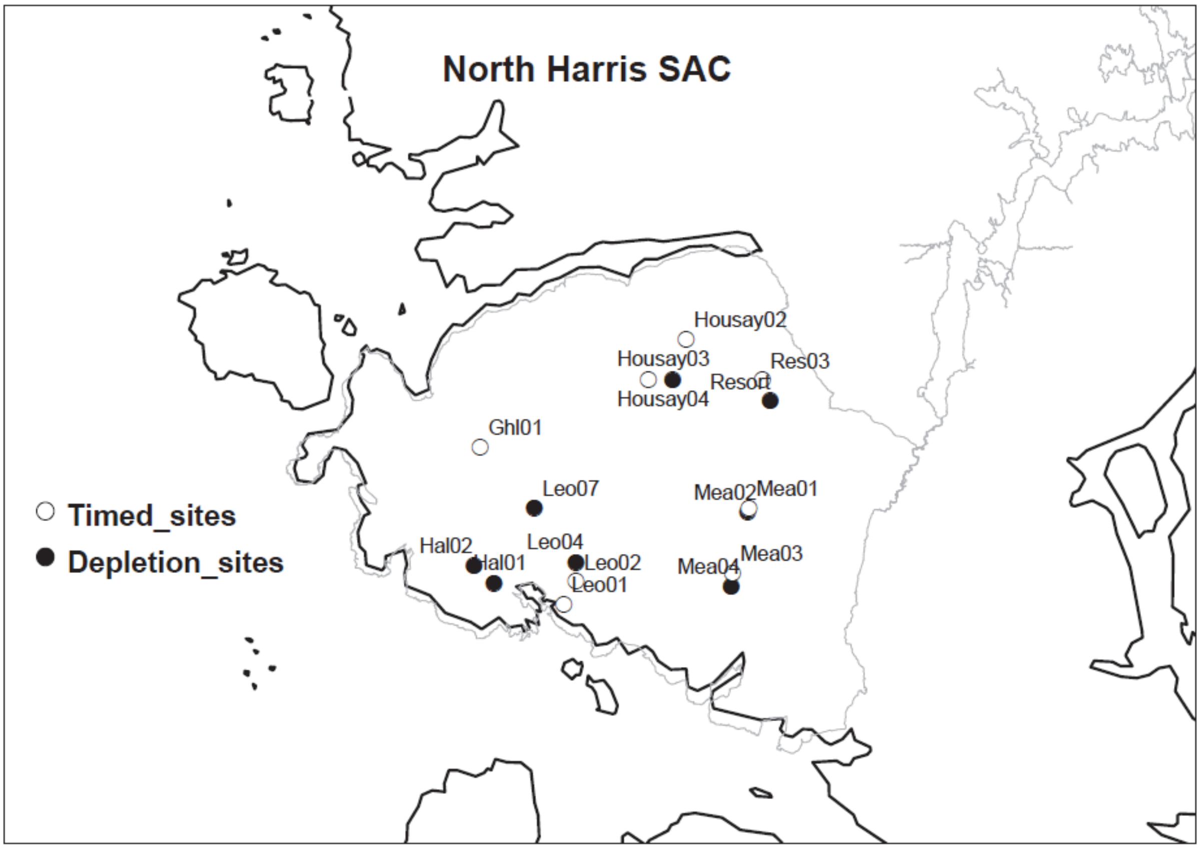
- Climate change;
- Water management for a hydropower scheme; and
- Forestry, particularly with regard to runoff rates.

11. NORTH HARRIS

a) Juvenile Assessment

Eight sites were surveyed using the standard SFCC catch depletion electrofishing method. A further eight sites were sampled using a five-minute timed electrofishing approach. All sites were situated within the North Harris SAC (Map 11.1). The sites were surveyed by staff of the Outer Hebrides Fisheries Trust.

Map 11.1 - Distribution of depletion and timed electrofishing sites on the North Harris SAC.



Depletion sites

Site details and a summary of electrofishing results are shown in Tables 11.1 – 11.4. 0+ Atlantic salmon were found at six depletion sites, and Zippin densities were calculable for all six. 1+ salmon were also found at six sites, and Zippin densities were calculable at five. 2+ fish were caught at four of the sites. Confidence limits were generally quite narrow. For fry, Zippin densities ranged from 15 - 75 per 100 m^2 (mean 46) and Carl & Strube densities ranged from 14 - 73 per 100 m^2 (mean 44). For 1+ fish, Zippin densities ranged from 0 - 30 (mean 11) and Carl & Strube densities from 0 - 28 (mean 10). The mean largest 0+ fish was 54 mm and the mean largest 1+ fish was 93 mm. Trout were present at all six sites.

Table 11.1 - Details of depletion electrofishing sites, North Harris SAC.

Site code	Date	Easting	Northing	Altitude (m)	Channel name
SACQ-NH-Hal02	09/08/11	102900	908903	26	Abhainn Haladail
SACQ-NH-Hal01	09/08/11	103444	908431	15	Abhainn Haladail
SACQ-NH-Mea04	11/08/11	109823	908339	45	Abhainn Mhiabhaig
SACQ-NH-Mea02	11/08/11	110263	910350	65	Abhainn Mhiabhaig
SACQ-NH-Resort	12/08/11	110877	913334	77	Abhainn Mhor
SACQ-NH-Housay04	15/08/11	108244	913914	57	Abhainn Thabhsaigh
SACQ-NH-Leo07	31/08/11	104524	910452	140	Abhainn Eabhal
SACQ-NH-Leo04	31/08/11	105650	908990	50	Abhainn Eabhal

Table 11.2 - Details of depletion electrofishing for 0+ and 1++ salmon, North Harris SAC.

Site code	Wetted area (m^2)	Zippin 0+	Carl & Strube 0+	Zippin 1+	Carl & Strube 1+	Zippin 2+	Carl & Strube 2+
SACQ-NH-Hal02	68.4	75.3	73.1	n/a	n/a	0.0	0.0
SACQ-NH-Hal01	181.5	15.1	14.3	16.5	16.5	0.0	0.0
SACQ-NH-Mea04	163.0	22.2	19.0	10.5	7.4	n/a	n/a
SACQ-NH-Mea02	128.0	71.5	64.8	22.7	21.1	7.2	7.0
SACQ-NH-Resort	104.0	32.3	30.8	29.8	27.9	10.9	10.6
SACQ-NH-Housay04	107.1	35.9	35.5	9.6	8.4	n/a	n/a
SACQ-NH-Leo07	102.7	0.0	0.0	0.0	0.0	0.0	0.0
SACQ-NH-Leo04	171.5	0.0	0.0	0.0	0.0	0.0	0.0

n/a denotes salmon present, but not in high enough densities to allow calculation of Zippin or Carl & Strube statistics. 0 denotes no salmon found at site.

Table 11.3 - Presence/absence of salmon year classes and of trout 0+ and 1++ at depletion sites, North Harris SAC.

Site code	Salmon age class present?				Trout present?	
	0+	1+	2+	3++	0+	1++
SACQ-NH-Hal02	Y	Y	N	Y	Y	N
SACQ-NH-Hal01	Y	Y	N	Y	Y	N
SACQ-NH-Mea04	Y	Y	Y	N	Y	Y
SACQ-NH-Mea02	Y	Y	Y	N	Y	Y
SACQ-NH-Resort	Y	Y	Y	N	Y	Y
SACQ-NH-Housay04	Y	Y	Y	N	Y	Y
SACQ-NH-Leo07	N	N	N	N	Y	Y
SACQ-NH-Leo04	N	N	N	N	Y	Y

Table 11.4 - Fork length of salmon of different age classes, North Harris SAC.

Site code	0+ mean fork length	No. 0+	1+ mean fork length	No. 1+	2+ mean fork length	No. 2+	3+ mean fork length	No. 3+
SACQ-NH-Hal02	32	47	78	7	n/a	0	154	1
SACQ-NH-Hal01	54	26	93	30	n/a	0	176	1
SACQ-NH-Mea04	37	26	68	11	91	1	n/a	0
SACQ-NH-Mea02	32	63	66	25	98	9	n/a	0
SACQ-NH-Resort	33	29	66	26	100	11	n/a	0
SACQ-NH-Housay04	32	38	74	9	91	1	n/a	0
SACQ-NH-Leo07	n/a	0	n/a	0	n/a	0	n/a	0
SACQ-NH-Leo04	n/a	0	n/a	0	n/a	0	n/a	0

n/a denotes means could not be calculated as no salmon of that age class were found at the site

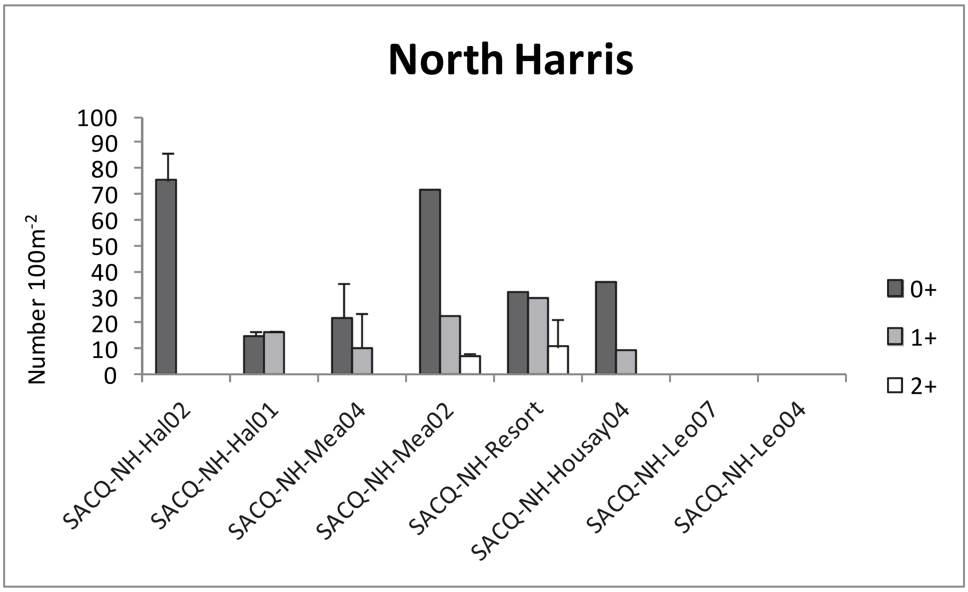


Figure 11.1 - Juvenile salmon population density estimated by the Zippin method for the SAC monitoring sites on the North Harris SAC.

Timed sites

Locational details for the eight timed sites are given in Table 11.5. 0+ and 1++ salmon were caught at all of the timed sites. CPUE for fry ranged from 0.6 per min to 8.4/min and for 1++ fish, ranged from 0.2/min to 1.4/min. 2+ salmon were caught at three sites. Trout were found at three sites.

Table 11.5 - Details of timed electrofishing sites, North Harris SAC.

Site code	Easting	Northing	River	Altitude (m)
SACT-NH-Leo01	105315	907844	Abhainn Eabhal	20
SACT-NH-Leo02	105650	908465	Abhainn Eabhal	50
SACT-NH-Mea01	110296	910430	Abhainn Mhiabhaig	70
SACT-NH-Mea03	109855	908703	Abhainn Mhiabhaig	45
SACT-NH-Res03	110665	913895	Abhainn Mhor	65
SACT-NH-Housay02	108612	915005	Abhainn Thabhsaigh	45
SACT-NH-Housay03	107593	913928	Abhainn Thabsaigh	70
SACT-NH-Ghl01	103066	912102	Allt a'Ghlinne	5

Table 11.6 - Salmon catch per unit effort (CPUE), North Harris SAC.

Site code	Survey date	Salmon 0+/min	Salmon 1++/min
SACT-NH-Leo01	09/08/11	5.4	1.0
SACT-NH-Leo02	09/08/11	8.4	1.4
SACT-NH-Mea01	11/08/11	1.8	0.6
SACT-NH-Mea03	11/08/11	0.6	1.4
SACT-NH-Res03	12/08/11	1.2	0.6
SACT-NH-Housay02	15/08/11	1.2	0.6
SACT-NH-Housay03	15/08/11	1.6	1.2
SACT-NH-Ghl01	31/08/11	2.4	0.2

Table 11.7 - Presence/absence of salmon year classes and of trout at timed sites, North Harris SAC.

Site code	Salmon age class present?				Trout present?
	0+	1+	2+	3+	
SACT-NH-Leo01	Y	N	Y	N	N
SACT-NH-Leo02	Y	Y	Y	N	Y
SACT-NH-Mea01	Y	Y	N	N	Y
SACT-NH-Mea03	Y	Y	N	N	N
SACT-NH-Res03	Y	Y	N	N	N
SACT-NH-Housay02	Y	Y	N	N	N
SACT-NH-Housay03	Y	Y	Y	N	N
SACT-NH-Ghl01	Y	Y	N	N	Y

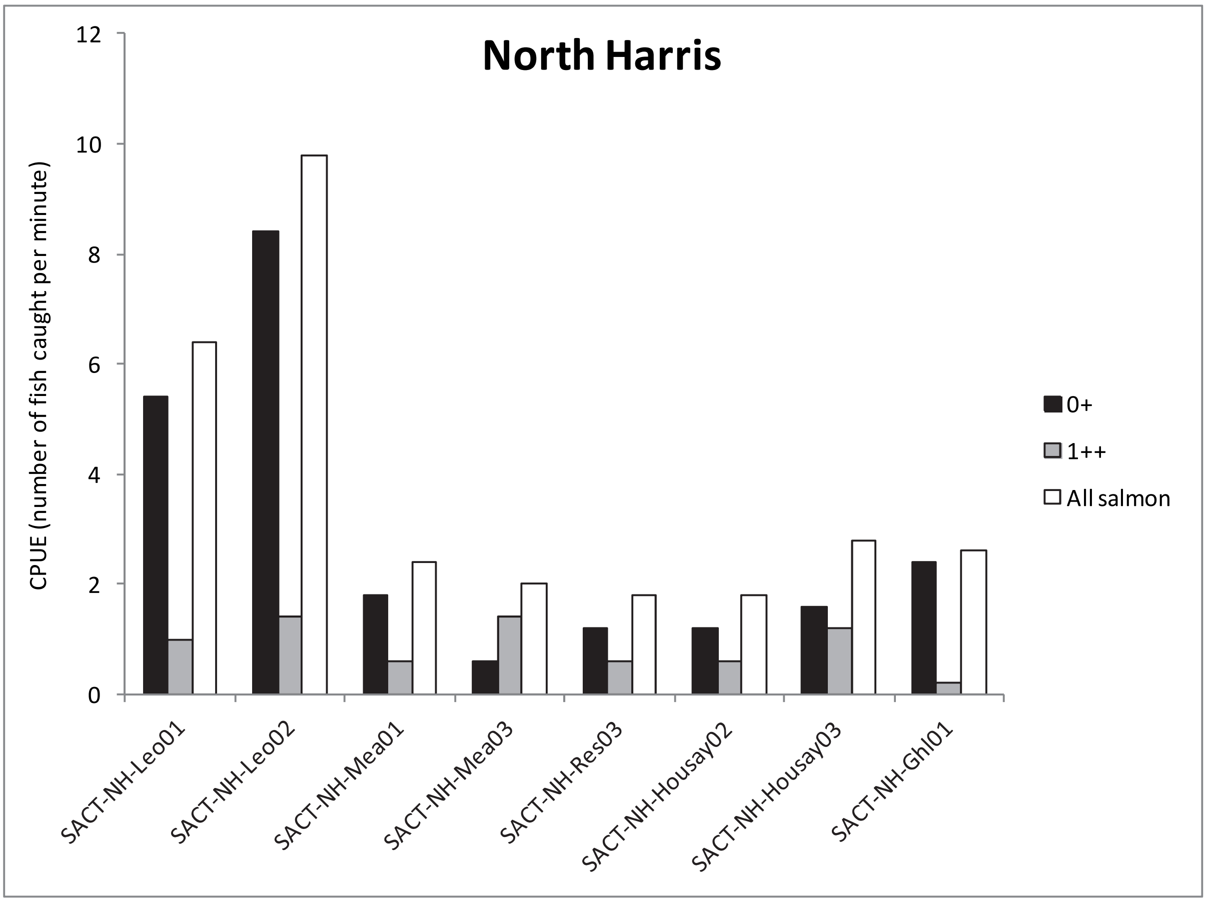


Figure 11.2 - Number of salmon (0+, 1++ and all salmon) caught per minute during five minutes of electrofishing at sites in the North Harris SAC.

Summary

When the densities of 0+ and 1++ juveniles are considered against the regional juvenile densities developed by Godfrey (2005), sites North Harris SAC occupy the two highest quintile bands as well as the lowest for both fry and parr (Table 11.8). This suggests that there is some variability in juvenile fish density across the catchment which, for both fry and parr, may reflect local differences in juvenile productivity. These differences may be associated with natural production limits associated with, for example, habitat quality or nutrient levels, the number of spawning adults reaching survey locations or the impact of external pressures which limit natural production or juvenile survival. When considered separately, both fry and parr could be considered to be in favourable status within the SAC.

Table 11.8 – Number of sites within the North Harris SAC falling within each quintile (according to absolute regional classification for 0+ and 1++ age classes) – and the resulting condition status.

SAC	Age class	Number of sites					Median grade	Favourable condition?
		0-20	21-40	41-60	61-80	81-100		
		E	D	C	B	A		
N. Harris	0+	2			1	5	A	Y
	1++	3			2	3	B	Y

A comparison of juvenile data from cycle 1 and cycle 2 indicate that the status of the North Harris has improved in 2011 compared to the previous assessment (Table 11.9). Fry densities were higher, raising the status of fry from unfavourable to favourable. Parr densities were favourable in 2004 and remained so in the current survey.

Table 11.9 - Comparison of condition status in 2004 and in 2011 for 0+ and 1++ age classes.

SAC		2004	2011	Change
N. Harris	0+	N	Y	+
	1++	Y	Y	=

b) Adult Assessment

Data for adult Atlantic salmon rod catch within the River Naver was analysed using the NASCO Rod Catch Assessment tool introduced and described in Section 1. This analysis considers exploitation of seasonal stock components (spring, summer and autumn) and suggests whether management is required. Trends in long-term rod catch data from Marine Scotland Science (1952-present) for the overall catch and the same seasonal run-time components is also interrogated.

The Marine Scotland Science rod catch statistics used in the following analyses are those of the Resort and Fincastle Fisheries District, and not those of the North Harris SAC area. The Area covered by the North Harris SAC is an entire estate with multiple catchments within it - including the rivers Meavaig, Leosaid, Ulladale and Resort. Catches for the catchments within the North Harris SAC area itself are not readily available. For the purposes of this monitoring exercise rod catch from the Resort and Fincastle District is assumed to be representative of the North Harris SAC.

Summary of 1952 Catch Statistics

Published rod catch statistics for Resort and Fincastle District (for North Harris SAC), covering the period 1952-2010 are shown in Figures 11.3, 11.4, 11.5 and 11.6.

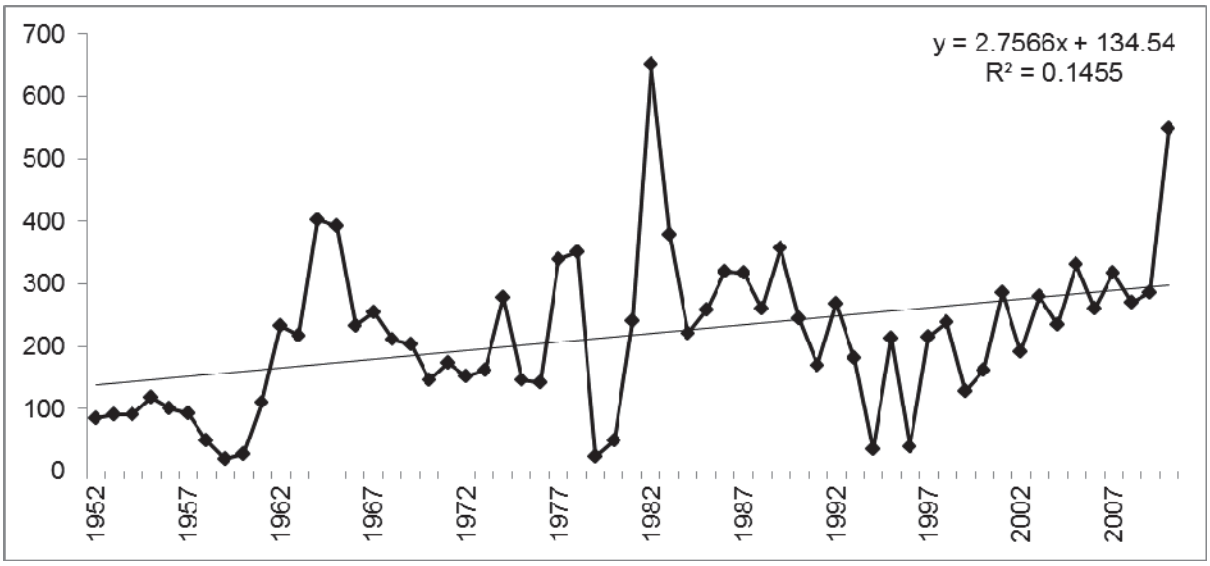


Figure 11.3 - Resort and Fincastle District (for North Harris SAC) total rod catch 1952-2010 (salmon and grilse, retained and released).

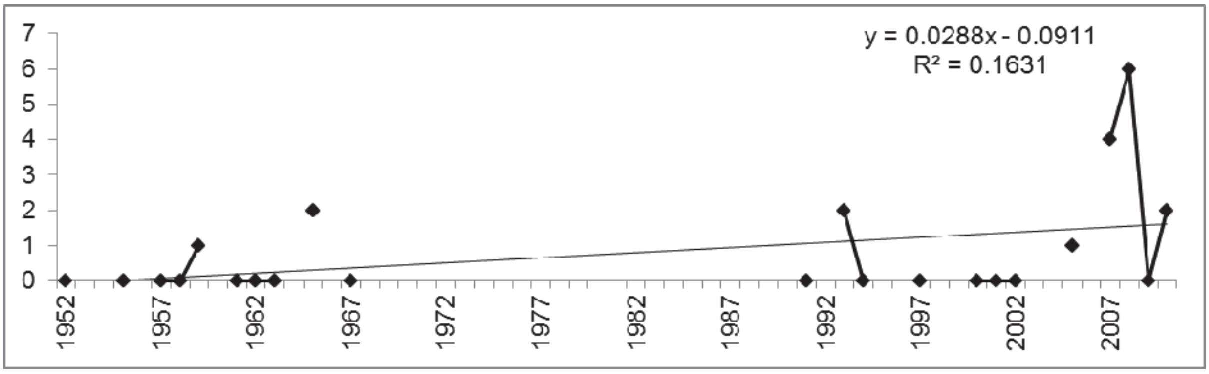


Figure 11.4 - Resort and Fincastle District (for North Harris SAC) total spring rod catch 1952-2010 (salmon and grilse, retained and released).

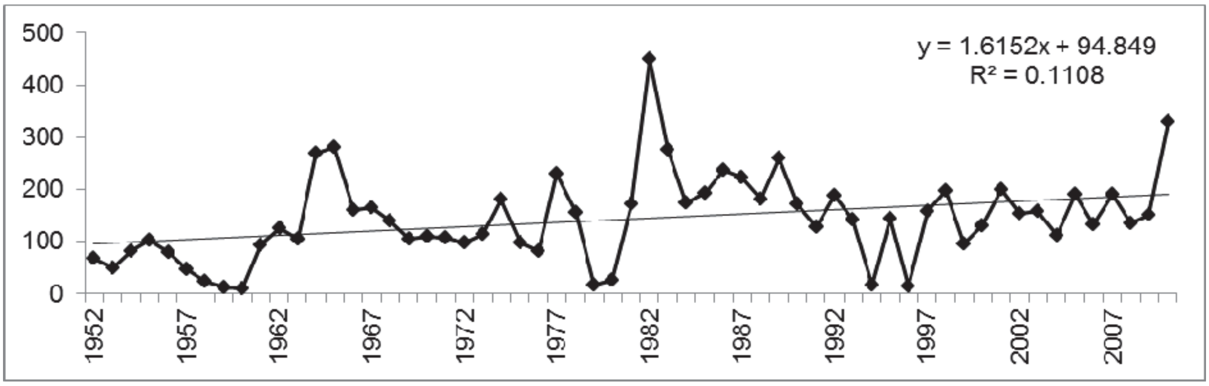


Figure 11.5 - Resort and Fincastle District (for North Harris SAC) total summer rod catch 1952-2010 (salmon and grilse, retained and released).

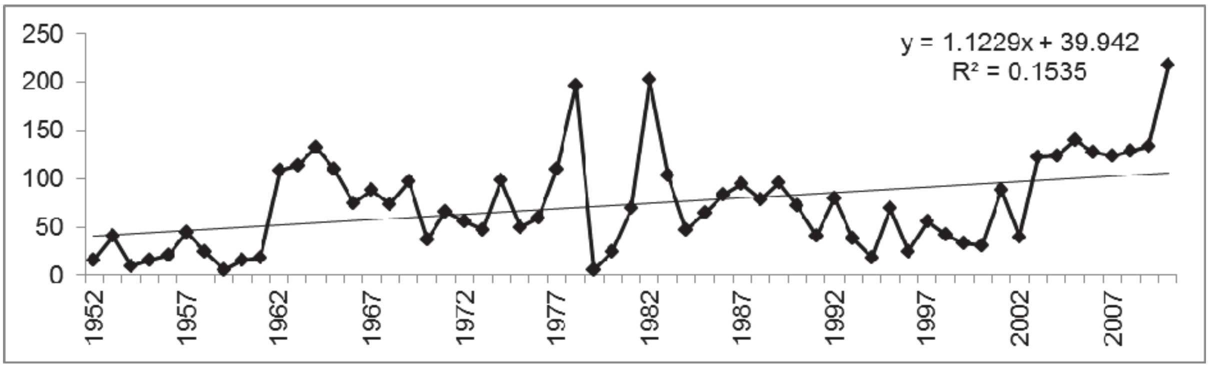


Figure 11.6 - Resort and Fincastle District (for North Harris SAC) total autumn rod catch 1952-2010 (salmon and grilse, retained and released).

The total Atlantic salmon rod catch for the District (Figure 11.3) shows an increasing trend over the time series, but with fluctuating and variable catches throughout the period. Periods of low catch are notable in the early records (1952-1961) and in 1979-1980, 1996 and 1994. Periods of high rod catch occurred from 1977-1992 (with the exception of 1979-1980) and there has been a general increase in rod catch from 2000 to 2010. The rod catch in 2010 was the second highest recorded within the data series.

Both the summer (Figure 11.5) and autumn (Figure 11.6) rod catch both show a similar increasing catch trend, with similar annual variation seen in the total catch (Figure 11.4). The autumn catch in particular has, since 2003, been increasing. Spring rod catches in the District (Figure 11.4) has always been, and remain, at very low levels. Zero returns are reported in several years. As a consequence, the very low catches and the absence of records mean that it is not safe to interpret any trend in the spring rod catch.

It is considered that the reporting of rod catch over the period has been relatively consistent and there is no confirmed evidence that any trends summarised may be attributable to a change in reporting accuracy or inconsistency. Notwithstanding this view, there are periods within the data series when very low rod catches have been declared. The reason(s) for these very low returns is not known but may reflect variable fishing effort, some inconsistency of catch returns or suggest seasonal conditions which were less favourable for angling. In these, generally small, west coast catchments rod catch is often closely related to the occurrence of high water events which are necessary both to encourage migration of fish into the river and to produce favourable angling conditions.

Angling effort in the Fincastle fishery is not constant on a year to year basis, and this is mainly due to unpredictable angling conditions. Catch and release is widely practiced in the District as a conservation measure. However, the Outer Hebrides Fisheries Trust also advise that this practice may, in some of the smaller fisheries, result in an over-reporting of catch due to the same fish being captured on more than one occasion when angling conditions are good. The OHFT is considering the introduction of a marking scheme to seek to quantify the effect of multiple catches on angling returns.

Application of Rod Catch Assessment Tool

Rod catches from the Resort and Fincastle District (for North Harris SAC) over the last 20 years (1991-2010) were applied to the rod catch assessment tool to assess whether exploitation of each run-time component required management action.

The results of these analyses for North Harris are shown in Table 11.10, and the data used to complete these tests are available in Appendix 1. The output of these analyses suggest that no reduction in exploitation is required for any seasonal component.

Table 11.10 - Summary of the Rod Catch Assessment Tool Tests for Resort and Fincastle District (for North Harris SAC).

Test	Spring	Summer	Autumn
A	No	No	No
B	No	No	No
C	No	No	No

Rod catches for the 20 year period used during this assessment (1991-2010) are shown in Figures 11.7, 11.8, 11.9 and 11.10. An F-test was applied to each of the seasonal components to assess whether they deviated from horizontal and the results of which are summarised in Table 11.11. These suggest that there has been a significant increase (at the 95% confidence level) in summer and autumn rod catches over the time period. Insufficient data was available to enable a trend assessment of the spring rod catch.

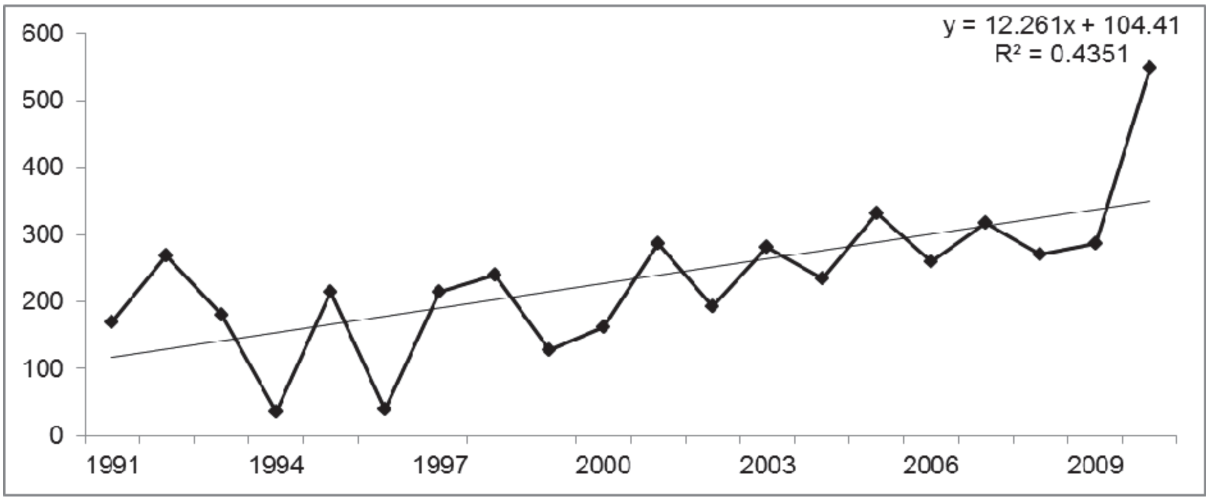


Figure 11.7 - Resort and Fincastle District (for North Harris SAC) total rod catch 1991-2010 (salmon and grilse, retained and released).

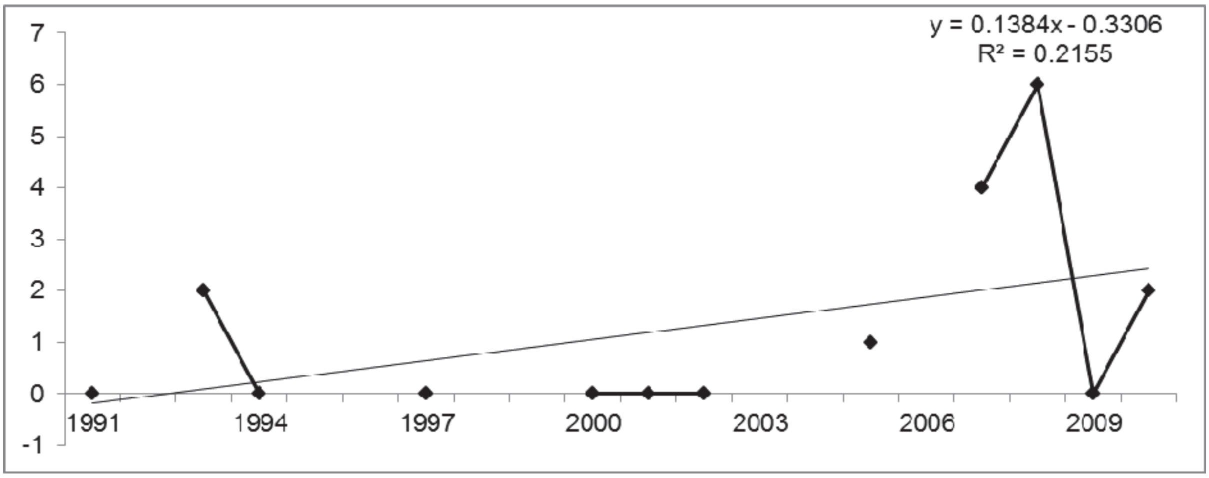


Figure 11.8 - Resort and Fincastle District (for North Harris SAC) spring rod catch 1991-2010 (salmon and grilse, retained and released).

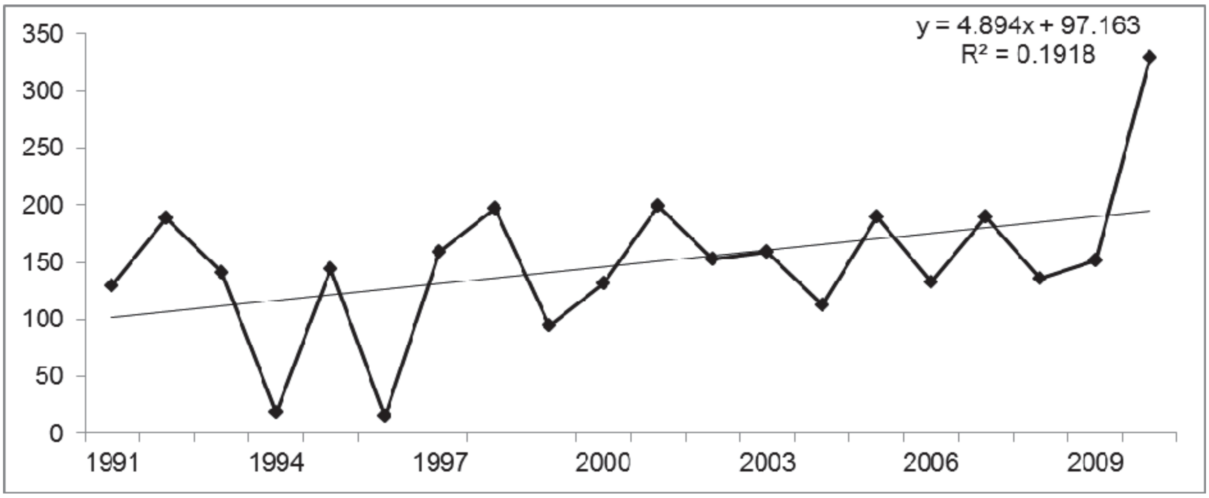


Figure 11.9 - Resort and Fincastle District (for North Harris SAC) summer rod catch 1991-2010 (salmon and grilse, retained and released).

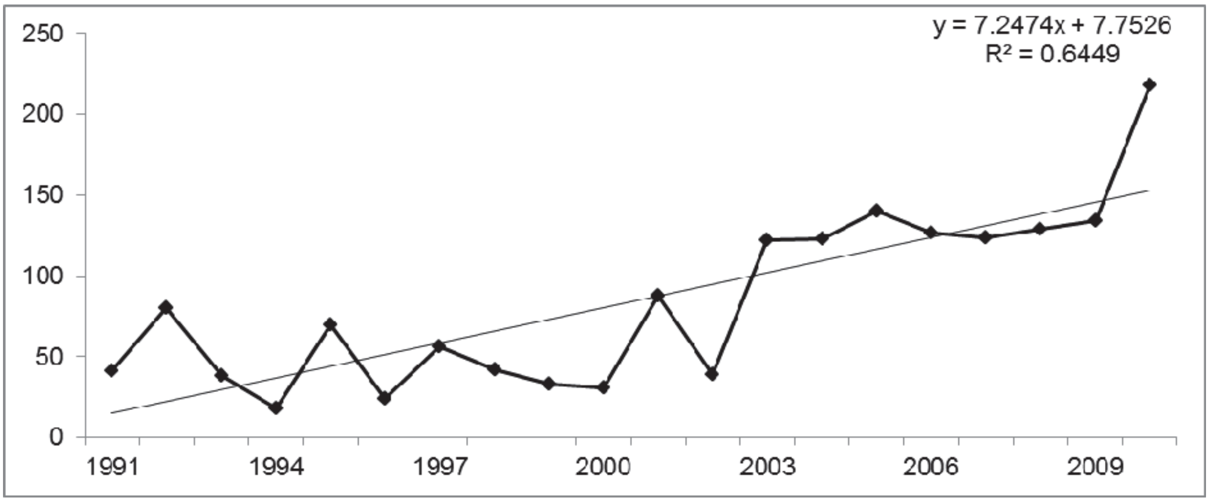


Figure 11.10 - Resort and Fincastle District (for North Harris SAC) autumn rod catch 1991-2010 (salmon and grilse, retained and released).

Table 11.11 - Summary of F-Test Results on Resort and Fincastle District (for North Harris SAC) Seasonal Rod Catch (1991-2010).

Component	Observations	F-Value	F-Significance
Spring	20	n/a	n/a
Summer	20	4.273	0.053
Autumn	20	32.688	2.02E

The percentage change in the spring, summer and autumn rod catches SCM cycles against the year of designation (1997) was also undertaken. The first SCM assessment covered the period 2002-2004, whilst the second includes data extending from 2002-2010. In this review the rod catch is averaged for each cycle period and the increase or decrease in average rod catch expressed as a percentage of the rod catch in the year of designation.

This comparison is shown graphically in Figure 11.11 and indicates that, for the summer and autumn stock components, there has been an increase in average rod catch in both cycles when compared to that in the year of designation.

The increase is greatest for the summer rod catch in each cycle, with increases in average catch since designation in 1997 exceeding 900% in each instance. This is due to the fact that the summer rod catch in the designation year (15 fish in total) is the lowest in the time series. In all years since that time, other than 1999, the declared rod catch has exceeded 100 fish. A record rod catch of 329 fish was declared within the dataset covered by cycle two. This sequence of catches, which were significantly greater than the catch in the year of designation, has resulted in the average catch over each assessment cycle period being many times greater than that recorded in the 'baseline' year.

Similarly, the average autumn rod catch in each SCM cycle is greater than that recorded in the year of designation, with the average rod catch in cycle 2 being more than 100% greater. Again, this is due in large part to the autumn catch in 1996 being low (24 fish in total) in comparison to the following years. This represents the lowest catch in the data series (from designation to the present), with all years since 2003 recording catches in excess of 100 fish. The highest rod catch (218) was declared in 2010.

There is insufficient data for the spring rod catch over either of the SCM cycles to allow a meaningful comparison against the rod catch in the year of designation.

Figure 11.11 - Stock trend assessment since North Harris SAC Designation (1997) in cycle 1 (1997-2004) and cycle 2 (1997-2010).

Summary

The overall rod catch within the Resort and Fincastle District (for North Harris SAC) over the period 1952-2010 shows an increasing trend, but with significant annual variation. Periods of low catch are notable in the early years of the long-term data series (1952-1961), and low rod catches were also recorded in 1979-1980, 1996 and 1994. Periods of high rod catch are were evident in 1977-1992 (with the exception of 1979-1980), and there has been a general increase in rod catch from 2000 to 2010. After 1982, the 2010 rod catch was the highest on record. Both the summer and autumn rod catches exhibit a similar increasing trend, with similar annual variation in catch patterns to that observed in the total rod catch statistics. The autumn catch in particular has been steadily since 2003. The spring rod catch has, always been, very low - with many years reporting a zero return.

The application of the NASCO rod catch assessment tool to rod catches declared over the last 20 years (1991-2010) suggest that no reduction in exploitation is required for any of the seasonal run-time components. When rod catch trends for each run-time component are considered individually, a significant increase in summer and autumn components is confirmed. There are insufficient data to determine any temporal changes in the spring rod catch.

In combination, these analyses of adult rod catch in North Harris SAC indicate an improving catch over both the long (since 1952) and short (last 20 years) term. There is no indication that further conservation measures are required from application of the NASCO rod catch assessment tool.

c) Habitats supporting the qualifying feature

1. Water quality and quantity

The status of each water body within the SAC, for which SEPA hold data, was obtained from the SEPA River Basin Planning interactive website

A total of four WFD water bodies representing a river length of 69 km are recognised within the North Harris SAC. Of these, two are classified as being of good ecological status (river length 45 km) and are protected from deterioration in class. Of the remaining two water bodies (river length 25 km), one is classified as being at poor ecological status and the other, a heavily modified waterbody (HMWB), is classified as of moderate ecological potential. Both require measures to bring them up to at least good ecological status, or good ecological potential within the RBMP. The poor ecological status waterbody is so classified because of the presence of abstraction pressures caused by renewable energy generation. The HMWB is classified as being at moderate ecological potential because morphological alterations affecting fish passage, point source pollution from aquaculture, and abstraction for renewable energy generation. Table 11.12 below summarises the number of water bodies and the length of channel within each status category.

Table 11.12 - Number of water bodies and length of channel within each WFD status category in the North Harris SAC.

WFD status (2009)	High	Good	Moderate	Poor	Bad	Total
Number of water bodies		2		1		3
Number of HMWBs			1			1
Length of channel (km)		45	7	18		69

2. Trends, changes and activities

The OHFT consider the primary negative pressure on Atlantic salmon within the North Harris SAC to be fish farms (escapees, disease, parasites). Invasive non-native species and a dam on Loch Leosaid (which restricts fish migration) are also considered to be important. Positive impacts are derived from improvements to fisheries management, a reduction in deer grazing pressure, and changes to forestry practices.

The OHFT consider that the main activities having a negative impact on Atlantic salmon in the North Harris SAC are:

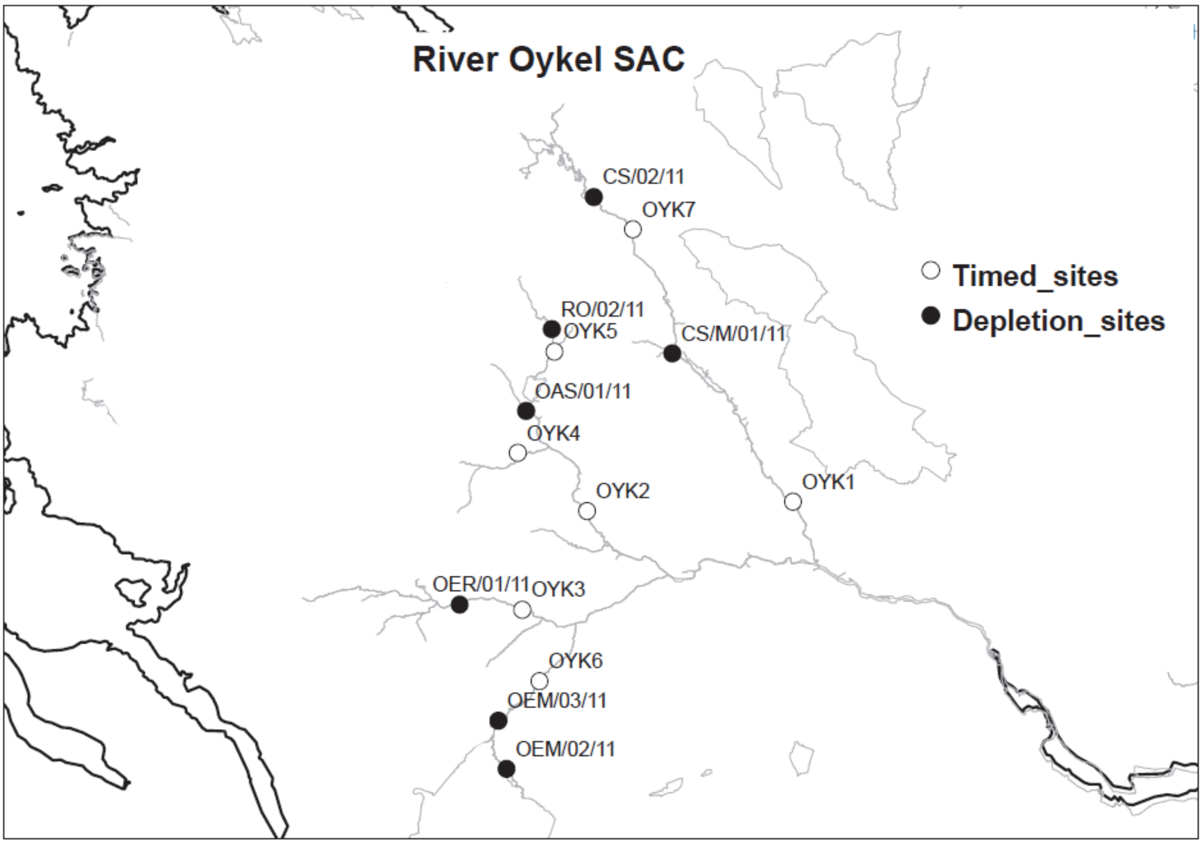
- Fish farms (escapees, disease, parasites);
- Invasive non-native species; and
- A dam restricting fish migration.

12. RIVER OYKEL

a) Juvenile Assessment

Seven sites were surveyed using the standard SFCC catch depletion electrofishing method. A further seven sites were sampled using a five-minute timed electrofishing approach. All sites were situated within the River Oykel SAC (Map 12.1). The sites were surveyed by staff of the Kyle of Sutherland DSFB.

Map 12.1 - Distribution of depletion and timed electro fishing sites on the River Oykel SAC.



Depletion sites

Site details and a summary of electro fishing results are shown in Tables 12.1 – 12.4. 0+ and 1+ salmon were found at all seven depletion sites, although Zippin densities were only calculable for six of the 0+ samples. 2+ fish were caught at three of the sites. Confidence limits were generally quite wide. For fry, Zippin densities ranged from 5 - 180 per 100 m^2 (mean 67) and Carl & Strube densities ranged from 4 - 167 per 100 m^2 (mean 62). For 1+ fish, Zippin densities ranged from 9 - 67 (mean 32) and Carl & Strube densities from 5 – 64 (mean 27). The largest number of 0+ fish were found in the Mulzie Burn while the largest number of 1+ fish were found in the River Cassely (mean 45 and 87 respectively). Trout were present at only four sites.

Table 12.1 - Details of depletion electrofishing sites, River Oykel SAC.

Site code	Date	Easting	Northing	Altitude (m)	Channel name
OEM/02/11	07/07/11	230077	889427	298	Mulzie
OEM/03/11	07/07/11	229604	892139	234	Mulzie
OAS/01/11	13/07/11	231161	909577	155	Allt Strath Seasgaich
RO/02/11	14/07/11	232613	914190	197	Oykel
CS/02/11	15/07/11	234970	921624	243	River Cassley
OER/01/11	01/08/11	227439	898672	173	Rappach
CS/M/01/11	19/07/11	239395	912832	87	Gleann na Muic

Table 12.2 - Details of depletion electrofishing for 0+ and 1++ salmon, River Oykel SAC.

Site code	Wetted area (m^2)	Zippin 0+	Carl & Strube 0+	Zippin 1+	Carl & Strube 1+	Zippin 2+	Carl & Strube 2+
OEM/02/11	103.0	11.4	10.7	47.1	46.6	n/a	n/a
OEM/03/11	97.6	n/a	n/a	8.6	5.1	n/a	n/a
OAS/01/11	112.3	179.5	167.4	27.6	26.7	0.0	0.0
RO/02/11	98.0	70.4	67.4	13.7	11.2	n/a	n/a
CS/02/11	91.7	4.8	4.4	66.8	64.3	0.0	0.0
OER/01/11	109.3	56.2	50.3	35.2	13.7	5.6	5.5
CS/M/01/11	100.5	81.8	71.6	22.0	20.9	0.0	0.0

n/a denotes salmon present, but not in high enough densities to allow calculation of Zippin or Carl & Strube statistics. 0.0 denotes no salmon found at site.

Table 12.3 - Presence/absence of salmon year classes and of trout 0+ and 1++ at depletion sites, River Oykel SAC.

Site code	Salmon age class present?				Trout present?	
	0+	1+	2+	3++	0+	1++
OEM/02/11	Y	Y	Y	N	N	Y
OEM/03/11	Y	Y	Y	N	Y	Y
OAS/01/11	Y	Y	N	Y	Y	Y
RO/02/11	Y	Y	Y	N	N	N
CS/02/11	Y	Y	N	N	N	Y
OER/01/11	Y	Y	Y	N	N	N
CS/M/01/11	Y	Y	N	N	N	N

Table 12.4 - Fork length of salmon of different age classes, River Oykel SAC.

Site code	0+ mean fork length	No. 0+	1+ mean fork length	No. 1+	2+ mean fork length	No. 2+	3+ mean fork length	No. 3+
OEM/02/11	41	11	83	47	109	4	n/a	0
OEM/03/11	45	4	82	5	110	1	n/a	0
OAS/01/11	41	126	80	30	n/a	0	n/a	0
RO/02/11	33	57	67	11	99	3	n/a	0
CS/02/11	43	4	87	53	n/a	0	n/a	0
OER/01/11	36	44	56	12	84	6	n/a	0
CS/M/01/11	34	53	75	21	n/a	0	n/a	0

n/a denotes means could not be calculated as no salmon of that age class were found at the site.

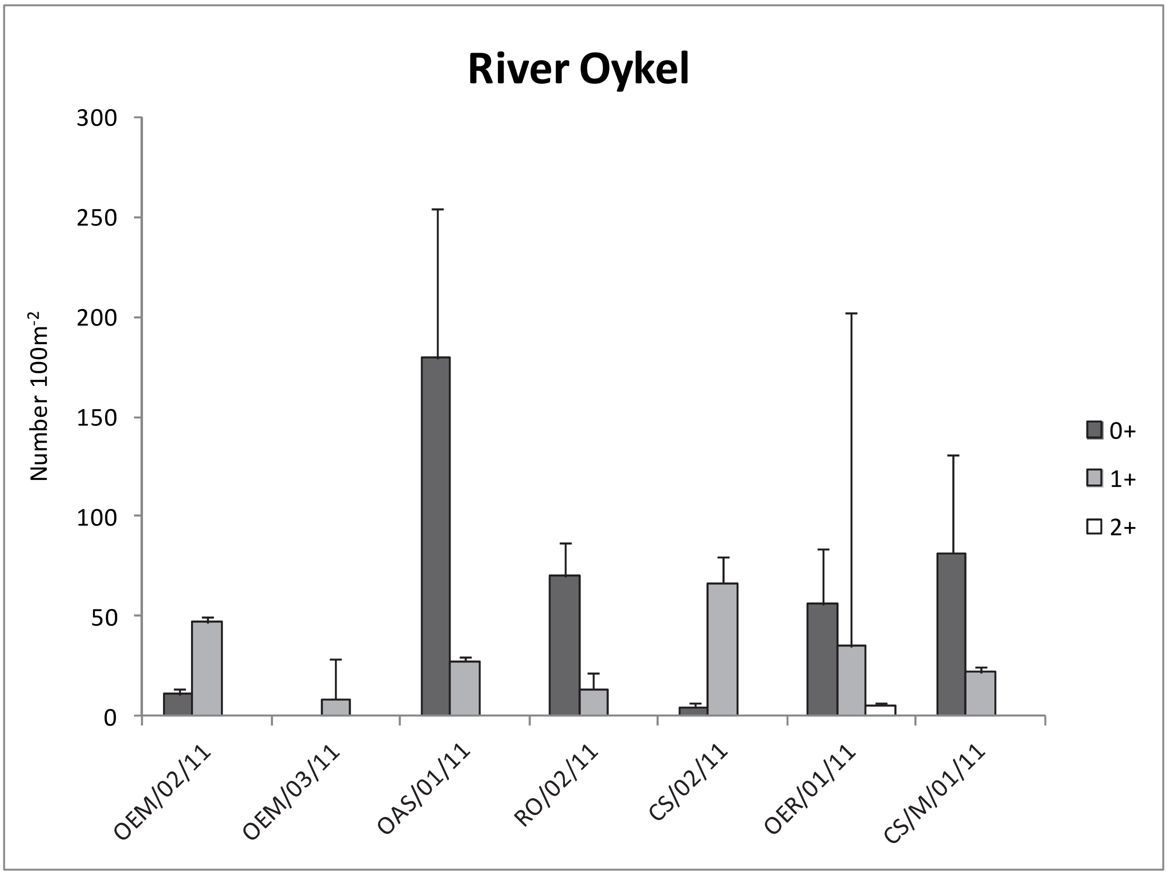


Figure 12.1 - Juvenile salmon population density estimated by the Zippin method for the SAC monitoring sites on the River Oykel SAC.

Timed sites

Details of the seven timed sites are given in Table 12.5. 0+ salmon were caught at one of the timed sites, and 1+ fish at six sites. CPUE for fry ranged from 0/min to 3.8/min and for

1++ fish, ranged from 0/min to 3.4/min. 2+ Atlantic salmon were caught at only one of the sites, as were trout.

Table 12.5 - Details of timed electrofishing sites, River Oykel SAC.

Site code	Easting	Northing	River	Altitude (m)
OYK3	230952	898382	Rappach	133
OYK7	237186	919815	Cassley	195
OYK1	246181	904467	Cassley	37
OYK6	231925	894367	Mulzie	183
OYK2	234598	903952	Oykel	62
OYK4	230709	907217	Eileag	154
OYK5	232761	912918	Oykel	195

Table 12.6 - Salmon catch per unit effort (CPUE), River Oykel SAC.

Site code	Survey date	Salmon 0+/min	Salmon 1++/min
OYK3	01/08/11	0.6	1.0
OYK7	02/08/11	0.2	1.4
OYK1	03/08/11	0.2	0.4
OYK6	03/08/11	0.2	0.8
OYK2	03/08/11	3.8	0.8
OYK4	03/08/11	0.0	0.6
OYK5	03/08/11	2.2	1.2

Table 12.7 - Presence/absence of salmon year classes and of trout at timed sites, River Oykel SAC.

Site code	Salmon age class present?				Trout present?
	0+	1+	2+	3+	
OYK3	Y	Y	N	N	N
OYK7	Y	Y	N	N	N
OYK1	Y	Y	N	N	N
OYK6	Y	Y	N	N	N
OYK2	Y	Y	N	N	N
OYK4	N	Y	N	N	Y
OYK5	Y	Y	N	N	N

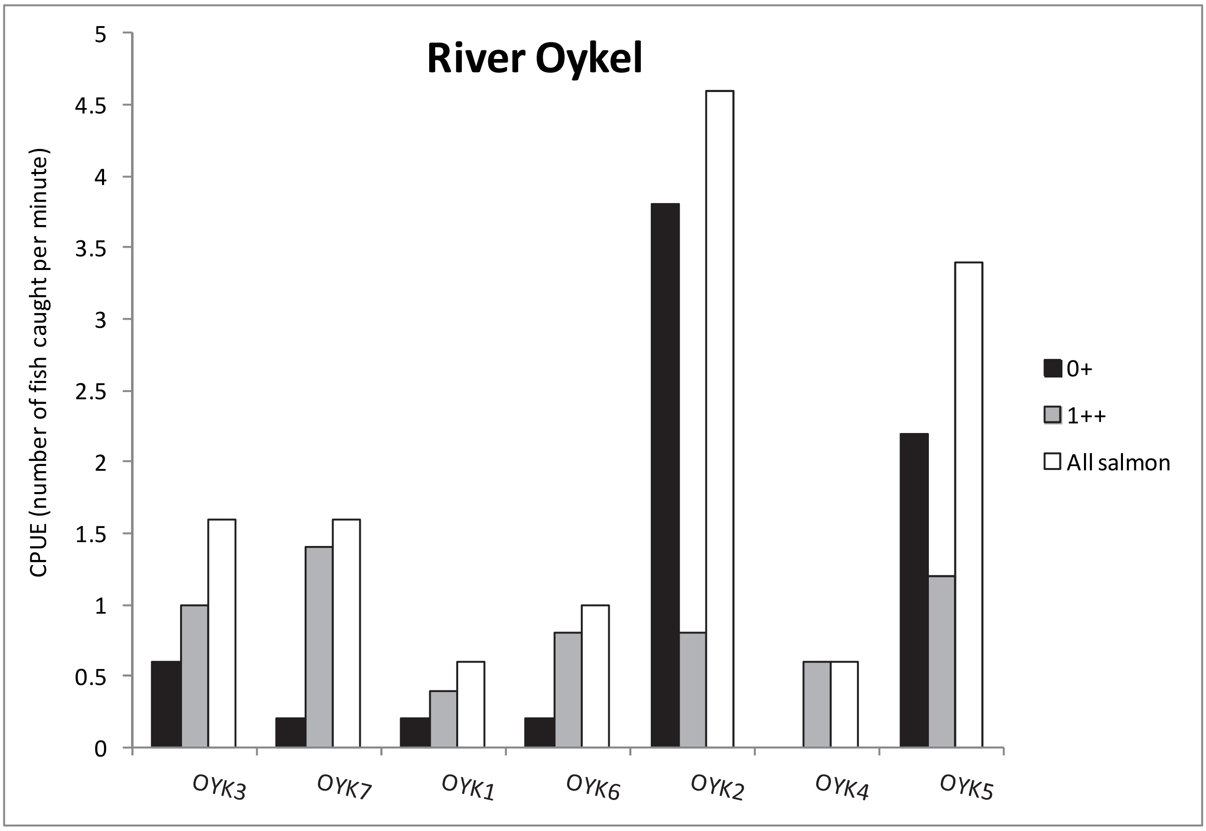


Figure 12.2 - Number of salmon (0+, 1++ and all salmon) caught per minute during five minutes of electrofishing at sites on the River Oykel.

Summary

When the densities of 0+ and 1++ juveniles are considered against the regional juvenile densities developed by Godfrey (2005) fish densities at sites within the River Oykel are spread across the full range of quintile bands for fry, but concentrated in the top two bands for parr (Table 12.8). This indicates a certain amount of variability in fry density between some sites reflecting local differences in juvenile productivity. These differences may be associated with natural production limits associated with, for example, habitat quality or nutrient levels, the number of spawning adults reaching survey locations or the impact of external pressures which limit natural production or juvenile survival. However, despite the variability in fry density, data suggest that both the fry and parr elements should be considered to be in favourable status within the SAC.

Table 12.8 – Number of sites within the River Oykel SAC falling within each quintile (according to absolute regional classification for 0+ and 1++ age classes) – and the resulting condition status.

SAC	Age class	Number of sites					Median grade	Favourable condition?
		0-20	21-40	41-60	61-80	81-100		
		E	D	C	B	A		
Oykel	0+	1	1	1		4	A	Y
	1++				1	6	A	Y

A comparison of juvenile data from cycle 1 and cycle 2 indicate that the status of the River Oykel has improved in 2011 compared to the previous assessment (Table 12.9). Fry densities were higher, raising the status of fry from unfavourable to favourable. Parr densities were favourable in 2004 and remained so in the current survey.

Table 12.9 - Comparison of condition status in 2004 and in 2011 for 0+ and 1++ age classes.

SAC		2004	2011	Change
Oykel	0+	N	Y	+
	1++	Y	Y	=

b) Adult assessment

Data for adult Atlantic salmon rod catch within the River Oykel was analysed using the NASCO Rod Catch Assessment tool introduced and described in Section 1. This analysis considers exploitation of the seasonal components (spring, summer and autumn) suggests whether management is required. Trends in long-term rod catch data from Marine Scotland Science (1952-present) for the overall catch and the same seasonal run-time components is also interrogated.

The Marine Scotland Science the catch statistics used in the following assessments are those of the Kyle of Sutherland Fisheries District as a whole and not those of the River Oykel. These are not readily available. The Kyle of Sutherland District includes catches from four major catchments and fisheries: the rivers Cassley, Carron, Shin and Oykel. For the purposes of these assessments the analyses of the catches from the District is assumed to be representative of the River Oykel though this has not been demonstrated to be the case.

Summary of 1952 Catch Statistics

Rod catch statistics for the Kyle of Sutherland District (for the River Oykel), covering the period 1952-2010, are shown in Figures 12.3, 12.4, 12.5 and 12.6.

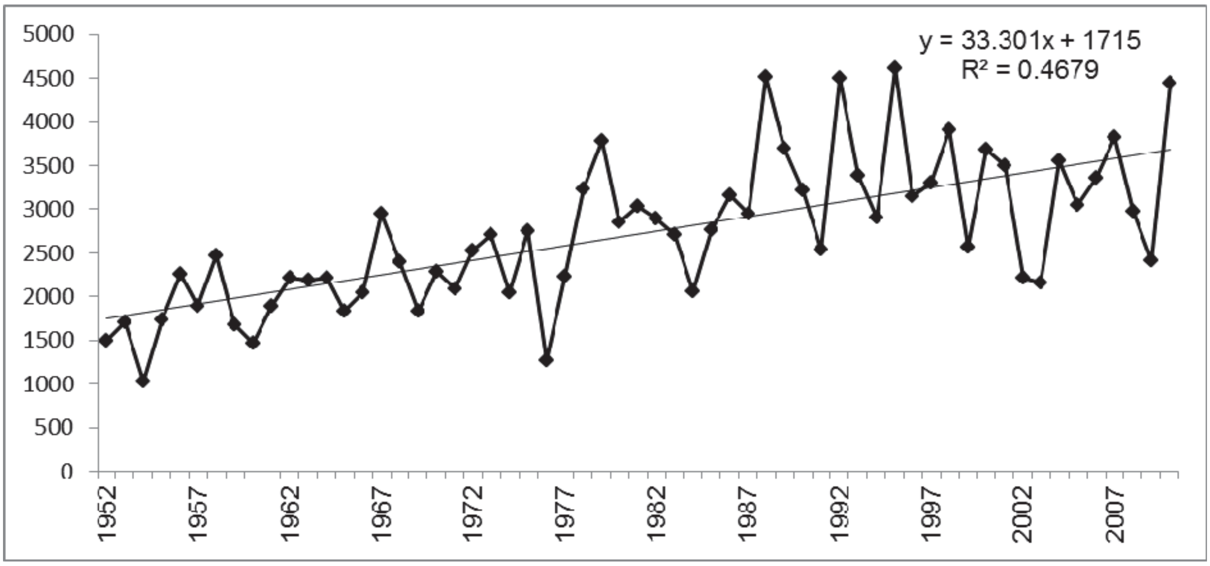


Figure 12.3 - Kyle of Sutherland District (for River Oykel) total rod catch 1952-2010 (salmon and grilse, retained and released).

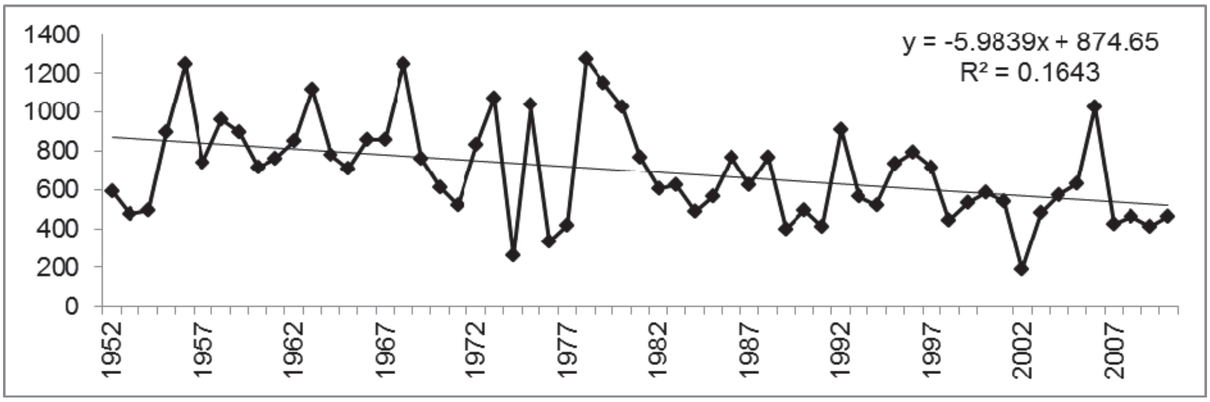


Figure 12.4 - Kyle of Sutherland District (for River Oykel) total spring rod catch 1952-2010 (salmon and grilse, retained and released).

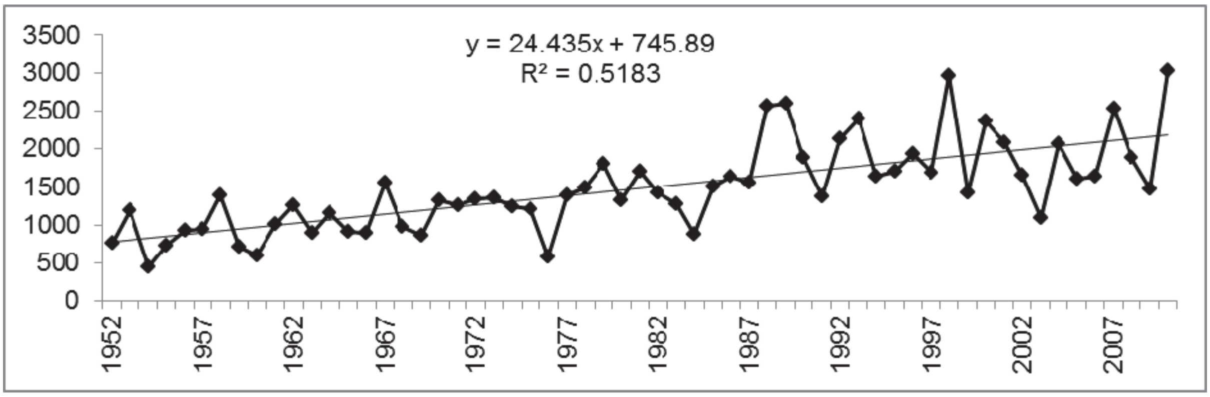


Figure 12.5 - Kyle of Sutherland District (for River Oykel) total summer rod catch 1952-2010 (salmon and grilse, retained and released).

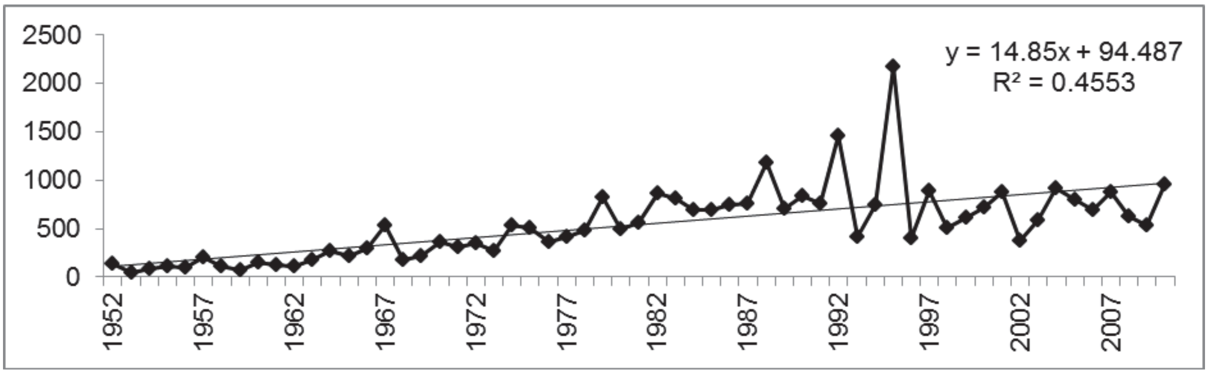


Figure 12.6 - Kyle of Sutherland District (for River Oykel) total autumn rod catch 1952-2010 (salmon and grilse, retained and released).

The total rod catch for Atlantic salmon across the District (Figure 12.3) shows a progressive and consistent increasing trend within the data series. Recorded rod catches during this period increase from around 1500 at the beginning of the data series to >4000 at the end. Both the summer and autumn rod catches (Figures 12.5 and 12.6) show a similar increasing trend although this is less marked than that observed in the total catch. It should be noted, however, that very few autumn fish were recorded in the early part of the data series, and ~1000 fish per year are recorded in more recent years. The spring rod catch shows a gradual decline across the time series (Figure 12.4).

It is considered that the reporting of rod catch over the period has been consistent and there is no evidence that any trends summarised may be attributable to a change in reporting accuracy or inconsistency.

The Kyle of Sutherland District operates an active Catch and Release policy, and return rates are reported now to be the second highest in Scotland. The policy is reviewed regularly across the District and the last of these further encouraged the return of all fish >65 cm. In respect of the River Oykel itself, the proprietors group have, for over ten years, required the return of all spring fish as a conservation measure for that component of the stock.

A reduction in netting activity has taken place within the District as a whole, and this has occurred over an extended period of years. It is the policy of the local DSFB to seek to buy netting rights as these become available, in an attempt to continue to reduce the extent of these fisheries.

In the past the Kyle of Sutherland DSFB operated a significant hatchery operation, and this included the release of fish into the River Oykel and its tributaries. Stocking within the system by the DSFB stopped in 2005.

More generally, the DSFB have sought to support better and more sensitive land management practices in the upper catchment, largely associated with forestry and upland drainage practice, and the wiser education of the general public and school children in conservation and fisheries management.

Application of Rod Catch Assessment Tool

Rod catches from the Kyle of Sutherland District (for the River Oykel) over the last 20 years (1991-2010) were applied to the rod catch assessment tool to assess whether exploitation of each run time component required management action.

The results of these tests for the River Oykel are shown in Table 12.10, and data used to complete these tests are available in Appendix 1. The output of these analyses suggest that no reduction in exploitation is required for any of the spring, summer or autumn run-time components.

Table 12.10 - Summary of the Rod Catch Assessment Tool Tests for the Kyle of Sutherland District (for the River Oykel).

Test	Spring	Summer	Autumn
A	No	No	No
B	No	No	No
C	No	No	No

Rod catches for the 20 year period used in this part of the assessment (1991-2010) are shown in Figures 12.7, 12.8, 12.9 and 12.10. An F-test was applied to each of the seasonal components to assess whether these trends deviated from horizontal and the results are summarised in Table 12.13. These suggest that no significant trend exists in any of the spring, summer or autumn rod catches over this 20-year period.

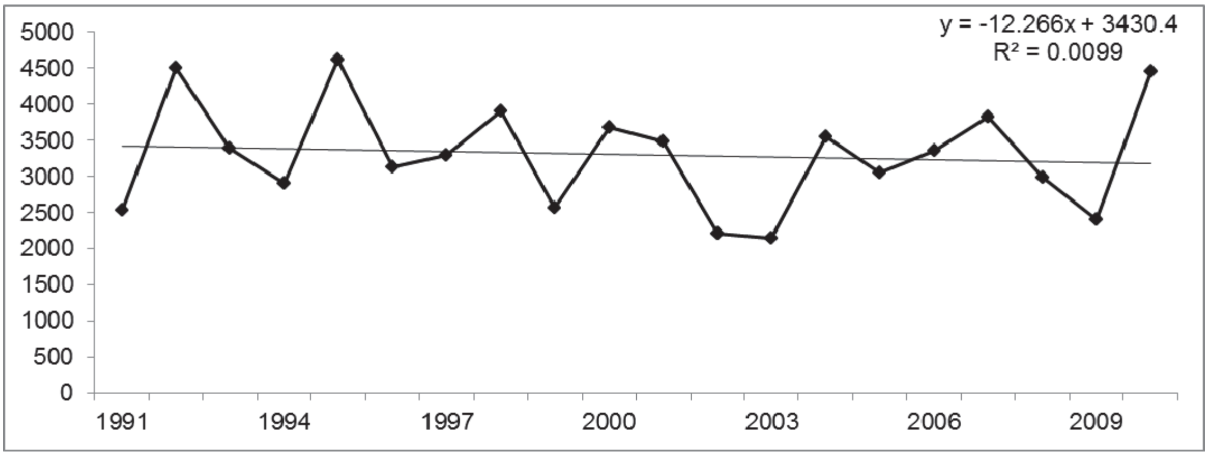


Figure 12.7 - Kyle of Sutherland District (for River Oykel) total rod catch 1991-2010 (salmon and grilse, retained and released).

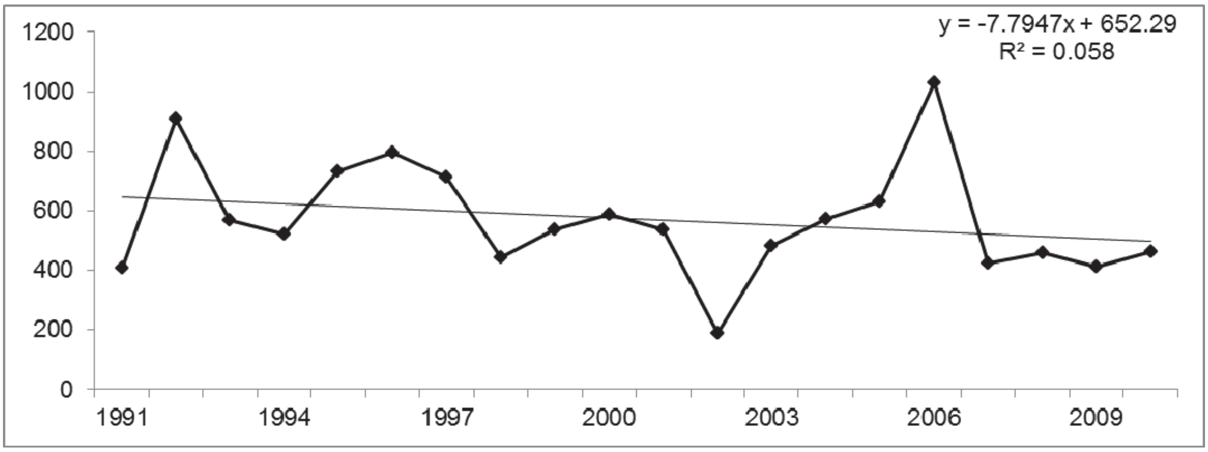


Figure 12.8 - Kyle of Sutherland District (for River Oykel) spring rod catch 1991-2010 (salmon and grilse, retained and released).

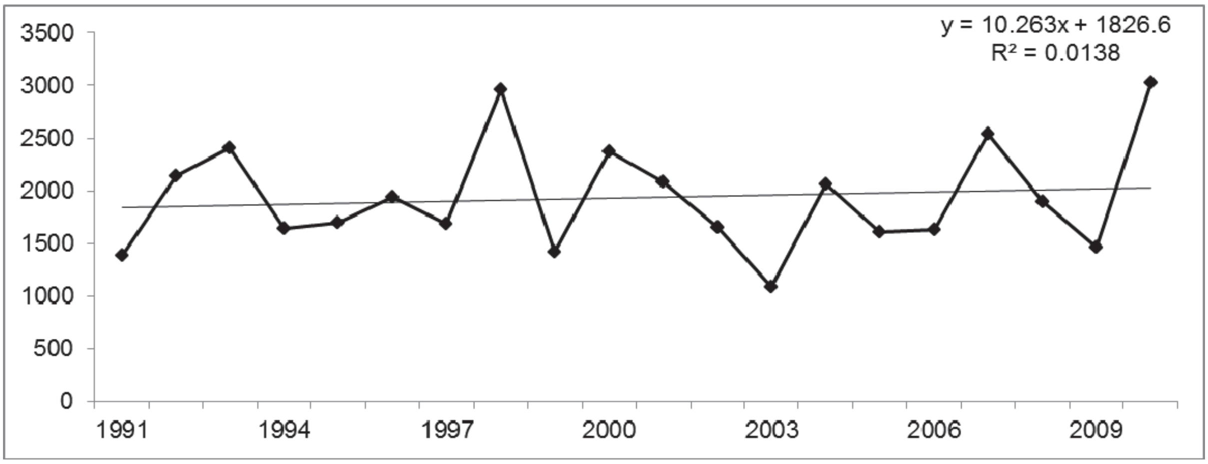


Figure 12.9 - Kyle of Sutherland District (for River Oykel) summer rod catch 1991-2010 (salmon and grilse, retained and released).

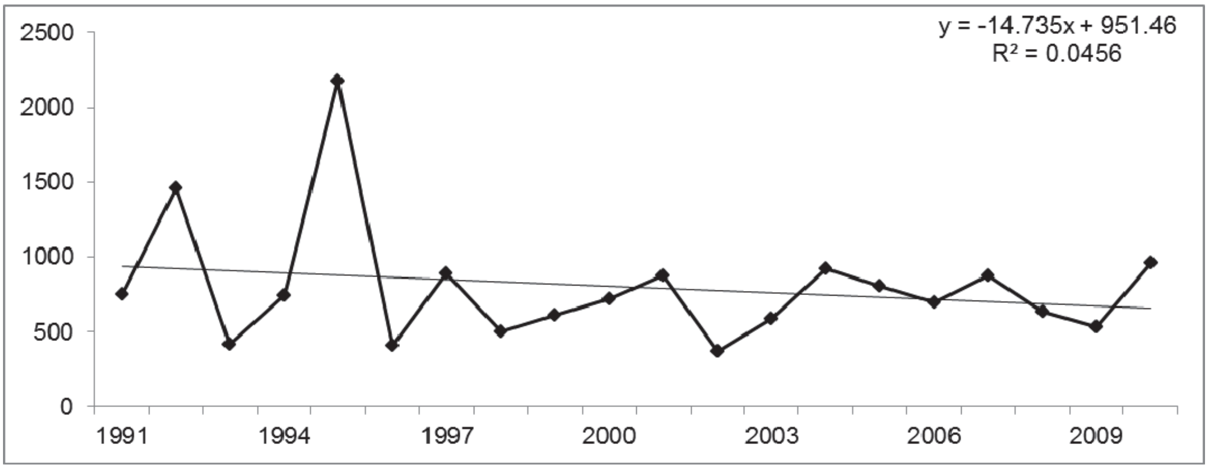


Figure 12.10 - Kyle of Sutherland District (for River Oykel) autumn rod catch 1991-2010 (salmon and grilse, retained and released).

Table 12.11 - Summary of F-Test Results on River Oykel Seasonal Rod Catch (1991-2010).

Component	Observations	F-Value	F-Significance
Spring	20	1.108	0.306
Summer	20	0.251	0.622
Autumn	20	0.859	0.366

The percentage change in the spring, summer and autumn rod catches SCM cycles against the year of designation (2001) was also undertaken. The first SCM assessment covered the period 2002-2004, whilst the second includes data extending from 2002-2010. In this review the rod catch is averaged for each cycle period and the increase or decrease in average rod catch expressed as a percentage of the rod catch in the year of designation.

This comparison is shown graphically in Figure 12.11 and indicates that for all of the spring, summer and autumn stock components in the Kyle of Sutherland District (for the River Oykel) the average rod catch over each cycle is less than the catch in the year of designation. In the main these decreases are 10%-20% less than catch in 2001 and in each instance the decrease is more in cycle one than cycle two.

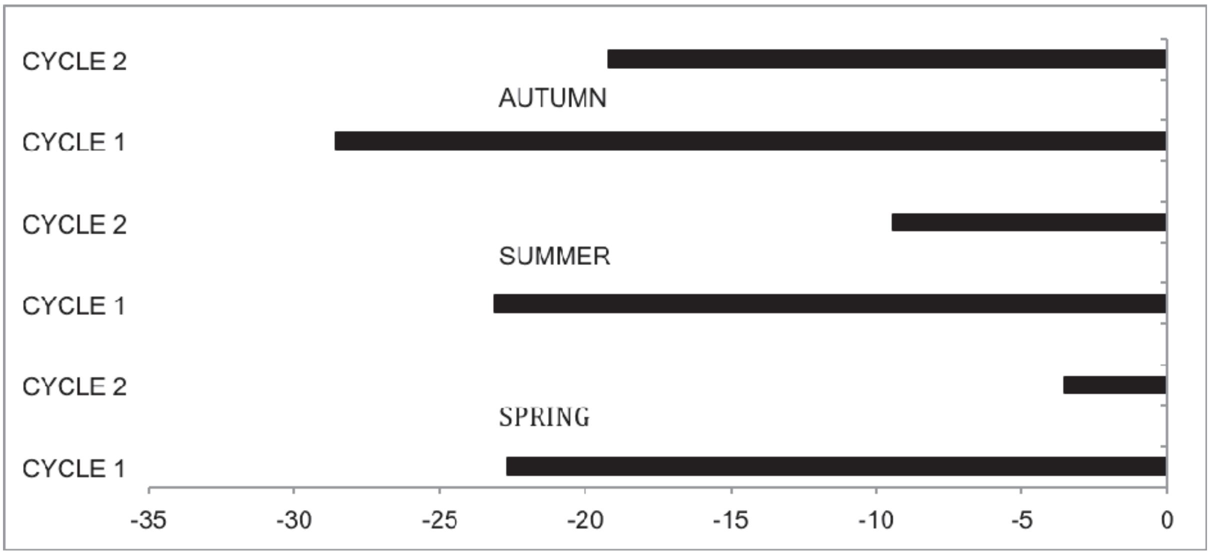


Figure 12.11 - Stock trend assessment since River Oykel SAC Designation (2001) in cycle 1 (2002-2004) and cycle 2 (2002-2010).

Summary

The overall rod catch for Atlantic salmon within the Kyle of Sutherland District (for River Oykel) over the period 1952-2010 shows a consistent and gradual increase over the long-term. Similar, but less pronounced increases are also present in the summer and autumn rod catch, and the autumn fishery now represents a significant proportion of the total rod catch within the District. This is notable given the poor contribution of autumn fish to the declared rod catches at the beginning of the data series.

Application of the NASCO rod catch assessment tool to the declared rod catches over the last 20 years (1991-2010) suggest that no reduction in exploitation is required for any of the seasonal run-time components. When rod catch trends for each run-time component are considered individually there is no significant positive or negative deviation from horizontal for the spring, summer or autumn catch components.

In combination, these analyses of adult Atlantic salmon rod catch within the Kyle of Sutherland District (which in this instance is assumed to be representative of the River Oykel SAC), suggest an increasing overall rod catch profile since the beginning of the 1952-2010 dataset. Within this, there has been a decline in spring rod catches and an increased catch of summer and autumn fish over the same timeframe. When catches are viewed within the shorter 20 year (1991-2010) period used for the NASCO rod catch assessment tool, no significant changes in rod catch, for any of the seasonal components could be seen.

c) Habitats supporting the qualifying feature

1. Water quality and quantity

The status of each water body within the SAC, for which SEPA hold data, was obtained from the SEPA River Basin Planning interactive website.

A total of seven WFD water bodies representing a river length of 101 km are located within the River Oykel SAC. Of these, six are classifies as being of high or good ecological status (total river length 95 km) and are protected from deterioration. The remaining waterbody is classified as being of moderate ecological status (total river length 6 km) and measures are therefore required to bring it up to good or high status within the RBMP. The waterbody which classified as being at moderate status is so classified due to morphological alterations due to forestry planting close to river banks. There are no Heavily Modified Water Bodies in the River Oykel SAC. Table 12.12 below summarises the number of water bodies and the length of channel within each status category.

Table 12.12 - Number of water bodies and length of channel within each WFD status category in the River Oykel SAC.

WFD status (2009)	High	Good	Moderate	Poor	Bad	Total
Number of water bodies	1	5	1			7
Length of channel (km)	32	63	6			101

2. Trends, changes and activities

The Kyle of Sutherland DSFB suggest that the primary negative impacts on Atlantic salmon within the River Oykel catchment are related to forestry activities. Agricultural operations and water quality are also considered to be significant issues. Grazing, burning, water management, recreation, flood defence and freshwater fish farms also have a negative impact on fish within the catchment.

The KoSDSFB suggest that the main activities which have a negative impact on Atlantic salmon within the River Oykel SAC are:

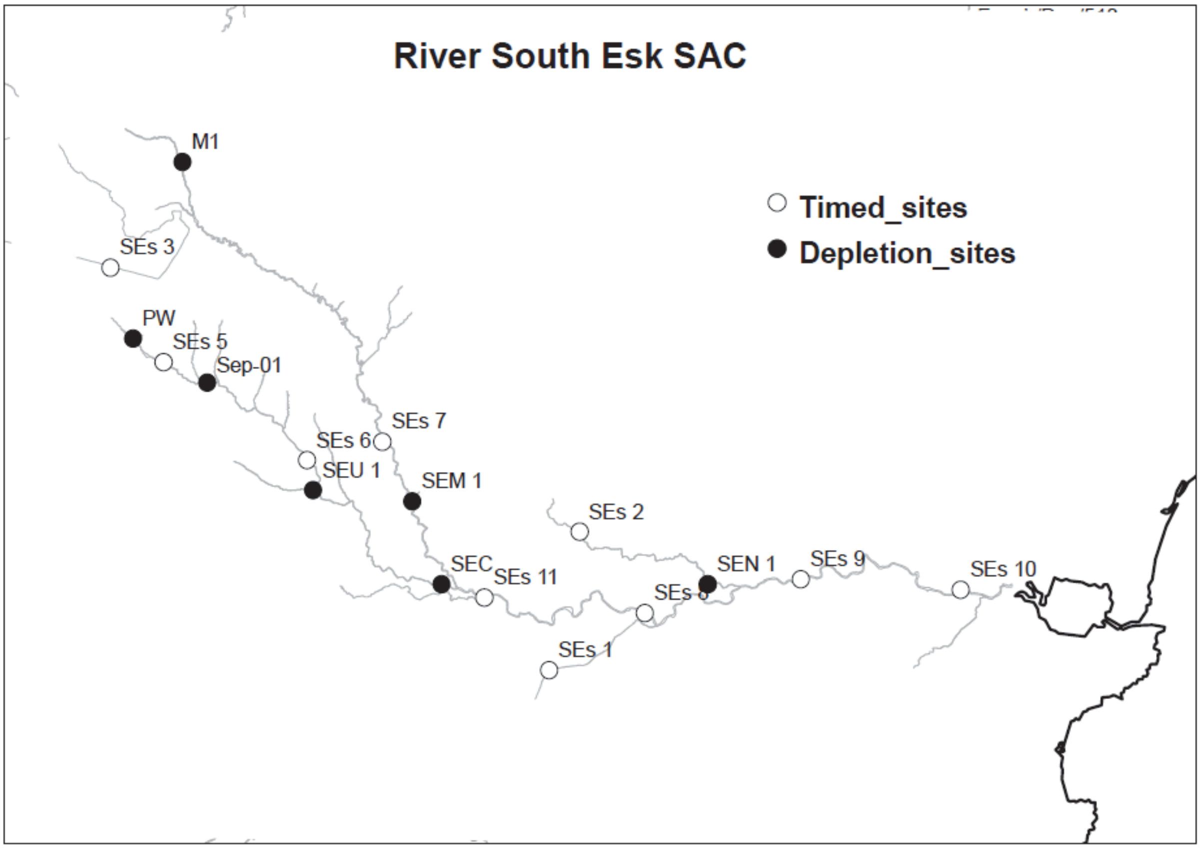
- Forestry;
- Agricultural operations; and
- Water quality.

13. RIVER SOUTH ESK

a) Juvenile Assessment

Six sites were surveyed using the standard SFCC catch depletion electrofishing method. A further 10 sites were sampled using a five-minute timed electrofishing approach. All sites were situated within the River South Esk SAC (Map 13.1). The sites were surveyed by staff of the Esk District Salmon Fisheries Board and Esks River and Fisheries Trust.

Map 13.1 - Distribution of depletion and timed electro-fishing sites on the River South Esk SAC.



Depletion sites

Site details and a summary of electrofishing results are shown in Tables 13.1 – 13.4. Zippin and Carl and Strube estimates for fry were calculable for all sites although confidence limits were wide for the Lednathie Burn. Six sites were calculable for 1+ fish and two sites for 2+. For fry, Zippin densities ranged from 7-183 per 100 m^2 (mean 65) and Carl and Strube densities ranged from 6-155 per 100 m^2 (mean 59). 0+ fish were caught at all seven sites, 1+ at six sites and 2+ fish at only two sites. 2+ fish were only present in the Prosen Water and the main river channel. The largest 0+, 1+ and 2+ fish (mean values) were all from the Burn of Glenmoye. Trout were present at all seven sites. The highest densities of 0+ fish were found in the Lednathie Burn and Noran Water (183 and 110 per 100 m^2 respectively – Zippin estimates) (Figure 13.1). The same two burns also had the highest densities of 1+ fish (48 and 90 respectively – Zippin estimates. The lowest densities of 0+ fish were found in the Prosen Water (7 per 100 m^2).

Table 13.1 - Details of depletion electrofishing sites, River South Esk SAC.

Site code	Date	Easting	Northing	Altitude (m)	Channel name
PW	06/10/11	325800	769900	390	Prosen Water
SEM 1	29/09/11	338750	762350	180	Burn of Glenmoye
SEC	31/07/11	340100	758500	135	South Esk
M1	01/08/11	328100	778100	280	South Esk
SEU 1	23/08/11	334150	762870	200	Lednathie Burn
SEP 1	23/08/11	329250	767850	290	Prosen Water
SEN 1	29/07/11	352450	758500	40	Noran Water

Table 13.2 - Details of depletion electrofishing for 0+ and 1++ salmon, River South Esk SAC.

Site code	Wetted area (m^2)	Zippin 0+	Carl & Strube 0+	Zippin 1+	Carl & Strube 1+	Zippin 2+	Carl & Strube 2+
PW	124.7	6.7	5.7	20.0	19.5	6.9	6.9
SEM 1	73.3	33.6	32.7	28.5	27.3	n/a	n/a
SEC	80.0	11.3	11.3	n/a	n/a	n/a	n/a
M1	96.0	62.3	59.4	58.7	52.1	8.3	7.3
SEU 1	36.7	183.2	155.4	48.0	43.6	0.0	0.0
SEP 1	76.8	45.2	41.7	22.7	20.8	0.0	0.0
SEN 1	97.5	110.0	108.7	90.1	50.2	n/a	n/a

n/a denotes salmon present, but not in high enough densities to allow calculation of Zippin or Carl & Strube statistics. 0 denotes no salmon found at site.

Table 13.3 - Presence/absence of salmon year classes and of trout 0+ and 1++ at depletion sites, River South Esk SAC.

Site code	Salmon age class present?				Trout present?	
	0+	1+	2+	3++	0+	1++
PW	Y	Y	Y	N	Y	N
SEM 1	Y	Y	Y	N	Y	Y
SEC	Y	Y	Y	N	Y	N
M1	Y	Y	Y	N	Y	N
SEU 1	Y	Y	N	N	Y	Y
SEP 1	Y	Y	N	N	Y	Y
SEN 1	Y	Y	Y	N	Y	Y

Table 13.4 - Fork length of salmon of different age classes, River South Esk SAC.

Site code	0+ mean fork length	No. 0+	1+ mean fork length	No. 1+	2+ mean fork length	No. 2+	3+ mean fork length	No. 3+
PW	43	5	80	17	111	6	n/a	0
SEM 1	58	24	108	20	136	1	n/a	0
SEC	52	9	93	5	108	1	n/a	0
M1	33	50	60	39	91	7	n/a	0
SEU 1	45	42	91	15	n/a	0	n/a	0
SEP 1	45	29	83	16	n/a	0	n/a	0
SEN 1	41	100	88	31	113	2	n/a	0

n/a denotes means could not be calculated as no salmon of that age class were found at the site.

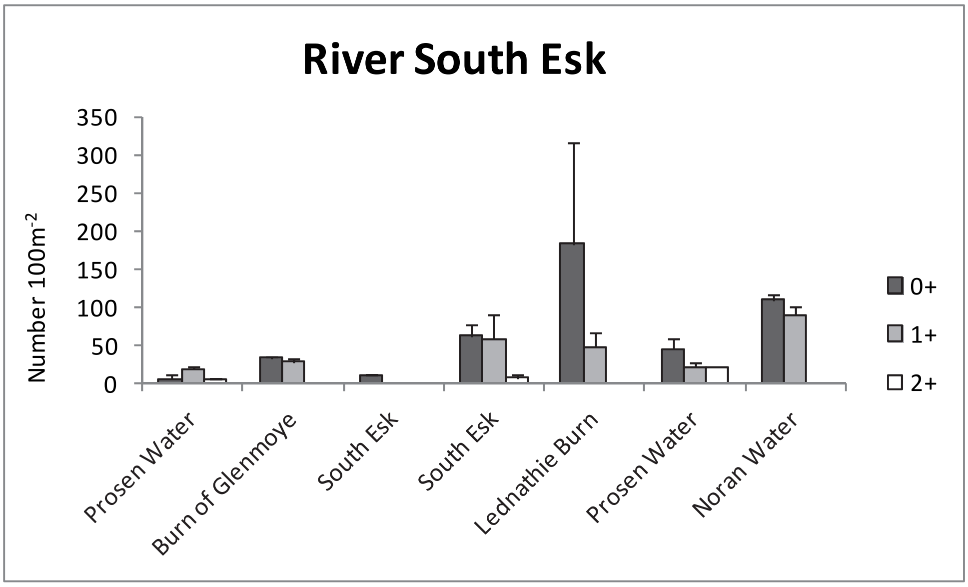


Figure 13.1 - Juvenile salmon population density estimated by the Zippin method for the SAC monitoring sites on the River South Esk SAC.

Timed sites

Details of the ten timed sites are given in Table 13.5. CPUE for fry ranged from 0.27/min to 2/min and for 1++ fish, ranged from 0.07/min to 1.13/min (Table 13.6, Figure 13.2). 0+ salmon were caught at nine of the ten timed sites, and 1+ fish at eight sites (Table 13.7). Trout were found at seven sites.

Table 13.5 - Details of timed electrofishing sites, River South Esk SAC.

Site code	Easting	Northing	River	Altitude (m)
SEs 1	345100	754500	Lemno Burn	50
SEs 2	346510	760940	Noran Water	160
SEs 10	364180	758240	South Esk	15
SEs 7	337360	765100	South Esk	205
SEs 3	323560	772780	South Esk	240
SEs 6	333870	764260	Upper Prosen	230
SEs 5	327220	768810	Upper Prosen	340
SEs 9	356756	758730	South Esk	30
SEs 8	349535	757155	South Esk	50
SEs 11	342090	757880	South Esk	90

Table 13.6 - Salmon catch per unit effort (CPUE), River South Esk SAC.

Site code	Survey date	Salmon 0+/min	Salmon 1++/min
SEs 1	13/07/11	0.3	0.1
SEs 2	15/07/11	0.7	0.1
SEs 10	25/07/11	1.9	0.0
SEs 7	26/07/11	1.4	0.6
SEs 3	26/07/11	0.6	0.7
SEs 6	27/07/11	1.5	1.1
SEs 5	27/07/11	0.6	0.9
SEs 9	29/07/11	0.0	0.0
SEs 8	29/07/11	2.0	0.6
SEs 11	31/07/11	3.6	0.1

Table 13.7 - Presence/absence of salmon year classes and of trout at timed sites, River South Esk SAC.

Site code	Salmon age class present?				Trout present?
	0+	1+	2+	3+	
SEs 1	Y	Y	N	N	Y
SEs 2	Y	Y	N	N	Y
SEs 10	Y	N	N	N	N
SEs 7	Y	Y	N	N	Y
SEs 3	Y	Y	N	N	N
SEs 6	Y	Y	N	N	Y
SEs 5	Y	Y	Y	N	Y
SEs 9	N	N	N	N	N
SEs 8	Y	Y	Y	N	Y
SEs 11	Y	Y	N	N	Y

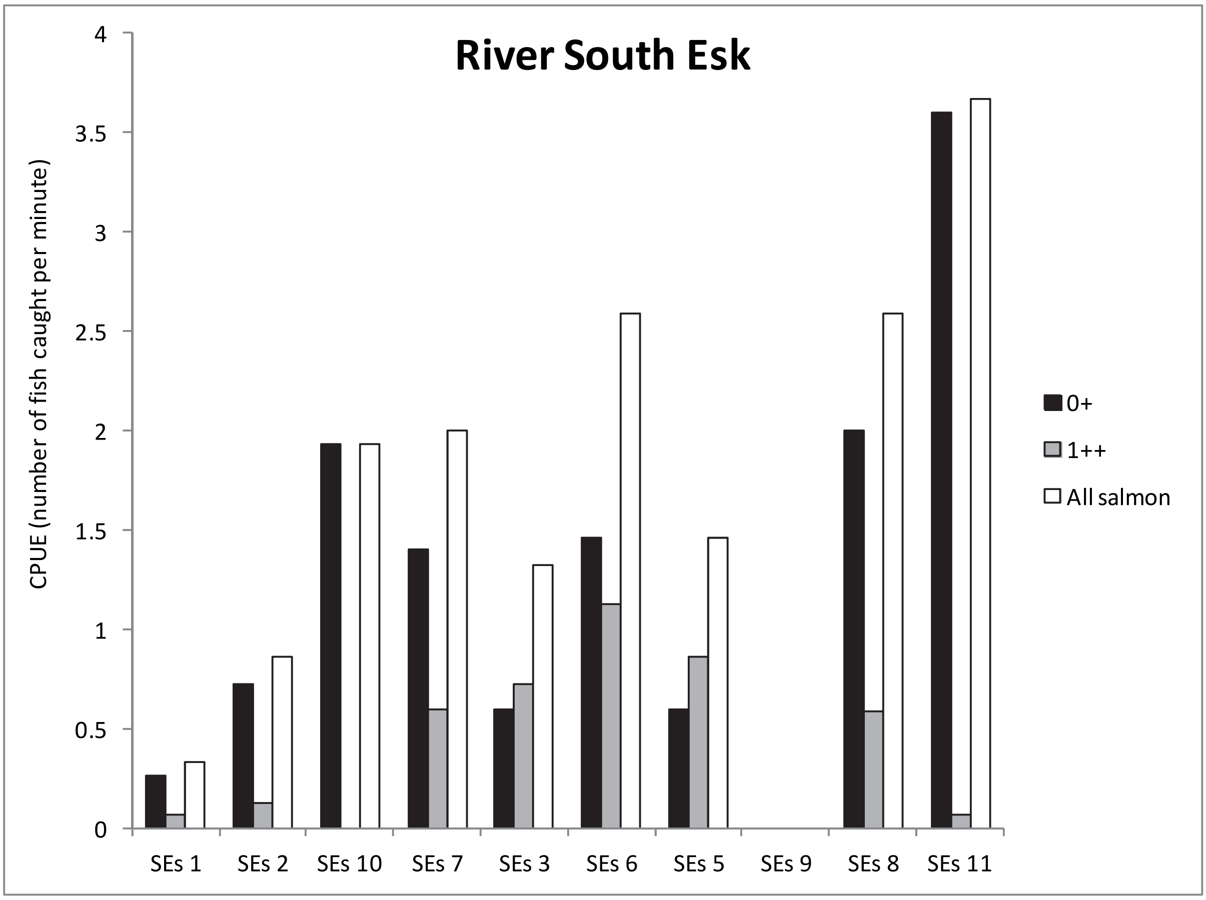


Figure 13.2 - Number of salmon (0+, 1++ and all salmon) caught per minute during five minutes of electrofishing at sites on the River South Esk.

Summary

When the densities of 0+ and 1++ juveniles are compared to the regional juvenile densities developed by Godfrey (2005) fish numbers in the River South Esk are spread across all the quintile bands for fry, but concentrated within the top band for parr (Table 13.8). This indicates a high variability in fry density across the catchment, possibly reflecting local differences in juvenile productivity and recruitment. Despite the variability in fry densities, most of the sites are located within the highest bands, and so it is suggested that fry can be considered to be in favourable status. We suggest that the parr element of the population is also considered to be favourable within in the SAC.

Table 13.8 – Number of sites within the River South Esk SAC falling within each quintile (according to absolute regional classification for 0+ and 1++ age classes) – and the resulting condition status.

SAC	Age class	Number of sites					Median grade	Favourable condition?
		0-20	21-40	41-60	61-80	81-100		
		E	D	C	B	A		
S. Esk	0+	1	1	1	2	2	B	Y
	1++	1				6	A	Y

A comparison of juvenile data from cycle 1 and cycle 2 indicate that the status of the River South Esk has improved in 2011 compared to the previous assessment (Table 13.9). Fry densities were higher, raising the status of fry from unfavourable to favourable. Parr densities were favourable in 2004 and remained so in the current survey.

Table 13.9 - Comparison of condition status in 2004 and in 2011 for 0+ and 1++ age classes

SAC		2004	2011	Change
S. Esk	0+	N	Y	+
	1++	Y	Y	=

b) Adult Assessment

Data for adult Atlantic salmon rod catch within the River Oykel was analysed using the NASCO Rod Catch Assessment tool introduced and described in Section 1. This analysis considers exploitation of the seasonal components (spring, summer and autumn) suggests whether management is required. Trends in long-term rod catch data from Marine Scotland Science (1952-present) for the overall catch and the same seasonal run-time components are also interrogated.

Summary of 1952 Catch Statistics

Rod catch statistics for the River South Esk, covering the period 1952-2010, for the total catch and each of the seasonal run components are shown in Figures 13.3, 13.4, 13.5 and 13.6.

Figure 13.3 - River South Esk total rod catch 1952-2010 (salmon and grilse, retained and released).

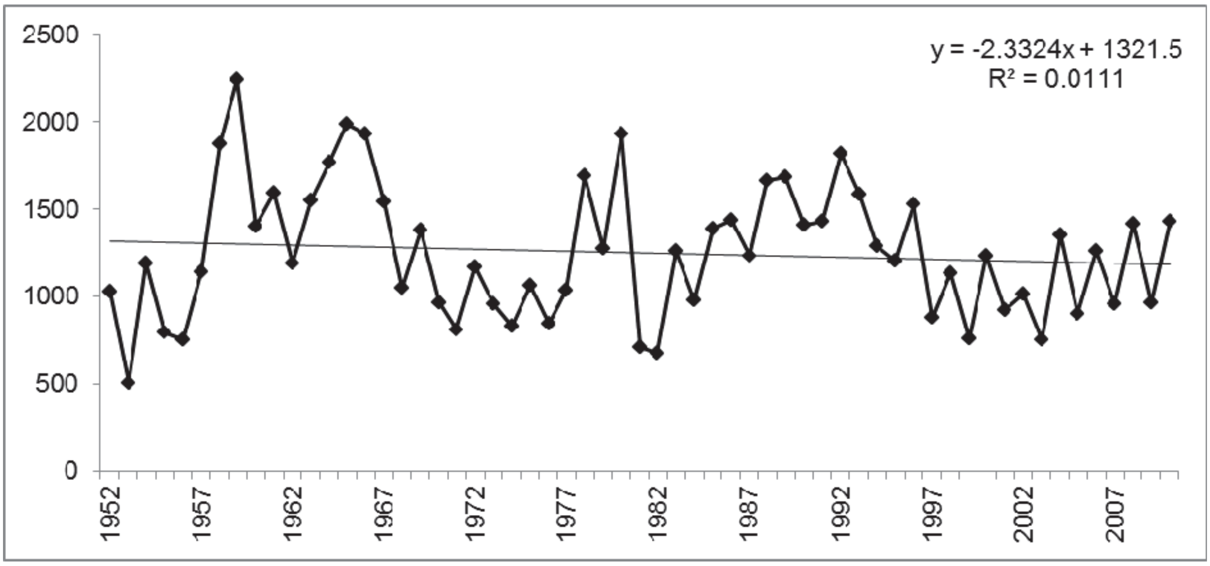


Figure 13.3 - River South Esk total rod catch 1952-2010 (salmon and grilse, retained and released).

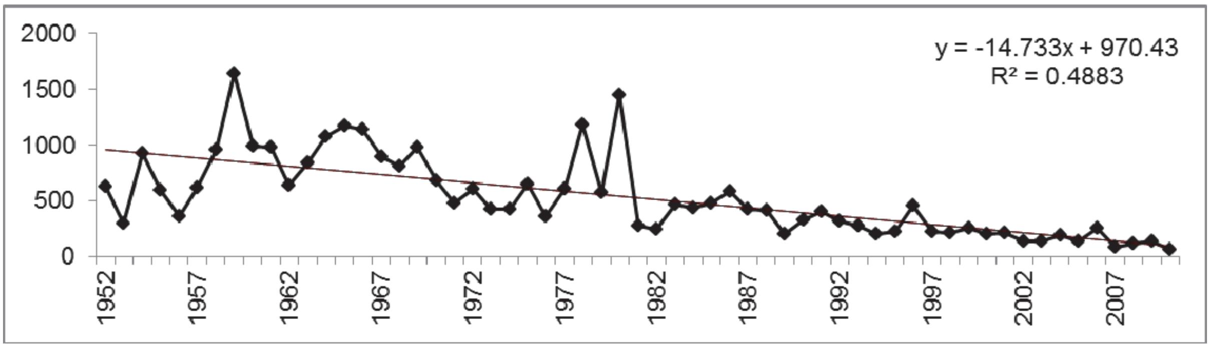


Figure 13.4 - River South Esk total spring rod catch 1952-2010 (salmon and grilse, retained and released).

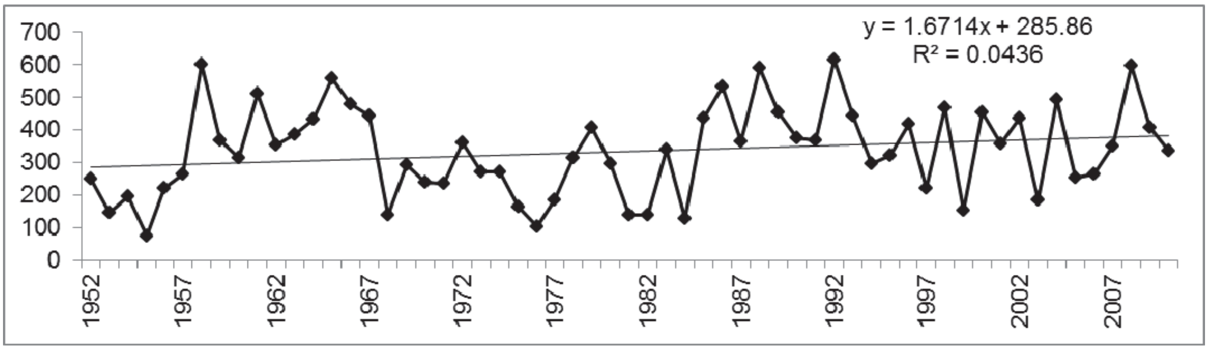


Figure 13.5 - River South Esk total summer rod catch 1952-2010 (salmon and grilse, retained and released).

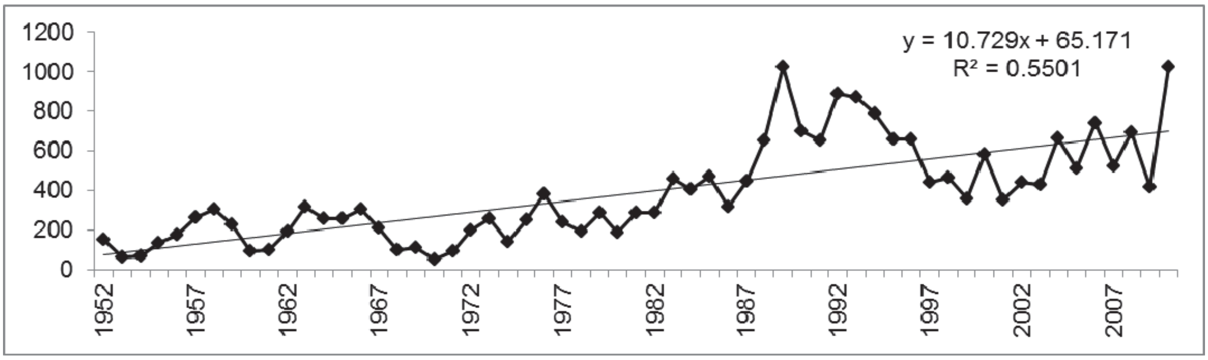


Figure 13.6 - River South Esk total autumn rod catch 1952-2010 (salmon and grilse, retained and released)

The total rod catch for Atlantic salmon in the River South Esk (Figure 13.3) shows a variable catch over the time series. The spring rod catch (Figure 13.4) shows a marked decline over the long-term data series. The summer rod catch (Figure 13.5), by contrast, shows an increasing trend in rod catch, with a notably large rod catch in 2008. Similarly, the autumn rod catch (Figure 13.6) shows an increasing trend in rod catch over the time series, greater than that of the summer component. The 2010 autumn rod catch was one of the two largest in the data series.

It is considered that the reporting of rod catch over the period has been consistent and representative and there is no evidence that any trends summarised may be attributable to a change in reporting accuracy or inconsistency. Over the past 15 years there has been an increasing move towards voluntary catch and release on the River South Esk. A formal catch and release policy was imposed in 2005, where all fish taken by rod and line up to 31 May were required to be returned. In parallel with the application of this policy, the netting close season was extended from 15 February to 30 April in 2005. Both of these measures were introduced to seek to conserve and protect spring stocks.

Up to 2007 there was a coastal netting operation in Montrose Bay. This ceased to operate in that year and this may have helped to ensure additional adult returns to the river from all run components and, potentially, an increase in the overall river stock.

Application of Rod Catch Assessment Tool

Rod catches from the River South Esk over the last 20 years (1991-2010) were applied to the rod catch assessment tool to assess whether exploitation of each run time component requires management action.

The results of these tests for the River South Esk are shown in Table 13.10, and the data used to complete these tests are available in Appendix 1. The output of these analyses suggest that no reduction in exploitation is required for the summer or autumn run-time components. However, Test A for spring fish confirms that the lowest catch in the period is the most recent (2010) record, indicating that that a reduction in exploitation of the spring stock, and investigation into whether local problems exist may be justified.

Table 13.10 - Summary of the Rod Catch Assessment Tool Tests for River South Esk.

Test	Spring	Summer	Autumn
A	Yes	No	No
B	No	No	No
C	No	No	No

Rod catches for the 20 year period used in this assessment (1991-2010) are shown in Figures 13.7, 13.8, 13.9 and 13.10. An F-test was applied to each of the seasonal components to assess whether the trend deviated from horizontal and the results for these are summarised in Table 13.11. These suggest a significant negative trend (at the 95% confidence level) in the spring rod catch but the absence of a significant trend in the summer and autumn rod catch over the same period.

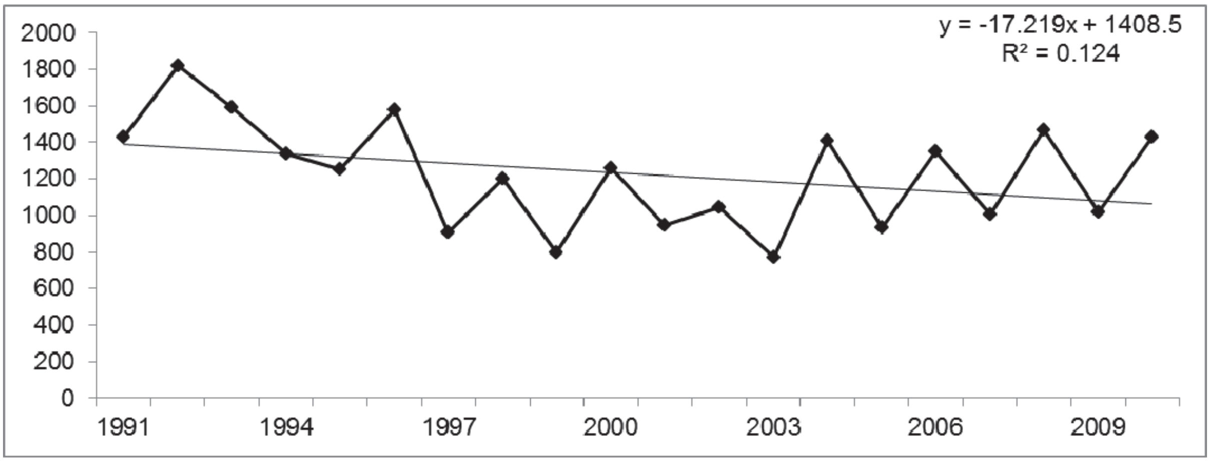


Figure 13.7 - River South Esk total rod catch 1991-2010 (salmon and grilse, retained and released).

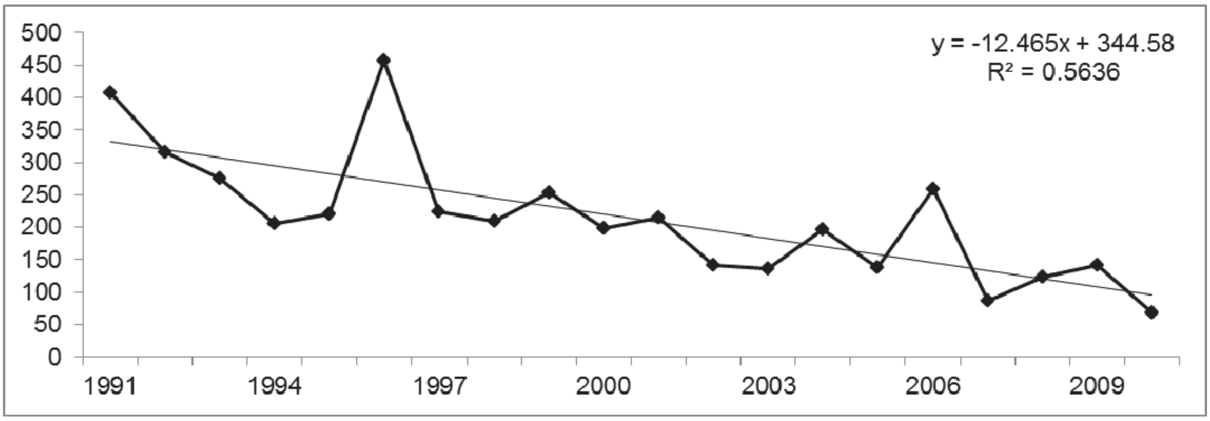


Figure 13.8 - River South Esk spring rod catch 1991-2010 (salmon and grilse, retained and released).

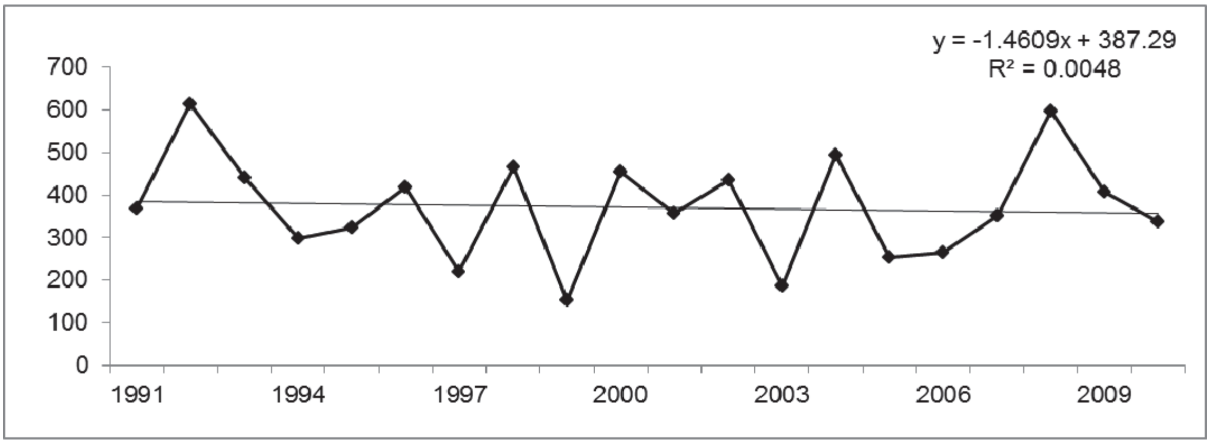


Figure 13.9 - River South Esk summer rod catch 1991-2010 (salmon and grilse, retained and released).

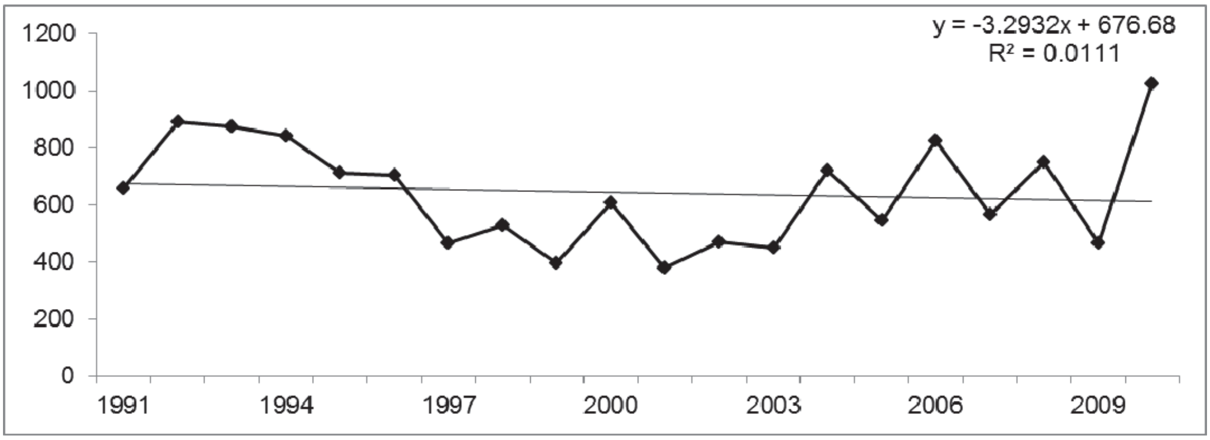


Figure 13.10 - River South Esk autumn rod catch 1991-2010 (salmon and grilse, retained and released).

Table 13.11 - Summary of F-Test Results on River South Esk Seasonal Rod Catch (1991-2010).

Component	Observations	F-Value	F-Significance
Spring	20	23.242	0.0001
Summer	20	0.88	0.770
Autumn	20	0.202	0.658

The percentage change in the spring, summer and autumn rod catches SCM cycles against the year of designation (2001) was also undertaken. The first SCM assessment covered the period 2002-2004, whilst the second includes data extending from 2002-2010. In this review the rod catch is averaged for each cycle period and the increase or decrease in average rod catch expressed as a percentage of the rod catch in the year of designation.

This comparison is shown graphically in Figure 13.11, and indicates that for the both the summer and autumn stock components on the River South Esk there has been an increase in average rod catch since the year of designation. This increase is most prominent in the autumn rod catch. However, the average catch of the spring stock component has declined since the year of designation over each of the cycle one and cycle two assessment periods.

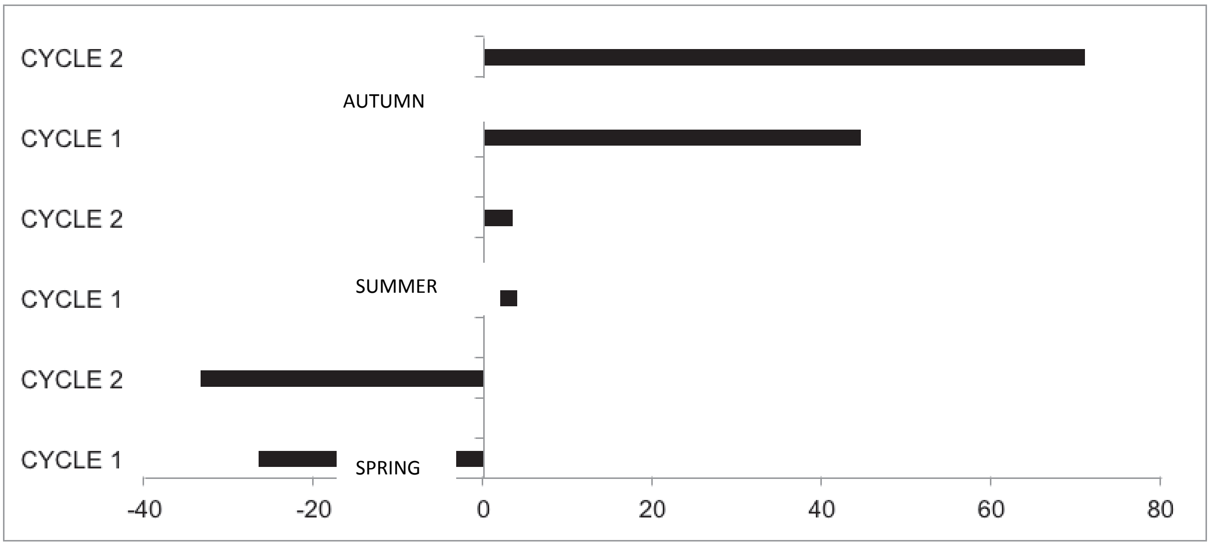


Figure 13.11 - Stock trend assessment since River South Esk SAC Designation (2001) in cycle 1 (2002-2004) and cycle 2 (2003-2010).

Summary

The overall trend in catch of the River South Esk over the period 1952-2010 shows a stable total rod catch. However, within this overall stable position both the summer and, particularly, autumn catches have increased significantly whilst the spring rod catch has reduced. In recent years the summer and autumn fishery components have recorded catches above the long-term trend (notably in 2008 and 2010) though there are no obvious signs of recovery in catches of the spring stock component.

The application of the NASCO rod catch assessment tool to the recorded catches over the last 20 years (1991-2010) suggest that no reduction in exploitation is required and no investigations into the existence of local problems are necessary for the summer and autumn run-time components. However, a reduction in exploitation and commencement of investigations into local problems is suggested as necessary for the spring stock due to the 2010 catch being the lowest in the 20 year period. When catches for each run-time component are considered individually over this period there is no significant change in either the summer or autumn rod catch but a significant decrease in spring rod catch is confirmed.

When average catch is compared since designation in 2001 over cycle one (2003-2004) and cycle two (2003-2010) there is an increase in the rod catch of summer and, particularly, autumn run-time components. Again, however, there is a decline in the spring catch over both these cycles of between 25-35% on each occasion.

In combination these analyses of adult rod catch in the River South Esk indicate an improving situation in respect of the summer and autumn run components. However, there is evidence in all parts of the assessment of continued decline in the spring stock component over the period since designation in 2001 and prior to that.

c) Habitats supporting the qualifying feature

1. Water quality and quantity

The status of each water body within the SAC, for which SEPA hold data, was obtained from the SEPA River Basin Planning interactive website

A total of nine WFD water bodies representing a river length of 194 km are recognised as being within the boundary of the River South Esk SAC. Of these, four are classified as being at high or good ecological status or good ecological potential (total length 59 km) and these are protected from a deterioration in class. The remaining five (river length 133 km) are classified as being at moderate, poor or bad ecological status or bad ecological potential. These waterbodies require the implementation of measures to bring them up to high/good ecological status or good ecological potential. The sites at moderate, poor and bad ecological status are so classified because of pressures such as point source pollution, water abstraction, the presence of American signal crayfish (*Pacifastacus leniusculus*), abstraction for arable farming, diffuse pollution from forestry and forestry planting close to the banks. The waterbody at bad ecological potential classification is so classified because of issues relating to diffuse pollution from sewage disposal and arable farming, morphological alterations from channelisation and abstraction for arable farming. Table 13.12 below summarises the number of water bodies and the length of channel within each status category.

Table 13.12 - Number of water bodies and length of channel within each WFD status category in the River South Esk SAC.

WFD status (2009)	High	Good	Moderate	Poor	Bad	Total
Number of water bodies	1	2	2	1	1	7
Number of HMWBs		1			1	2
Length of channel (km)	11	48	58	32	45	194

2. Trends, changes and activities

The Esk District Salmon Fisheries Board and Esks River and Fisheries Trust consider suggest that the two within-catchment activities considered to have the largest negative impact on Atlantic salmon in the River South Esk SAC are arable farming in the mid to lower catchment; and extensive open ditch cleaning in 2007 and 2008 leading to erosion and a significant increase in silt input in the upper catchment. The operation, outside the South Esk SAC boundary, of a mixed stock salmon net fishery from 01 May to 31 August is identified by the Esk DSFB and Esk Rivers & Fisheries Trust as being of concern. This coastal netting operation is currently being investigated by Marine Scotland Science as part of a three-year study into the spawning locations of spring fish in the South Esk and the extent to which this fishery is operating as a mixed stock fishery harvesting fish from the South Esk and other catchments. These studies will help to further identify the factors responsible for the declining Spring component of the River South Esk SAC Atlantic salmon stock, particularly when preferred spawning locations are identified.

Grazing, canalisation, water quality issues related to heavy livestock stocking, management of the upper catchment for grouse and partridge, dredging to reduce flooding, water management for renewable energy and fish farming are also considered by the Esk District Salmon Fisheries Board and Esks River and Fisheries Trust to be issues for Atlantic salmon within the SAC. Recent assessments by SEPA have also identified significant channel morphology and agricultural practice issues in the catchment.

Positive impacts within the catchment are identified as being improvements brought about by the five-year control plans in place for giant hogweed and Japanese knotweed; comprehensive trapping of mink; and spraying of piri piri. The catchment has been designated by SNH as a priority catchment, and this has already brought substantial focus and monitoring work to the area. Fisheries management activities aiming to halt the long-term decline of multi-sea-winter salmon and sea trout are also seen as being positive developments. Recent fisheries management activities include channel realignment and projects to improve salmon access through the removal or remediation of barriers to fish passage.

The Esk District Salmon Fisheries Board and Esks River and Fisheries Trust consider that the main activities having a negative impact on Atlantic salmon within the River South Esk SAC are:

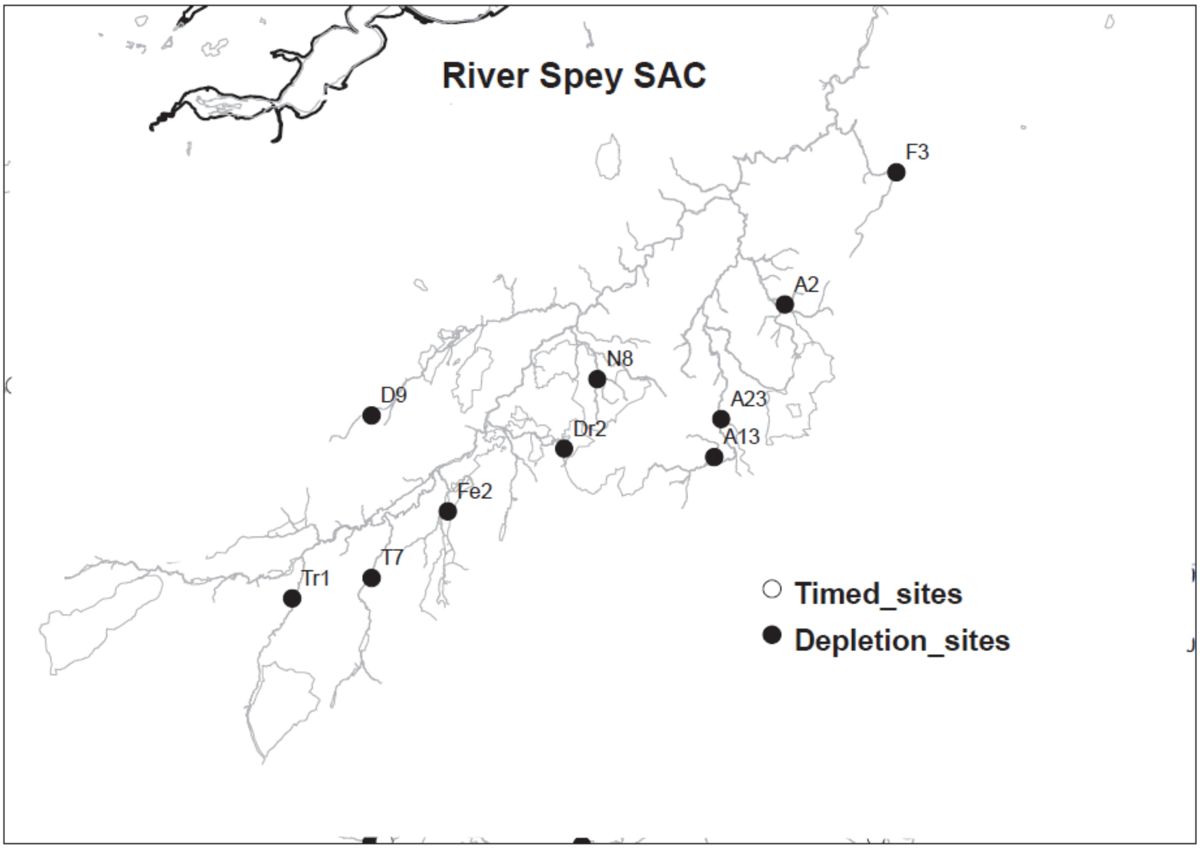
- Arable farming;
- Land and channel drainage operations; and
- Activities affecting the morphology of river channels.

14. RIVER SPEY

a) Juvenile Assessment

Ten sites were surveyed using the standard SFCC catch depletion electrofishing method. No additional sites were sampled using the five-minute timed electrofishing approach. All sites were situated within the River Spey SAC (Map 14.1) which incorporates all of the major tributaries and some of the smaller burns and has a total area of 57.3 km^2. The sites were surveyed by staff of the Spey Foundation.

Map 14.1 - Distribution of depletion and timed electro-fishing sites on the River Spey SAC.



Depletion sites

Site details and a summary of electrofishing results are shown in Tables 14.1 – 14.4. Zippin and Carl and Strube estimates for fry were calculable for all sites were they were present (there was one site with no fry present). Confidence limits were reasonably small. All ten sites had 1+ fish present, but only seven of these were calculable. 2+ fish were present at eight sites but only five were calculable. For fry, Zippin densities ranged from 4-90 per 100 m^2 (mean 37) and Carl and Strube densities ranged from 4-88 per 100 m^2 (mean 25). 0+ fish were caught at nine sites, 1+ at all 10 sites and 2+ fish at eight sites. The largest 0+ fish were found on the Tromie Burn (mean 57 mm) while the River Truim had the largest 1+ fish (91 mm) and the Fiddich Burn had the largest 2+ fish (125 mm) (Table 14.4). Trout were present at nine of the ten sites. The highest densities of 0+ and 1+ fish were found in the

River Livet (90 and 45 per 100 m^2 respectively – Zippin estimates) (Figure 14.1). The lowest densities of 0+ fish were found in the Allt Ruadh (four per 100 m^2).

Table 14.1 - Details of depletion electrofishing sites, River Spey SAC.

Site code	Date	Easting	Northing	Altitude (m)	Channel name
A13	23/10/11	315500	807450	460	Burn of Loin
T7	21/09/11	276600	793750	320	River Tromie
A2	22/09/11	323500	824800	275	River Livet
A23	25/09/11	316300	811800	365	River Avon
D9	04/09/11	276600	812200	480	River Dulnain
F3	05/09/11	336150	839800	190	Fiddich Burn
N8	06/09/11	302250	816300	290	River Nethy
Dr2	08/09/11	298450	808450	360	River Luineag
Tr1	09/09/11	267600	791400	285	River Truim
Fe2	20/09/11	285250	801300	290	Allt Ruadh

Table 14.2 - Details of depletion electrofishing for 0+ and 1++ salmon, River Spey SAC.

Site code	Wetted area (m^2)	Zippin 0+	Carl & Strube 0+	Zippin 1+	Carl & Strube 1+	Zippin 2+	Carl & Strube 2+
A13	93.5	70.8	68.5	22.6	18.2	n/a	n/a
T7	139.8	33.6	32.2	8.0	7.9	n/a	n/a
A2	106	89.6	87.7	44.6	43.4	n/a	n/a
A23	90.5	14.8	12.2	10.5	9.9	0.0	0.0
D9	147.2	20.9	20.4	5.9	5.4	7.1	6.8
F3	156.4	49.2	48.6	11.6	11.5	2.0	1.9
N8	89.6	22.3	21.1	n/a	n/a	n/a	n/a
Dr2	70.0	0.0	0.0	n/a	n/a	11.9	7.1
Tr1	127.2	22.9	22.0	23.5	22.0	3.4	3.2
Fe2	105.8	4.1	3.8	n/a	n/a	7.9	4.7

n/a denotes salmon present, but not in high enough densities to allow calculation of Zippin or Carl & Strube statistics. 0 denotes no salmon found at site.

Table 14.3 - Presence/absence of salmon year classes and of trout 0+ and 1++ at depletion sites, River Spey SAC.

Site code	Salmon age class present?				Trout present?	
	0+	1+	2+	3++	0+	1++
A13	Y	Y	Y	Y	Y	Y
T7	Y	Y	Y	N	Y	N
A2	Y	Y	Y	Y	Y	Y
A23	Y	Y	N	N	Y	N
D9	Y	Y	Y	N	Y	Y
F3	Y	Y	Y	N	N	N
N8	Y	Y	Y	N	Y	N
Dr2	N	Y	Y	N	Y	Y
Tr1	Y	Y	Y	N	Y	N
Fe2	Y	Y	Y	N	Y	Y

Table 14.4 - Fork length of salmon of different age classes, River Spey SAC.

Site code	0+ mean fork length	No. 0+	1+ mean fork length	No. 1+	2+ mean fork length	No. 2+	3+ mean fork length	No. 3+
A13	39	58	73	15	97	2	120	1
T7	57	40	88	11	108	4	n/a	0
A2	45	86	83	45	112	1	133	1
A23	39	11	66	9	n/a	0	n/a	0
D9	48	29	74	8	97	10	n/a	0
F3	43	76	85	18	125	3	n/a	0
N8	37	19	75	3	108	1	n/a	0
Dr2	n/a	0	76	3	101	5	n/a	0
Tr1	56	27	91	26	111	4	n/a	0
Fe2	45	4	81	3	104	5	n/a	0

n/a denotes means could not be calculated as no salmon of that age class were found at the site

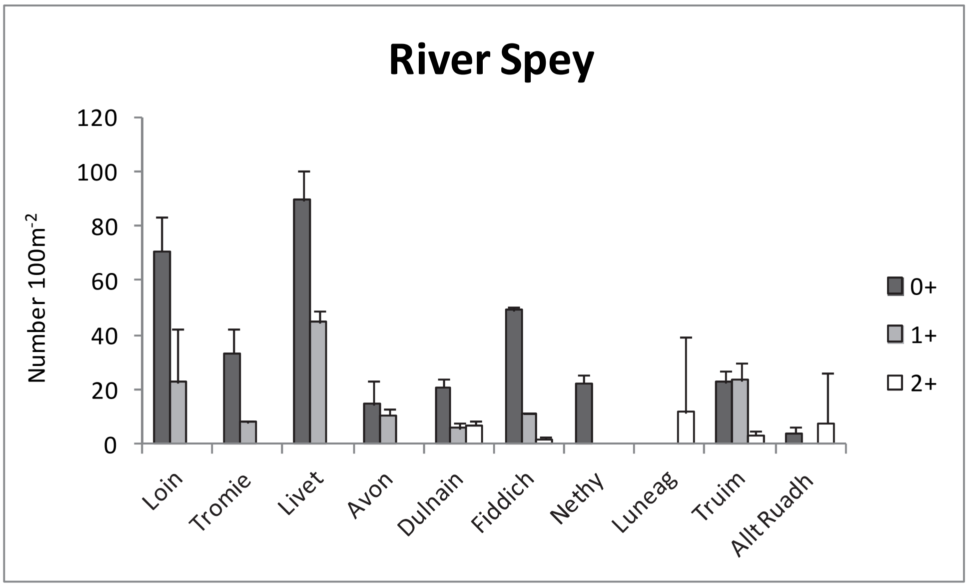


Figure 14.1 - Juvenile salmon population density estimated by the Zippin method for the SAC monitoring sites on the River Spey SAC.

Timed sites

No timed surveys were carried out within the River Spey SAC in 2011.

Summary

When the densities of 0+ and 1++ juveniles are considered in relation to regional juvenile densities developed by Godfrey (2005) the River Spey has sites in each of the quintile bands

(Table 14.5). This indicates a high variability in juvenile fish density across the catchment which, for both fry and parr, reflects variable and local differences in juvenile productivity. These differences may be associated with natural production limits associated with for example, habitat quality or nutrient levels, the number of spawning adults reaching survey locations or the impact of external pressures which limit natural production or juvenile survival. Such variability of productivity is not surprising and is entirely expected in large catchments such as the Spey where there is likely to be an uneven spread of, for example, habitat quality, water quality and anthropogenic pressures all of which can influence juvenile production and survival. However, it is suggested, based upon the sites surveyed, that juvenile populations are in favourable status within the SAC.

The variability in juvenile densities found during the survey, whilst not resulting in an overall status assessment less than 'favourable' suggests that within a large catchment such as the Spey there will be areas of higher and lower production and areas where local management problems and issues exist and may require active management and action to resolve. There is a significant body of additional electro-fishing information available on the River Spey (see section b1a) which would allow a finer resolution of areas of high and low juvenile productivity.

Table 14.5 – Number of sites within the River Spey SAC falling within each quintile (according to absolute regional classification for 0+ and 1++ age classes) – and the resulting condition status.

SAC	Age class	Number of sites					Median grade	Favourable condition?
		0-20	21-40	41-60	61-80	81-100		
		E	D	C	B	A		
Spey	0+	2	1	3	2	2	C	Y
	1++	1	2	4	1	2	C	Y

Whilst the juvenile survey shows that the status of the Spey improved in 2011 compared to the previous assessment (Table 14.6), the mean salmon fry and parr densities recorded in 2011 at the SAC monitoring sites were considerably lower than those recorded in 2004. Analysis of the comprehensive Spey electrofishing database by the Spey Foundation indicates a downward trend in juvenile densities in many upper river sites. Identification of fine-scale trends in juvenile densities will require a more comprehensive monitoring regime than is available within the site condition monitoring process.

Table 14.6 - Comparison of condition status in 2004 and in 2011 for 0+ and 1++ age classes.

SAC		2004	2011	Change
Spey	0+	N	Y	+
	1++	Y	Y	=

b) Adult Assessment

Data for adult Atlantic salmon rod catch within the River Spey were analysed using the NASCO Rod Catch Assessment tool introduced and described in Section 1. This analysis considers exploitation of the seasonal components (spring, summer and autumn) suggests whether management is required. Trends in long-term rod catch data from Marine Scotland Science (1952-present) for the overall catch and the same seasonal run-time components are also interrogated.

Summary of 1952 Catch Statistics

Rod catch statistics for the River Spey, covering the period 1952-2010, for the total catch and each of the seasonal run time components, are shown in Figures 14.3, 14.4, 14.5 and 14.6.

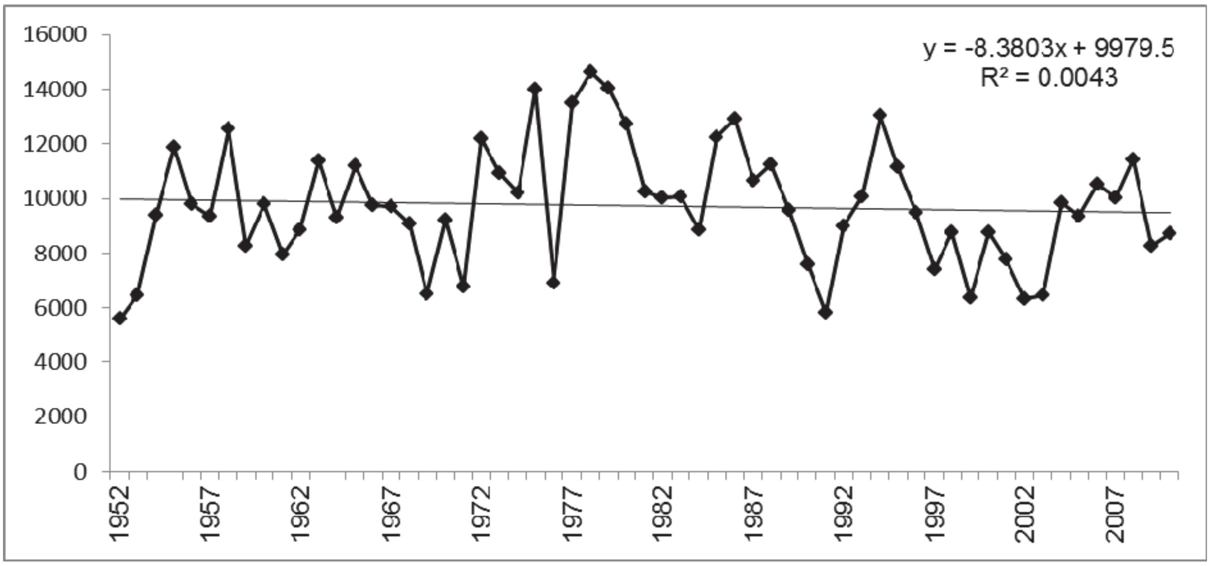


Figure 14.3 - River Spey total rod catch 1952-2010 (salmon and grilse, retained and released).

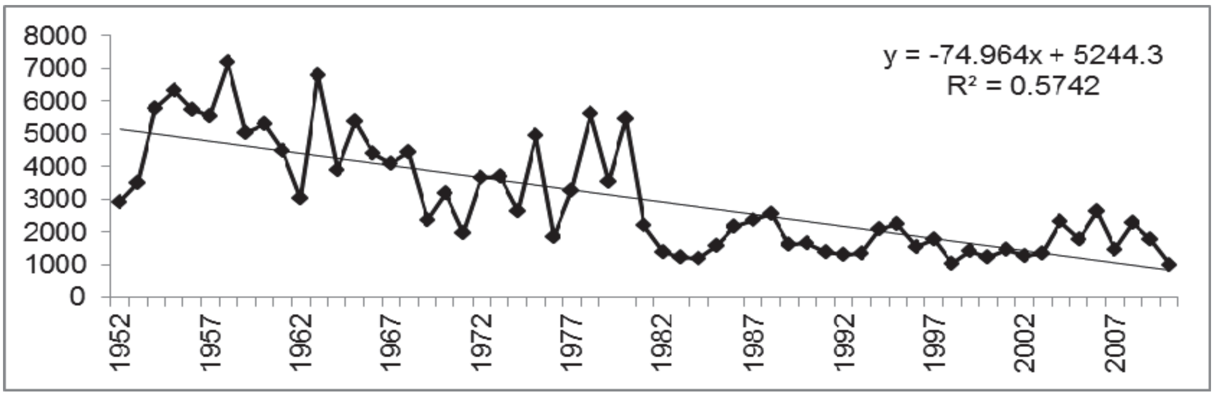


Figure 14.4 - River Spey total spring rod catch 1952-2010 (salmon and grilse, retained and released).

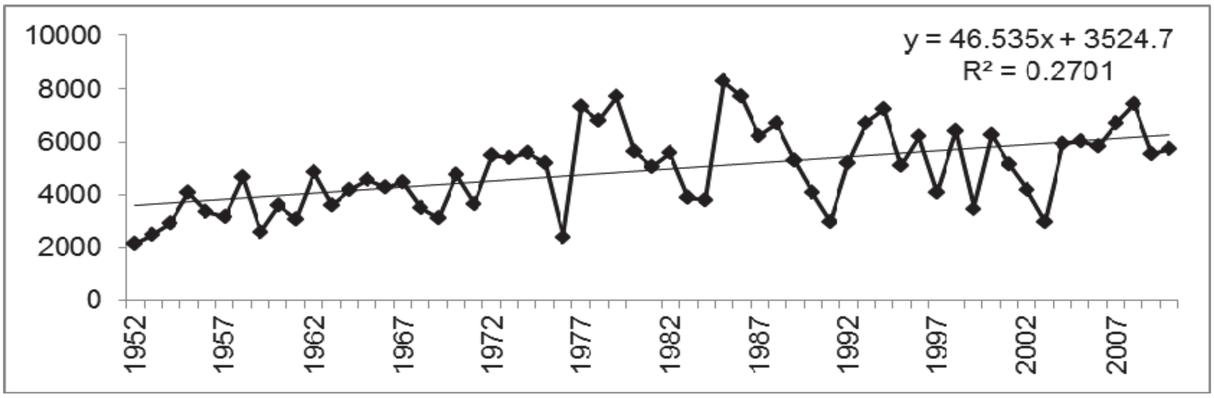


Figure 14.5 - River Spey total summer rod catch 1952-2010 (salmon and grilse, retained and released).

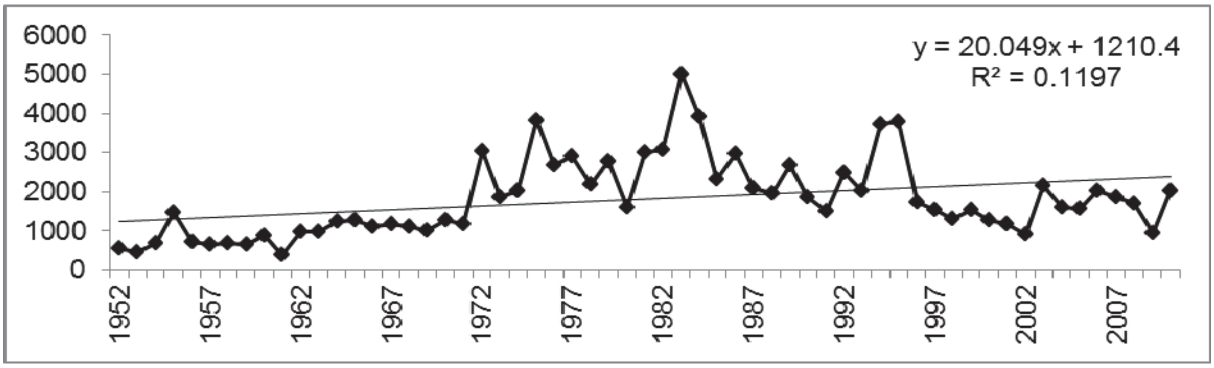


Figure 14.6 - River Spey total autumn rod catch 1952-2010 (salmon and grilse, retained and released).

The total rod catch for Atlantic salmon in the River Spey (Figure 16.3) shows a relatively stable total catch across the long-term time series, although annual fluctuations were pronounced and regular throughout the period. Extended periods of consistently high or low rod catch are not obviously apparent. High rod catches are recorded in the mid-late 1970's and lower catches are reported in the early 1950s, late-1960's-early-1970's and the late-1990's-early 2000's. The spring rod catch (Figure 16.4) shows a negative trend, becoming more pronounced after 1980 to date. This follows periods of higher catch from the mid-1950's to 1980. Both the summer and autumn rod catches (Figures 16.5 and 16.6) show gradual positive trends over the dataset, although the autumn component had a notable period of low rod catch from the early 1950's-1970. All catches from 1995 fall beneath the trend line.

It is considered that the reporting of rod catch over the period has been consistent and representative and there is no evidence that any trends summarised may be attributable to a change in reporting accuracy or inconsistency.

The Spey DSFB have developed and applied conservation measures which are published and reviewed annually. The most significant of these is catch and release, and this is applied throughout the full angling season (11 February - 31 September). This policy requires the return of all hen fish, as well as the first, and every second, fish thereafter across the season. In reality catch and release is now applied by anglers beyond these standards and over the early spring period (February - April) some 85% of fish are returned. Across the whole season 82% of fish are reported as returned.

There are no netting operations active in the District. Previous netting activities ceased prior to the designation of the SAC.

Application of Rod Catch Assessment Tool

Rod catches from the River Spey over the last 20 years (1991-2010) were applied to the NASCO rod catch assessment tool to assess whether exploitation of each run time component requires management action.

The results of these tests for the River Spey are shown in Table 14.7. The data used to complete these tests is available in Appendix 1. These tests show that the only component that could potentially require management action is the spring component. This fails on the first and weakest test where the last year in the record was the lowest catch. This test result indicates that consideration should be given to a further reduction in exploitation and that local investigations as to whether local problems exist should be considered. The summer and autumn components do not fail any of the tests indicating that no reduction in exploitation or local investigations are currently required.

Table 14.7 - Summary of the Rod Catch Assessment Tool Tests for River Spey

Test	Spring	Summer	Autumn
A	Yes	No	No
B	No	No	No
C	No	No	No

Rod catches for the 20 year period used in this assessment (1991-2010) are are shown in Figures 14.7, 14.8, 14.9 and 14.10. An F-test was applied to each of the seasonal components to assess whether they deviated from horizontal, and the results for these are summarised in Table 14.8. These suggest that no significant change in the rod catch trend, for any of the three seasonal components, has taken place over this period.

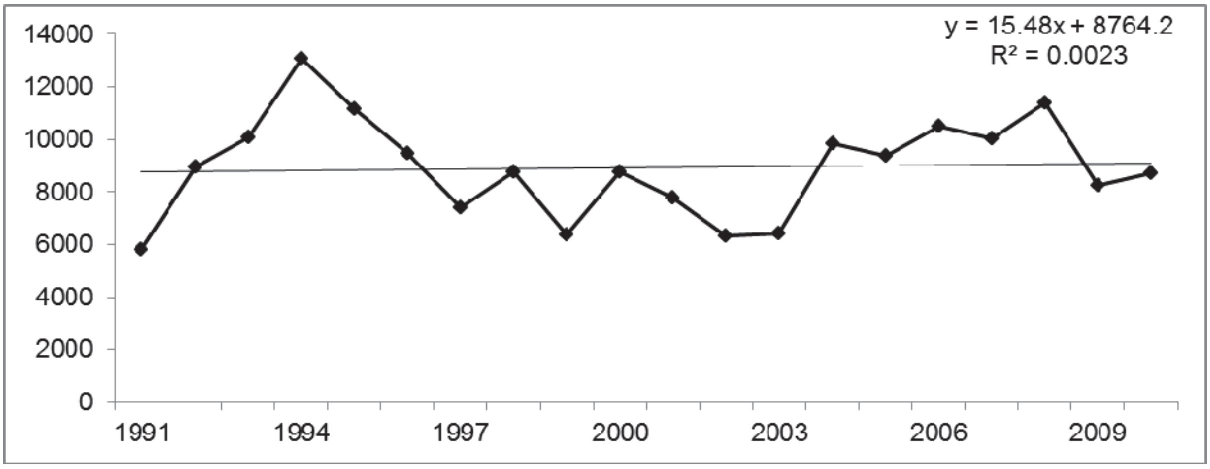


Figure 14.7 - River Spey total rod catch 1991-2010 (salmon and grilse, retained and released).

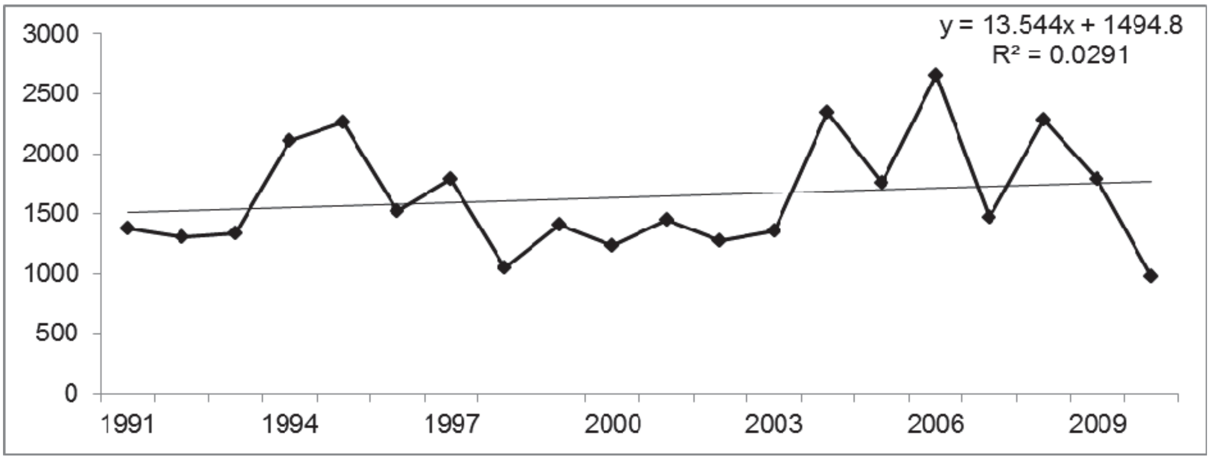


Figure 14.8 - River Spey spring rod catch 1991-2010 (salmon and grilse, retained and released).

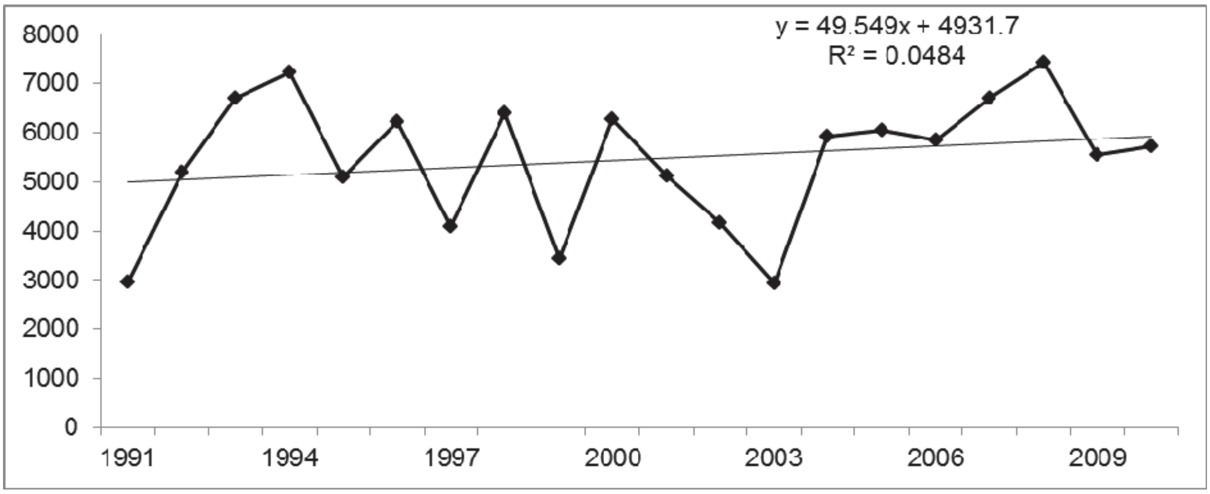


Figure 14.9 - River Spey summer rod catch 1991-2010 (salmon and grilse, retained and released).

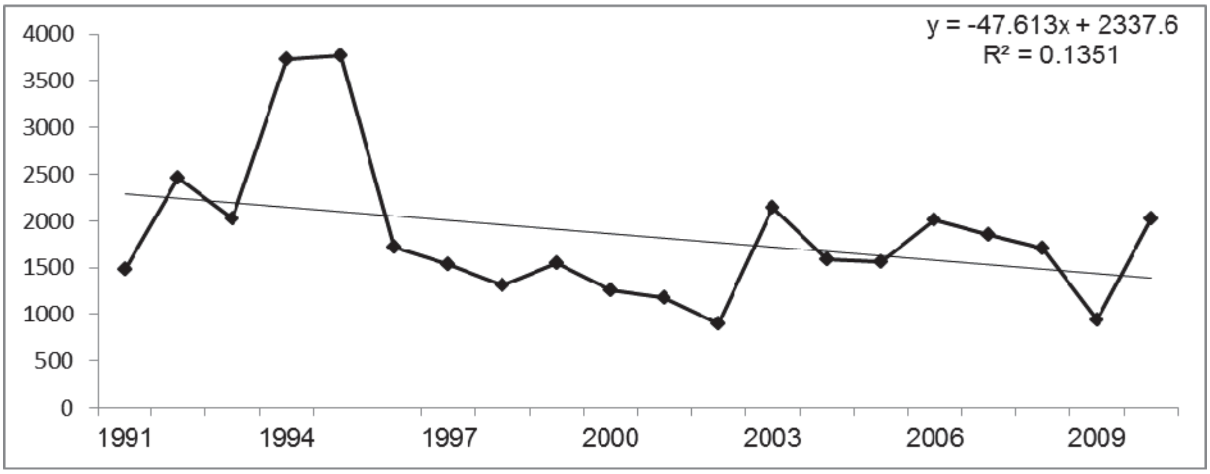


Figure 14.10 - River Spey autumn rod catch 1991-2010 (salmon and grilse, retained and released).

Table 14.8 - Summary of F-Test Results on River Spey Seasonal Rod Catch (1991-2010).

Component	Observations	F-Value	F-Significance
Spring	20	0.539	0.472
Summer	20	1.413	0.250
Autumn	20	0.699	0.414

The percentage change in the spring, summer and autumn rod catches SCM cycles against the year of designation (1999) was also undertaken. The first SCM assessment covered the period 2002-2004, whilst the second includes data extending from 2002-2010. In this review

the rod catch is averaged for each cycle period and the increase or decrease in average rod catch expressed as a percentage of the rod catch in the year of designation.

This comparison is shown graphically in Figure 14.11 and indicates that, for the spring and summer run-time components, there has been an increase in average rod catch since the year of designation in each cycle. The spring component shows a smaller increase in average rod catch in each cycle since designation (<20% in each instance) whereas the average summer catches are >40% and >50% above that in the year of designation in cycle one and cycle two respectively. However, it should be noted that the summer rod catch in 1999 was amongst the lowest in the last 20 years and so averages compared against this low baseline value are more likely to show an increase in catch than if a high rod catch was recorded in the year of designation.

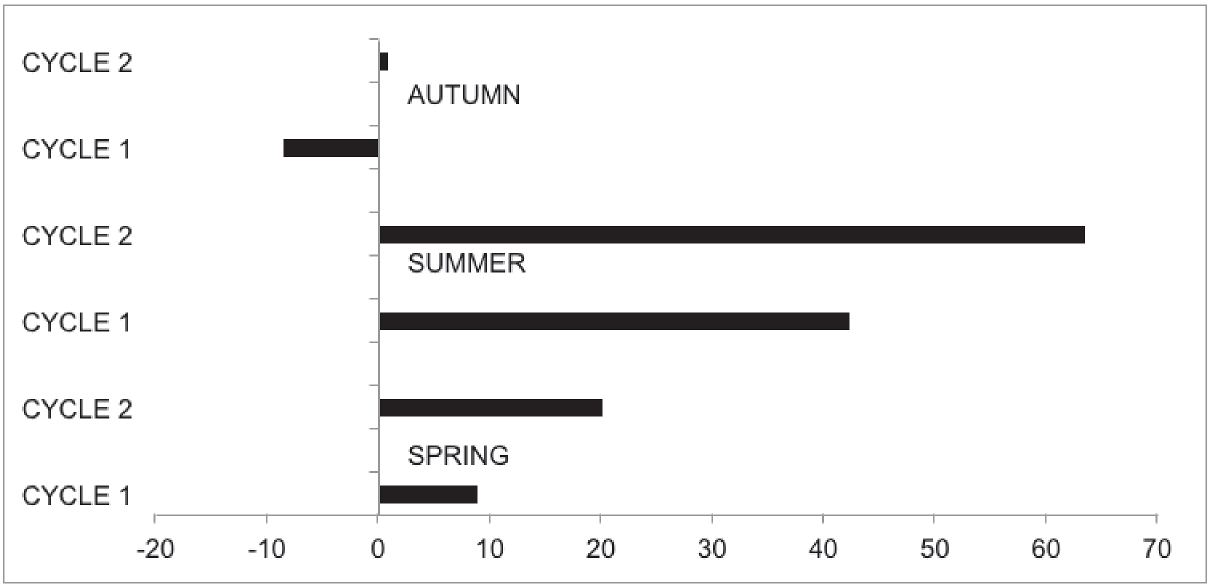


Figure 14.11 - Stock trend assessment since River Spey SAC Designation (1999) in cycle 1 (2002-2004) and cycle 2 (2003-2010).

Summary

The overall rod catch for Atlantic salmon in the River Spey SAC over the period 1952-2010 shows a stable trend over the time series, although within this there is a notable decline in the spring rod catch and reciprocal increases in both summer and autumn salmon rod catches.

Application of the NASCO rod catch assessment tool to declared rod catches over the last 20 years (1991-2010) suggest that no reduction in exploitation is required for the summer or autumn run-time components is required. However, a reduction in exploitation and investigations into local issues may be required for the spring stock component due to the failure of one of the rod catch assessment tool tests. When rod catch trends for each run-time component were considered individually over this period, no significant change was observed.

When average catch for each of the two SCM cycles is compared to those recorded in the year of designation (1999) the average rod catch is higher in each cycle for both the summer and spring components. The average autumn rod catch in cycle one is less than in the year of designation and about the same as the designation year over cycle two. The average summer rod catch shows the most substantial (positive) difference when compared to the year of designation, and this is partly explained by fact that summer rod catch in 1999 being amongst the lowest in the series.

In combination these assessments suggest a fairly static total rod catch, but with a decline in spring catch over the 1952-2010 period within the River Spey. Although there is no statistically significant decline in the spring rod catch over the assessment period, management reduction in exploitation of the spring run-time component may require consideration. This is supported by the outputs of the NASCO rod catch assessment tool. The conservation measures already put in place by the Spey DSFB already ensure the return of all hen fish and deliver catch and return rates of >80% across the season.

c) Habitats supporting the qualifying feature

1. Water quality and quantity

The status of each water body within the SAC, for which SEPA hold data, was obtained from the SEPA River Basin Planning interactive website.

A total of 50 WFD water bodies representing a river length of 726 km are present within the boundary of the River Spey SAC. Of these, 25 of these are classified as being of good or high ecological status or good ecological potential (total length of 369 km) and are protected from deterioration from that class. The remaining 25 (river length of 364 km) are classified as being at moderate, poor or bad ecological status or bad ecological potential. Measures are therefore required to bring these waterbodies up to high or good ecological status or, if appropriate, good ecological potential. Of the five HMWBs in the Spey included in this classification four are at good ecological potential and one is classified as being at poor ecological potential. The most common cause of waterbody classification being less than good status or potential is morphological alteration giving rise to fish passage issues. This is the main pressure responsible for 17 of the 18 moderate ecological status classifications within the SAC. The other moderate status classification was due pressures related to morphological alterations resulting from forestry. The waterbody at bad ecological status owes that classification to issues relating water abstraction for whisky manufacture.

The HMWB classified as being at poor ecological potential is identified as such because of issues related to abstraction for renewable energy and resultant fish passage issues. Table 14.10 below summarises the number of water bodies and the length of channel within each status category.

Table 14.10 - Number of water bodies and length of channel within each WFD status category in the River Spey SAC.

WFD status	High	Good	Moderate	Poor	Bad	Total

(2009)						
Number of water bodies	7	18	18	1	1	45
Number of HMWBs		4		1		5
Length of channel (km)	61	308	327	10	20	726

2. Trends, changes and activities

The Spey Fisheries Board and Spey Foundation suggest that water abstraction from the SAC to neighbouring catchments is a major issue affecting Atlantic salmon. Proposals are being considered that will divert water from the Spey catchment and there is concern over the correct management of any new abstraction facilities and the current (approx) 45 other significant abstractions.

The current water transfer and abstraction activities are also the main cause of the morphological impacts identified within the WFD classifications. However there is increasingly better consultation between developers and the Spey Fisheries Board and, for example, road and bridge repairs and replacement are now carried out following consultation between these groups in order to maintain and improve fish passage across the catchment.

Invasive non-native species have also been highlighted as having (or potentially having) a substantial negative impact on Atlantic salmon with the riparian and aquatic plant species present being subject to active management programmes and activities as a consequence.

There are improvements in riparian management activities in the catchment with the Spey Catchment Management Plan and others including the forestry and wider land management sectors improving riparian management practices. Deer numbers have been controlled through culling, and the use of deer fencing has improved exclusion areas including in riparian zones.

The introduction of a catch and release policy by the Spey DSFB has made a positive contribution to the management of the salmon in the catchment.

The main activities considerd by the Spey Fishery Board and Spey Foundation to have a negative impact on Atlantic salmon in the River Spey SAC are:

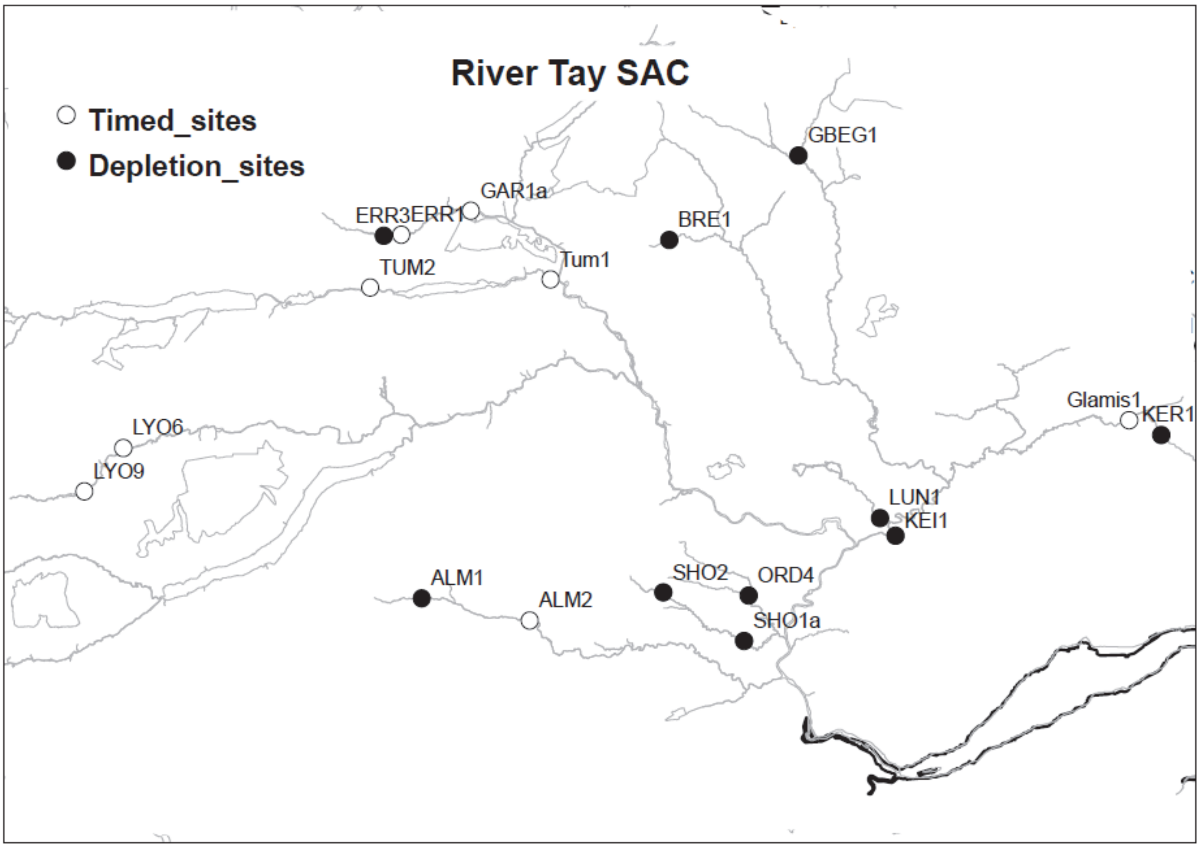
- Current management and operation of existing and future management and operation of new major water abstraction schemes;
- Morphological changes and alterations; and
- Invasive non-native species.

15. RIVER TAY

a) Juvenile Assessment

Ten sites were surveyed using the standard SFCC catch depletion electrofishing method. Eight additional sites were sampled using a five-minute timed electrofishing approach. All sites were situated within the River Tay SAC (Map 15.1). The sites were surveyed by staff of the Tay District Salmon Fisheries Board.

Map 15.1 - Distribution of depletion and timed electrofishing sites on the River Tay SAC.



Depletion sites

Site details and a summary of electrofishing results are shown in Tables 15.1 – 15.4. 0+ and 1+ salmon were present at all ten sites. Trout were present at eight sites. Zippin and Carl & Strube estimates for fry were calculable for all 10 sites, and for 1+ fish, were calculable for nine sites. Confidence limits were generally narrow. For fry, Zippin densities ranged from 29 – 309 per 100 m^2 (mean 106) and Carl & Strube densities ranged from 28 - 308 per 100 m^2 (mean 107). The highest 0+ densities were found in the Keithick Burn and the lowest in the Brerechan Burn. For 1+ fish, Zippin densities ranged from 16 - 68 per 100 m^2 (mean 35) and Carl & Strube densities ranged from 15 - 67 per 100 m^2 (mean 37). The highest 1+ densities were found in the Allt a Ghlinne Bhig and the lowest in the Lunan Water. 2+ salmon were found at five sites, but were not found in high enough numbers to allow density estimates to be calculated. The largest 0+ fish were caught in the Shochie Burn and the largest 1+ fish in the Ordie Burn (mean 60 mm and 113 mm respectively).

Table 15.1 - Details of depletion electrofishing sites, River Tay SAC.

Site code	Date	Easting	Northing	Altitude (m)	Channel name
SHO2	19/9/11	299960	733818	190	Shochie Burn
SHO1a	20/09/11	306733	729725	55	Shochie Burn
ERR3	21/09/11	276600	763700	200	River Errochty
ORD4	22/09/11	307100	733550	50	Ordie Burn
KEI1	23/09/11	319380	738560	40	Keithick Burn
KER1	23/09/11	341600	747000	58	Kerbet Burn
GBEG1	26/09/11	311274	770445	339	Allt a Ghlinne Bhig
BRE1	26/09/11	300454	763355	290	Brerechan Burn
ALM1	27/09/11	279774	733317	400	Almond
LUN1	05/10/11	318078	740050	35	Lunan Water

Table 15.2 - Details of depletion electrofishing for 0+ and 1++ salmon, River Tay SAC.

Site code	Wetted area (m^2)	Zippin 0+	Carl & Strube 0+	Zippin 1+	Carl & Strube 1+	Zippin 2+	Carl & Strube 2+
SHO2	125.3	51.5	48.7	46.6	46.3	n/a	n/a
SHO1a	139.5	107.9	106.1	29.0	28.0	0.0	0.0
ERR3	96.3	70.2	68.6	42.8	41.6	0.0	0.0
ORD4	85.1	61.5	58.8	18.9	18.8	0.0	0.0
KEI1	50.7	308.9	307.7	36.4	35.5	0.0	0.0
KER1	96.6	206.4	205.0	n/a	n/a	0.0	0.0
GBEG1	138.0	98.8	97.1	68.1	67.4	n/a	n/a
BRE1	102.0	28.7	28.4	39.4	39.2	n/a	n/a
ALM1	119.4	72.3	72.1	37.7	37.7	n/a	n/a
LUN1	224.9	55.9	53.4	16.2	15.1	n/a	n/a

n/a denotes salmon present, but not in high enough densities to allow calculation of Zippin or Carl & Strube statistics. 0.0 denotes no salmon found at site.

Table 15.3 - Presence/absence of salmon year classes and of trout 0+ and 1++ at depletion sites, River Tay SAC.

Site code	Salmon age class present?				Trout present?	
	0+	1+	2+	3++	0+	1++
SHO2	Y	Y	Y	N	Y	Y
SHO1a	Y	Y	N	N	Y	Y
ERR3	Y	Y	N	N	N	N
ORD4	Y	Y	N	N	Y	Y
KEI1	Y	Y	N	N	Y	N
KER1	Y	Y	N	N	N	N
GBEG1	Y	Y	Y	N	Y	Y
BRE1	Y	Y	Y	N	Y	Y
ALM1	Y	Y	Y	N	Y	Y
LUN1	Y	Y	Y	N	Y	Y

Table 15.4 - Fork length of salmon of different age classes, River Tay SAC.

Site code	0+ mean fork length	No. 0+	1+ mean fork length	No. 1+	2+ mean fork length	No. 2+	3+ mean fork length	No. 3+
SHO2	45	51	86	58	121	2	n/a	0
SHO1a	60	130	106	36	n/a	0	n/a	0
ERR3	43	62	80	39	125	1	n/a	0
ORD4	60	44	113	16	n/a	0	n/a	0
KEI1	55	152	105	18	n/a	0	n/a	0
KER1	60	178	84	12	n/a	0	n/a	0
GBEG1	41	122	73	90	105	8	n/a	0
BRE1	50	29	91	40	119	8	n/a	0
ALM1	41	84	87	45	125	1	n/a	n/a
LUN1	49	93	91	32	115	2	n/a	0

n/a denotes means could not be calculated as no salmon of that age class were found at the site.

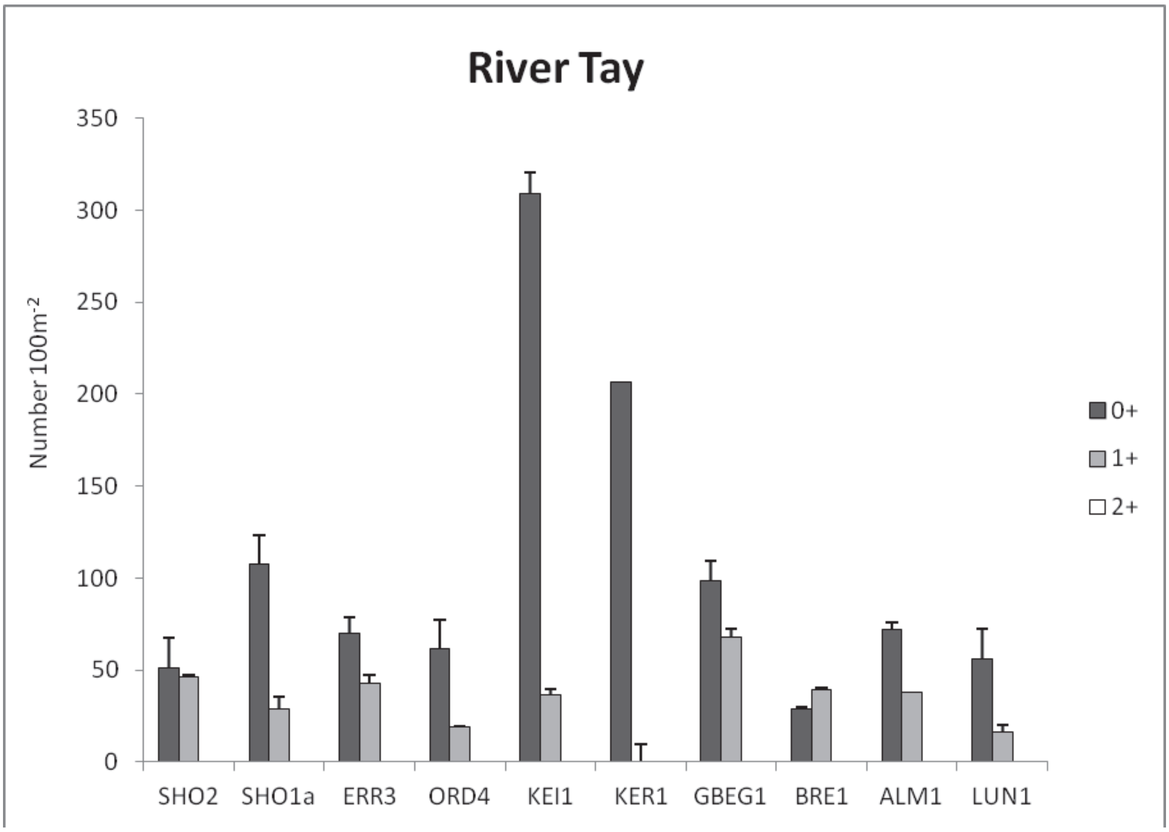


Figure 15.1 - Juvenile salmon population density estimated by the Zippin method for the monitoring sites on the River Tay SAC.

Timed sites

Details of the eight timed sites are given in Table 15.5. 0+ and 1++ salmon were caught at all eight sites. CPUE for fry ranged from 2-23/min, and for 1++ fish ranged from 1–9/min (Table 15.6). Trout were caught at only four of the eight sites.

Table 15.5 - Details of timed electrofishing sites, River Tay SAC

Site code	Easting	Northing	River	Altitude (m)
ERR1	278070	763800	Errochty	200
Tum1	290543	760040	Tummel	100
Glamis1	338904	748234	Glamis Burn	60
TUM2	275468	759373	Tummel	152
ALM2	288803	731461	Almond	220
LYO9	251554	742286	Lyon	275
LYO6	254800	745900	Lyon	215
FIL2	235800	728100	Fillan	165

Table 15.6 - Salmon catch per unit effort (CPUE), River Tay SAC.

Site code	Survey date	Salmon 0+/min	Salmon 1++/min
ERR1	21/09/11	5.0	3.0
Tum1	21/09/11	4.4	2.8
Glamis1	23/09/11	17.2	1.6
TUM2	29/09/11	5.4	0.8
ALM2	29/09/11	23.4	8.2
LYO9	28/10/11	2.4	4.8
LYO6	28/10/11	4.6	4.6
FIL2	28/10/11	5.2	1.2

Table 15.7 - Presence/absence of salmon year classes and of trout at timed sites, River Tay SAC.

Site code	Salmon age class present?				Trout present?
	0+	1+	2+	3+	
ERR1	Y	Y	Y	N	Y
Tum1	Y	Y	Y	N	N
Glamis1	Y	Y	Y	N	Y
TUM2	Y	Y	Y	N	Y
ALM2	Y	Y	N	N	Y
LYO9	Y	Y	N	N	N
LYO6	Y	Y	N	N	N
FIL2	Y	Y	Y	N	N

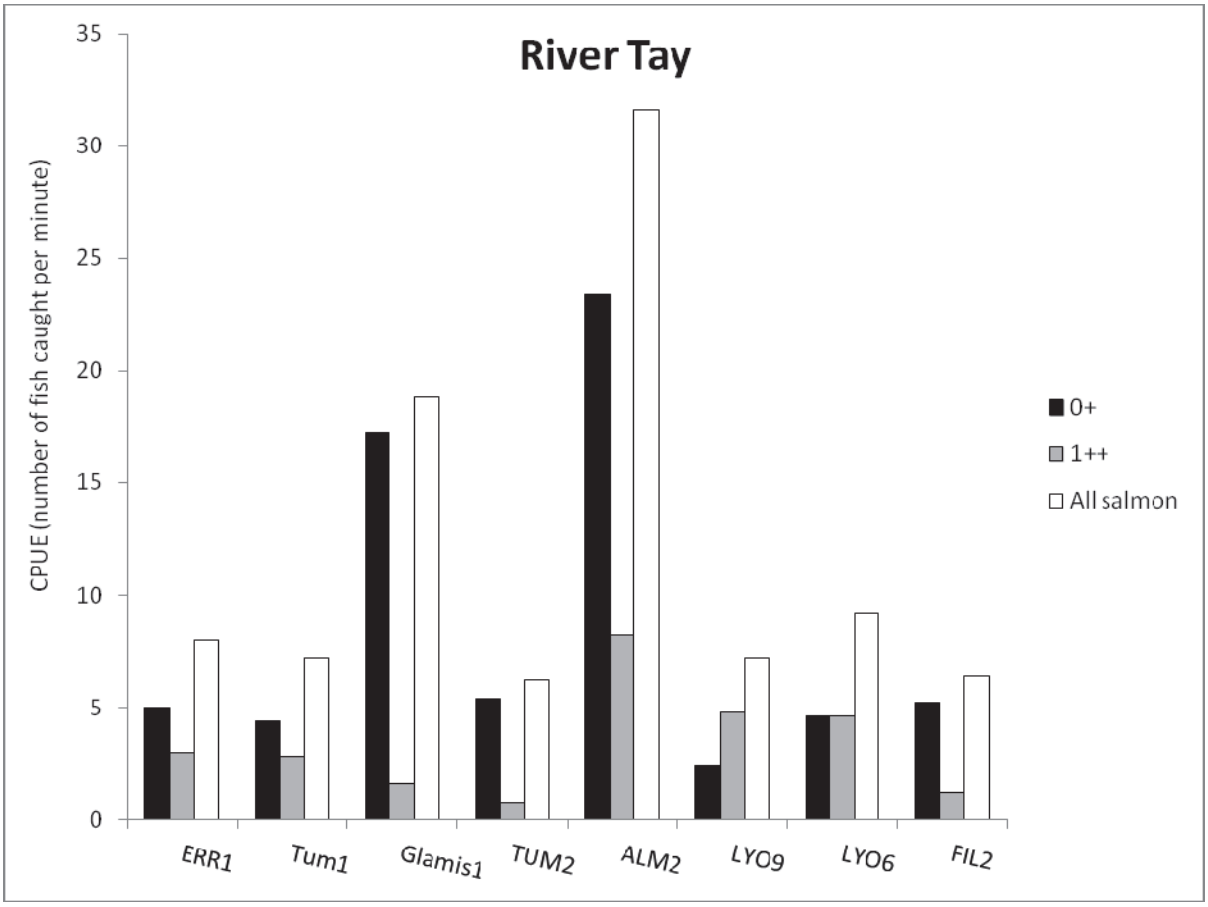


Figure 15.2 - Number of salmon (0+, 1++ and all salmon) caught per minute during five minutes of electrofishing at sites on the River Tay.

Summary

When the densities of 0+ and 1++ juveniles are considered in relation to regional juvenile densities developed by Godfrey (2005) the River Tay has sites lie mainly in the two highest quintile bands (Table 15.8), with two sites in the middle and lowest bands for fry. Overall, this indicates consistently high juvenile productivity across the catchment, particularly for parr. These high densities may reflect good habitat and/or water quality, good numbers of spawning adults reaching survey locations or the absence of acute external pressures which limit natural production or juvenile survival. These data suggest that fry and, particularly, parr could be considered to be in favourable status within the SAC.

Table 15.8 – Number of sites within the River Tay SAC falling within each quintile (according to absolute regional classification for 0+ and 1++ age classes) – and the resulting condition status.

SAC	Age class	Number of sites					Median grade	Favourable condition?
		0-20	21-40	41-60	61-80	81-100		
		E	D	C	B	A		
Tay	0+	1		1	6	2	B	Y
	1++				2	8	A	Y

A comparison of juvenile data from cycle 1 and cycle 2 show the mean Atlantic salmon fry and parr densities recorded at monitoring sites in 2011 were similar to those recorded in 2004 and this monitoring attribute remains favourable.

Table 15.9 - Comparison of condition status in 2004 and in 2011 for 0+ and 1++ age classes.

SAC		2004	2011	Change
Tay	0+	Y	Y	=
	1++	Y	Y	=

b) Adult Assessment

Data for adult Atlantic salmon rod catch within the River Tay were analysed using the NASCO Rod Catch Assessment tool introduced and described in Section 1. This analysis considers exploitation of the seasonal components (spring, summer and autumn) suggests whether management is required. Trends in long-term rod catch data from Marine Scotland Science (1952-present) for the overall catch and the same seasonal run-time components are also interrogated.

Summary of 1952 Catch Statistics

Rod catch statistics for the River Tay, covering the period 1951-2010, for the total catch and each of the seasonal run time components, are shown in Figures 15.3, 15.4, 15.5 and 15.6.

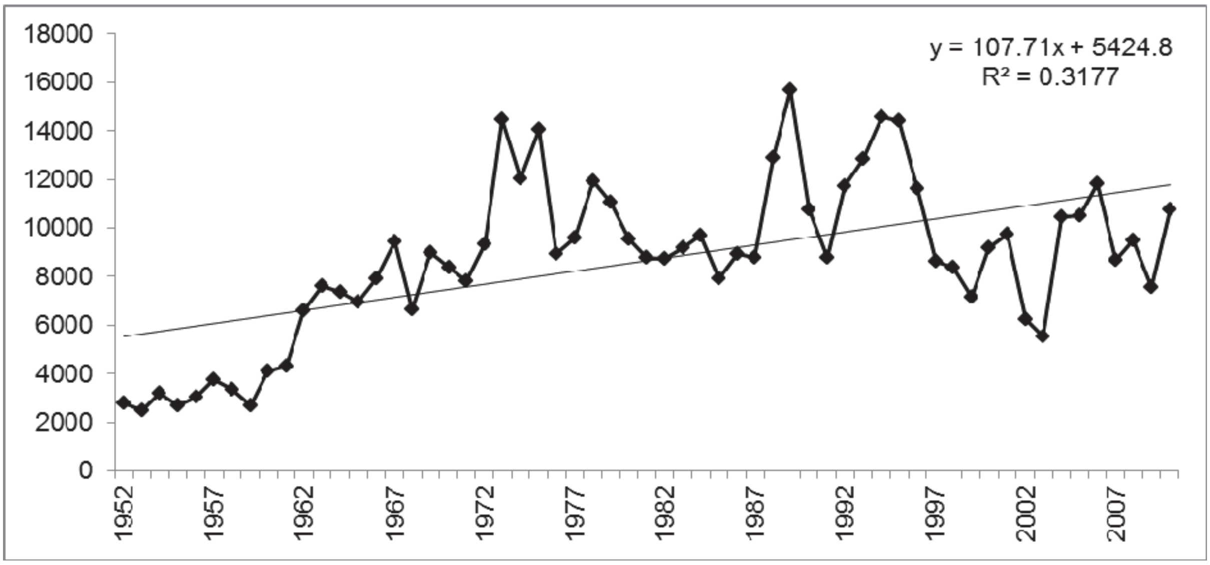


Figure 15.3 - River Tay total rod catch 1952-2010 (salmon and grilse, retained and released).

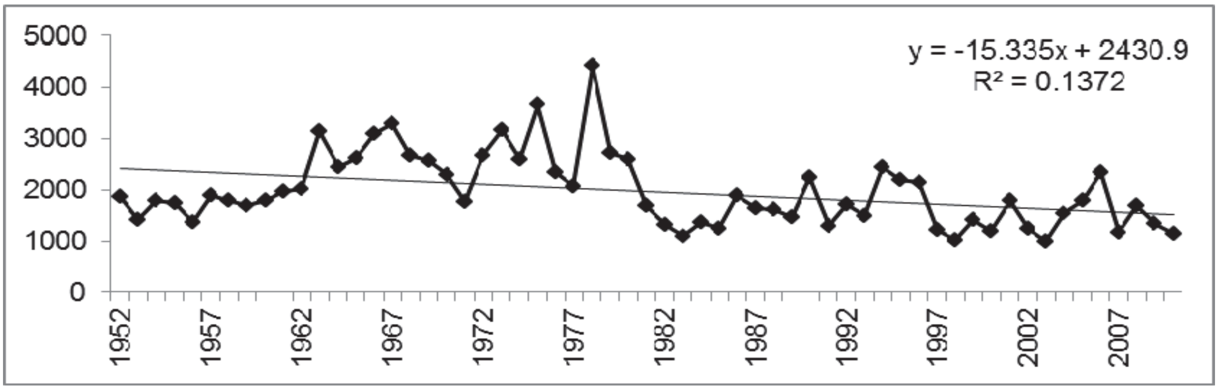


Figure 15.4 - River Tay total spring rod catch 1952-2010 (salmon and grilse, retained and released).

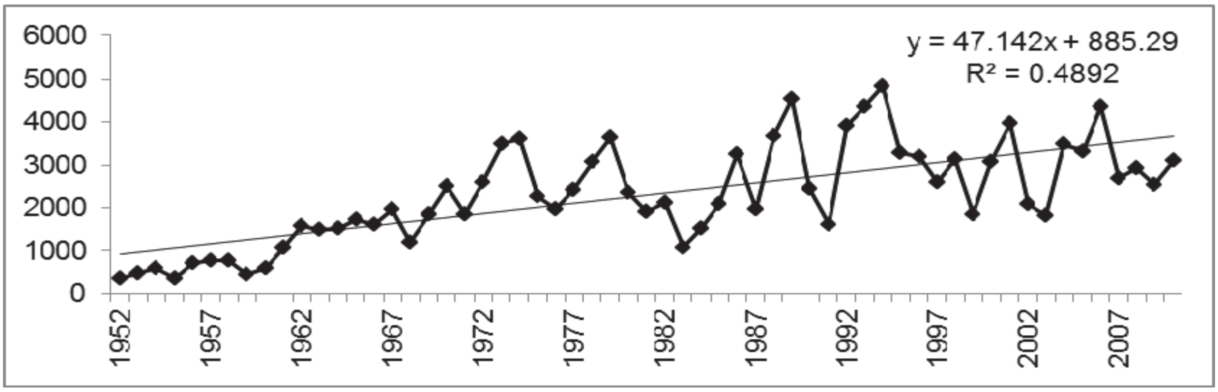


Figure 15.5 River Tay total summer rod catch 1952-2010 (salmon and grilse, retained and released).

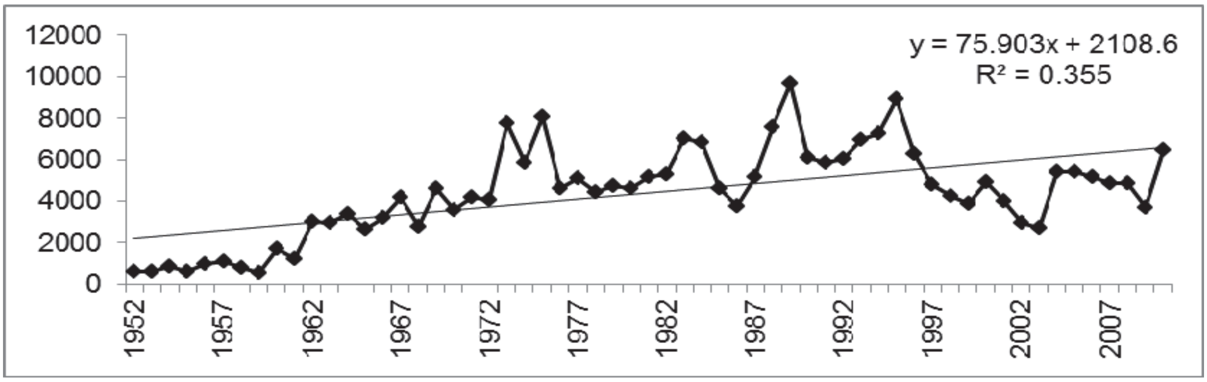


Figure 15.6 - River Tay total autumn rod catch 1952-2010 (salmon and grilse, retained and released).

The total rod catch for the River Tay (Figure 15.3) shows a general increasing trend over the period 1952 - 2010. The lowest rod catches (circa 3000 fish) occured in the early period of records, 1952-1959. Rod catches increased in the early 1960's to numbers in excess of 6000 fish. Rod catches from the 1960's have, however, been variable although notable peaks occurred in the early 1970's and the mid-1990's, when catches in excess of 14000 fish were recorded. The highest recorded rod catch was declared in 1989. Lower catches, of around 5-7000 fish, occurred in 2002 and 2003.

When compared to the situation elsewhere, the spring rod catch (Figure 15.4) has remained 'relatively' stable over the time series, however the long-term trend line suggests an overall decline. Rod catches remained stable from 1952 until the early 1960's and then again from the early 1980s to 2010. Peak spring rod catches occurred in the mid-late 1960's and through the 1970s. The summer rod catch (Figure 15.5) has increased over the time series from a low baseline the 1950s. From the 1960's-2010 the summer rod catch has shown some interannual variation, but the highest rod catches occurred in the early 1970's, late 1980's and early 1990's. Low rod catch returns occurred in in 1983 and 1984. The autumn rod catch records (Figure 15.6) were low in the River Tay from 1952 to the early 1960's.

Since that time, the autumn catch, which is the largest seasonal component of the total rod catch, has remained relatively stable. Peak returns occurred in the mid-1970's, late-1980's and mid-1990's. Low rod catches were reported in 2002 and 2003, but catches to 2010 have indicated a modest recovery. Over the long-term time series the trend for autumn fish has been one of increasing rod catch trend. This trend is influenced by low recorded catches in the early years of the dataset.

The reporting of rod catch over the time series has not been consistent. The Tay DSFB/Tay Foundation has found that between 1986 and 1993 the number of fishing beats supplying data increased by almost 100% as a result of a review of the government database. It is also suspected that the reporting accuracy for some beats has also improved in recent years. As a consequence it is believed that catches in the later 1990s and 2000s may appear higher relative to earlier decades than they would be without this change in extent and accuracy of rod catch returns, and high rod catches in the latter part of the time series does not necessarily indicate a stronger stock of adult fish within the system. This is particularly true of autumn catches as many of the new beats added are considered to catch more fish in the latter half of the angling season. Given this is the situation with respect to Tay data, the Tay DSFB/Tay Foundation have raised more general concerns as to the reliability and overall accuracy of the published catch statistics and suggest that a comprehensive national review of the returns process is required. Whilst these concerns are acknowledged, such a review is not part of the current SCM process.

Over the period for which these data have been collected there may have also been significant changes in angling effort. The Tay DSFB/Tay Foundation believe that total angling effort may have been lower in the 1950's than later in the time series, and that this may, at least in part, explain the low catches observed in the early years of the published records. Also of note, is the view that, since at least 2000, angling effort in the spring period particularly has started to decline. The Tay Foundation add that, in the 1970's and 1980's, a significant proportion of the rod catch was made using natural baits such as shrimp, prawn and worm. However, shrimp and prawn fishing was banned in the autumn from 1992 and completely in 1999. While not illegal, worm fishing is now discouraged in the spring and autumn. The impact of these changes in method use are, however, unquantified.

Finally, rod catch within the Tay system will have been affected by changes in commercial net fishing effort. There was formerly a significant commercial seine net fishery for Atlantic salmon in the estuary of the River Tay. As recently as the late 1980's as many as 40000 Atlantic salmon were caught annually. Netting effort reduced from the late 1980's and, following a partial buy-out in 1992, the main net fishery was closed after the end of the 1996 season, leaving only a very small netting presence. From the 1980's there was also a gradual decrease in coastal netting along the Scottish coast and, from 1993, in offshore netting effort along the coast of North East of England. These nets are known to take River Tay salmon, as well as fish from other Scottish rivers, notably the River Tweed. After 2003 netting effort in that fishery fell markedly as a result of another buyout. Thus, the recent rod catch might not follow the pre-fishery abundance of salmon in the same way as it would have in the recent past and may be more likely to underestimate any decline in abundance.

Owing to the locally perceived and observed decline in salmon abundance, particularly in the spring, the Tay DSFB has, in recent years, sought to limit angling catches as a practical conservation measure. It recommends that anglers release all salmon caught before 1st June, and all female salmon caught thereafter. After 1st June it is recommended that only one male salmon should be retained per day and that, where possible, fresh run fish weighing under 10 pounds should be selected.

Application of Rod Catch Assessment Tool

Rod catches from the River Tay over the last 20 years (1991-2010) were applied to the NASCO rod catch assessment tool to assess whether exploitation of each run time component requires management action.

The results of these tests for the River Tay rod catch are shown in Table 15.10, and the data used to complete these tests is available in Appendix 1. The output of these analyses suggest that no reduction in exploitation is currently required for any of the run-time components.

It is desirable in larger systems, such as the River Tay, to refine these rod catch assessments by breaking the system down into meaningful sub-units and fishery groups which themselves may show different results if considered in this way. For example, a major tributary known to generate spring or autumn fish may demonstrate trends or patterns of catch for this run time component when assessed locally which are not confirmed by a whole river assessment of this component. However, such analysis was not within the scope of this assessment, nor is it the required level of assessment required for site condition monitoring. The Tay DSFB/Tay Foundation consider that, because observed inconsistencies in catch recording differ in geographic areas (reporting has always been good in the lower part of the main stem of the River Tay but poor in some tributaries) such an exercise might generate more refined, representative and reliable time series information if completed.

Table 15.10 - Summary of the Rod Catch Assessment Tool tests for River Tay

Test	Spring	Summer	Autumn
A	No	No	No
B	No	No	No
C	No	No	No

Rod catches for the 20 year period used in this assessment (1991-2010) are shown in Figures 15.7, 15.8, 15.9 and 15.10. An F-test was applied to each of the seasonal components to assess whether the trend line deviated from horizontal, and the results of these are summarised in Table 15.11.

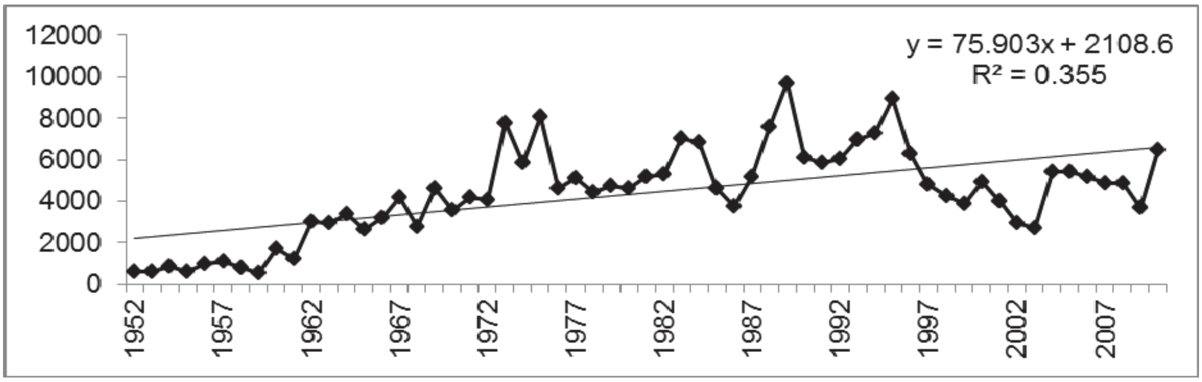


Figure 15.7 - River Tay total rod catch 1991-2010 (salmon and grilse, retained and released).

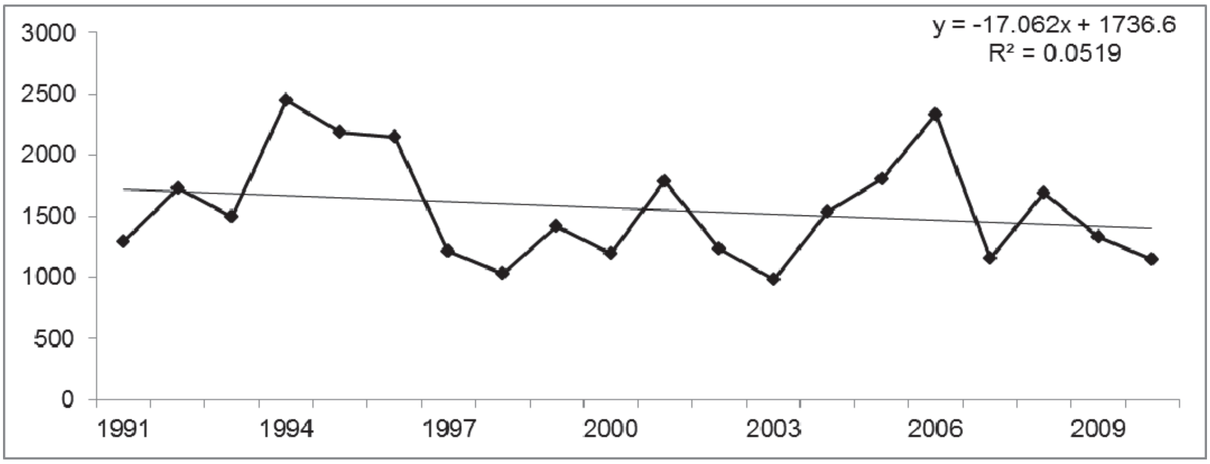


Figure 15.8 - River Tay spring rod catch 1991-2010 (salmon and grilse, retained and released).

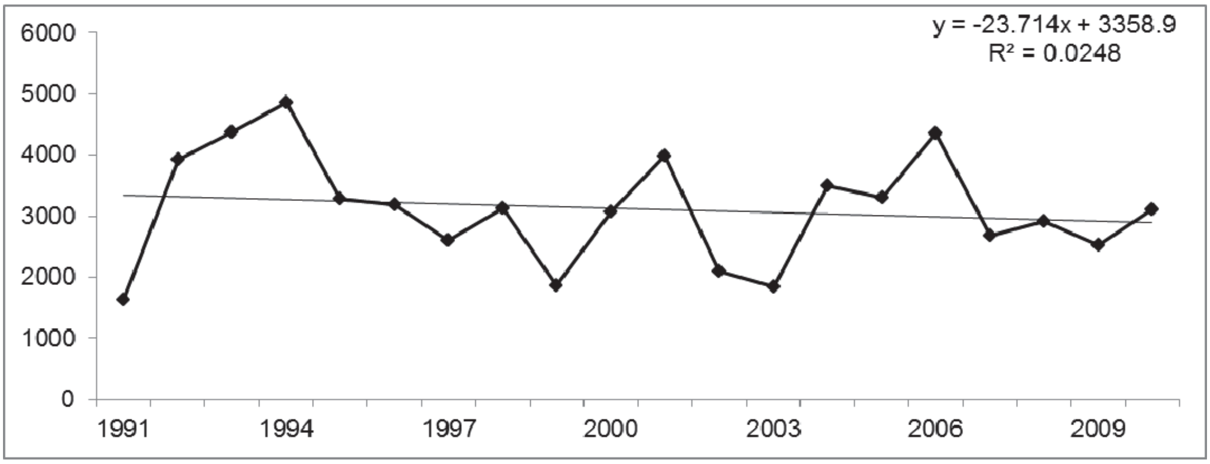


Figure 15.9 - River Tay summer rod catch 1991-2010 (salmon and grilse, retained and released).

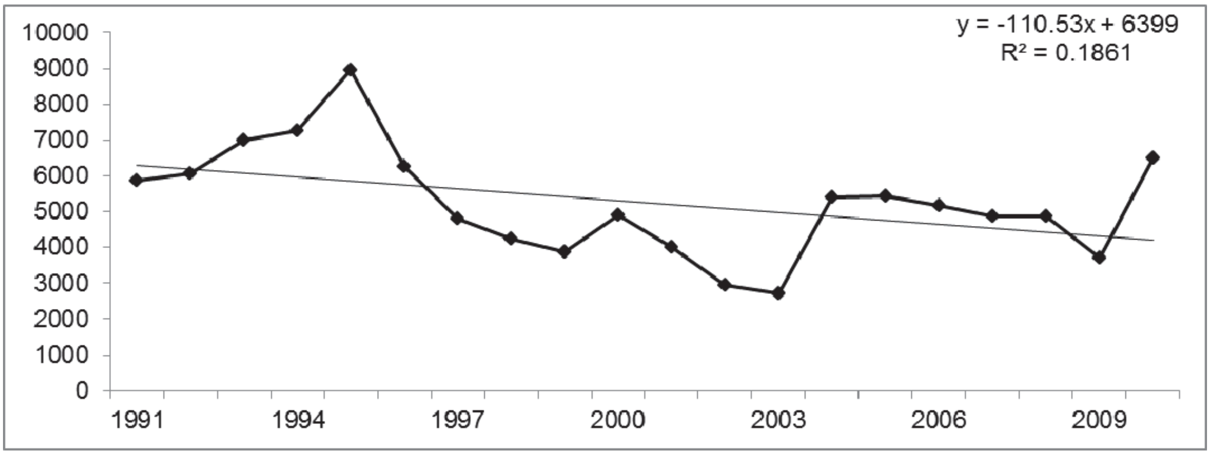


Figure 15.10 - River Tay autumn rod catch 1991-2010 (salmon and grilse, retained and released).

Table 15.11 - Summary of F-Test Results on River Tay Seasonal Rod Catch (1991-2010).

Component	Observations	F-Value	F-Significance
Spring	20	0.986	0.334
Summer	20	0.458	0.507
Autumn	20	4.117	0.058

The percentage change in the spring, summer and autumn rod catches SCM cycles against the year of designation (2002) was also undertaken. The first SCM assessment covered the period 2002-2004, whilst the second includes data extending from 2002-2010. In this review the rod catch is averaged for each cycle period and the increase or decrease in average rod catch expressed as a percentage of the rod catch in the year of designation.

This comparison is shown graphically in Figure 15.11 and indicates that for all stock components on the River Tay there has been an increase in average rod catch in SCM cycle 1 and 2 when compared to rod catches in 2002. This increase is greatest in the autumn rod catch and smallest in the spring rod catch in each cycle. These comparisons, although useful in comparing average catch since designation, are significantly influenced by the low rod catch declared in 2002. The overall rod catch in 2002 was the 5th lowest from 1991-2010; the 4th lowest for spring fish; the 2nd lowest for summer and autumn fish.

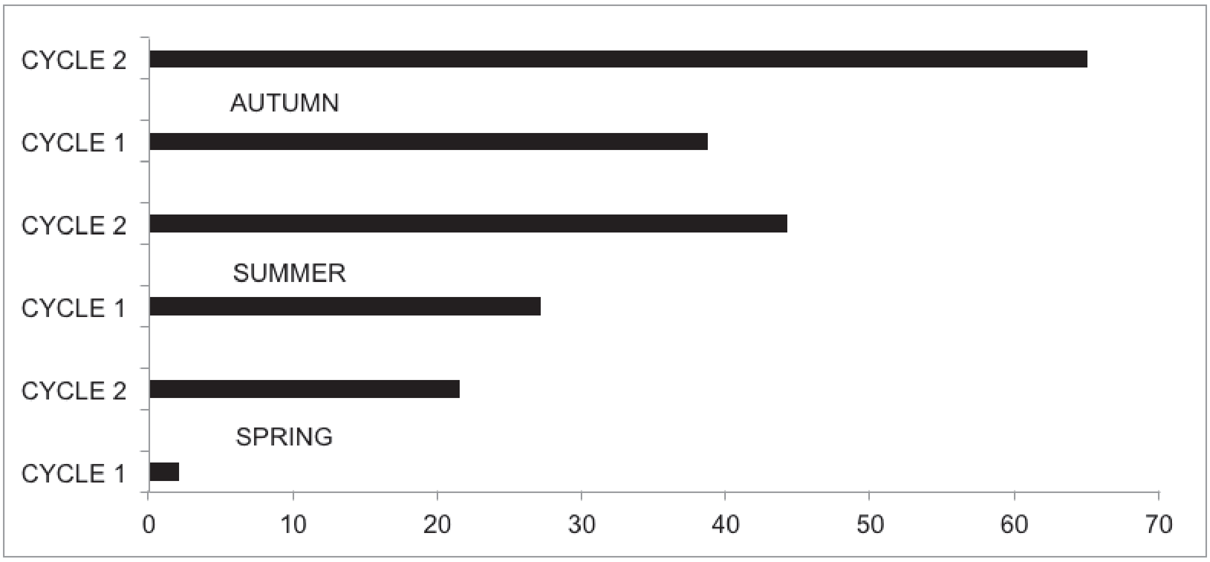


Figure 15.11 - Stock trend assessment since River Tay SAC Designation (2002) in cycle 1 (2003-2004) and cycle 2 (2003-2010).

Summary

The overall rod catch for Atlantic salmon in the River Tay SAC over the period 1952-2010 shows an increasing trend. Within this, however, the spring rod catch shows a slight decline, whilst the autumn and summer catches have increased. Particularly low summer and autumn catches from 1952-early 1960's have contributed significantly to the increasing rod catch trends for these seasonal components, and overall rod catch. From the early 1960's the total rod catch has been variable, with declared catches ranging between <6000 and >14000 fish. High rod catches were particularly evident in the early 1970's, the mid-1990's and in 1989.

A number of changes in fishing effort have taken place within the River Tay system in recent years. The 1990's saw a significant reduction in net fishing effort within the Tay District, although the North East England drift net fishery may also take a significant number of Tay fish. This has not, however, been quantified. Significant changes in the use of particular angling methods, which were previously permitted in the Tay, have taken place. The use of some natural baits (such as prawns and shrimps) are now prohibited, although use of worms is still allowed. In addition to these measures, a programme of voluntary catch and release has been progressively introduced throughout the system as a means of protecting spring fish and female Atlantic salmon throughout the season.

Application of the NASCO rod catch assessment tool to declared rod catches over the last 20 years (1991-2010) suggest that no reduction in exploitation is currently required. However, it is acknowledged that in a system as large as the Tay, major tributaries and areas of the catchment may exhibit patterns of catch for run-time components which may generate different results from the rod catch assessment tool if deployed at a local level. Such analyses did not form part of this analysis which considered the SAC as a whole, but it is recognised that local fishery managers may wish to undertake such assessments to inform local management and conservation measures.

Application of these data to F-tests suggest that there has been no significant change in rod catch in any of the run-time components over this 20-year period.

When average rod catches for each of the two SCM cycles is compared to those recorded in the year of designation, there is a pronounced increase in each cycle for all seasonal components. The greatest increases are shown in the summer and autumn rod catches and may be due to the low rod catches declared in 2002.

Taken as a whole, these analyses of adult rod catch in the River Tay indicate an improving situation in respect of the autumn, summer and autumn run components in the years since designation when the whole river is considered.

The Tay DSFB have raised general concerns as to the robustness and completeness of the catch statistics for the District but these have not been quantified and review of this, although desirable, is outside the scope of this work.

c) Habitats supporting the qualifying feature

1. Water quality and quantity

The status of each water body within the SAC, for which SEPA hold data, was obtained from the SEPA River Basin Planning interactive website

A total of 75 WFD water bodies representing a river length 944 km occur within the River Tay SAC. Of these, 43 are classified as being of good or high ecological status or potential (total length of 533 km) and are protected from deterioration from that class. The remaining 32 waterbodies (river length of 411 km) are classified as being at moderate, poor or bad ecological status or potential. These waterbodies require the implementation of measures to bring them up to good of high ecological staus, or good ecological potential. Of the 17 HMWBs included in this classification, nine are of high (one) or good (eight) ecological potential with the remaining eight being of moderate (three), poor (two) or bad (three) ecological potential. The most common pressures in the catchment which cause water bodies to be classified at less than good ecological status or potential are: diffuse pollution due to arable and mixed farming; water abstraction for arable farming; morphological alterations; abstraction for renewable energy; barriers to fish passage; and point source pollution from sewage discharges. Table 15.12 below summarises the number of water bodies and the length of channel within each status category.

Table 15.12 - Number of water bodies and length of channel within each WFD status category in the River Tay SAC.

WFD status (2009)	High	Good	Moderate	Poor	Bad	Total
Number of water bodies	7	27	16	6	2	58
Number of HMWBs	1	8	3	2	3	17
Length of channel (km)	71	462	245	92	73	944

2. Trends, changes and activities

In addition to pressures and activities listed above, invasive non-native species have also been identified as a major risk to Atlantic salmon within the Tay catchment. Particular reference made to the presence of North American signal crayfish. The introduction of a formerly native species, the Eurasian beaver (*Castor fiber*) is also considered by the Tay DSFB/Tay Foundation to be a potential risk, particularly if the distribution of this species expands in future years. The potential expansion of hydro schemes are also a major issue of concern, although the planning and CAR licensing process for these will consider the SAC interests – including Atlantic salmon.

Two changes have been identified which are considered by the Tay DSFB/Tay Foundation to be likely to bring improvements to the system are: 1) improvements in water quality resulting from better regulation of sheep dip use and disposal; and 2) the ongoing development of better fisheries management practices e.g. catch and release conservation measures within the catchment.

Further positive contributions to the system are also anticipated through the process of WFD Controlled Activity Regulations (CAR) licence reviews to be undertaken by SEPA. Currently these reviews are at a relatively early stage but provide the prospect of requiring potentially significant revision to a range of current activities in the catchment. Within the Tay reviews of current licenses associated with hydro-power and other water abstractions are considered by the Tay DSFB/Tay Foundation to be likely to provide the greatest potential benefits to the catchment. The River Tay has also been selected as a WFD Priority Catchment for diffuse pollution by SEPA, and this also should prioritise the system for further co-ordinated restoration activities.

The main pressures having, or likely to have a negative impact, on Atlantic salmon in the River Tay SAC are considered to be:

- Invasive Non Native Species (e.g. American signal crayfish), and the spread of Eurasian beaver;

- Hydro schemes - new development and current operation and morphological change associated with these; and
- Diffuse pollution from agriculture.

16. RIVER TEITH

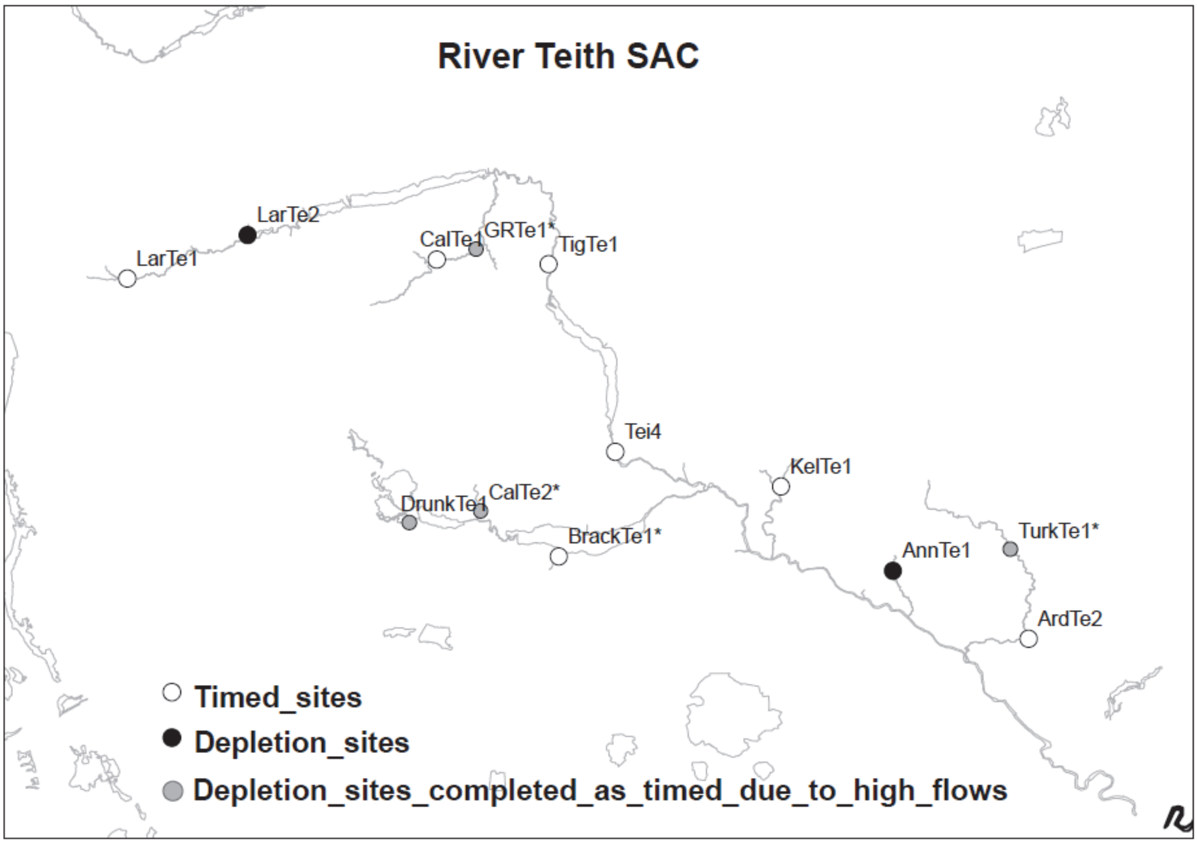
a) Juvenile Assessment

Two sites were surveyed using the standard SFCC catch depletion electrofishing method. An additional 12 sites were sampled using a five-minute timed electrofishing approach. All sites were situated within the River Teith SAC (Map 16.1). The sites were surveyed by staff of the River Forth Fisheries Trust.

Five of the 12 timed sites were planned to be quantitative sites, but prolonged high flows throughout the second half of August and most of September prevented stop nets from being used. Timed surveys were the best available alternative. Tables 16.5 - 16.7 identify those timed sites that were planned as quantitative.

One site on the main River Teith that could not be surveyed due to consistently high flows was replaced with a site 5 m into a nearby tributary (the Tighane Burn). One site on the Eas Cobhain (a large tributary of the River Teith) also could not be surveyed due to consistently high flows. This was replaced by an alternative site approximately 5 m into a nearby tributary (the Gleann Riabhach). Four further timed sites on the main channel of the River Teith could not be surveyed due to consistently high flows, and there were no nearby tributaries to act as replacement sites. These missing sites are identified in Table 16.5.

Map 16.1 - Distribution of depletion and timed electrofishing sites on the River Teith SAC.



Depletion sites

Site details and a summary of electrofishing results are shown in Tables 16.1 – 16.4. Salmon and trout were present at both sites, but 0+ salmon were only present at one site. Zippin and Carl & Strube estimates for fry were calculable for the one site they were present while for 1+ fish were calculable for both sites and for 2+ fish, were calculable for the one site where they were present. Confidence limits were quite wide at both sites. For the one site where fry were present – the River Larig, the Zippin density was 70 per 10 0m^2 while the Carl & Strube density was 64 per 100 m^2. For 1+ fish, Zippin densities ranged from 12 - 28 per 100 m^2 (mean 20) and Carl & Strube densities ranged from 5 - 23 per 100 m^2 (mean 14). The highest 1+ densities were found in the Annet Burn which also had the largest 1+ salmon (mean 106 mm).

Table 16.1 - Details of depletion electrofishing sites, River Teith SAC.

Site code	Date	Easting	Northing	Altitude (m)	Channel name
LarTe2	19/08/11	243703	718084	150	River Larig
AnnTe1	30/08/11	269941	704357	25	Annet Burn

Table 16.2 - Details of depletion electrofishing for 0+ and 1++ salmon, River Teith SAC.

Site code	Wetted area (m^2)	Zippin 0+	Carl & Strube 0+	Zippin 1+	Carl & Strube 1+	Zippin 2+	Carl & Strube 2+
LarTe2	226.9	70.3	64.4	12.2	5.3	3.4	2.7
AnnTe1	100.0	0.0	0.0	28.2	23.0	n/a	n/a

n/a denotes salmon present, but not in high enough densities to allow calculation of Zippin or Carl & Strube statistics. 0.0 denotes no salmon found at site.

Table 16.3 - Presence/absence of salmon year classes and of trout 0+ and 1++ at depletion sites, River Teith SAC.

Site code	Salmon age class present?				Trout present?	
	0+	1+	2+	3++	0+	1++
LarTe2	Y	Y	Y	N	Y	N
AnnTe1	N	Y	Y	N	Y	Y

Table 16.4 - Fork length of salmon of different age classes, River Teith SAC.

Site code	0+ mean fork length	No. 0+	1+ mean fork length	No. 1+	2+ mean fork length	No. 2+	3+ mean fork length	No. 3+
LarTe2	44	99	76	10	100	6	n/a	0
AnnTe1	n/a	0	106	20	132	2	n/a	0

n/a denotes means could not be calculated as no salmon of that age class were found at the site.

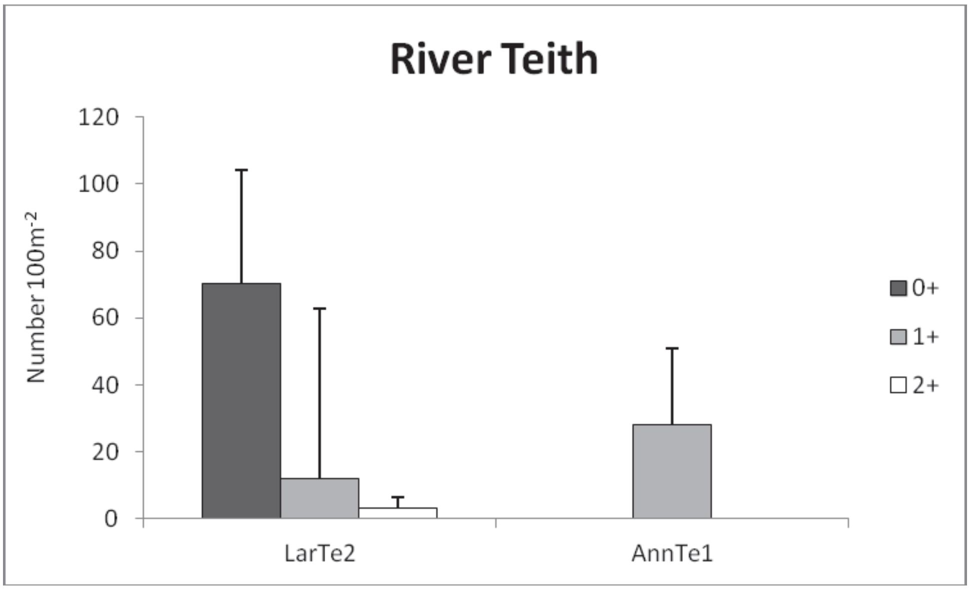


Figure 16.1 - Juvenile salmon population density estimated by the Zippin method for the SAC monitoring sites on the River Teith SAC.

Timed sites

Details of the 12 timed sites are given in Table 16.5. 0+ fish were caught at nine of the 12 timed sites, while 1++ fish were caught at eight sites. CPUE for fry ranged from 0–5/min, and for 1++ fish ranged from 0–2/min (Table 16.6). Trout were caught at ten of the sites.

Table 16.5 - Details of timed electrofishing sites, River Teith SAC

Site code	Easting	Northing	River	Altitude (m)
ArdTe2	275448	701572	Ardoch Burn	49
LarTe1	238796	716314	Larig	260
TigTe1	255943	716903	Tighanes Burn	130
Tei4	258646	709223	Teith	124
KelTe1	265381	707809	Keltie Water	100
BrackTe1*	265381	707809	Brackland Burn	90
CalTe1	251391	717078	Calair Burn	276
ArdTe1*	274715	705239	Ardoch Burn	151
TurkTe1*	253177	706810	Turk	71
CalTe2*	252991	717517	Calair Burn	191
GRTe1*	250269	706330	Gleann Riabhach	191
DrunkTe1	256357	704945	Drunkie Burn	90
Te1†	276100	697100	Teith	10
Te2†	270750	702200	Teith	30
Te3†	264400	705100	Teith	60
Te5†	260300	706950	Teith	80

* Originally planned as a quantitative site.
† Main channel sites that could not be surveyed due to high flows.

Table 16.6 - Salmon catch per unit effort (CPUE), River Teith SAC.

Site code	Survey date	Salmon 0+/min	Salmon 1++/min
ArdTe2	29/08/11	4.93	1.87
LarTe1	19/08/11	0.52	0.28
TigTe1	05/09/11	1.40	0.00
Tei4	05/09/11	2.05	0.05
KelTe1	23/09/11	0.35	0.15
BrackTe1	23/09/11	1.85	0.75
CalTe1	26/09/11	0.00	0.00
ArdTe1	27/09/11	0.10	0.55
TurkTe1	27/09/11	0.25	0.65
CalTe2	28/09/11	0.00	0.25
GRTe1	28/09/11	0.08	0.48
DrunkTe1	13/10/11	0.00	0.00

Table 16.7 - Presence/absence of salmon year classes and of trout at timed sites, River Teith SAC.

Site code	Salmon age class present?				Trout present?
	0+	1+	2+	3+	
ArdTe2	Y	Y	N	N	Y
LarTe1	Y	Y	Y	N	Y
TigTe1	Y	N	N	N	Y
Tei4	Y	Y	N	N	Y
KelTe1	Y	Y	Y	N	Y
BrackTe1	Y	Y	Y	N	Y
CalTe1	N	N	N	N	Y
ArdTe1	Y	Y	Y	Y	Y
TurkTe1	Y	Y	Y	N	Y
CalTe2	N	N	Y	N	N
GRTe1	Y	Y	N	N	Y
DrunkTe1	N	N	N	N	N

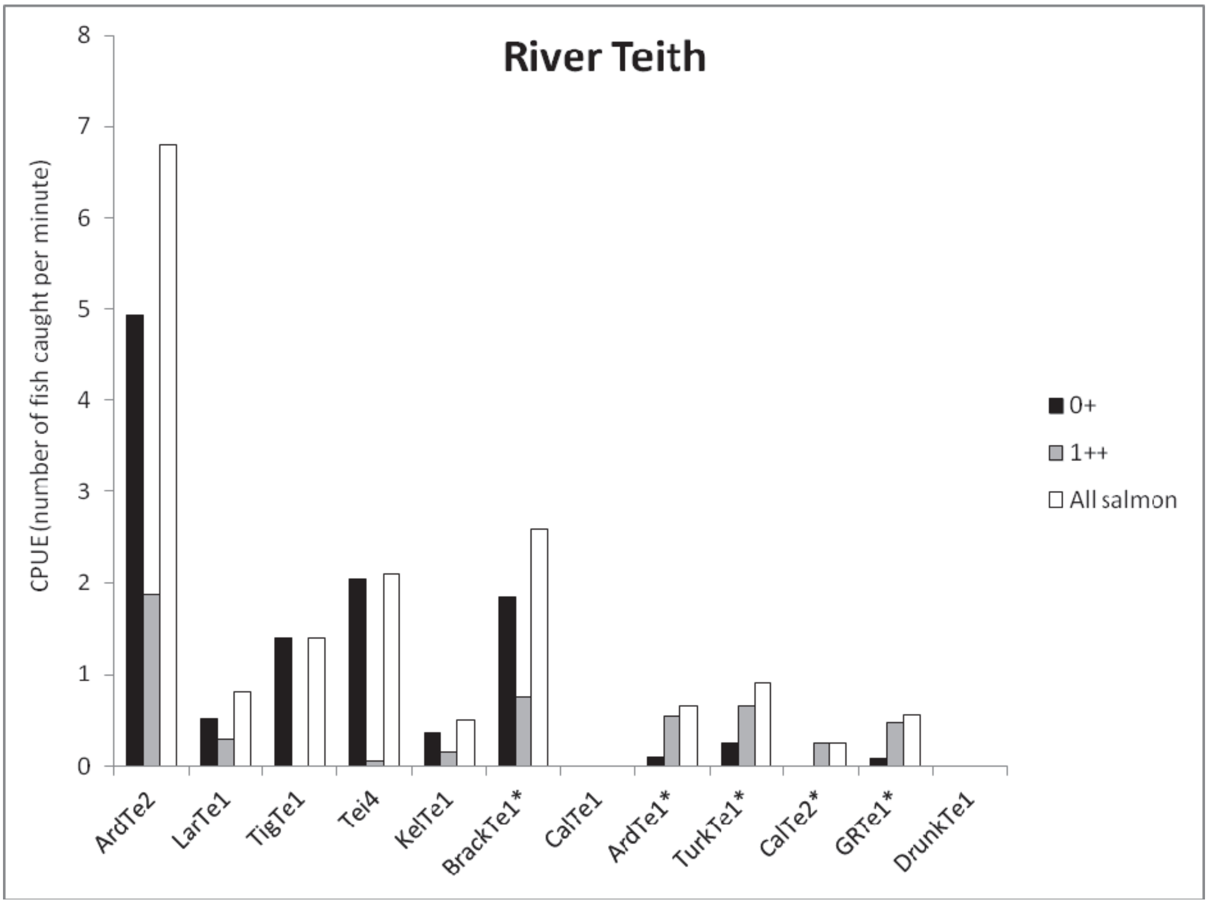


Figure 16.2 - Number of salmon (0+, 1++ and all salmon) caught per minute during five minutes of electrofishing at sites on the River Teith.

* Sites that were originally planned as quantitative, but due to high flows, could only be completed as timed surveys.

Summary

Depletion surveys were carried out only for a subset of River Teith sites due to prolonged wet weather. As a result, there are only two depletion sites available for the 2011 assessment as compared to seven sites in 2004. For fry, one site fell within the lowest quintile while the other was near the top. Both sites were in the two highest bands for parr (Table 16.8). Assessed separately it is suggested that fry can be considered to be in unfavourable status and that parr are in favourable status within the SAC (see Table 16.8).

Table 16.8 – Number of sites within the River Teith SAC falling within each quintile (according to absolute regional classification for 0+ and 1++ age classes) – and the resulting condition status.

SAC	Age class	Number of sites					Median grade	Favourable condition?
		0-20	21-40	41-60	61-80	81-100		
		E	D	C	B	A		
Teith	0+	1			1		D	N
	1++				1	1	B	Y

A comparison of data from cycle 1 and cycle 2 indicate that the status of the River Teith was the same in 2011 compared to the previous assessment (Table 16.9). For both assessment, fry were considered to be in unfavourable status whilst parr were in favourable status.

Table 16.9 - Comparison of condition status in 2004 and in 2011 for 0+ and 1++ age classes.

SAC		2004	2011	Change
Teith	0+	N	N	=
	1++	Y	Y	=

b) Adult Assessment

Data for adult Atlantic salmon rod catch within the River Teith were analysed using the NASCO Rod Catch Assessment tool introduced and described in Section 1. This analysis considers exploitation of the seasonal components (spring, summer and autumn) suggests whether management is required. Trends in long-term rod catch data from Marine Scotland Science (1952-present) for the overall catch and the same seasonal run-time components are also interrogated.

As a function of the way in which rod catch returns are collated by Marine Scotland Science the catch statistics used in the following assessments are those of the Forth Fisheries District as a whole and not those of the River Teith itself which are not specifically available.

Summary of 1952 Catch Statistics

Rod catch statistics for the Forth District, covering the period 1952-2010, for the total catch and each of the seasonal run time components, are shown in Figures 16.3, 16.4, 16.5 and 16.6.

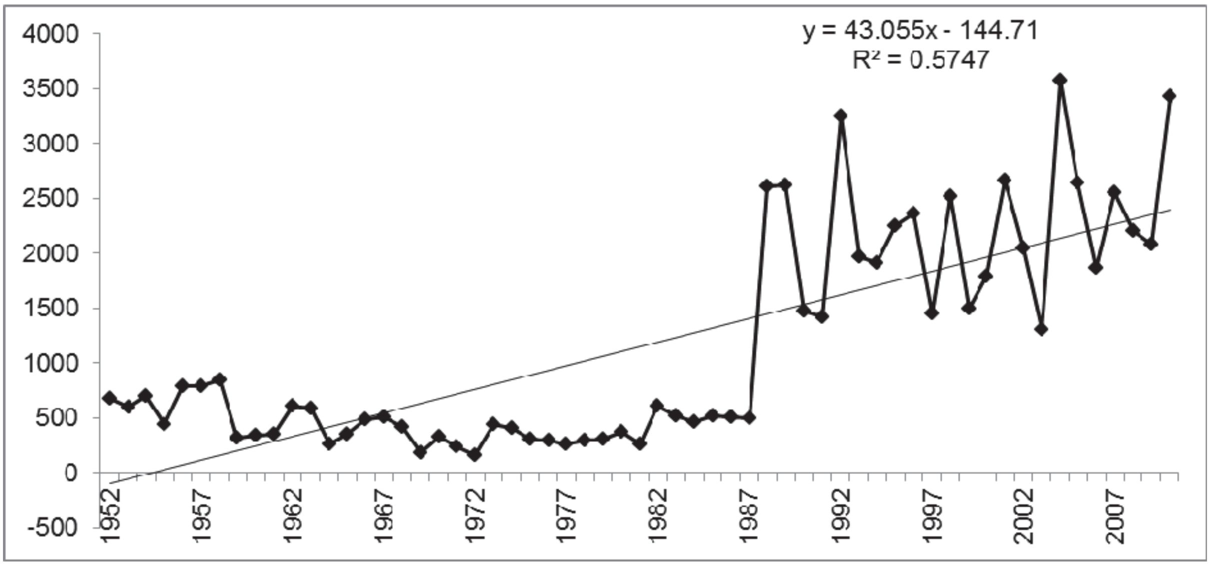


Figure 16.3 - Forth District (for River Teith) total rod catch 1952-2010 (salmon and grilse, retained and released).

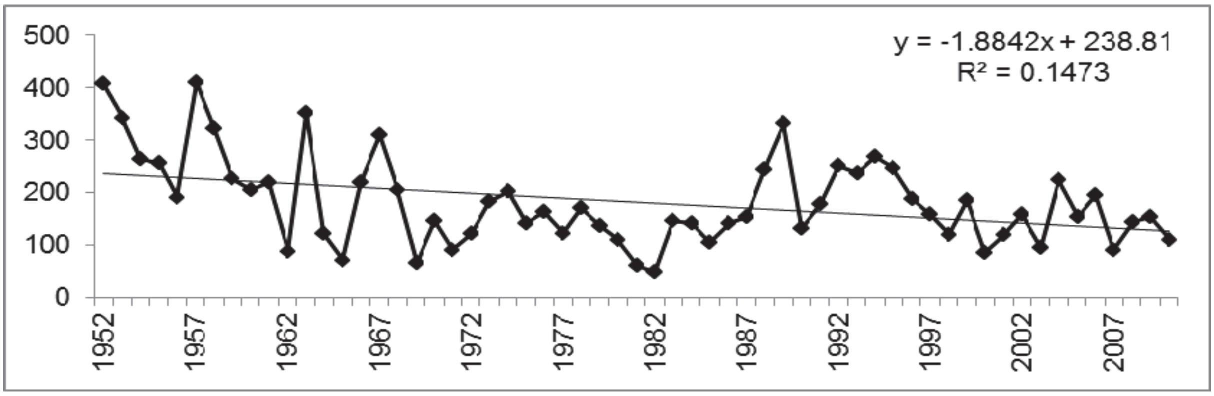


Figure 16.4 - Forth District (for River Teith) total spring rod catch 1952-2010 (salmon and grilse, retained and released).

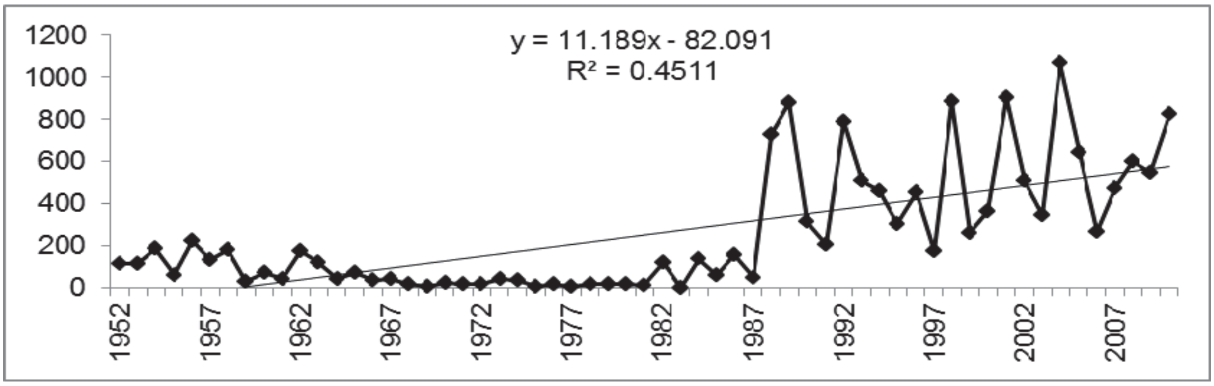


Figure 16.5 Forth District (for River Teith) total summer rod catch 1952-2010 (salmon and grilse, retained and released).

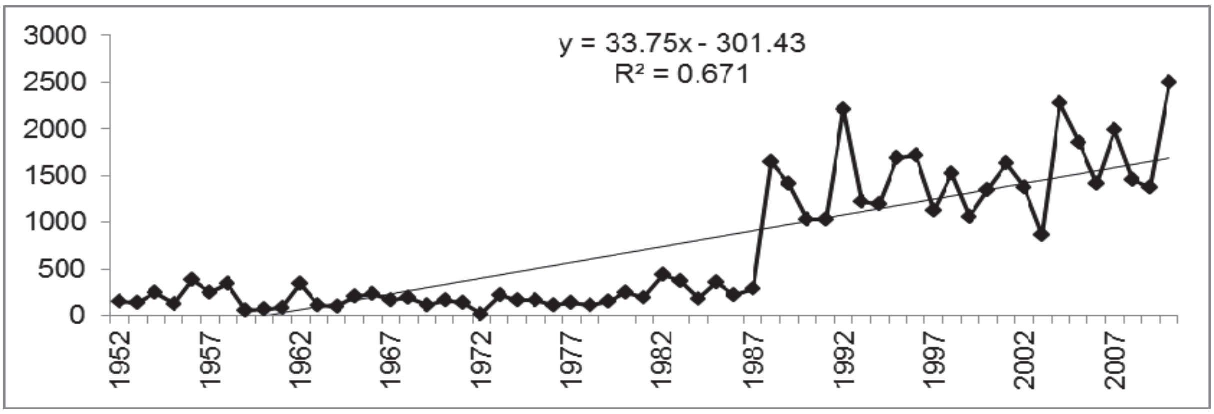


Figure 16.6 - Forth District (for River Teith) total autumn rod catch 1952-2010 (salmon and grilse, retained and released).

The total rod catch for Atlantic salmon in the River Teith (Figure 16.3) shows a relatively stable trend from the beginning of the series until a dramatic increase (from ~500 to ~2500) in reported catch at the end of the 1980's. This increased level in declared rod catch has been largely maintained, although some inter-annual variation exists. The spring rod catch (Figure 16.4), whilst showing increased abundance in some years (such as 1988) does not follow the same positive trend as that seen for the total rod catch. The summer and autumn rod catches (Figures 16.5 and 16.6) both show, like the total catch, significantly increased catches from around 1988, and these have been largely maintained in subsequent years. Both the summer and autumn rod catches are the driver behind the increase in overall rod catch in the District since that time.

The substantial and sudden increase in catches in the Forth District has never been fully explained and therefore there must be a level of uncertainty surrounding the validity of the early (pre-1988) data within the time series. It has been suggested that the increase was coincident with a decrease in netting effort within the area, but that has not been fully established. The Forth DSFB consider that is it more likely that the changes shown represent a shift in the extent or scale of catch reporting to a central recording processes. Given the magnitude of the change, and that the basis for it remains largely unexplained, it is suggested that any interpretation of Figures 16.3 – 16.6 should be undertaken with caution.

An increase in voluntary catch and release by anglers across the District has taken place in recent years, and particularly since 1994. Additional management recommendations are also being brought forward.

Many areas in the Forth District were subject to, and continue to be, impacted by the past industrialisation of Central Scotland, and in particular the pollution and barriers to fish migration which resulted. Although not wholly urban, and recognising the significant parts of the District which are rural in nature, these past activities are likely to have restricted the success of Atlantic salmon in many catchments of the Forth District. Equally, water quality within the District has improved following the decline of heavy industries and the better regulation of discharges, firstly by the River Purification Boards, and latterly by the Scottish Environment Protection Agency (SEPA). It is likely that these improvements have made a positive contribution to Atlantic salmon production and rod catches in many catchments within the District.

Application of Rod Catch Assessment Tool

Rod catches from the River Teith over the last 20 years (1991-2010) were applied to the NASCO rod catch assessment tool to assess whether exploitation of each run time component requires management action.

The results of these tests for the Forth District (for River Teith) are shown in Table 16.10, and data used to complete these tests is available in Appendix 1. These tests suggest that no reduction in exploitation is required for any of the spring, summer or autumn run-time components.

Table 16.10 - Summary of the Rod Catch Assessment Tool tests for River Teith

Test	Spring	Summer	Autumn
A	No	No	No
B	No	No	No
C	No	No	No

Rod catches for the 20 year period used in this assessment (1991-2010) are shown in Figures 16.7, 16.8, 16.9 and 16.10. An F-test was applied to each of the seasonal components to assess whether they deviated from horizontal, and the results for these are summarised in Table 16.11. These suggest no significant change in the summer and autumn rod catch trend, but a significant downward trend (at the 95% confidence level) in the spring catch over the period.

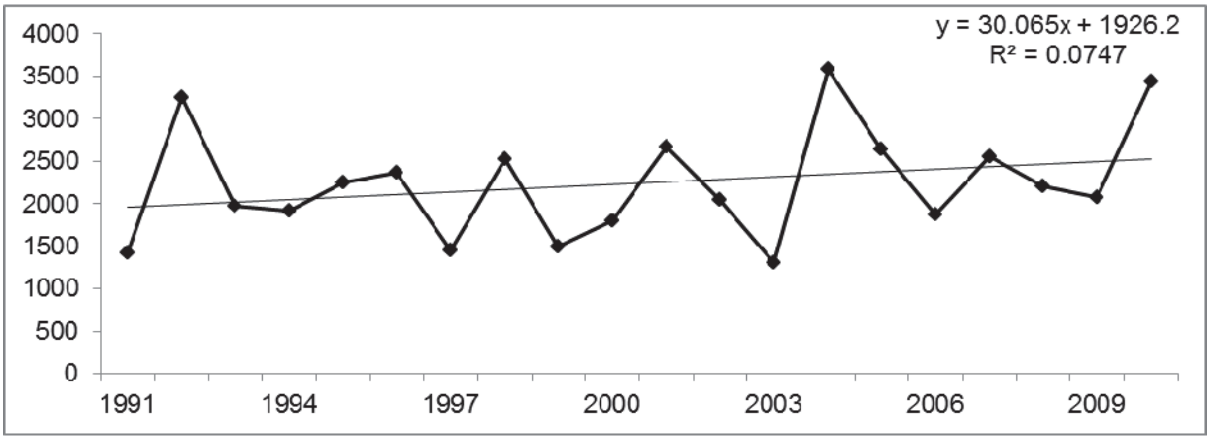


Figure 16.7 - River Teith total rod catch 1991-2010 (salmon and grilse, retained and released).

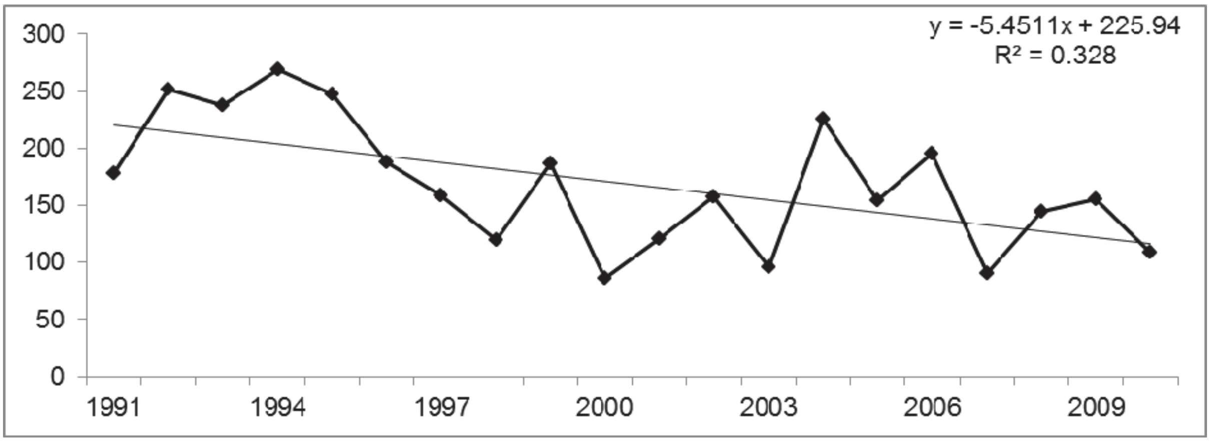


Figure 16.8 - River Teith spring rod catch 1991-2010 (salmon and grilse, retained and released).

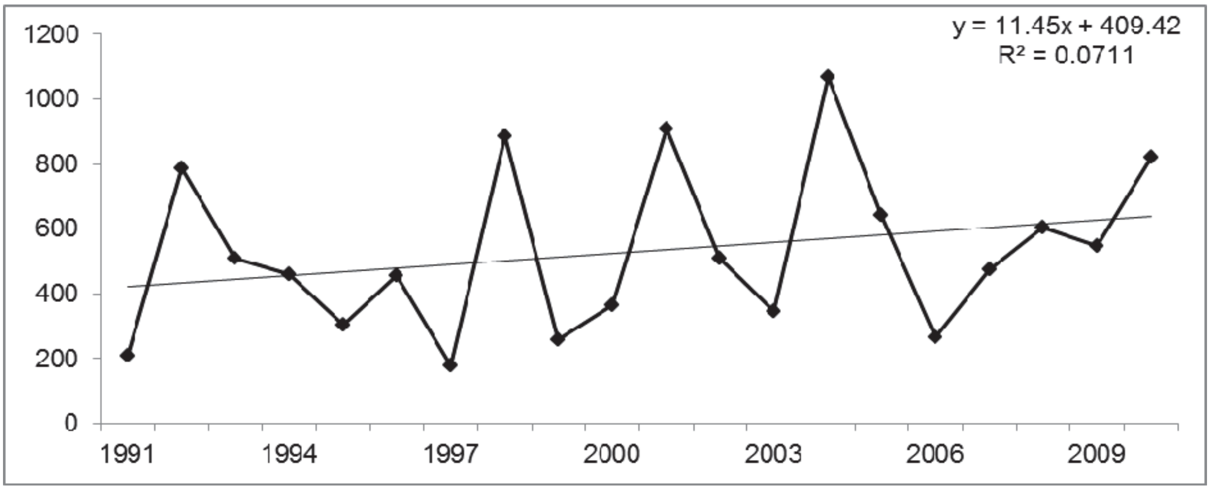


Figure 16.9 - River Teith summer rod catch 1991-2010 (salmon and grilse, retained and released).

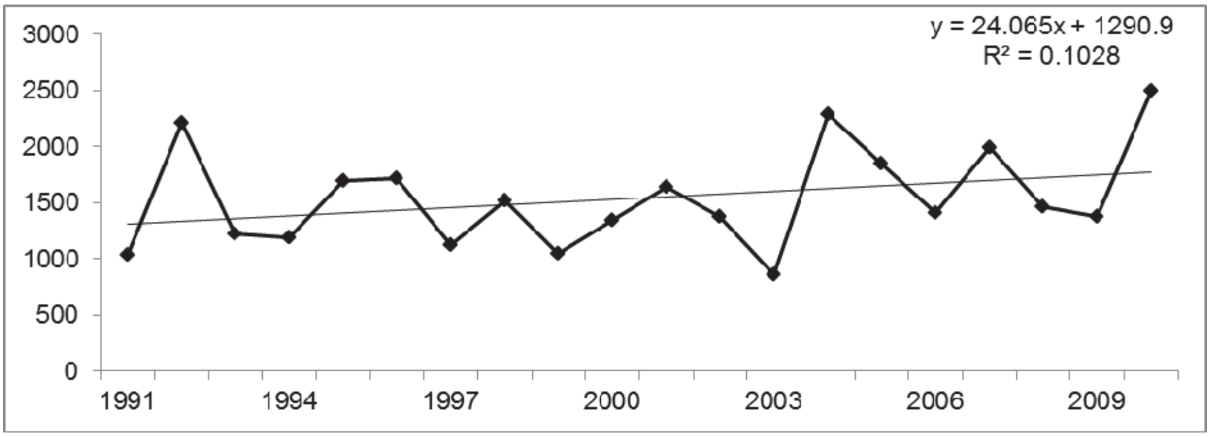


Figure 16.10 - River Teith autumn rod catch 1991-2010 (salmon and grilse, retained and released).

Table 16.11 - Summary of F-Test Results on River Teith Seasonal Rod Catch (1991-2010).

Component	Observations	F-Value	F-Significance
Spring	20	8.785	0.008
Summer	20	1.377	0.256
Autumn	20	2.063	0.168

The percentage change in the spring, summer and autumn rod catches SCM cycles against the year of designation (2001) was also undertaken. The first SCM assessment covered the period 2002-2004, whilst the second includes data extending from 2002-2010. In this review

the rod catch is averaged for each cycle period and the increase or decrease in average rod catch expressed as a percentage of the rod catch in the year of designation.

This comparison is shown graphically in Figure 16.11 and indicates that for the summer component in the Forth District there has been an decrease in average rod catch since the year of designation in each cycle. This is partly explained by recognising that the summer catch in 2001 was the second highest in the data series and so data compared against this high baseline are likely to show a decrease. Similarly, the spring rod catch has increased in each cycle when compared to the 2001 – largely due to the fact that the 2001 spring rod catch was the third lowest in the dataset. The autumn rod catch shows a small decrease since designation in cycle one and a small increase in cycle two.

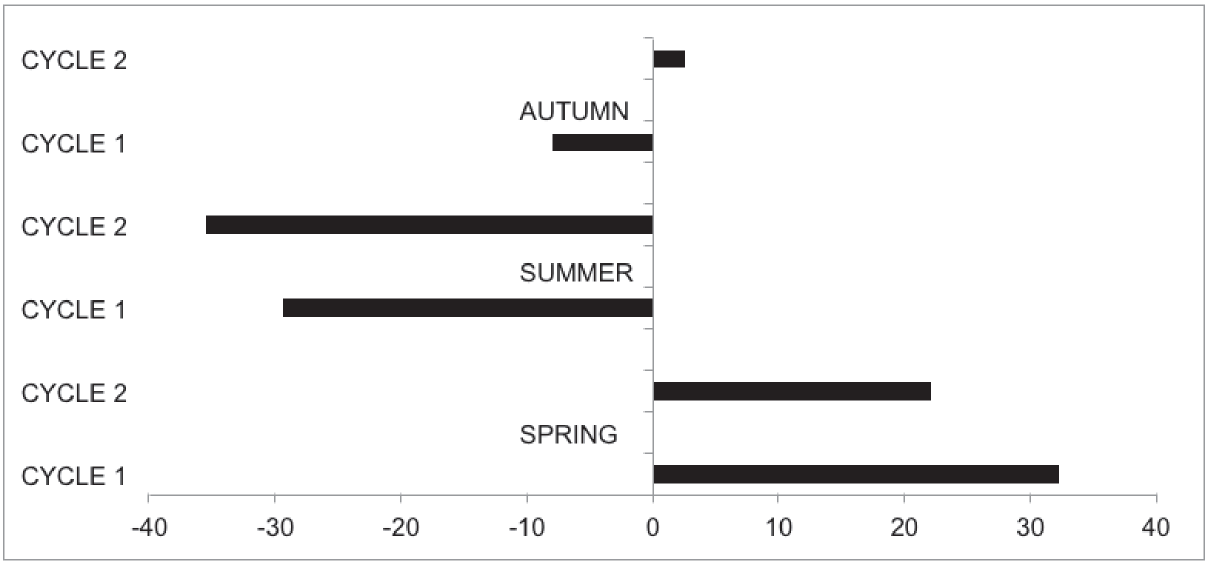


Figure 16.11 - Stock trend assessment since Forth District (for River Teith) SAC Designation (2001) in cycle 1 (2002-2004) and cycle 2 (2003-2010).

Summary

The overall rod catch for Atlantic salmon in the River Forth Fishery District, which includes the River Teith SAC, shows an increasing trend over the period 1952-2010. This increase is driven by a reported increase in summer and autumn salmon rod catches, whilst spring rod catches have declined over the long term. However, a large and unexplained increase in catch exists within these figures from around 1988 which may indicate a sudden change in the reporting of catch statistics across the District and/or a genuine change in real rod catches.

Application of the NASCO rod catch assessment tool to declared rod catches over the last 20 years (1991-2010) suggest that no reduction in exploitation is required for any of the spring, summer or autumn run-time components. When rod catch trends for each run-time component are considered individually over this period, no significant change in either the summer or autumn rod catch was evident, but a significant decrease in spring rod catch has occurred.

When average rod catch for each of the two SCM cycles is compared to those recorded in the year of designation, there is an increase in the spring rod catch in each cycle. This may be, at least in part, a function of the relatively low spring rod catch recorded in the year of designation. Similarly, there is a decline in the summer rod catch over both these cycles which may be, at least in part, a function of the relatively high catch recorded for this run-time component in the year of designation. The autumn catch shows a small increase in rod catch in cycle two and a small decrease in rod catch over cycle one.

In combination, these assessments indicate, for the Forth Fishery District as a whole, an improving total rod catch which is largely a function of strong summer and autumn catches. Although no management reduction in exploitation of any run-time component is suggested as necessary by the NASCO rod catch assessment tool there has been a statistically significant decline in the spring rod catch over the last 20 years.

c) Habitats supporting the qualifying feature

1. Water quality and quantity

The status of each water body within the SAC, for which SEPA hold data, was obtained from the SEPA River Basin Planning website.

A total of 18 WFD water bodies representing a river length of 170 km are identified as being present within the boundary of the River Teith SAC. Of these, 11 are classified as being of good ecological status or good ecological potential (total length 113 km) and are protected against deterioration from that class. The remaining seven (river length 57 km) are classified as being at moderate, poor or bad ecological status and, therefore, require improvement to bring them up to at least good status within the next RBMP. The most common causes of waterbody classification being less than good status are: morphological alterations due to forestry activities; restriction of fish passage; and flow regulation involving impoundment and abstraction. There are two Heavily Modified Waterbodies within the system and these are both at good ecological potential. Table 16.12 below summarises the number of water bodies and the length of channel within each status category.

Table 16.12 - Number of water bodies and length of channel within each WFD status category in the River Teith SAC.

WFD status (2009)	High	Good	Moderate	Poor	Bad	Total
Number of water bodies		9	2	4	1	16
Number of HMWBs		2				2
Length of channel		113	33	10	14	170

(km)

2. Trends, changes and activities

The River Forth Fisheries Trust suggest that issues relating to agriculture (including overgrazing), forestry and water management for mini hydro schemes pose the greatest threat to Atlantic salmon within the River Teith catchment. Water quality and water-based recreation are also identified as issues of concern. Measures to control of invasive non-native species is now in place within the catchment and this has contributed to a positive and improving picture.

The RFFT indicated that the main activities having a negative impact on Atlantic salmon in the River Teith SAC are:

- Agriculture;
- Water management for mini hydro schemes; and
- Forestry.

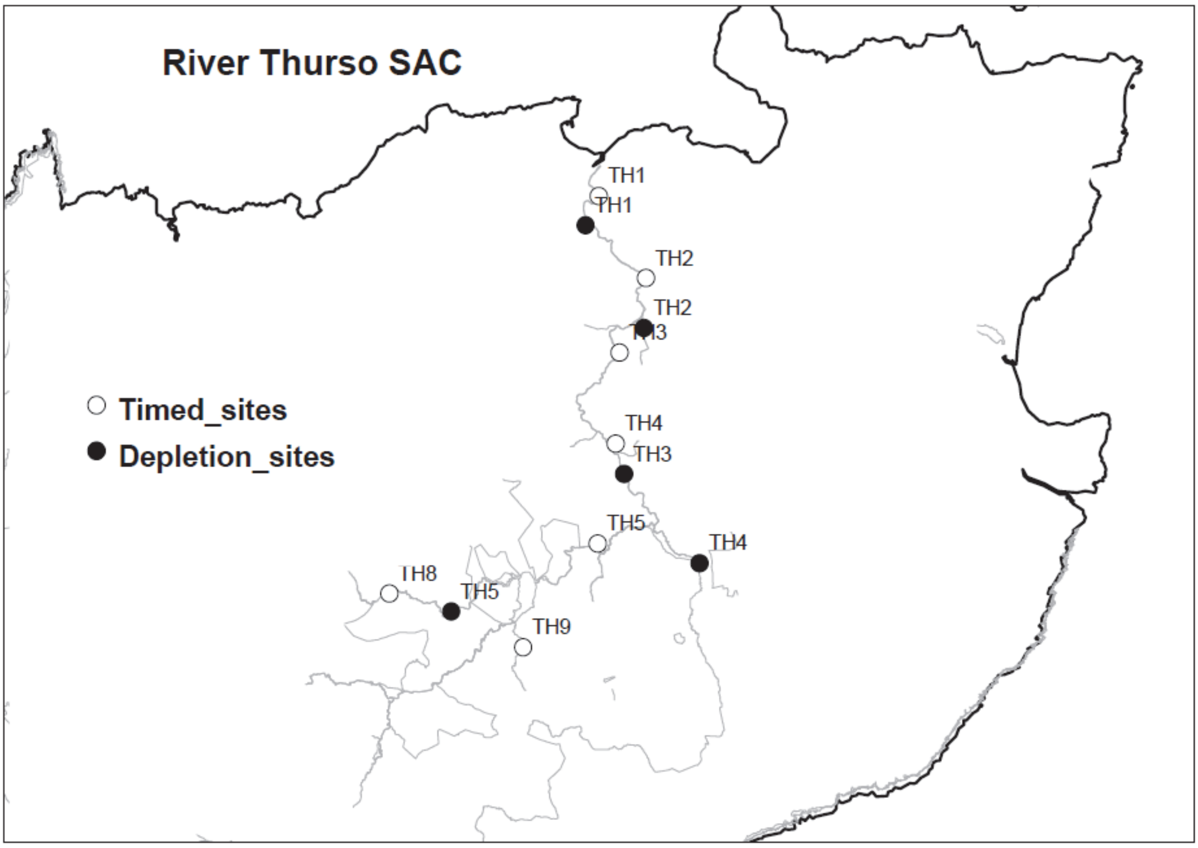
17. RIVER THURSO

a) Juvenile Assessment

Five sites were surveyed using the standard SFCC catch depletion electrofishing method. An additional seven sites were sampled using a five-minute timed electrofishing approach. All sites were situated within the River Thurso SAC (Map 17.1). The sites were surveyed by staff of the Lochaber Fisheries Trust.

At the time of survey (undertaken over period 01-04 October 2011), conditions were not ideal for effective or efficient fishing due to high water levels. It is considered that these conditions will have affected data relating to juvenile fish densities in the 2011 survey, and this will lower the confidence with which some of the conclusions can be drawn. In addition, survey sites above Loch More could not be accessed for survey in 2011 although two quantitative sites were included from this area in the 2004 survey. The absence of these sites introduces a bias towards the northern part of the catchment which may further compromise the robustness of the survey generally, and the comparisons which can be made with the 2004 work.

Map 17.1 - Distribution of depletion and timed electrofishing sites on the River Thurso SAC.



Depletion sites

Site details and a summary of electrofishing results are shown in Tables 17.1 – 17.4. Atlantic salmon were present at all five sites. Zippin and Carl & Strube estimates for fry were calculable for all sites while for 1+ fish were calculable for three sites and for 2+ fish, were calculable for two sites. Confidence limits were generally narrow. For fry, Zippin densities ranged from 6 – 137 per 100 m^2 (mean 53) and Carl & Strube densities ranged from 6 – 134 per 100 m^2 (mean 52). The highest 0+ densities were found in the Geise Burn and the lowest in the Sibster Burn. For 1+ fish, Zippin densities ranged from 4 - 9 per 100 m^2 (mean 7) and Carl & Strube densities ranged from 4 - 8 per 100 m^2 (mean 6). The highest 1+ densities were found in the Geise Burn and the lowest in the Little River. The largest 0+ and 1+ fish were found in the Sleach Water (mean 58mm and 125mm respectively).

Table 17.1 - Details of depletion electrofishing sites, River Thurso SAC.

Site code	Date	Easting	Northing	Altitude (m)	Channel name
TH4	01/10/11	317050	947050	80	Little River
TH5	03/10/11	303900	944500	130	Sleach Water
TH2	03/10/11	314100	959550	30	Sibster Burn
TH3	03/10/11	313050	951800	55	Thurso
TH1	04/10/11	311000	965000	30	Geise Burn

Table 17.2 - Details of depletion electrofishing for 0+ and 1++ salmon, River Thurso SAC.

Site code	Wetted area (m^2)	Zippin 0+	Carl & Strube 0+	Zippin 1+	Carl & Strube 1+	Zippin 2+	Carl & Strube 2+
TH4	100.9	30.8	30.7	4.0	4.0	n/a	n/a
TH5	116.0	13.3	12.9	n/a	n/a	0.0	0.0
TH2	110.7	6.4	6.3	n/a	n/a	n/a	n/a
TH3	120.0	75.5	74.1	7.0	4.2	n/a	n/a
TH1	85.7	136.9	134.3	9.3	8.2	11.1	10.5

n/a denotes salmon present, but not in high enough densities to allow calculation of Zippin or Carl & Strube statistics. 0.0 denotes no salmon found at site.

Table 17.3 Presence/absence of salmon year classes and of trout 0+ and 1++ at depletion sites, River Thurso SAC.

Site code	Salmon age class present?				Trout present?	
	0+	1+	2+	3++	0+	1++
TH4	Y	Y	N	N	N	N
TH5	Y	Y	N	N	N	N
TH2	Y	N	N	N	Y	Y
TH3	Y	Y	N	N	N	N
TH1	Y	Y	Y	N	Y	Y

Table 17.4 Fork length of salmon of different age classes, River Thurso SAC.

Site code	0+ mean fork length	No. 0+	1+ mean fork length	No. 1+	2+ mean fork length	No. 2+	3+ mean fork length	No. 3+
TH4	49	31	95	4	n/a	0	n/a	0
TH5	58	15	125	2	n/a	0	n/a	0
TH2	51	7	n/a	0	n/a	0	n/a	0
TH3	52	82	102	5	n/a	0	n/a	0
TH1	55	100	106	7	123	9	n/a	0

n/a denotes means could not be calculated as no salmon of that age class were found at the site.

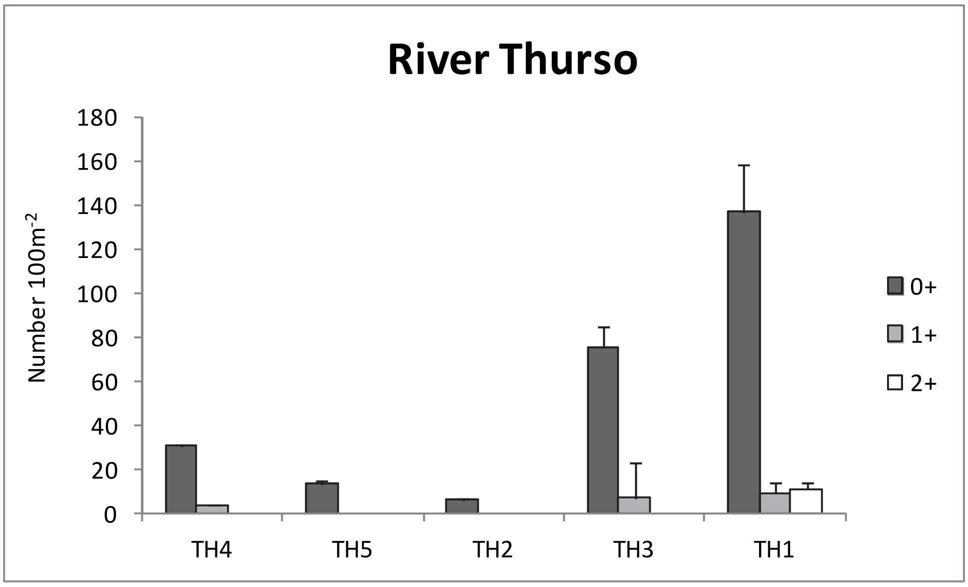


Figure 17.1 - Juvenile salmon population density estimated by the Zippin method for the monitoring sites on the River Thurso SAC.

Timed sites

Details of the seven timed sites are given in Table 17.5. 0+ fish were caught at six sites, while 1++ fish were caught at only four sites. CPUE for fry and for 1++ salmon ranged from 0–1/min (Table 17.6). Trout were caught at two of the sites.

Table 17.5 - Details of timed electrofishing sites, River Thurso SAC.

Site code	Easting	Northing	River	Altitude (m)
TH3	312800	958250	Thurso	45
TH4	312600	953400	Thurso	50
TH5	311650	948100	Thurso	100
TH1	311700	966550	Thurso	15
TH2	314200	962200	Thurso	20
TH9	307700	942600	Allt Backlass	140
TH8	300600	945450	Sleach Water	150

Table 17.6 - Salmon catch per unit effort (CPUE), River Thurso SAC.

Site code	Survey date	Salmon 0+/min	Salmon 1++/min
TH3	01/10/11	1.9	0.2
TH4	02/10/11	0.0	0.0
TH5	02/10/11	2.4	0.3
TH1	02/10/11	1.13	1.0
TH2	02/10/11	0.1	0.6
TH9	02/10/11	0.7	0.0
TH8	03/10/11	1.2	0.0

Table 17.7 - Presence/absence of salmon year classes and of trout at timed sites, River Thurso SAC.

Site code	Salmon age class present?				Trout present?
	0+	1+	2+	3+	
TH3	Y	Y	N	N	Y
TH4	N	N	N	N	N
TH5	Y	Y	Y	N	N
TH1	Y	Y	Y	N	N
TH2	Y	Y	Y	N	N
TH9	Y	N	N	N	N
TH8	Y	N	N	N	Y

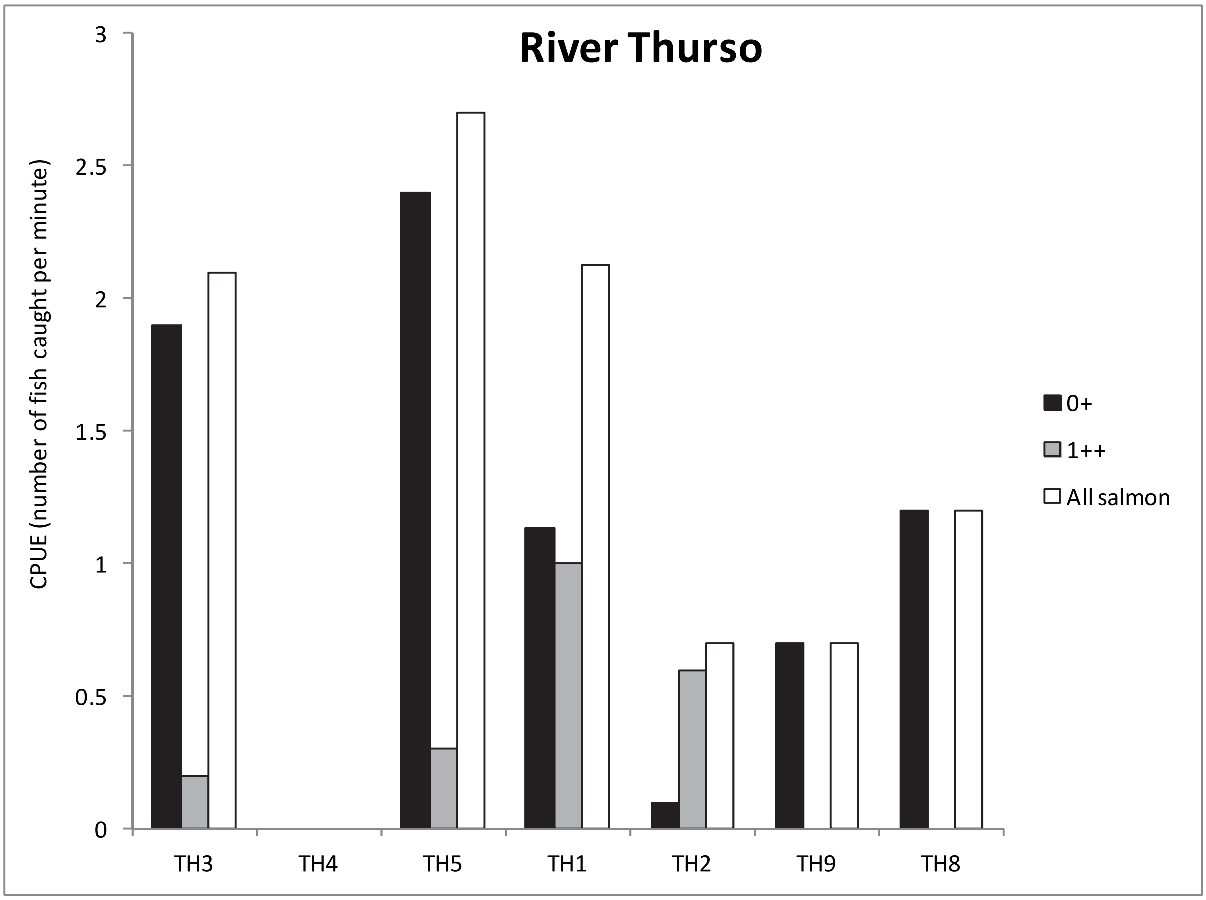


Figure 17.2 - Number of salmon (0+, 1++ and all salmon) caught per minute during five minutes of electrofishing at sites on the River Thurso.

Summary

When the densities of 0+ and 1++ juveniles are considered against the regional juvenile densities developed by Godfrey (2005) the River Thurso has sites in the lowest and top quintiles (Table 17.8). This indicates a high variability in juvenile fish densities across the catchment which, for both fry and parr, may reflect local differences in productivity and recruitment. These differences may be associated with natural production limits associated with, for example, habitat quality or nutrient levels, the number of spawning adults reaching survey locations or the impact of external pressures which limit natural production or juvenile survival. Assessed separately, it is suggested that fry are in favourable status, while parr are considered to be in unfavourable status. It is suggested, therefore, that overall assessment, based upon the sites surveyed, is that juvenile populations are in unfavourable status within the SAC. However, it is known that flow conditions at the time of survey were not optimal and it is considered that fishing efficiency was not high. This may have reduced the capture rates of fish in the surveys and contributed to the suggested 'unfavourable' parr status.

Table 17.8 – Number of sites within the River Thurso SAC falling within each quintile (according to absolute regional classification for 0+ and 1++ age classes) – and the resulting condition status.

SAC	Age class	Number of sites					Median grade	Favourable condition?
		0-20	21-40	41-60	61-80	81-100		
		E	D	C	B	A		
Thurso	0+		1	1		3	A	Y
	1++	2	1	1		1	D	N

The variability in juvenile densities obtained during these surveys might suggest that, within the River Thurso catchment, there are areas of higher and lower production and areas where local management problems and issues exist which require active management to resolve. However, given the sub-optimal sampling conditions experienced during the survey any such conclusion may not be fully justified. Future assessments in the River Thurso should prioritise the need to complete all scheduled survey sites, during optimal conditions, in order to provide robust data from throughout the catchment.

Whilst the juvenile survey shows that the status of the River Thurso has deteriorated in 2011 when compared to the previous assessment (Table 17.9), the mean salmon fry and parr densities recorded in 2011 at the SAC monitoring sites were considerably lower than those recorded in 2004. While both fry and parr densities were lower than in 2004, only the parr densities were low enough to reduce the condition status of the SAC for the juvenile component of the survey. However, once again, the sub optimal sampling conditions in 2011 should be borne in mind as these are likely to have contributed to the reduced densities captured in that year when compared to 2004.

Table 17.9 - Comparison of condition status in 2004 and in 2011 for 0+ and 1++ age classes.

SAC		2004	2011	Change
Thurso	0+	Y	Y	=
	1++	Y	N	-

b) Adult Assessment

Data for adult Atlantic salmon rod catch within the River Thurso were analysed using the NASCO Rod Catch Assessment tool introduced and described in Section 1. This analysis considers exploitation of the seasonal components (spring, summer and autumn) suggests whether management is required. Trends in long-term rod catch data from Marine Scotland Science (1952-present) for the overall catch and the same seasonal run-time components are also interrogated.

Summary of 1952 Catch Statistics

Rod catch statistics for the River Thurso, covering the period 1952-2010, for the total catch and each of the seasonal run time components are shown in Figures 17.3, 17.4, 17.5 and 17.6.

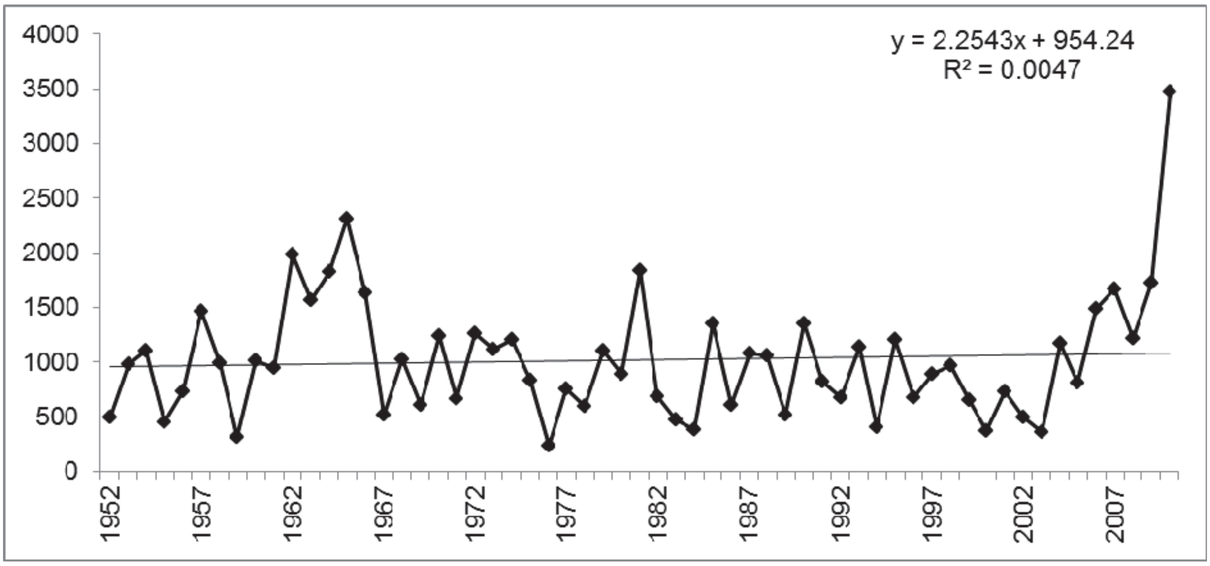


Figure 17.3 – River Thurso total rod catch 1952-2010 (salmon and grilse, retained and released).

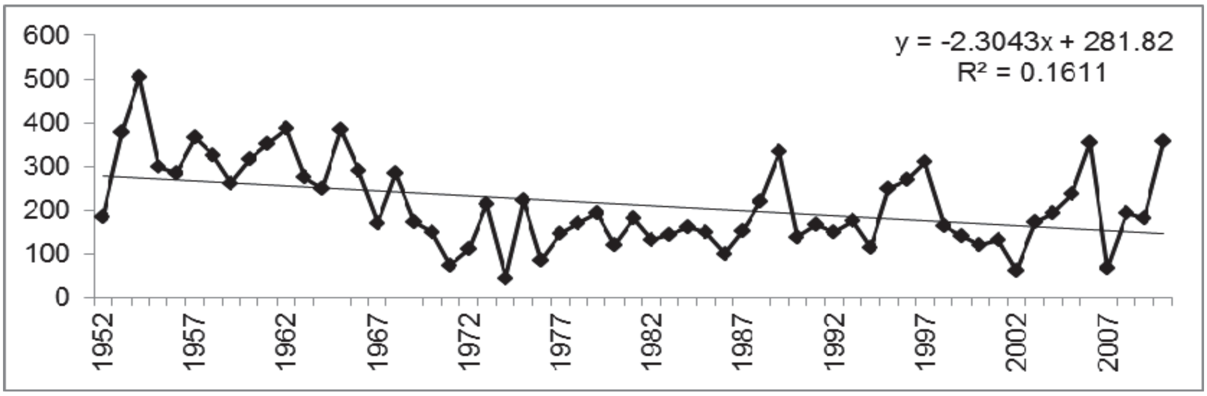


Figure 17.4 – River Thurso total spring rod catch 1952-2010 (salmon and grilse, retained and released).

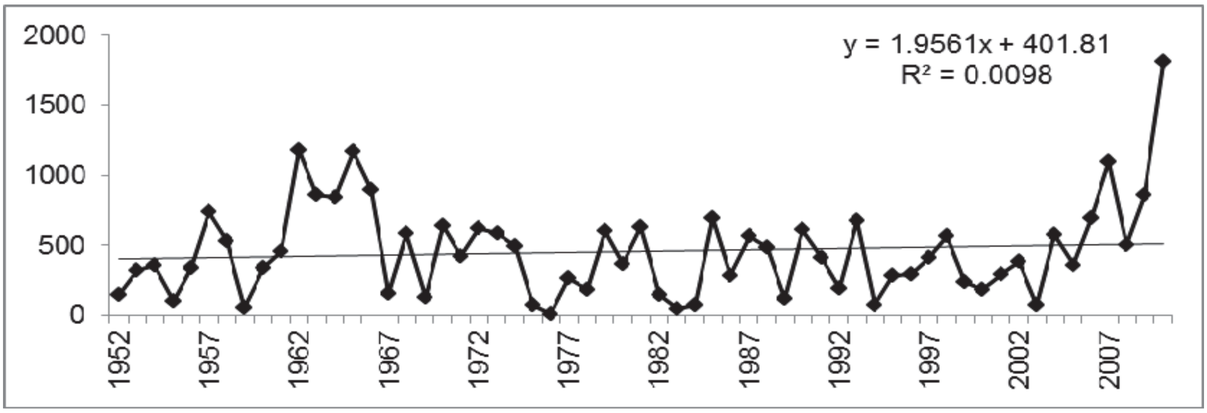


Figure 17.5 River Thurso total summer rod catch 1952-2010 (salmon and grilse, retained and released).

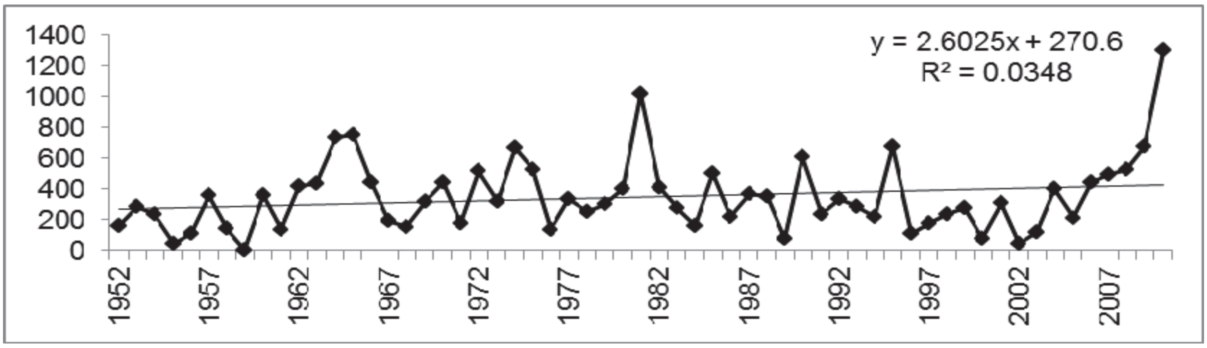


Figure 17.6 – River Thurso total autumn rod catch 1952-2010 (salmon and grilse, retained and released).

The total rod catch for Atlantic salmon in the River Thurso (Figure 17.3) shows a relatively stable trend over the period 1952-2010. Periods of high rod catch occurred in the mid-1960's and from 2006-2010. The 2010 rod catch (3500 fish) is the highest on record and is around 1000 fish greater than the previous high catch and two-three times greater than those typically declared. The spring rod catch (Figure 17.4) was highest in the early catch records and remained high until the mid-1960's. The lowest spring rod catches were recorded through the 1970's and, following a relatively stable catch period in the 1980s, has been more variable during the 1990's and 2000's. Particularly strong spring rod catches were declared in 2010 and 2006. A notably low return was declared in 2007. Summer rod catches (Figure 17.5) have been relatively stable over the long-term time series, with high rod catches occurring in the mid-1960's, 2007, 2009 and 2010. Autumn rod catch (Figure 17.6) is also relatively stable over long-term dataset, with high rod catches occurring in the mid-1960's, 1981 and 2010.

The reporting of rod catch over the period appears to have been consistent and representative. There is no evidence that any of the rod catch trends summarised may be attributable to a change in reporting accuracy or inconsistency.

A voluntary catch and release scheme has been in operation within the catchment for a number of years. This scheme requests the return of all early running spring fish, and the release of all hen fish caught after 1st August. It is understood that a new catch and release conservation policy is in preparation for use in the 2013 season which will require total catch and release of all fish up to June 15th, and limit the number of fish which can be retained by anglers from June 15th to two fish per week until the end of the season.

Up until 2005 a commercial net and coble fishery operated in the river. This fishery was not active before the middle of June in any year, to conserve spring fish, and ceased to operate completely from 2005.

Application of Rod Catch Assessment Tool

Rod catches from the River Thurso over the last 20 years (1991-2010) were applied to the NASCO rod catch assessment tool to assess whether exploitation of each run time component requires management action.

The results of these tests for the River Thurso rod catch are shown in Table 17.10, and the data used to complete these tests is available in Appendix 1. The output of these analyses suggest that no reduction in exploitation is currently required for any of the run-time components.

Table 17.10 - Summary of the Rod Catch Assessment Tool tests for River Thurso.

Test	Spring	Summer	Autumn
A	No	No	No
B	No	No	No
C	No	No	No

Rod catches for the 20 year period used in this analysis (1991-2010) are shown in Figures 17.7, 17.8, 17.9 and 17.10 for the total rod catch and for each seasonal run time components. An F-test was applied to each of the seasonal components to assess the significance of each trend, and the results of these are summarised in Table 17.11. These indicate that there is a significant increase (at the 95% confidence level) in summer and autumn rod catch, but there is no significant change in spring rod catch.

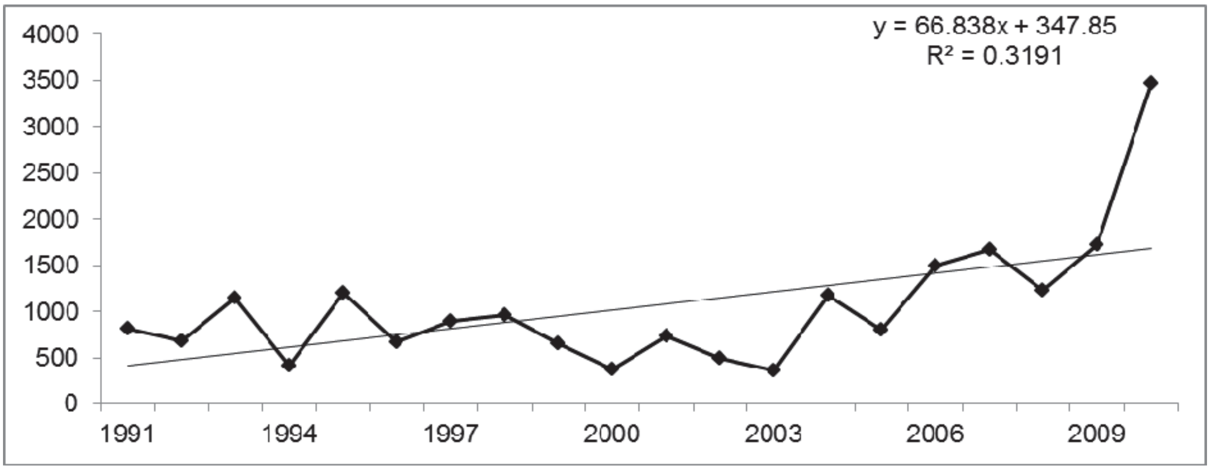


Figure 17.7 - River Thurso total rod catch 1991-2010 (salmon and grilse, retained and released).

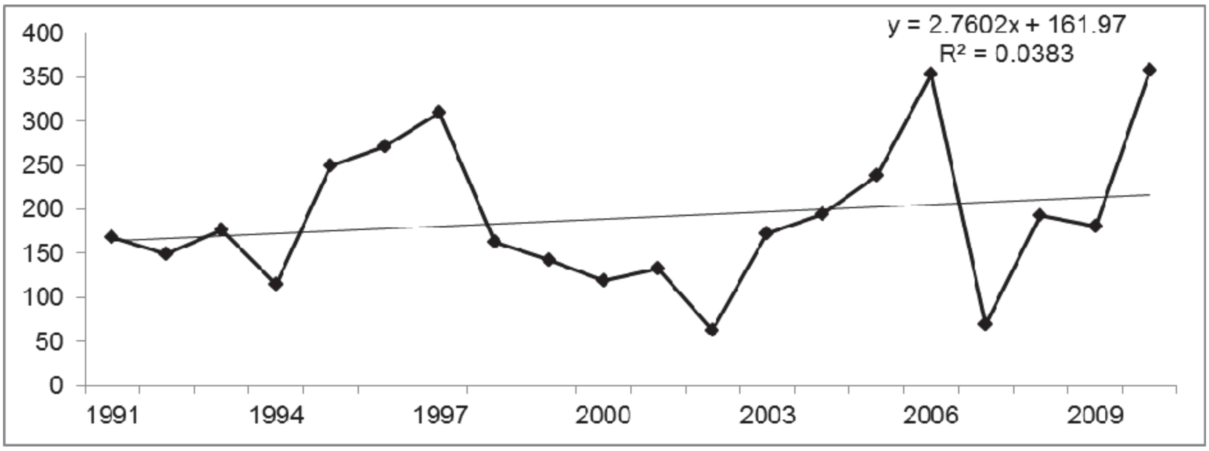


Figure 17.8 - River Thurso spring rod catch 1991-2010 (salmon and grilse, retained and released).

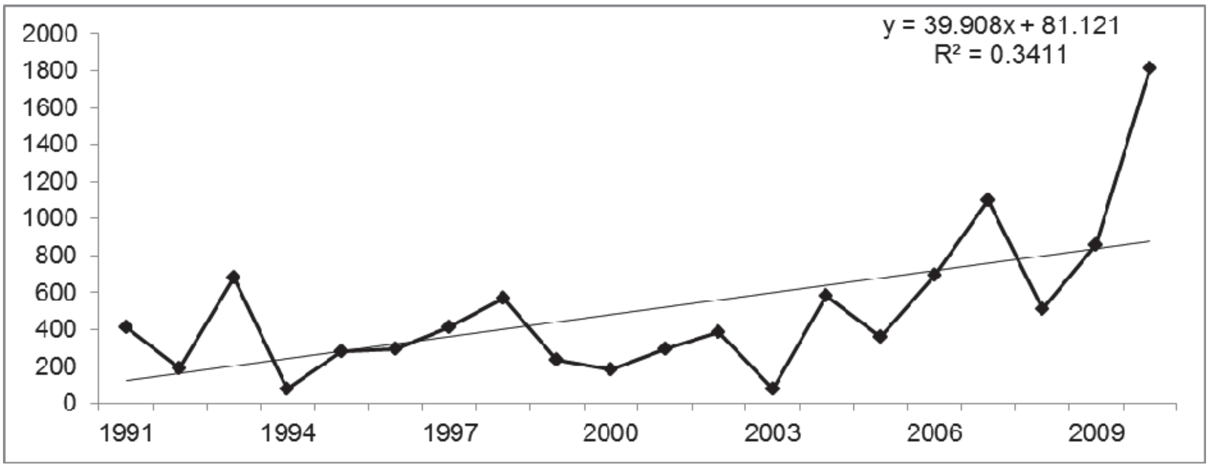


Figure 17.9 - River Thurso summer rod catch 1991-2010 (salmon and grilse, retained and released).

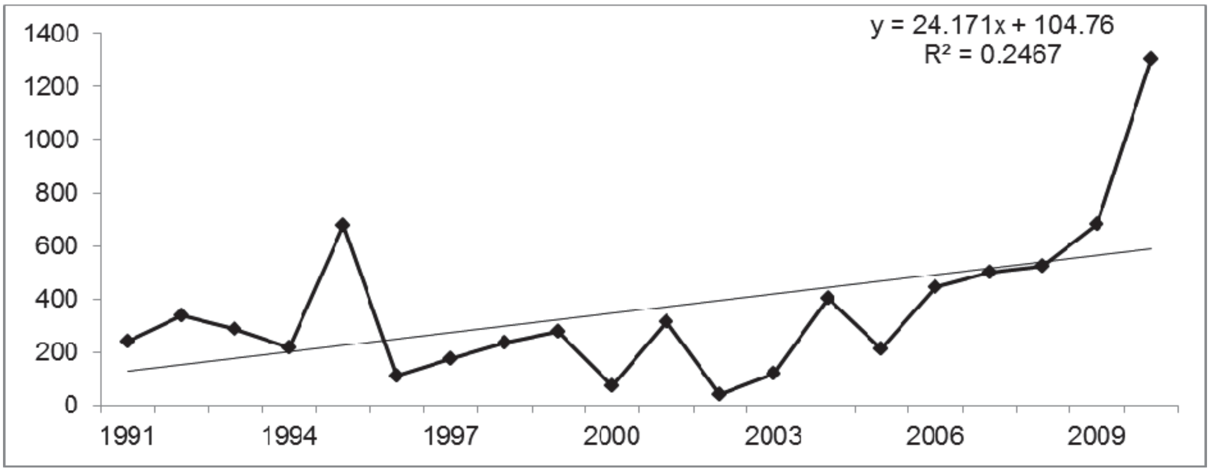


Figure 17.10 - River Thurso autumn rod catch 1991-2010 (salmon and grilse, retained and released).

Table 17.11 - Summary of F-Test Results on River Thurso Seasonal Rod Catch (1991-2010).

Observations	Component	F-Value	F-Significance
20	Spring	0.717	0.408
20	Summer	9.316	0.007
20	Autumn	5.896	0.026

The percentage change in the spring, summer and autumn rod catches SCM cycles against the year of designation (2001) was also undertaken. The first SCM assessment covered the period 2002-2004, whilst the second includes data extending from 2002-2010. In this review

the rod catch is averaged for each cycle period and the increase or decrease in average rod catch expressed as a percentage of the rod catch in the year of designation.

This comparison is shown graphically in Figure 17.11, and indicates that for each of the spring, summer and autumn run time components (but particularly the summer component), the average catch in cycle two is greater than that recorded in 2001. In cycle two, the spring (seven occasions), summer (eight occasions) and autumn (six occasions) catches in the period 2002-2010 are greater than those recorded in 2001. Rod rod catches from the River Thurso have been, generally, increasing since designation. For the spring and summer run time components, the 2007 and 2010 catches were particularly strong. The poor performance of autumn rod catch in cycle one, which was less than that recorded in 2001, was due largely to the particularly low rod catches in 2002 and 2003.

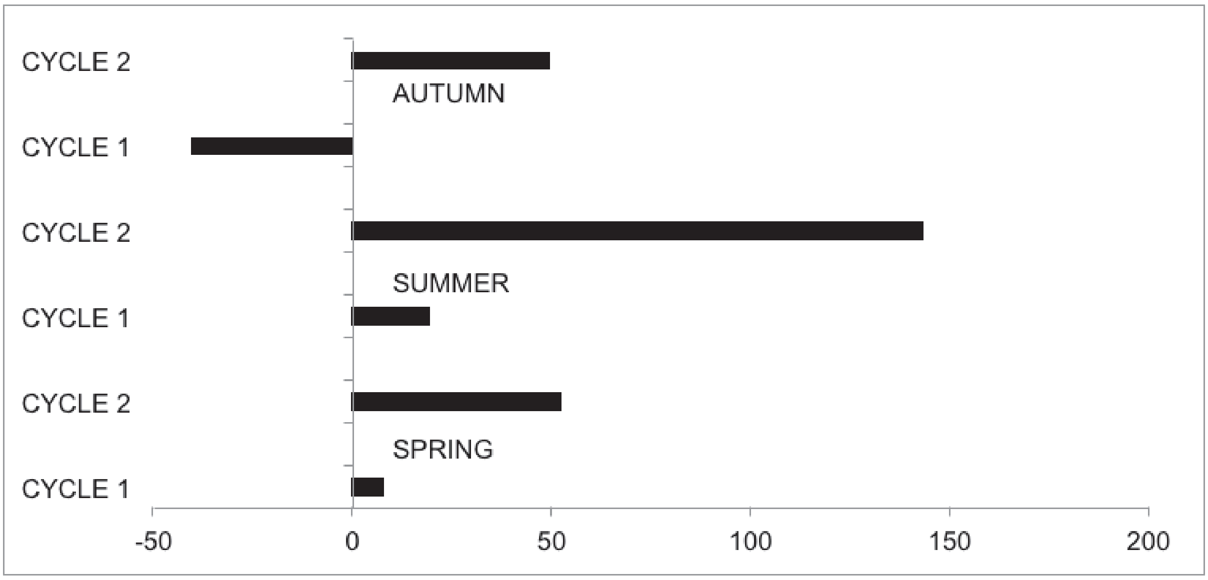


Figure 17.11 - Stock trend assessment since River Thurso SAC Designation (2001) in cycle 1 (2002-2004) and cycle 2 (2002-2010).

Summary

The overall catch for Atlantic salmon in the River Thurso SAC over the period 1952-2010 has been fairly stable over the data series. Periods of high total rod catch occurred in the mid-1960's and 2006-2010. This pattern is generally reflected in the summer and autumn rod catch components, whilst the spring catch has shown a general decline over the long-term dataset.

Application of the NASCO rod catch assessment tool to declared rod catches over the last 20 years (1991-2010) suggest that no reduction in exploitation is required for any of the spring, summer or autumn run-time components. Application of the rod catch data to F-tests suggest that there are significant positive trend increases in both the summer and autumn catches, but no change in the spring component.

The average catch for each of the two SCM cycles are compared to those recorded in the year of designation. In cycle one there were increases in both the spring and summer rod catches but a reduction in the autumn catch since designation. The reduction in autumn catch was largely attributable to poor rod catches in 2002 and 2003. When the average catch over cycle 2 (2002-2010) is compared to that in 2001, all run time components show an increase from that declared in the year of designation. The majority of catches for each run time component exceed that declared in 2001. The summer rod catch in cycle two shows the strongest increase, and this is largely a result of the record catches in 2010 and strong returns in 2007 and 2009.

In combination these assessments indicate, for the River Thurso, the catches over the 1952-2010 period are relatively stable, there is no indication of a need for further conservation measures or investigations to any of the spring, summer or autumn run components as a result of application of the rod catch assessment tool to these catches over the period 1991-2010 and that the average catches since designation in 2001 are increasing.

c) Habitats supporting the qualifying feature

1. Water quality and quantity

The status of each water body within the SAC for which SEPA hold data was obtained from the SEPA River Basin Planning interactive website

A total of 12 WFD water bodies representing a river length of 178 km are identified as being present within the River Thurso SAC. Of these, nine are classified as being at good or high ecological status (total length 143.77 km) and this status is protected from deterioration from that class. Two water bodies (river length 29.95 km) are classified as being at moderate ecological status and therefore measures to be put into place to bring them up to at least good status within the RBMP. The reasons given waterbodies being at moderate status are: diffuse pollution from forestry and renewable energy generation; and morphological alterations.

One of the 12 water bodies within the River Thurso SAC is a heavily modified (HMWB). This is considered to be at poor ecological potential due to issues relating to flow regulation from an upstream loch, as well as morphological alterations (i.e. channel straightening and realignment). Table 17.12 below summarises the number of water bodies and the length of channel within each status category.

Table 17.12 - Number of water bodies and length of channel within each WFD status category in the River Thurso SAC.

WFD status (2009)	High	Good	Moderate	Poor	Bad	Total
Number of water bodies		9	2			11
Number of HMWBs				1		1
Length of channel (km)		143.77	29.95	4.59		178.31

2. Trends, changes and activities

Local fishery managers within the River Thurso SAC identify no major or emerging negative pressures within the site. Historic drainage and nutrient issues associated with old forestry planting in the upper catchment are no longer considered to be problematic.

Positive trends relate to measures developed to improve fisheries management. This includes the voluntary application of a catch and release policy on the river. This will be formalised in season 2013, and will require the return of all fish to June 15th and limit anglers to a maximum of two retained fish a week thereafter.

In addition, improving agricultural practice in the catchment is advised which is sensitive to the requirements of the river and the salmon stocks within it.

The main activities having a negative impact on salmon in the River Thurso SAC:

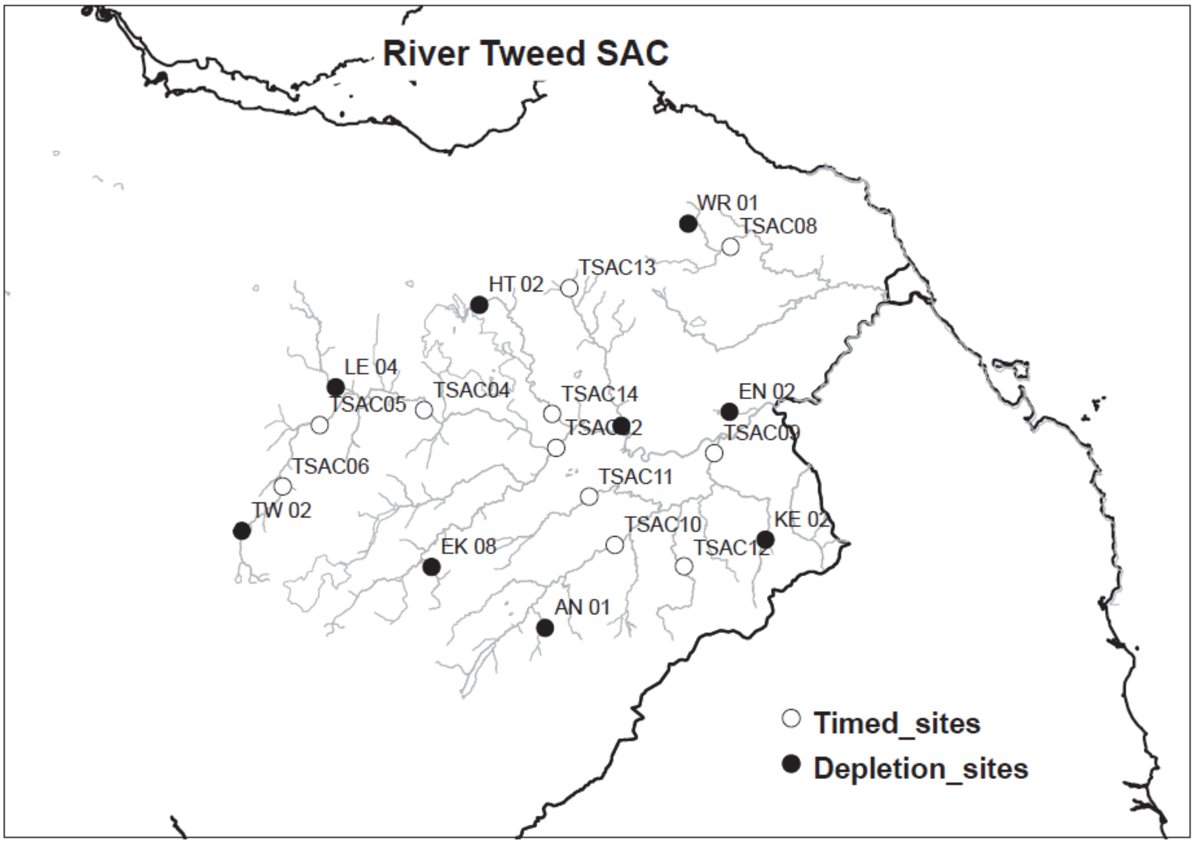
1. None advised by local managers, although diffuse pollution and morphological alterations are the most significant current pressures according to WFD classification.

18. RIVER TWEED

a) Juvenile Assessment

Nine sites were surveyed using the standard SFCC catch depletion electrofishing method. An additional 11 sites were sampled using a five-minute timed electrofishing approach. All sites were situated within the River Tweed SAC (Map 18.1). The sites were surveyed by staff of the Tweed Foundation.

Map 18.1 - Distribution of depletion and timed electrofishing sites on the River Tweed SAC



Depletion sites

Site details and a summary of electrofishing results are shown in Tables 18.1 – 18.4. All nine depletion sites had 0+ and 1+ salmon present, but 2+ salmon were only recorded at one site. Zippin and Carl & Strube estimates for fry and 1+ fish were calculable for all nine sites, and confidence limits were generally narrow. For fry, Zippin densities ranged from 51 – 291 per 100 m^2 (mean 154) and Carl & Strube densities ranged from 49 – 290 per 100 m^2 (mean 152). The highest 0+ densities were found in the Kale Water and the lowest in the Lyne Water. For 1+ fish, Zippin densities ranged from 9 – 47 per 100 m^2 (mean 26) and Carl & Strube densities ranged from 9 – 46 per 100 m^2 (mean 25). The highest 1+ densities were found in the Lyne Water and the lowest in the Rankle Burn. 2+ salmon were only found in the Whiteadder Water, but were not found in high enough numbers to allow density estimates to be calculated. The largest 0+ and 1+ fish were found in the Leader Water (mean 63 mm) and the Allan Water (120 mm) respectively.

Table 18.1 - Details of depletion electrofishing sites, River Tweed SAC.

Site code	Date	Easting	Northing	Altitude (m)	Channel name
WR 01	02/08/11	367095	663254	214	Whiteadder Water
EN 02	05/08/11	372800	637300	40	Eden Water
LE 04	23/08/11	318568	640701	180	Lyne Water
TW 02	23/08/11	305671	620883	280	Tweed
AN 01	31/08/11	347450	607500	170	Allan Water
KE 02	31/08/11	377715	619685	130	Kale Water
LR 05G	05/09/11	357900	635400	80	Leader Water
HT 02	07/09/11	338323	652073	260	Heriot Water
EK 08	29/09/11	331786	615876	320	Rankle Burn

Table 18.2 - Details of depletion electrofishing for 0+ and 1++ salmon, River Tweed SAC.

Site code	Wetted area (m^2)	Zippin 0+	Carl & Strube 0+	Zippin 1+	Carl & Strube 1+	Zippin 2+	Carl & Strube 2+
WR 01	109.2	91.4	88.8	36.8	35.7	n/a	n/a
EN 02	99.7	124.0	122.4	40.0	38.1	0.0	0.0
LE 04	110.1	51.5	48.7	46.6	46.3	0.0	0.0
TW 02	114.3	153.5	152.2	13.7	13.1	0.0	0.0
AN 01	85.5	85.2	84.2	11.9	10.5	0.0	0.0
KE 02	145.0	291.3	290.4	28.2	27.6	0.0	0.0
LR 05G	161.2	172.6	171.9	21.7	21.1	0.0	0.0
HT 02	194.4	257.0	256.2	20.9	20.1	0.0	0.0
EK 08	132.0	155.5	154.6	9.3	9.1	0.0	0.0

n/a denotes salmon present, but not in high enough densities to allow calculation of Zippin or Carl & Strube statistics. 0 denotes no salmon found at site.

Table 18.3 - Presence/absence of salmon year classes and of trout 0+ and 1++ at depletion sites, River Tweed SAC.

Site code	Salmon age class present?				Trout present?	
	0+	1+	2+	3++	0+	1++
WR 01	Y	Y	Y	N	N	N
EN 02	Y	Y	N	N	Y	Y
LE 04	Y	Y	N	N	N	Y
TW 02	Y	Y	N	N	Y	Y
AN 01	Y	Y	N	N	Y	N
KE 02	Y	Y	N	N	Y	Y
LR 05G	Y	Y	N	N	Y	N
HT 02	Y	Y	N	N	Y	Y
EK 08	Y	Y	N	N	Y	Y

Table 18.4 - Fork length of salmon of different age classes, River Tweed SAC.

Site code	0+ mean fork length	No. 0+	1+ mean fork length	No. 1+	2+ mean fork length	No. 2+	3+ mean fork length	No. 3+
WR 01	54	87	104	39	145	1	n/a	0
EN 02	54	114	111	36	n/a	0	n/a	0
LE 04	45	51	86	58	n/a	0	n/a	0
TW 02	52	158	96	15	n/a	0	n/a	0
AN 01	60	71	120	9	n/a	0	n/a	0
KE 02	59	405	118	38	n/a	0	n/a	0
LR 05G	63	271	115	34	n/a	0	n/a	0
HT 02	53	471	110	36	n/a	0	n/a	0
EK 08	59	193	104	12	n/a	0	n/a	0

n/a denotes means could not be calculated as no salmon of that age class were found at the site.

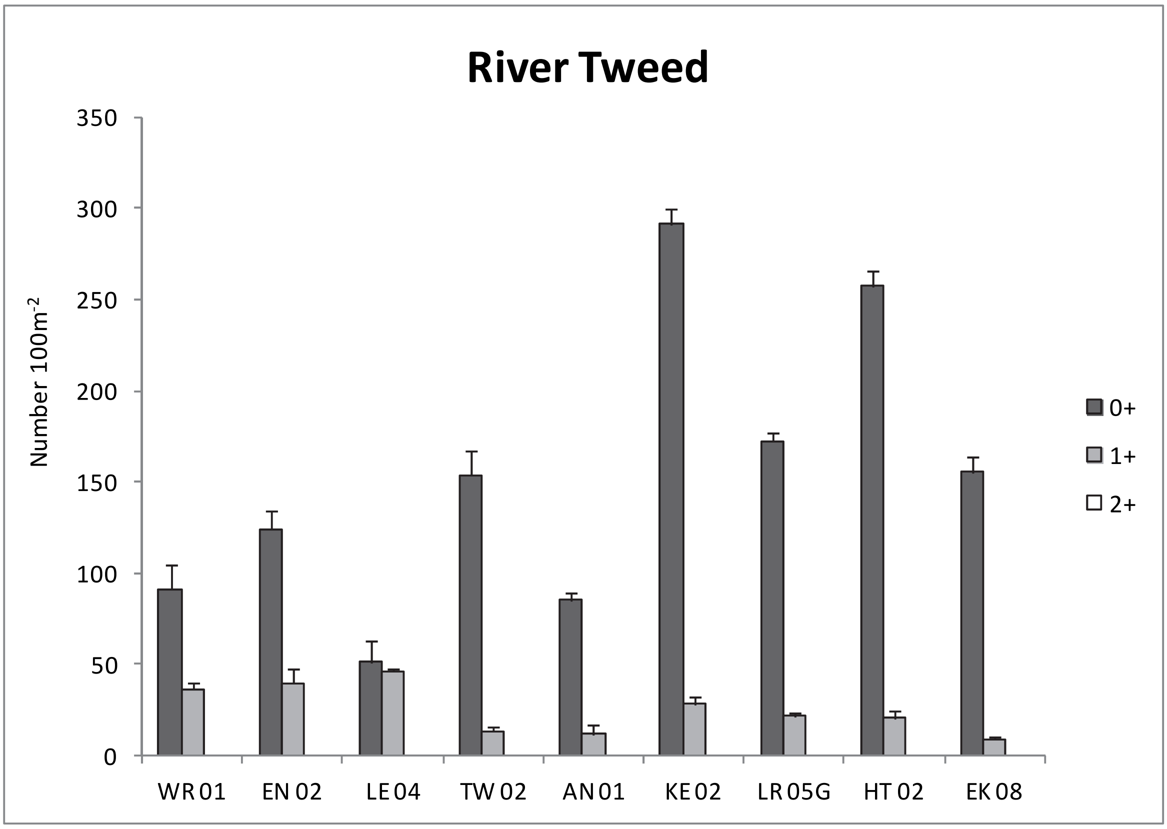


Figure 18.1 - Juvenile salmon population density estimated by the Zippin method for the SAC monitoring sites on the River Tweed SAC.

Timed sites

Details of the 11 timed sites are given in Table 18.5. 0+ fish were caught at all of the timed sites, while 1++ fish were only caught at seven sites. CPUE for fry ranged from 2–24/min, and for 1+ fish ranged from 0–3/min (Table 18.6). No salmon older than 1+ were caught at any of the timed sites. Trout were caught at eight of the sites.

Table 18.5 - Details of timed electrofishing sites, River Tweed SAC.

Site code	Easting	Northing	River	Altitude (m)
TSAC09	370684	631587	Teviot Water	45
TSAC11	353483	625593	Ale Water	135
TSAC02	348910	632330	Tweed	110
TSAC04	330739	637579	Tweed	145
TSAC12	366513	616006	Jed Water	100
TSAC14	349705	6635114	Gala Water	109
TSAC08	372930	660062	Whiteadder	165
TSAC10	357022	618937	Teviot Water	80
TSAC13	350760	654360	Kelphope Burn	225
TSAC05	316390	635480	Tweed	180
TSAC06	311260	627000	Tweed	220

Table 18.6 - Salmon catch per unit effort (CPUE), River Tweed SAC.

Site code	Survey date	Salmon 0+/min	Salmon 1++/min
TSAC09	26/08/11	10.4	0.0
TSAC11	29/08/11	3.0	0.0
TSAC02	30/08/11	12.4	0.2
TSAC04	30/08/11	23.8	0.4
TSAC12	31/08/11	1.6	1.4
TSAC14	07/09/11	3.4	0.2
TSAC08	12/09/11	9.6	3.0
TSAC10	30/09/11	8.6	1.4
TSAC13	05/08/11	14	0.0
TSAC05	24/08/11	7.0	0.0
TSAC06	24/08/11	2.6	0.6

Table 18.7 - Presence/absence of salmon year classes and of trout at timed sites, River Tweed SAC.

Site code	Salmon age class present?				Trout present?
	0+	1+	2+	3+	
TSAC09	Y	N	N	N	N
TSAC11	Y	N	N	N	Y
TSAC02	Y	Y	N	N	Y
TSAC04	Y	Y	N	N	Y
TSAC12	Y	Y	N	N	Y
TSAC14	Y	Y	N	N	N
TSAC08	Y	Y	N	N	Y
TSAC10	Y	Y	N	N	Y
TSAC13	Y	N	N	N	Y
TSAC05	Y	N	N	N	N
TSAC06	Y	Y	N	N	Y

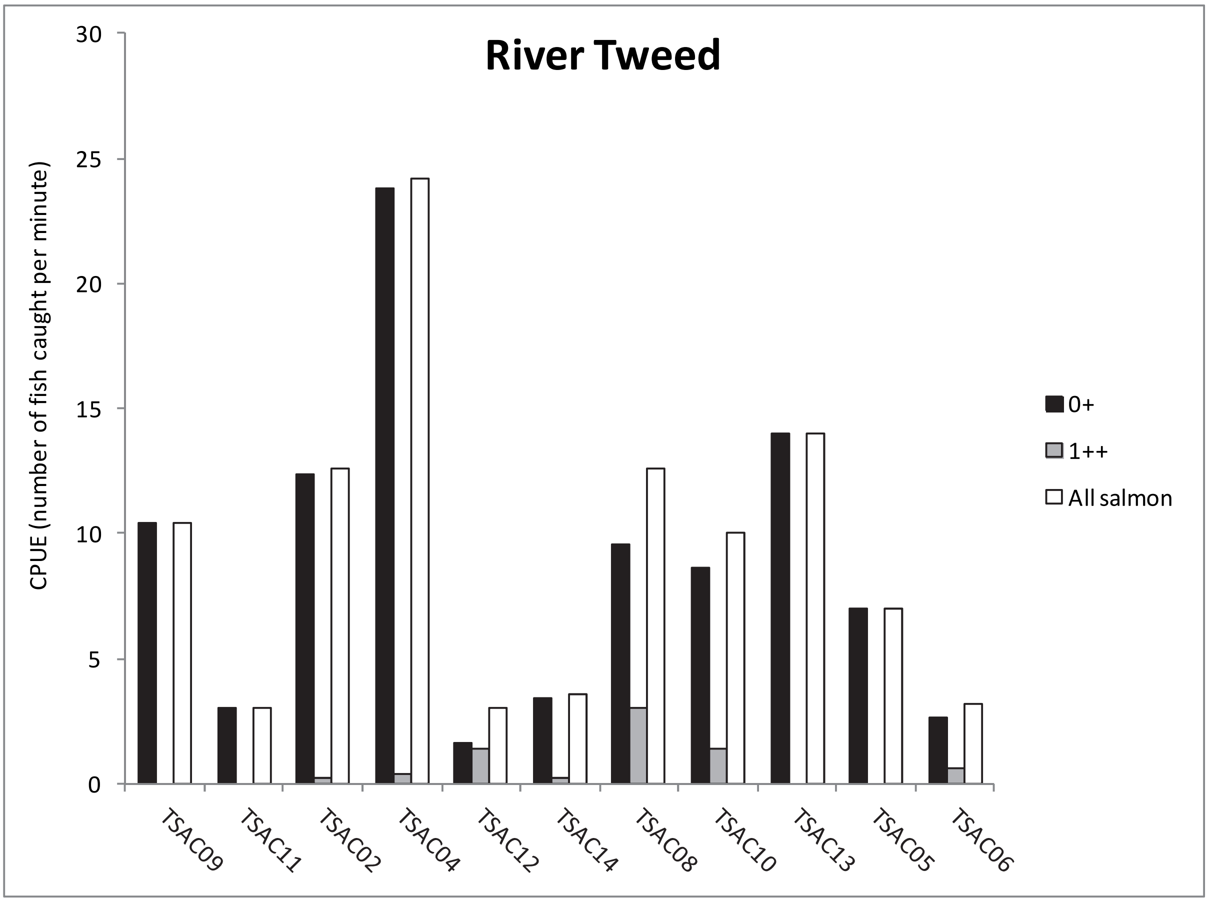


Figure 18.2 - Number of salmon (0+, 1++ and all salmon) caught per minute during five minutes of electrofishing at sites on the River Tweed.

It should be noted that any consideration of juvenile salmon abundances on the Tweed should recognise that S1 smolts are a significant and increasing feature of the population. This is shown by the scale reading of adult fish undertaken by the Tweed Foundation, and means that many juveniles must leave the river in April and May before juvenile electro-fishing commences in July and that 1++ parr numbers will be reduced as a result of this S1 smolt migration. This trend will not be evenly distributed throughout the catchment, but will be more pronounced in more lowland, warmer, parts and less so in colder, upland, areas. Parr abundances cannot therefore be taken as a way of accurately comparing juvenile populations between different parts of the catchment, used as a robust index of populations over time without qualification. or to make comparisons with other rivers where S1 smolts are absent or rare.

Summary

When the densities of 0+ and 1++ juvenile Atlantic salmon are considered in relation to regional juvenile densities developed by Godfrey (2005), fish densities within the River Tweed are concentrated in the upper quintile bands for both fry and parr (Table 18.8). This indicates consistently high juvenile fish densities across the catchment. The high densities could be the result of good habitat quality, a high number of spawning adults reaching survey locations or the absence of external pressures which limit natural production or juvenile survival. Assessed separately, it is suggested that juvenile populations are in favourable status within the SAC.

Table 18.8 – Number of sites within the River Tweed SAC falling within each quintile (according to absolute regional classification for 0+ and 1++ age classes) – and the resulting condition status.

SAC	Age class	Number of sites					Median grade	Favourable condition?
		0-20	21-40	41-60	61-80	81-100		
		E	D	C	B	A		
Tweed	0+				3	6	A	Y
	1++			1	2	6	A	Y

A comparison of juvenile data from cycle 1 and cycle 2 indicate that the status of the River Tweed is the same in 2011 compared to the previous assessment (Table 18.9). Both fry and parr were in favourable condition in 2004 and it is suggested that the same applies in 2011 for the River Tweed SAC.

Table 18.9 - Comparison of condition status in 2004 and in 2011 for 0+ and 1++ age classes.

SAC		2004	2011	Change
Tweed	0+	Y	Y	=
	1++	Y	Y	=

b) Adult Assessment

Data for adult Atlantic salmon rod catch within the River Spey were analysed using the NASCO Rod Catch Assessment tool introduced and described in Section 1. This analysis considers exploitation of the seasonal components (spring, summer and autumn) suggests whether management is required. Trends in long-term rod catch data from Marine Scotland Science (1952-present) for the overall catch and the same seasonal run-time components are also interrogated.

Summary of 1952 Catch Statistics

Rod catch statistics for the River Tweed, covering the period 1952-2010, for the total catch and each of the spring, summer and autumn run-time components are shown in Figures 18.3, 18.4, 18.5 and 18.6.

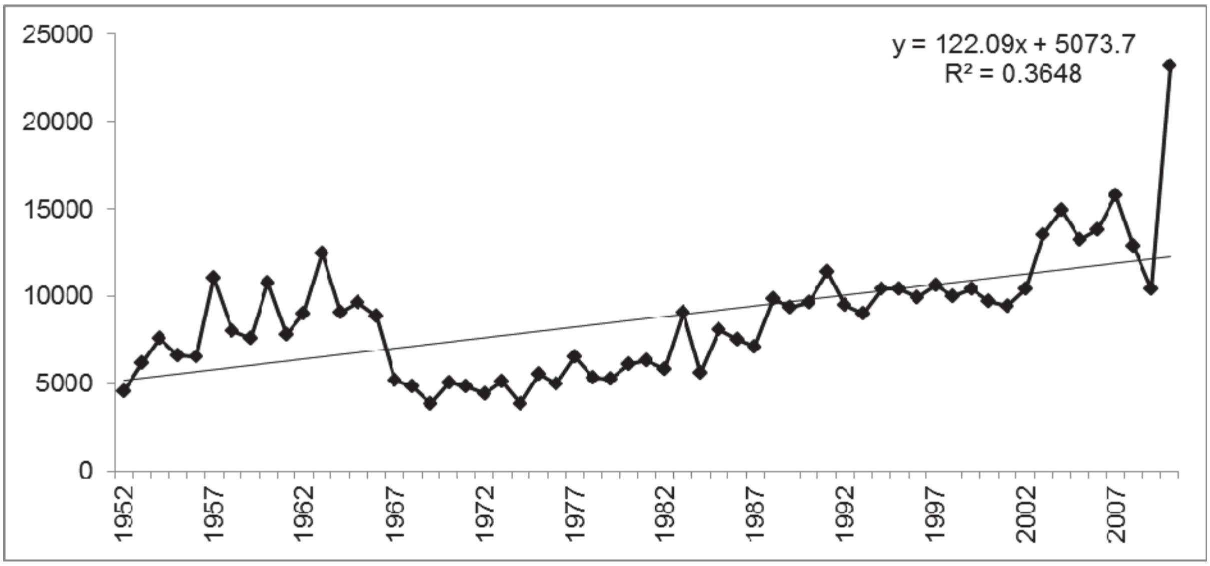


Figure 18.3 - River Tweed total rod catch 1952-2010 (salmon and grilse, retained and released).

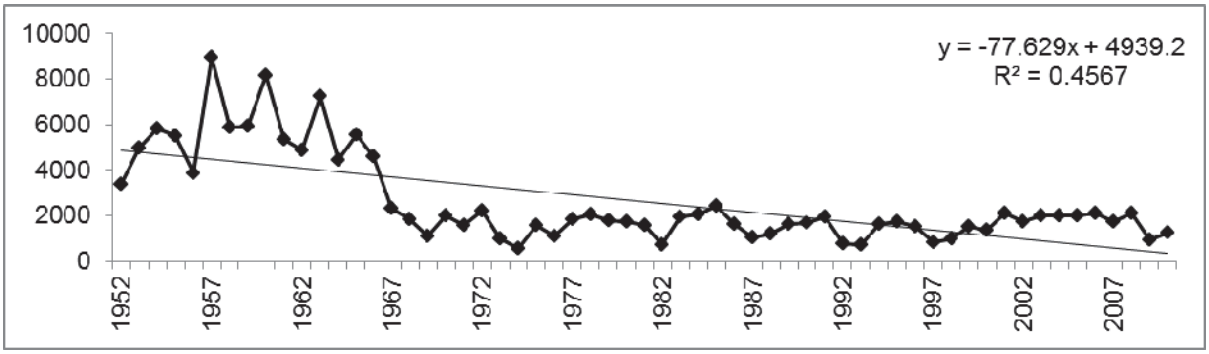


Figure 18.4 - River Tweed total spring rod catch 1952-2010 (salmon and grilse, retained and released).

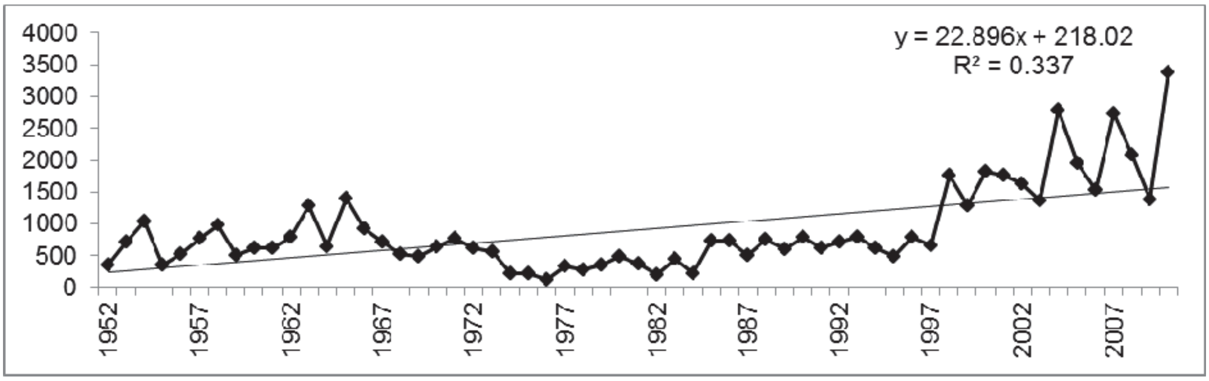


Figure 18.5 - River Tweed total summer rod catch 1952-2010 (salmon and grilse, retained and released).

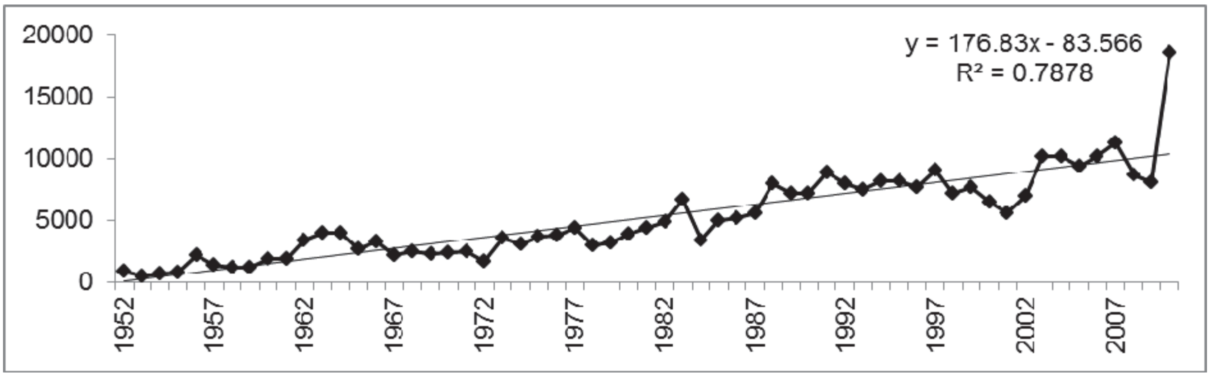


Figure 18.6 - River Tweed total autumn rod catch 1952-2010 (salmon and grilse, retained and released).

The total rod catch for Atlantic salmon in the River Tweed (Figure 18.3) shows an upward linear trend over the long-term dataset. Periods of higher total rod catch occurred in the mid-1950's-1960's and, following a period of reduced catch in the 1970's and 1980's a further period of elevated catch above the trend line in all but one year since 2000. However, the spring rod catch trend (Figure 18.4) shows an overall decline over the data series following a period of high catches in the 1950s-1960s. Both the summer and autumn rod catches (Figure 18.5 and 18.6) indicate an increasing trend in catch over the long-term dataset.

Unusually for most rivers, a particularly long time series of catch data is available for the River Tweed. The features of this sequence are not fully captured in the 1952-2010 rod catch data series. In many systems shifts between autumn and spring dominance over the Atlantic Salmon range over extended periods are well recognised and the Tweed is known to show a particularly strong and repeated change in run-time and related catch phases. This is reflected by the nature of the runs changing dramatically from phase to phase over time. The period since 1952 (covered by Figures 18.3 – 18.6), captures both the end of the latest spring dominated phase that began around 1915 and the start of the present, autumn-dominated period. As these two phases represent quite distinct situations, and covers periods not fully within the 1952-date time series of catch statistics used, this limits the completeness of the current analysis. For example a more robust representation of the spring and autumn catches than that represented in Figure 18.4 and 18.6 would show an extended period of catch records and demonstrate the cyclical nature of these catches over time. According to the Tweed Foundation, during the spring catch phase around 80% of the catchment produced spring salmon while less than 20% does so (in this present autumn phase) This phase is, itself, currently showing early indications of coming to an end, with grilse giving way to multi-sea winter fish in the catch.

Due to the long-term switches in run timing dominance on the River Tweed, concerns have been raised as to the linear trend analysis undertaken within the current study and local managers also prefer to consider the run-time components in smaller sub-catchment/ fishery units than the whole river/SAC analysis undertaken here. An alternative representation of the trends in the spring, summer and autumn catches for the River Tweed are shown in Figures 18.7, 18.8 and 18.9 which show, particularly for the spring catch, the sudden fall in this fishery at the end of the 1960's. Less clear for the period represented is the related increase in rod catch in the summer and autumn fisheries, although the trend lines from the point of spring fishery change (circa 1968), indicate an increase in catch of each of these components following reduction in the spring catches.

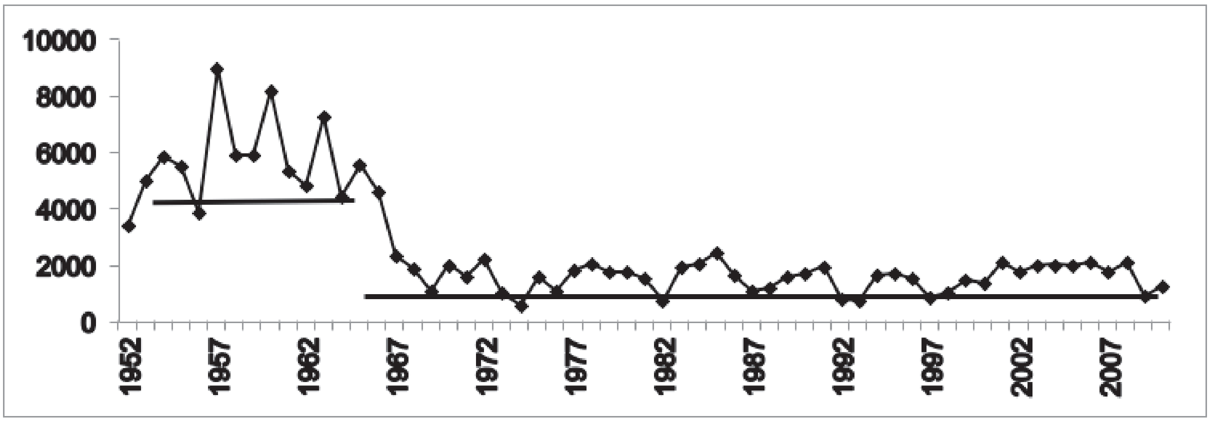


Figure 18.7 - River Tweed total spring rod catch 1952-2010 (salmon and grilse, retained and released) with straight line trend lines for each distinct population phase.

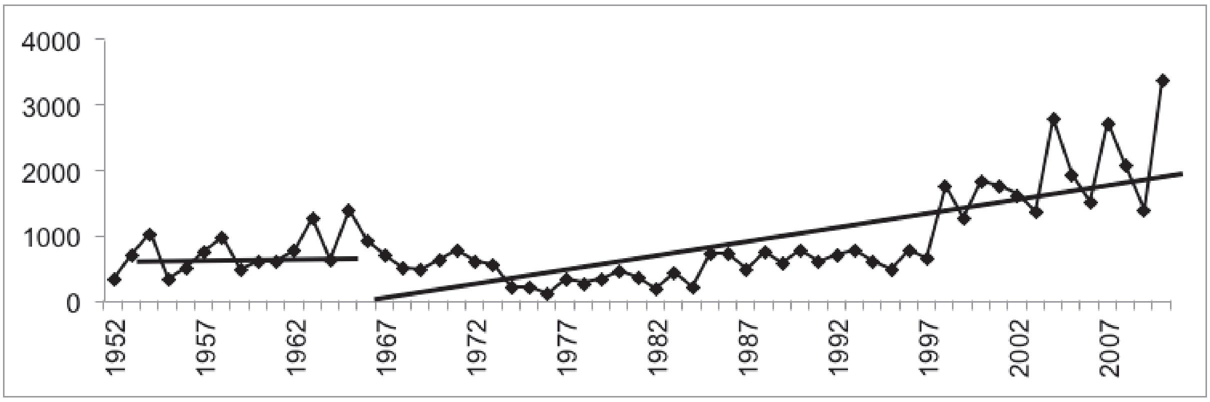


Figure 18.8 - River Tweed total summer rod catch 1952-2010 (salmon and grilse, retained and released) with straight line trend lines for each distinct population phase.

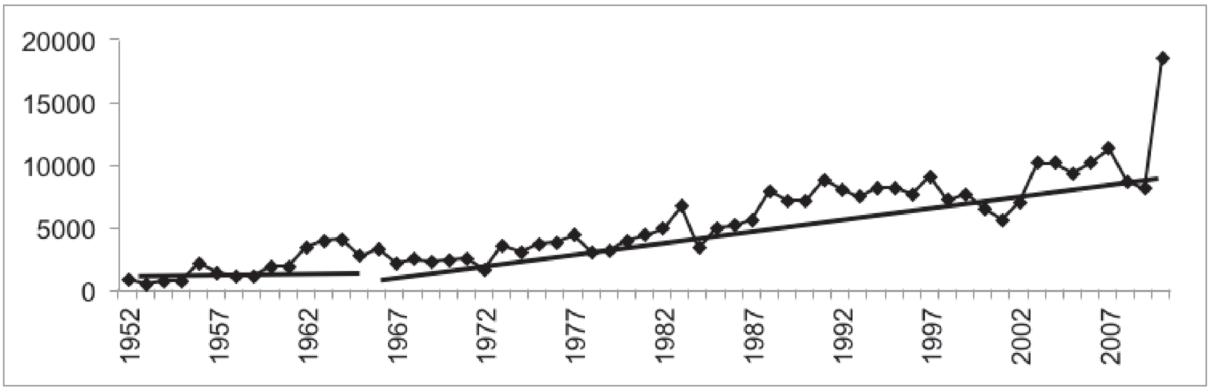


Figure 18.9 - River Tweed total autumn rod catch 1952-2010 (salmon and grilse, retained and released) with straight line trend lines for each distinct population phase.

As far as can be determined it is considered that the reporting of rod catch over the period has been consistent and representative and there is no evidence that any trends summarised may be attributable to a change in reporting accuracy or inconsistency. Major changes that could have affected catch records since 1952 are, however:

1949	Opening access to the Gala Water, (approx 10% of catchment):
1959	Opening access to the Leader Water (approx 10% of catchment)
1967-74	Ulceral Dermal Necrosis (UDN) affected angling
1986-90	Twelve river netting stations bought out
1991	Prawn fishing banned, worm fishing restricted
1992	Edington Cauld eased, the last major barrier on the Whiteadder, where a new Spring Salmon population then developed.
1998	Partial catch and release policy for Spring Salmon introduced until end of June for rod fisheries and total catch and release for net fisheries: (evidence from the tagging of released fish was that second capture rates were very low, so tagging was discontinued).
2000	Three major estuary netting stations bought out.
2000	Start of North East England Drift Net fishery season changed to June from March
2002	North East England Drift net buy-out: licences reduced from 62 to 14
2010	Total catch and release policy introduced for rod fisheries until end of June and to 15th June for net fisheries

The North East England Drift net fishery is a mixed stock fishery and catches fish from a number of rivers on the East coast of Scotland and England. It has always been assumed, however, that the largest contributor of fish to this catch has been fish destined for the River Tweed. New genetic information produced for the Environment Agency confirms that around 70% of both the Atlantic salmon caught in the drift nets and in the coastal nets is of Scottish origin. The genetic identification of individual rivers stocks is, as yet, less reliable, but it indicates that about half of the Scottish component of this catch could be River Tweed fish. Finer scale genetic analyses of Atlantic salmon caught in the North East England Drift Net Fishery are being undertaken and this will inform how many of these fish were destined for the River Tweed SAC and other Scottish Atlantic salmon SACs on the east coast. This fishery will be phased out over the next decade.

The Tweed Foundation advise that the low spring catches in 1992 and 1997 form part of a series of five-yearly low catches dating back to a major flood on the River Ettrick in 1977 which took place at the peak time for spawning of spring salmon. The 1993 and 1998 low rod catches are also part of a shorter five-yearly cycle of poor catches. At this time, 70-80% of River Tweed spring salmon were five year old fish (2.2s) making them vulnerable to this sort of repeat-generational damage. In more recent years, this concentration into a single age class has reduced with the advent of more S1 and 3SW fish. These patterns of recurring low spring catches in five-yearly cycles provides evidence than when stocks are low that this can affect recruitment into the next generation to perpetuate the cycle. Such cycles may challenge the assumption that annual catch totals are independent of each other and can be considered separately. The Tweed Foundation consider this to be a weakness in the NASCO catch assessment tool.

Application of Rod Catch Assessment Tool

Rod catches from the River Tweed over the last 20 years (1991-2010) were applied to the NASCO rod catch assessment tool to assess whether exploitation of each run time component requires management action.

The results of these tests for the River Tweed rod catch are shown in Table 18.10, and the data used to complete these tests is available in Appendix 1. The output of these analyses suggest that no reduction in exploitation is required for any of the stock components.

It is considered desirable in larger systems, such as the River Tweed, to refine these rod catch assessments by breaking the system down into meaningful sub-units and fishery groups if the data is available to do this effectively. In the Tweed this could reasonably take place due to the spring fishery being largely generated, for example, from the Ettrick catchment but supporting fisheries across the whole catchment. However, such detailed analysis was not within the scope of this work.

However, additional analysis undertaken by the Tweed Foundation has sought to recognise the patterns of production and catch known to exist within the catchment. For example, few spring fish are contributed by the Upper Tweed catchment and analysis of the spring run-time component for the lower and middle river only is considered by the Tweed Foundation to indicate a need for management action including the further reduction in exploitation of these stocks. This assessment is being used by the Tweed Foundation and River Tweed Commissioners to inform conservation measures they wish to develop for the river and the spring stocks.

Table 18.10 - Summary of the Rod Catch Assessment Tool Tests for River Tweed.

Test	Spring	Summer	Autumn
A	No	No	No
B	No	No	No
C	No	No	No

Rod catches for the 20 year period considered (1991-2010) are shown in Figures 18.10, 18.11, 18.12 and 18.13. An F-test was applied to each of the seasonal components to assess significance of observed trends and the results of this analysis are summarised in

Table 18.11. These show no significant trend in the rod catch of spring and summer fish, but a significant increase (at the 95% confidence level) in the autumn rod catch component over the data series.

The general analysis of spring salmon rod catches by this method does not identify cycles or patterns which may exist in large catchments. For example, it is possible that catches below a certain level can relate to low catches in the next generation in a cycle; this indicates that it is possible that stocks can become too low to fully populate nursery areas and that this cycle can be recurrent. Figure 18.11 shows examples of this periodicity in the low spring catches of 1992 and 1993 and 1997 and 1998 which come at the end of a 20 year period of these cycles. The low catches of 2009 are at a level at which such a cycle can start and it may be that a further low spring catch is shown in 2013 as a result of the weak spring fish component in 2009.

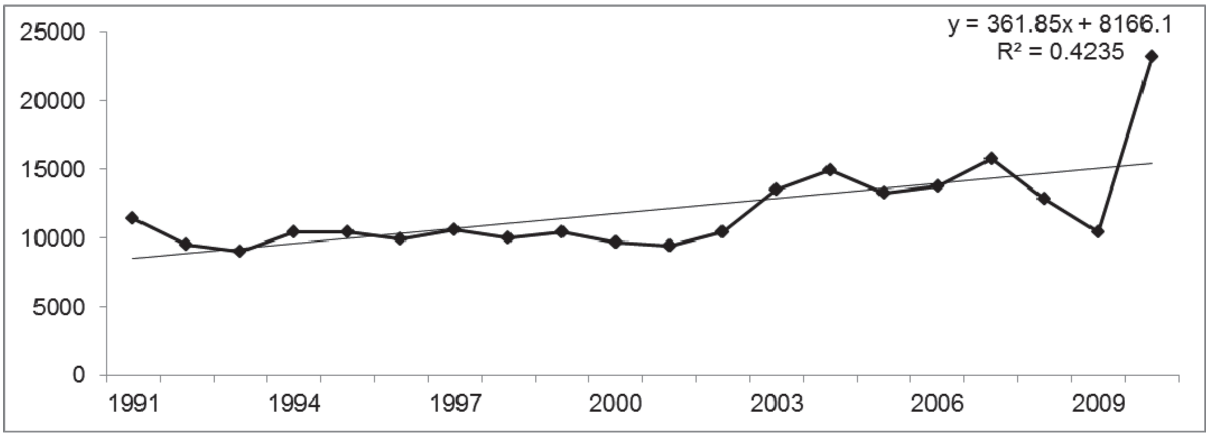


Figure 18.10 - River Tweed total rod catch 1991-2010 (salmon and grilse, retained and released).

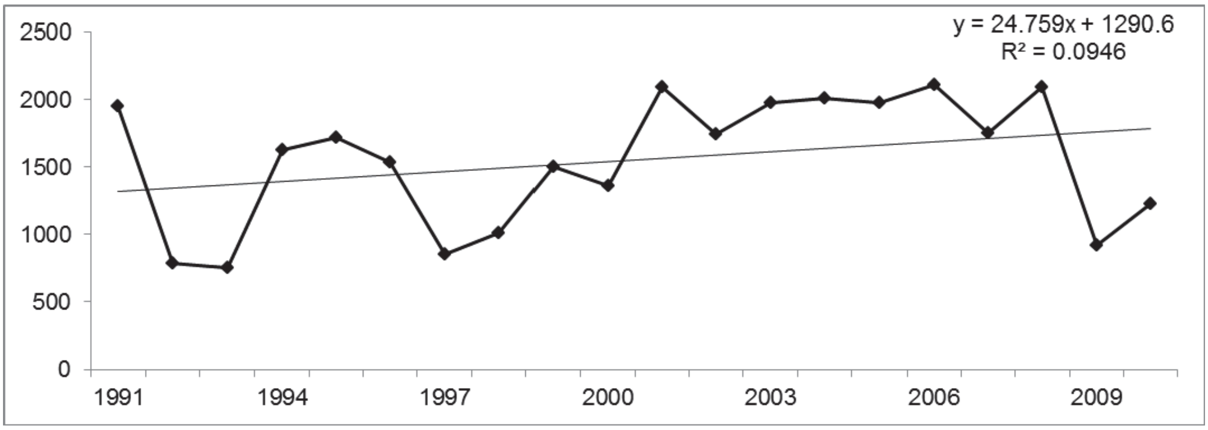


Figure 18.11 - River Tweed spring rod catch 1991-2010 (salmon and grilse, retained and released).

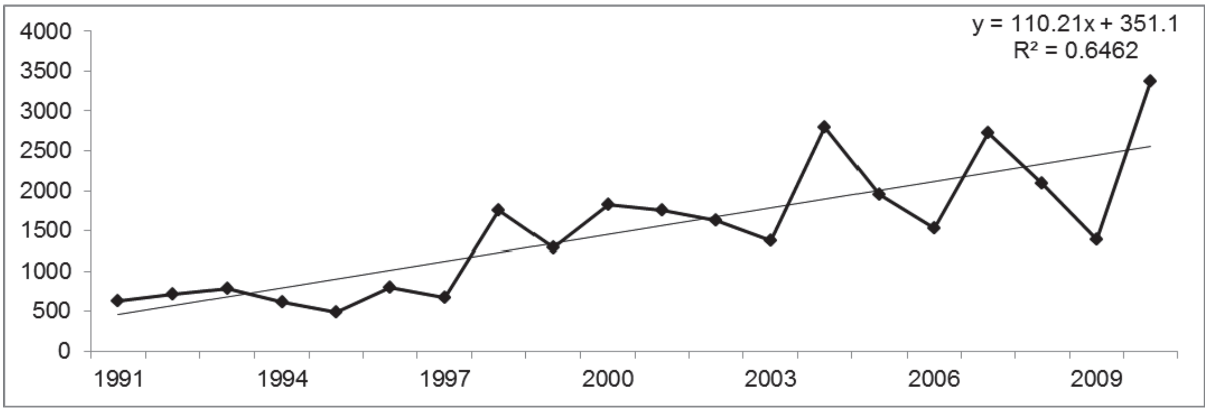


Figure 18.12 - River Tweed summer rod catch 1991-2010 (salmon and grilse, retained and released).

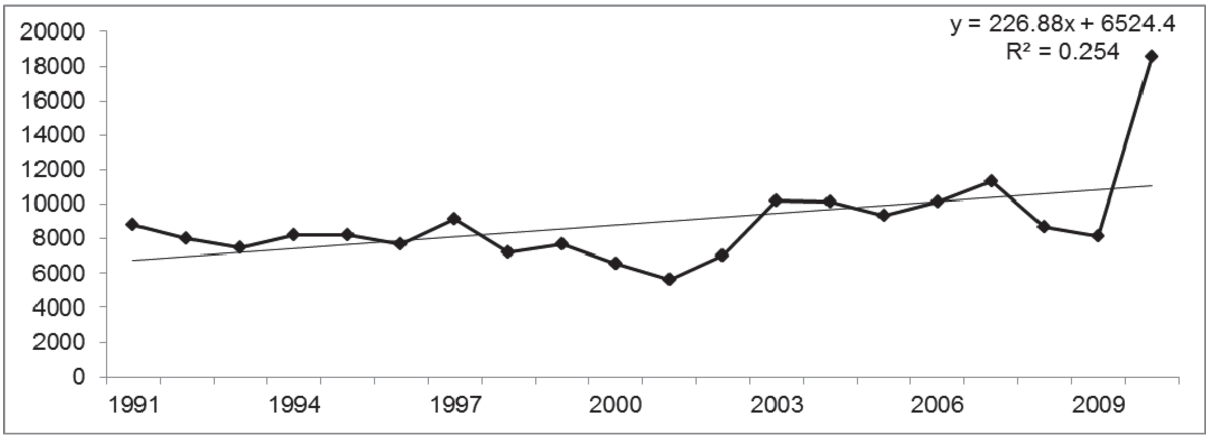


Figure 18.13 - River Tweed autumn rod catch 1991-2010 (salmon and grilse, retained and released).

Table 18.11 - Summary of F-Test Results on River Tweed Seasonal Rod Catch (1991-2010).

Component	Observations	F-Value	F-Significance
Spring	20	1.882	0.187
Summer	20	32.873	1.950
Autumn	20	6.129	0.023

The percentage change in the spring, summer and autumn rod catches SCM cycles against the year of designation (1999) was also undertaken. The first SCM assessment covered the period 2002-2004, whilst the second includes data extending from 2002-2010. In this review the rod catch is averaged for each cycle period and the increase or decrease in average rod catch expressed as a percentage of the rod catch in the year of designation.

This comparison is shown graphically in Figure 18.11 and indicates that for the both the summer and autumn stock components on the River Tweed there has been an increase in average rod catch since the year of designation. This is particularly prominent in the autumn catch where average catch has increased by >60% in cycle 1 and >80% in cycle two. There has been a decline in average catch over both cycles in the average spring rod catch.

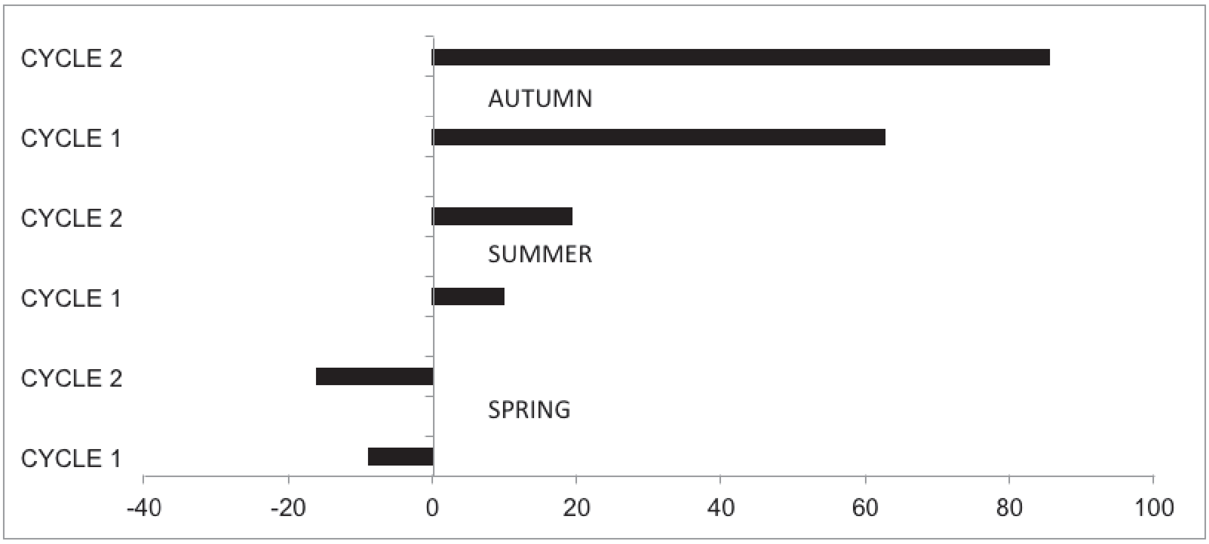


Figure 18.11 - Stock trend assessment since River Tweed SAC Designation (2001) in cycle 1 (2002-2004) and cycle 2 (2003-2010).

Summary

The overall rod catch for Atlantic salmon in the River Tweed SAC shows an increasing overall trend over the period 1952-2010. Within this general increase summer and autumn catches have shown an increasing upward trend, whilst spring rod catches have declined. Within the overall spring catch, however, the catches since 2000 remain above the trend line. Similarly, summer catches recorded since around 2000 also fall above the increasing long-term trend line. It is acknowledged that these changes and trends from the 1952 rod catch records may not capture longer-term changes and cycles in catch from the River Tweed - where change from spring to autumn dominated fisheries and catches are recorded over longer time sequence data. Recognising this limitation, an alternative representation of catch trends have also been provided over the period considered which recognise the long-term cycling of the River Tweed fishery between spring and autumn dominated catches.

In 1948/1949 (Leader and Gala Waters) and again in the 1990s (Whiteadder) significant tributaries of the River Tweed have become accessible to salmon and are now productive again. These access improvements have made an additional 30% of the catchment available to the Atlantic salmon and are likely to have significantly supported the increased rod catches recorded over these periods.

Application of the NASCO rod catch assessment tool to declared rod catches over the last 20 years (1991-2010) suggest that no reduction in exploitation is required and no investigations into the existence of local problems are necessary for any of the spring, summer or autumn run-time components. However, it is acknowledged that in a system as large as the River Tweed major tributaries and areas of the catchment may exhibit patterns of catch for run-time components which may generate different results from the rod catch assessment tool if deployed against parts of the catch as opposed to the catch from the SAC as a whole. Such analyses did not form part of this analysis, but it is recognised that local fishery managers may wish to undertake such assessments to inform local management and conservation measures.

When the rod catch trend for each run-time component were considered individually over this period, none were found to be statistically significant.

When average catch for each of the two SCM cycles is compared to those recorded in the year of designation there is an increase in both the summer and, particularly, autumn run-time components. However, there is a decline in the average spring rod catch over both these cycles since designation.

In combination these analyses of adult rod catch in the River Tweed SAC indicate an improving situation in respect of the summer and autumn run components. However, there is some evidence for concern for the spring stock component. Application of the rod catch assessment tool to the total river catch, and not broken down into meaningful sub-units or fishery groups within the catchment, is not enough (in the view of the Tweed Foundation) to suggest further reduction of exploitation or to show significant change over the 1991-2010 data series. However, when sub-units and fishery groups within the catchment are considered, a need for further conservation of the spring stock emerges and this is supported by the Tweed Foundation.

c) Habitats supporting the qualifying feature

1. Water quality and quantity

The status of each water body within the SAC, for which SEPA hold data, was obtained from the SEPA River Basin Planning website.

A total of 87 WFD water bodies representing a river length of 1173 km are recognised within the River Tweed SAC. Of these, 42 are classified as being of good ecological status or good ecological potential (total length 477 km) and are protected from deterioration from that class. The remaining 45 (river length 697 km) waterbodies are classified as being at moderate, poor or bad ecological status or potential. These waterbodies require the application of measures to bring them up to at least good ecological status within the relevant RBMP. The most common causes of waterbody classification being less than good status within the River Tweed SAC are: diffuse pollution from farming; morphological alterations for impoundment; forestry activities; and point source pollution from sewage discharges. There are ten Heavily Modified Waterbodies (HMWBs) identified within the site. Of these, four are classified as being at good ecological potential with the remaining six classified as being at moderate or poor or ecological potential. The HMWB designations which are classified as being less than good are classified as such because of issues relating to 1) flow regulation; and 2) morphological activities associated with impoundments.

Table 18.12 below summarises the number of water bodies and the length of channel within each status category.

Table 18.12 Number of water bodies and length of channel within each WFD status category in the River Tweed SAC.

WFD status (2009)	High	Good	Moderate	Poor	Bad	Total
Number of water bodies		38	31	7	1	77
Number of HMWBs		4	3	3		10
Length of channel (km)		477	533	131	32	1174

2. Trends, changes and activities

The spread of invasive non-native species, water management issues associated with impoundments (largely associated with public water supply), and water quality issues associated with agriculture and forestry have been highlighted as key negative pressures within the Tweed catchment.

The Tweed Foundation identify main activities having a negative impact on Atlantic salmon in the River Tweed SAC as being:

- Invasive non-native species;
- Water management associated with impoundments and water supply;
- Water quality associated with agriculture and forestry; and
- Morphological alterations from past channel canalisation and land drainage “activity”

APPENDIX 1: ROD CATCH ASSESSMENT TEST SUMMARY (ALL RIVERS)

This Appendix shows data used to complete rod catch assessment tests A, B and C in the current assessment cycle and identifies the lowest, second, third and fourth lowest catch in the sequence for each run-time component.

A standard colour code (below) is used to highlight low catch in the seasonal components.

Lowest
Second Lowest
Third Lowest
Fourth Lowest

Berriedale and Langwell: Catch Data (1991-2010) and Identification of 1-4 Lowest Records in Series

Year	Spring	Summer	Autumn	Total Catch
1991	0	0	0	0
1992	0	12	15	27
1993	7	44	11	62
1994	5	7	43	55
1995	5	0	34	39
1996	4	20	17	41
1997	9	19	5	33
1998	2	65	1	68
1999	0	28	8	36
2000	3	58	7	68
2001	5	40	4	49
2002	16	183	44	243
2003	2	4		6
2004	4	97	43	144
2005	10	23	23	56
2006	11	79	25	115
2007	7	94	28	129
2008	7	60	44	111
2009	9	93	21	123
2010	12	264	23	299

River Bladnoch: Catch Data (1991-2010) and Identification of 1-4 Lowest Records in Series

Year	Spring	Summer	Autumn	Total Catch
1991	122	52	67	241
1992	125	60	93	278
1993	65	82	111	258
1994	33	47	95	175
1995	25	4	98	127
1996	50	25	122	197
1997	25	14	141	180
1998	12	179	140	331
1999	20	10	53	83
2000	26	23	129	178
2001	6	34	87	127
2002	14	47	167	228
2003	17	14	63	94
2004	6	19	137	162
2005	19	6	83	108
2006	24	19	145	188
2007	4	40	92	136
2008	4	35	137	176
2009	16	25	86	127
2010	4	15	97	116

River Borgie: Catch Data (1991-2010) and Identification of 1-4 Lowest Records in Series

Year	Spring	Summer	Autumn	Total Catch
1991	21	88	33	142
1992	50	10	36	96
1993	35	274	28	337
1994	42	41	24	107
1995	57	47	41	145
1996	17	55	11	83
1997	59	183	30	272
1998	25	255	26	306
1999	23	156	21	200
2000	33	166	46	245
2001	13	147	37	197
2002	15	94	1	110
2003	48	68	33	149
2004	43	310	60	413
2005	77	216	72	365
2006	81	154	100	335
2007	34	348	206	588
2008	43	138	53	234
2009	23	110	51	184
2010	71	733	157	961

River Dee: Catch Data (1991-2010) and Identification of 1-4 Lowest Records in Series

Year	Spring	Summer	Autumn	Total Catch
1991	2571	1373	776	4720
1992	2003	1355	1191	4549
1993	2531	1263	1228	5022
1994	1956	1189	941	4086
1995	2392	1074	1525	4991
1996	2316	1177	348	3841
1997	1242	1072	774	3088
1998	927	1515	682	3124
1999	1255	942	574	2771
2000	1048	1421	515	2984
2001	2061	1775	818	4654
2002	1415	1563	790	3768
2003	1669	861	780	3310
2004	2163	2310	1573	6046
2005	2250	1918	1246	5414
2006	2262	1601	1757	5620
2007	1683	2595	1711	5989
2008	2104	2242	1886	6232
2009	1843	2663	2234	6740
2010	2277	3456	2995	8728

River Endrick: Catch Data (1991-2010) and Identification of 1-4 Lowest Records in Series

Year	Spring	Summer	Autumn	Total Catch
1991	12	96	157	265
1992	15	184	250	449
1993	19	247	180	446
1994	43	227	235	505
1995	32	143	453	628
1996	18	85	213	316
1997	24	98	244	366
1998	282	388	348	1018
1999	139	127	291	557
2000	9	88	245	342
2001	93	490	604	1187
2002	25	262	370	657
2003	34	167	270	471
2004	47	389	568	1004
2005	63	256	699	1018
2006	12	78	249	339
2007	26	357	705	1088
2008	4	231	498	733
2009	6	240	465	711
2010	20	115	354	489

Langavat: Catch Data (1991-2010) and Identification of 1-4 Lowest Records in Series

Year	Spring	Summer	Autumn	Total Catch
1991	4	371	250	625
1992	5	550	338	893
1993	5	594	176	775
1994	6	376	297	679
1995	3	325	405	733
1996	0	346	214	560
1997	4	283	321	608
1998	0	416	96	512
1999	1	337	207	545
2000	1	603	336	940
2001	0	826	245	1071
2002	2	683	233	918
2003	3	300	220	523
2004	2	433	305	740
2005	4	922	332	1258
2006	6	638	299	943
2007	10	762	366	1138
2008	1	455	263	719
2009	2	414	238	654
2010	1	868	412	1281

Langavat: Grimersta Catch Data (1991-2010) and Identification of 1-4 Lowest Records in Series

Year	Spring	Summer	Autumn	Total Catch
1991	3	237	134	374
1992	5	379	230	614
1993	5	338	87	480
1994	3	219	125	347
1995	2	231	155	388
1996	0	163	63	226
1997	3	148	100	251
1998	0	125	21	146
1999	1	155	100	256
2000	1	343	137	481
2001	0	485	143	628
2002	2	446	103	551
2003	3	137	99	239
2004	1	238	113	352
2005	4	451	117	572
2006	2	298	98	398
2007	8	318	78	404
2008	8	318	78	404
2009	2	189	58	249
2010	1	291	109	401

Little Gruinard: Catch Data (1991-2010) and Identification of 1-4 Lowest Records in Series

Year	Spring	Summer	Autumn	Total Catch
1991	2	169	46	217
1992	3	209	70	282
1993	3	255	33	291
1994	1	211	58	270
1995	5	118	78	201
1996	1	117	27	145
1997	6	119	84	209
1998	0	136	37	173
1999	1	94	42	137
2000	0	115	27	142
2001	1	132	70	203
2002	1	115	42	158
2003	3	81	70	154
2004	3	165	84	252
2005	2	199	92	293
2006	0	120	61	181
2007	0	350	146	496
2008	0	124	56	180
2009	1	245	111	357
2010	2	381	83	466

River Moriston: Catch Data (1991-2010) and Identification of 1-4 Lowest Records in Series

Year	Spring	Summer	Autumn	Total Catch
1991	101	407	263	771
1992	240	935	677	1852
1993	206	1060	396	1662
1994	250	921	544	1715
1995	427	932	748	2107
1996	136	545	367	1048
1997	166	256	212	634
1998	72	845	398	1315
1999	196	194	205	595
2000	142	423	345	910
2001	148	656	414	1218
2002	163	473	478	1114
2003	90	382	462	934
2004	222	739	585	1546
2005	226	962	635	1823
2006	249	534	391	1174
2007	85	689	697	1471
2008	138	509	455	1102
2009	97	354	472	923
2010	150	590	426	1166

River Naver: Catch Data (1991-2010) and Identification of 1-4 Lowest Records in Series

Year	Spring	Summer	Autumn	Total Catch
1991	184	499	200	883
1992	343	346	269	958
1993	462	1603	126	2191
1994	177	513	209	899
1995	172	130	184	486
1996	179	329	94	602
1997	348	556	211	1115
1998	112	775	78	965
1999	124	389	134	647
2000	174	850	171	1195
2001	268	466	123	857
2002	66	466	19	551
2003	146	193	141	480
2004	186	583	167	936
2005	234	462	211	907
2006	336	419	114	869
2007	195	917	245	1357
2008	179	502	146	827
2009	150	554	182	886
2010	305	1240	437	1982

North Harris: Catch Data (1991-2010) and Identification of 1-4 Lowest Records in Series

Year	Spring	Summer	Autumn	Total Catch
1991	0	129	41	170
1992	0	189	80	269
1993	2	141	38	181
1994	0	18	18	36
1995	0	144	70	214
1996	0	15	24	39
1997	0	159	56	215
1998	0	197	42	239
1999	0	95	33	128
2000	0	131	31	162
2001	0	199	88	287
2002	0	153	39	192
2003	0	159	122	281
2004	0	112	123	235
2005	1	190	140	331
2006	0	133	127	260
2007	4	190	124	318
2008	6	136	129	271
2009	0	152	134	286
2010	2	329	218	549

River Oykel: Catch Data (1991-2010) and Identification of 1-4 Lowest Records in Series

Year	Spring	Summer	Autumn	Total Catch
1991	408	1380	753	2541
1992	909	2137	1457	4503
1993	567	2406	420	3393
1994	521	1643	741	2905
1995	734	1700	2179	4613
1996	793	1942	405	3140
1997	714	1686	895	3295
1998	441	2963	504	3908
1999	535	1422	612	2569
2000	587	2370	720	3677
2001	537	2080	876	3493
2002	190	1651	373	2214
2003	483	1087	584	2154
2004	573	2060	920	3553
2005	630	1611	804	3045
2006	1029	1632	693	3354
2007	423	2534	873	3830
2008	460	1891	631	2982
2009	412	1467	533	2412
2010	463	3026	962	4451

River South Esk: Catch Data (1991-2010) and Identification of 1-4 Lowest Records in Series

Year	Spring	Summer	Autumn	Total Catch
1991	408	368	655	1431
1992	316	614	889	1819
1993	276	442	872	1590
1994	205	297	838	1340
1995	221	323	711	1255
1996	457	419	701	1577
1997	224	220	465	909
1998	209	467	527	1203
1999	254	152	393	799
2000	198	454	608	1260
2001	215	357	377	949
2002	141	435	468	1044
2003	137	186	449	772
2004	196	494	719	1409
2005	138	254	543	935
2006	259	266	823	1348
2007	87	351	565	1003
2008	123	596	748	1467
2009	142	407	467	1016
2010	68	337	1024	1429

River Spey: Catch Data (1991-2010) and Identification of 1-4 Lowest Records in Series

Year	Spring	Summer	Autumn	Total Catch
1991	1380	2945	1485	5810
1992	1307	5198	2464	8969
1993	1337	6710	2024	10071
1994	2108	7226	3737	13071
1995	2265	5098	3773	11136
1996	1524	6233	1723	9480
1997	1786	4081	1530	7397
1998	1045	6398	1311	8754
1999	1405	3430	1546	6381
2000	1237	6272	1259	8768
2001	1451	5131	1180	7762
2002	1271	4159	898	6328
2003	1355	2938	2145	6438
2004	2341	5930	1593	9864
2005	1760	6037	1562	9359
2006	2656	5851	2009	10516
2007	1465	6711	1851	10027
2008	2285	7424	1702	11411
2009	1789	5547	934	8270
2010	974	5721	2027	8722

River Tay: Catch Data (1991-2010) and Identification of 1-4 Lowest Records in Series

Year	Spring	Summer	Autumn	Total Catch
1991	1292	1625	5866	8783
1992	1725	3922	6057	11704
1993	1498	4375	6978	12851
1994	2445	4857	7266	14568
1995	2183	3285	8938	14406
1996	2146	3183	6273	11602
1997	1218	2603	4786	8607
1998	1026	3123	4248	8397
1999	1417	1860	3872	7149
2000	1198	3070	4914	9182
2001	1792	3977	4002	9771
2002	1232	2099	2927	6258
2003	984	1834	2707	5525
2004	1530	3502	5415	10447
2005	1803	3306	5423	10532
2006	2334	4356	5153	11843
2007	1154	2682	4852	8688
2008	1693	2914	4867	9474
2009	1334	2527	3722	7583
2010	1146	3099	6501	10746

River Teith: Catch Data (1991-2010) and Identification of 1-4 Lowest Records in Series

Year	Spring	Summer	Autumn	Total Catch
1991	178	207	1032	1417
1992	252	788	2209	3249
1993	238	510	1225	1973
1994	269	459	1191	1919
1995	247	305	1695	2247
1996	188	457	1715	2360
1997	159	178	1121	1458
1998	120	885	1520	2525
1999	187	258	1053	1498
2000	86	364	1345	1795
2001	121	907	1640	2668
2002	158	509	1379	2046
2003	96	346	866	1308
2004	226	1068	2285	3579
2005	154	641	1849	2644
2006	195	265	1415	1875
2007	91	473	1989	2553
2008	145	604	1462	2211
2009	155	546	1379	2080
2010	109	823	2501	3433

River Thurso: Catch Data (1991-2010) and Identification of 1-4 Lowest Records in Series

Year	Spring	Summer	Autumn	Total Catch
1991	168	413	238	819
1992	149	192	336	677
1993	177	680	288	1145
1994	115	76	219	410
1995	249	282	679	1210
1996	271	292	110	673
1997	310	410	177	897
1998	163	571	235	969
1999	142	237	276	655
2000	119	184	74	377
2001	133	291	314	738
2002	63	387	42	492
2003	172	75	117	364
2004	195	581	403	1179
2005	238	358	212	808
2006	354	693	444	1491
2007	69	1101	498	1668
2008	193	507	524	1224
2009	181	859	682	1722
2010	358	1814	1303	3475

River Tweed: Catch Data (1991-2010) and Identification of 1-4 Lowest Records in Series

Year	Spring	Summer	Autumn	Total Catch
1991	1954	627	8840	11421
1992	785	711	8005	9501
1993	748	789	7472	9009
1994	1627	616	8215	10458
1995	1723	483	8208	10414
1996	1537	792	7649	9978
1997	854	664	9124	10642
1998	1014	1761	7217	9992
1999	1499	1287	7676	10462
2000	1360	1828	6525	9713
2001	2095	1756	5604	9455
2002	1742	1631	7030	10403
2003	1981	1369	10172	13522
2004	2010	2790	10158	14958
2005	1981	1946	9364	13291
2006	2108	1527	10160	13795
2007	1754	2732	11313	15799
2008	2094	2092	8703	12889
2009	918	1387	8125	10430
2010	1228	3379	18572	23179

APPENDIX 2: COMPARISON OF CYCLE 1 AND CYCLE 2 ADULT ATLANTIC SALMON DATA USING THE NASCO ROD CATCH ASSESSMENT TOOL.

Summary of adult rod catch assessment of seasonal catch components for previous site condition monitoring period (1985-2004) using current rod catch assessment tool method.

Special Area of Conservation	Adult rod catch assessment (favourable = + unfavourable= -)			
	Spring	Summer	Autumn	Overall
Berriedale and Langwell Waters	+	+	+	+
River Bladnoch	-	+	+	-
River Borgie	+	+	+	+
River Dee	+	+	+	+
Endrick Water	+	+	+	+
Langavat	+	+	+	+
Little Gruinard River	+	+	+	+
River Moriston	+	+	+	+
River Naver	+	+	+	+
North Harris	-	+	+	-
River Oykel	+	+	+	+
River South Esk	-	+	+	-
River Spey	+	+	+	+
River Tay	+	+	-	-
River Teith	+	+	+	+
River Thurso	+	+	+	+
River Tweed	+	+	+	+

If the current adult rod catch assessment method was applied to the catches over the period 1985–2004 instead of the limited time series used during the Cycle 1 assessment, the adult component of the Berriedale and Langwell, Borgie, Dee, Endrick, Langavat, Little Gruinard, Moriston, Naver, Oykel, Spey, Teith, Thurso and Tweed SAC would have passed that element of the assessment process. Of these, only the Dee, Little Gruinard, Moriston, Oykel, Thurso and Tweed SACs would have passed both the juvenile and adult element of the assessment and been considered to be in favourable condition.

The 2005 (assessments generated using both the original adult assessment method applied and using the current NASCO adult rod catch assessment tool are shown for comparison) and 2011 assessments are presented in Table A1.

When the assessments made originally in 2005 are compared to those prepared in the current analyses there would appear to have been some improvement in site conditions between the assessment cycles in a number of the SACs. Whilst only four sites are suggested to be in unfavourable status in 2011, a total of thirteen (River Bladnoch, River Borgie, Endrick Water, Langavat, Little Gruinard, River Moriston, River Naver, River Oykel South Esk, River Spey, River Teith, River Thurso and River Tweed) were assigned unfavourable status in 2005.

However, when the current rod catch assessment is applied retrospectively to the catches of the period 1995-2004 (the period of catch used in the first site condition assessment exercise in 2005) it appears likely that a significant proportion of this apparent improvement may be attributed to the rod catch assessment method applied. When the current rod catch assessment tool is applied to the catches relevant to the 2005 assessment, then 13 sites are indicated to be in favourable condition and four sites in unfavourable condition; a proportion of favourable to unfavourable equal to that presented in the 2011 assessment cycle. This suggests that the method of adult rod catch assessment applied in 2005 would appear to have more strictly assessed the seasonal rod catch than the current method. As the current method is widely acknowledged to provide a more statistically robust and reliable assessment tool then it may be reasonable to propose that, for the adult rod catch at least, the 2005 site condition assessment exercise has underestimated the number of sites which were in favourable condition at that time.

It should be noted that two sites would be assessed as in unfavourable condition in each assessment cycle and regardless of method applied; the River Bladnoch and the River South Esk. The change in assessment method applied to the 2005 cycle moves the previously favourable condition catchments of North Harris and Tay to unfavourable condition. For the North Harris site this is for the spring fish component but as catches are so low for this seasonal component this assessment may not be reliable or significant. They Tay catch would be unfavourable for the autumn run component.

Table A1 – Comparisons of overall adult rod catch assessment for all SACs in 2005 and 2011 using original adult catch assessment tool (i) and applying the current tool (ii) to 2005 catches.

Special Area of Conservation	Adult rod catch assessment (favourable = + unfavourable = -)		
	2005 (i)	2005 (ii)	2011

Berriedale and Langwell Waters	+	+	+
River Bladnoch	-	-	-
River Borgie	-	+	+
River Dee	+	+	+
Endrick Water	-	+	-
Langavat	-	+	+
Little Gruinard River	-	+	+
River Moriston	-	+	+
River Naver	-	+	+
North Harris	+	-	+
River Oykel	-	+	+
River South Esk	-	-	-
River Spey	-	+	-
River Tay	+	-	+
River Teith	-	+	+
River Thurso	-	+	+
River Tweed	-	+	+

APPENDIX 3: LOCAL SURVEY AND MANAGEMENT INFORMATION SUMMARY (ALL RIVERS)

As part of the information gathered for the current SAC assessments a range of information associated with local surveys and management activities was collated through survey and questionnaire issued to local fisheries managers.

1. Berriedale and Langwell Rivers

1. Juvenile, smolt and adult surveying

This section sets out the extent of juvenile, smolt and adult survey work that has taken place in the Berriedale and Langwell SAC since the year of designation. The survey effort is summarised in Table 1.1.

i. Juvenile survey

The only juvenile survey work that has been carried out within the Berriedale and Langwell SAC since designation is that of SAC monitoring which took place in 2004 and 2011. Six fully quantitative and nine timed surveys were completed on each occasion.

ii. Smolt survey

No smolt survey work has been carried out within the Berriedale and Langwell SAC since designation.

iii. Adult survey

No additional adult survey work has been carried out within the Berriedale and Langwell SAC since designation.

Table 1.1 - Summary of the extent of survey work of each type in the Berriedale and Langwell SAC.

Survey effort since designation	High	Moderate	Low	No. surveys/ projects since designation
Juvenile survey			X	30
Smolt survey			X	0
Adult survey			X	0

2. Biosecurity

No INNS have been recorded for the Berriedale and Langwell SAC, and none were observed during the SAC monitoring carried out in 2011.

3. Stocking and fish movements

Although no stocking is known to have been undertaken in the Berriedale and Langwell SAC in the last decade, it is reported that the Langwell in particular has received stocking inputs from outside the area in the last 120 years from as far away as the Rhine and more recently the Ewe on the West Coast of Scotland. Dates of these stocking activities are unknown.

4. Barriers to fish passage

There are no man made weirs, dams or impoundements known to be preventing or partially preventing the passage of Atlantic salmon to their natural range.

2. River Bladnoch

1. Juvenile, smolt and adult surveying

This section sets out the extent of juvenile, smolt and adult survey work that has taken place in the River Bladnoch SAC since the year of designation. The survey effort is summarised in Table 2.1.

i. Juvenile survey

Since 2005, 103 fully or semi quantitative electro-fishing surveys and one timed survey have been carried out on the River Bladnoch. The vast majority of this work was carried out for the purposes of general stock assessment on tributaries as well as the main river channel, with a small number of project related surveys also being carried out.

ii. Smolt survey

Each year from 2005 to 2008, mark-recapture work has been carried out to determine smolt output from the Bladnoch. In addition, in 2008, a rotary screw trap was used in the upper catchment for the same purpose.

iii. Adult survey

Annually from 2005 to 2010, a fish trap was used on a tributary of the lower river.

Table 2.1 - Summary of the extent of survey work of each type in the River Bladnoch catchment.

Survey effort since designation	High	Moderate	Low	No. surveys/ projects since designation
Juvenile survey		X		104
Smolt survey		X		5
Adult survey		X		6

2. Biosecurity

Non native fish species were described as having a moderate impact in the catchment. These have been stocked into lochs, from where they have escaped into the river and are now moderately distributed in the catchment.

Japanese knotweed (*Fallopia japonica*), mink (*Neovision vision*) and rainbow trout (*Oncorhynchus mykiss*) are all present, albeit with restricted distributions. They have yet to have a demonstrable impact on Atlantic salmon in the Bladnoch catchment. Mink and rainbow trout are not currently being controlled, but some spraying of Japanese knotweed is taking place.

Although not generally regarded as being an invasive non-native species, Sitka spruce (*Picea sitchensis*) was identified by Galloway Fisheries Trust as the non-native species having the most significant impact on the Atlantic salmon in the catchment. This is due to their relationship with surface water acidification in combination with base poor geology and, largely historic, scavenging of acidifying air borne pollutants.

Table 2.2 - Summary of the impact of the five main INNS in the River Bladnoch catchment.

Species of greatest concern	Impact on salmon
Non native fish species	Moderate - Impact strongly suspected - no current management action.
Japanese knotweed	Low - Impact not yet demonstrated* - current control programme running from 2011 to 2014.
Rainbow trout	Low - Impact not yet demonstrated - no management action.
American mink	Low - Impact not yet demonstrated - no management action.

* Current control programme running from 2011 to 2014.

3. Stocking and fish movements

Between 2006 and 2011, over 300,000 salmon fry have been stocked into the River Bladnoch. The fry were sourced within the catchment, and the work was carried out to help the Atlantic salmon population recover following acidification. Electro-fishing surveys have been carried out routinely since stocking began in order to monitor progress.

4. Barriers to fish passage

There are no man made weirs, dams or impoundements known to be preventing or partially preventing the passage of Atlantic salmon to their natural range.

3. River Borgie

1. Juvenile, smolt and adult surveying

This section sets out the extent of juvenile, smolt and adult survey work that has taken place in the River Borgie SAC since the year of designation. The survey effort is summarised in Table 3.1.

i. Juvenile survey

Outwith that required to inform Site Condition Monitoring, no further surveys have been undertaken since designation in 1998. However, it is understood that some historic surveys were completed around this time, perhaps associated with the designation of the site itself, and that, additional surveys were undertaken by Colin Carnie and colleagues. The date of this work is not certain.

ii. Smolt survey

No quantitative smolt survey work has been carried out on the River Borgie since designation. However, qualitative visual observations of smolt movements are made by the fishery manager to assess the general health of the annual smolt migration.

iii. Adult survey

There have been no fully quantitative studies of adult numbers in the catchment and no fish counters exist or are operational. The local fishery manager, however, makes regular observations of spawning fish each autumn to support a general assessment of numbers and spawning area use.

Table 3.1 - Summary of the extent of survey work of each type in the River Borgie catchment.

Survey effort since designation	High	Moderate	Low	No. surveys/ projects since designation
Juvenile survey			X	0
Smolt survey			X	0
Adult survey			X	0

2. Biosecurity

There are no specific INNS concerns identified as being significant for Atlantic salmon within the River Borgie catchment.

3. Stocking and fish movements

No stocking was undertaken in 2011 although stocking activities may be recommenced in 2012 on a limited basis. However, in previous years it is understood that between 30,000 and 150,000 salmon fry were stocked annually into the catchment with the aim of supporting and enhancing natural population. All brood-stock throughout the hatchery operations have been sourced from the River Borgie.

4. Barriers to fish passage

There are no man made weirs, dams or impoundements known to be preventing or partially preventing the passage of Atlantic salmon to their natural range.

4. River Dee

1. Juvenile, smolt and adult surveying

This section sets out the extent of juvenile, smolt and adult survey work that has taken place in the River Dee SAC since the year of designation. The survey effort is summarised in Table 4.1.

i. Juvenile survey

Since 2005, a substantial body of data on juvenile stocks has been generated for the River Dee. Juvenile surveys have been undertaken to inform a range of local management objectives, activities and decision making and to provide general stock assessments for the catchment. A total of 2,315 timed and 268 semi or fully quantitative electro-fishing surveys have been undertaken.

Of the surveys completed approximately 20% were for the purposes of general stock assessment, 40% aimed to investigate the potential impact of developments or site specific pressures such as wind farm developments and barriers to fish movement, and the remaining 40% were to monitor and assess habitat restoration activities undertaken in the catchment.

The large majority of the surveys were carried out on Dee tributaries, with a minority taking place on the main channel itself.

ii. Smolt survey

Between 2005 and 2011, Marine Scotland Science have carried out smolt tagging on the Girnock Burn (between Ballater and Balmoral) to assess adult return rates.

iii. Adult survey

Between 2008 and 2010, the River Dee Trust and River Dee DSFB tagged 140 adult salmon to assess the feasibility and inform the assessment of extending the angling season. From 2008 to 2011, approximately 2,800 adult fish were scale-sampled to provide information on stock composition. Between 2010 and 2011, tissue samples taken for genetic analyses were obtained from over 400 adults for the same purpose.

Two fish counters have been employed on the Dee since SAC designation; one on the Feardar Burn in the upper Dee catchment which was in place from 2005 to 2009 with the aim of estimating spawning population size, and one on the Coy Burn from 2009 to 2011 to monitor recolonisation following the construction of a fish pass.

Table 4.1 - Summary of the extent of survey work of each type in the River Dee catchment.

Survey effort since designation	High	Moderate	Low	No. surveys/ projects since designation
Juvenile survey	X			2,583
Smolt survey		X		1
Adult survey	X			11

2. Biosecurity

The River Dee Trust have identified the two highest impact Invasive Non Native Species (INNS) within the SAC as being American mink and Japanese knotweed.

The former, while having a fairly restricted distribution, has nevertheless been shown to have a high impact on Atlantic salmon, and control activities are being carried out. Japanese knotweed is widely distributed within the catchment and is also being controlled. Himalayan balsam (*Impatiens glandulifera*) and giant hogweed (*Heracleum mantegazzianum*) were identified as having a moderate impact upon salmon in the River Dee catchment, with the former being extensively distributed and the latter moderately distributed. Neither species are currently being actively managed.

The parasitic nematode *Anasakis* spp. and rainbow trout were identified as having a low impact (or an as yet undemonstrated impact) within the River Dee catchment. Neither species is currently being managed.

Table 4.2 provides a summary of INNS of concern and their likely impact on Atlantic salmon.

In addition to these species there is concern as to the current extent and spread of *Ranunculus* sp. within the catchment. Although native to Scotland this species is not considered native to the Dee and is considered by the River Dee Trust and DSFB to be biologically undesirable in the catchment. Its presence is also having an impact on economically important angling activities.

Table 4.2 - Summary of the impact of the six main INNS in the River Dee catchment.

Species of greatest concern	Impact on salmon
American mink	High - A high impact demonstrated - current and quantifiable active management.
Japanese knotweed	High - A high impact demonstrated - current and quantifiable active management.
Himalayan balsam	Moderate - Impact strongly suspected - no current management action.

Giant hogweed	Moderate - Impact strongly suspected - no current management action.
Anasakis spp.	Low - Impact not yet demonstrated - no management action.
Rainbow trout	Low - Impact not yet demonstrated - no management action.

3. Stocking and fish movements

Between 2005 and 2010, approximately 150,000 Atlantic salmon fry of local provenance were stocked into the River Dee to colonise a section of river above a natural barrier. This work was carried out by the Dess and Aboyne Working Group, and electro-fishing has been carried out by the River Dee Trust to monitor the results of this stocking activity.

4. Barriers

There are a total of 11 weirs or impoundments that are known to influence fish passage on the Dee SAC (Table 4.3). Since 2008 a series of measures have been taken on a total of 12 other in stream structures to ease fish passage (Table 4.4).

Table 4.3 – Instream structures where fish passage is known to be an issue

Name of Watercourse	**Name of Barrier**	**Notes**
Culter Burn	Culter dam	5 m high dam blocking access to entire Culter tributary (>120 km); SEPA has issued enforcement notice with owners to fit fish pass by October 2014
Dinnet burn	Dinnet weir	Weir is close to Council road and Council think they own it. Issues arise because of impact of any work on stability of road.
Water of Aven / Feugh - upper catchment	Bucket mill weir	Owned by Community Trust who still operate this historic structure. Not a total barrier
Water of Aven / Feugh - upper catchment	Finzean saw mill weir	This weir is in use and operated by the Community Trust. Not a total barrier
Beltie Burn	Glassel house weir	Partial obstruction; owners looking to install hydro scheme (planning

		2013)
Kinnernie Burn	Waterton loch weir	Trust will be fitting a fish pass - licence application to SEPA earlier this year but has not been granted in time. Water Environment Fund funding already obtained. Upstream of Culter dam so work will depend on resolution on that structure.
Leuchar Burn	Garlogie dam	River Dee Trust are currently working with owners (Dunecht Estate) to get fish pass installed. As above this structure is upstream of Culter dam.
Loch of Skene	Loch of Skene weir	Trust will be fitting a fish pass – a licence application was made to SEPA in 2013 but was not been granted in time for works in 2013, due to Reservoirs Act requirements. WEF funding already obtained. Upstream of Culter dam
Culter burn	Denmill weir	Upstream of Culter dam so no salmon at present. WEF funding already obtained and designs prepared, however work is on-hold until Culter dam is resolved
Strathie burn, Sheeoch	Strathie weir	Owned by Forestry Commission; they think it might be a historic structure
Allt Coire an t-Slugain burn, Gairn	Slugain bridge apron and culvert	Council owned structure; burn needs revisiting to assess its priority

Table 4.4 – Instream structures where fish passage has been eased since 2008

Name of Watercourse	**Name of Barrier**	**Notes**
Allt Dinnie burn	Allt Dinnie weir	Trust fitted fish pass in 2009; electro fishing surveys show weir is no longer an obstruction.
Beltie Burn	Not named	Old FRS fish trap with concrete apron; dismantled and fish pass put in with CASS LIFE project
Burn of Cattie	Cattie weir East	Fish pass created under CASS LIFE project

Burn of Cattie	Cattie weir West	Fish pass created under CASS LIFE project
Burn of Corrichie	Hatton weir	Weir was fitted with fish pass in 2010 with support from WEF.
Burn of Corrichie	Hatton weir	Weir was fitted with fish pass in 2010 with support from RRF.
Water of Dye - upper catchment	Dye crump weir	Fitted with fish pass 2008
Water of Dye - upper catchment	Dye weir	Fitted with fish pass 2008
Allachy burn, River Tanar	Allachy ford	Fish pass fitted with RRF money in 2010; electro fishing surveys show ford is no longer a barrier.
Wester Shenalt, Gairn	Wester Shenalt ford	Trust fitted fish pass in 2010 with RRF money; however, ef surveys show it is still an obstruction. May be due to impacts of storm damage - loose gravel still in-filling fish pass during high flow events. Monitoring continuing
Water of Feugh - Burn of Curran	Mill of Cammie weir	Fish pass installed supported by SEPA WEF
Water of Feugh - Burn of Curran	Cammie weir	Fish pass installed supported by SEPA WEF

5. Endrick Water

1. Juvenile, smolt and adult surveying

This section sets out the extent of juvenile, smolt and adult survey work that has taken place in the Endrick Water SAC since the year of designation. The survey effort is summarised in Table 5.1.

i. Juvenile survey

Between 2003 and 2011, 94 semi or fully quantitative electro-fishing surveys were carried out on the Endrick system, along with 184 timed surveys. The vast majority were carried out for the purposes of general stock assessment and are additional to those completed in 2004 for the previous Site Condition Monitoring exercise.

ii. Smolt survey

Each year from 2008 to 2011, a rotary screw trap was used to monitor smolts to determine timings of the smolt run, population structures and estimates of run sizes. In addition, in 2010, monitoring of a hatchery smolt release programme took place to assess survival of marked fish stocked as pre-smolts above naturally impassable falls.

iii. Adult survey

No adult survey work has been carried out since designation.

Table 5.1 - Summary of the extent of survey work of each type in the Endrick Water catchment.

Survey effort since designation	High	Moderate	Low	No. surveys/ projects since designation
Juvenile survey		X		278
Smolt survey		X		5
Adult survey			X	0

2. Biosecurity

American mink have been identified as having the highest impact on the Endrick Water, with and extensive distribution throughout the catchment. Gudgeon (*Gobio gobio*), dace (*Leuciscus leuciscus*) and chub (*Leuciscus cephalus*) are also common downstream of Potts of Gartness, with ruffe (*Gymnocephalus cernuus*) having a moderate distribution. No management actions are currently in place. Table 5.2 provides a summary of INNS impact.

Table 5.2 - Summary of the impact of the five main INNS in the Endrick Water catchment.

Species of greatest concern	Impact on salmon
American mink	Moderate - Impact strongly suspected - no current management action.
Dace	Low - Impact not yet demonstrated - no management action.
Gudgeon	Low - Impact not yet demonstrated - no management action.
Chubb	Low - Impact not yet demonstrated - no management action.
Ruffe	Low - Impact not yet demonstrated - no management action.

3. Stocking and fish movements

The Loch Lomond Angling Improvement Association (LLAIA) carried out salmon stocking each year from 2003 to 2011. From 2003 to 2008, up to 100,000 fry were stocked each year. These were sourced within the catchment and were stocked for the purposes of enhancing the existing population. In 2008, approximately 3,000 hatchery-reared underyearlings were stocked from within the catchment. These were adipose clipped as fry and released above naturally impassable falls. They were monitored as S2 smolts captured using a rotary screw trap in 2010. In 2010, 4,000 hatchery-reared S2 smolts were released into the upper Endrick Water. These were monitored as pre-smolts captured using a rotary screw trap in 2010. In 2011, 5,000 hatchery-reared, adipose clipped S2 smolts were released into the upper river.

4. Barriers to fish passage

There are no man made weirs, dams or impoundements known to be preventing or partially preventing the passage of Atlantic salmon to their natural range.

6. Langavat

1. Juvenile, smolt and adult surveying

This section sets out the extent of juvenile, smolt and adult survey work that has taken place in the Langavat SAC since the year of designation. The survey effort is summarised in Table 6.1.

i. Juvenile survey

In 2009, 15 timed surveys were carried out for the purposes of general stock assessment on the March Burn, Fhir Mhaoil and Easa Ghil Burns, Langadale River (and tributaries) and tributaries of the Earbhaill.

ii. Smolt survey

Each year from 2006 to 2009, rod and line post-smolt surveys were carried out. With the exception of 2006, only sea trout smolts were caught in this way.

iii. Adult survey

No adult survey work has been carried out since designation.

Table 6.1 - Summary of the extent of survey work of each type in the Langavat catchment.

Survey effort since designation	High	Moderate	Low	No. surveys/ projects since designation
Juvenile survey			X	15
Smolt survey		X		4
Adult survey			X	0

2. Biosecurity

Giant hogweed and rhododendron (*Rhododendron ponticum*) are present within the SAC. Although the extent of their distribution has not been determined by survey, it is advised that these species are likely to be present in low densities and in isolated pockets. As a result it is considered that they have a low impact on Atlantic salmon.

Table 6.2 - Summary of the impact of the two main INNS in the Langavat catchment.

Species of greatest concern	Impact on salmon
Giant hogweed	Low - Impact not yet demonstrated - no management action.
Rhododendron	Low - Impact not yet demonstrated - no management action.

3. Stocking and fish movements

Up to 2005 the Grimersta Estate undertook annual stocking of approximately 40,000 Atlantic salmon fry to the Grimersta catchment. These fish were sourced from within the catchment and stocking was for the purpose of enhancing juvenile populations. No such stocking has taken place since 2005 and there are no plans to recommence such work.

4. Barriers to fish passage

There are no man made weirs, dams or impoundements known to be preventing or partially preventing the passage of Atlantic salmon to their natural range.

7. River Little Gruinard

1. Juvenile, smolt and adult surveying

This section sets out the extent of juvenile, smolt and adult survey work that has taken place in the River Little Gruinard SAC since the year of designation. The survey effort is summarised in Table 7.1.

i. Juvenile survey

There have been 32 timed electro-fishing surveys carried out in 2006, 2008 and 2009 for the purposes of general stock assessment. The 2006 surveys were located in the main channel and headwater streams, while in 2008, the main river below Fionn Loch was surveyed. In 2009, surveys concentrated on the headwater streams above Fionn Loch.

ii. Smolt survey

No smolt surveys have been carried out.

iii. Adult survey

No adult surveys have been carried out.

Table 7.1 - Summary of the extent of survey work of each type in the Little Gruinard catchment.

Survey effort since designation	High	Moderate	Low	No. surveys/ projects since designation
Juvenile survey			X	32
Smolt survey			X	0
Adult survey			X	0

2. Biosecurity

American mink are potentially a high risk within the Little Gruinard catchment (and have been trapped within 2km of a water vole population). No formal or catchment wide control programme is currently underway, but trapping is being carried out on an *ad hoc* basis. *R. ponticum* is present in the SAC, but currently has a relatively isolated distribution. It is, however, spreading in wooded areas within 1 km of the river in the upper catchment and has infested riparian areas in the lower catchment. European minnow (*Phoxinus phoxinus*) are present in a tributary of the upper river (the Beannach Burn), but have not yet spread to the main river channel.

Table 7.2 - Summary of the impact of the three main INNS in the Little Gruinard catchment.

Species of greatest concern	Impact on salmon
American mink	Unknown risk to Atlantic salmon (but high risk to water voles).
Rhododendron ponticum	Moderate risk.
European minnow	Unknown risk.

3. Stocking and fish movements

Stocking activities have not taken place in the Little Gruinard SAC since designation.

4. Barriers to fish passage

There are no man made weirs, dams or impoundements known to be preventing or partially preventing the passage of Atlantic salmon to their natural range.

8. River Moriston

1. Juvenile, smolt and adult surveying

This section sets out the extent of juvenile, smolt and adult survey work that has taken place in the River Moriston SAC since the year of designation. The survey effort is summarised in Table 8.1.

i. Juvenile survey

In 2004/5 and from 2007 to 2010, 46 semi or fully quantitative electro-fishing surveys and 63 times surveys were carried out on the River Moriston and its tributaries (no surveys were carried out in 2006). The 2004/5 surveys included SAC monitoring and the 2008 work was largely in support of the FASMOP project.

ii. Smolt survey

No smolt survey work has been carried out since designation.

iii. Adult survey

No adult survey work has been carried out since designation.

Table 8.1 - Summary of the extent of survey work of each type in the River Moriston catchment.

Survey effort since designation	High	Moderate	Low	No. surveys/ projects since designation
Juvenile survey		X		109
Smolt survey			X	0
Adult survey			X	0

2. Biosecurity

Two species have been identified as potentially having some impact on salmon in the River Moriston. These are European minnow and pike (*Esox lucius*). Both are extensively distributed and common in the catchment and are thought to have a moderate impact on Atlantic salmon. No current management is in place.

Table 8.2 - Summary of the impact of the two main INNS in the River Moriston catchment.

Species of greatest concern	Impact on salmon
European minnow	Moderate - Impact strongly suspected - no current management action.
Pike	Moderate - Impact strongly suspected - no current management action.

3. Stocking and fish movements

In 2008, approximately 9,000 salmon eggs of local provenance were introduced to the river as part of an egg box/artificial redd experiment to test water quality upstream of Ceannocroc Heck. Subsequent electro-fishing was carried out to monitor the results.

4. Barriers

There is one licenced instream structure that is known to be an influence on fish passage (Table 4.3).

Name of Watercourse	**Name of Barrier**	**Notes**
River Moriston - Dundreggan Dam to Bun Loyne	Not named	Assume heck - fish pass fitted. Needs further discussion with SSE. CAR licence CAR/L/1011471

9. River Naver

1. Juvenile, smolt and adult surveying

This section sets out the extent of juvenile, smolt and adult survey work that has taken place in the River Naver SAC since the year of designation. The survey effort is summarised in Table 9.2.

i. Juvenile survey

From 2003 to 2011, electro-fishing surveys were carried annually within the River Naver catchment. This work included a total of 106 semi or fully quantitative surveys and 41 times surveys. The majority were carried out for the purposes of general stock assessment, but there were also several project and impact related surveys. The impact related projects centred around an investigation of the effects of Scottish and Southern Energy’s catchwater on the River Vagastie.

ii. Smolt survey

No smolt survey work has been carried out since designation.

iii. Adult survey

An adult tagging project has been carried out annually since 2003 to determine the number of fish entering the river. Table 9.1 below shows the number of adults and grilse tagged each year, and the resultant estimate of returning adults.

Table 9.1 - Number of salmon tagged each year and estimate of returning adult numbers.

Year	Number of grilse or adults tagged	Estimate of returning numbers
2003	191	4,560
2004	250	5,208
2005	251	5,250
2006	217	7,848
2007	514	9,785
2008	337	5,977
2009	292	6,090
2010	645	13,001

Table 9.2 - Summary of the extent of survey work of each type in the River Naver catchment.

Survey effort since designation	High	Moderate	Low	No. surveys/ projects since designation
Juvenile survey		X		147
Smolt survey			X	0
Adult survey		X		8

2. Biosecurity

Only one species has been highlighted as a biosecurity concern in the River Naver; the European minnow. This species is moderately distributed in the catchment, but the impact on Atlantic salmon has not been investigated and there is no management action currently in place to control it. The river is vulnerable to the introduction of other new species through a number of routes (anglers, canoes, etc) which could have a negative impact.

Table 9.3 - Summary of the impact of the one main INNS in the River Naver catchment.

Species of greatest concern	Impact on Atlantic salmon
European minnow	Low - Impact not yet demonstrated - no management action.

3. Stocking and fish movements

Stocking with unfed salmon fry of local provenance has taken place every year from 2003 to 2009, and also in 2011. In the first three years, between 150,000 and 320,000 fry were introduced for the purposes of stock enhancement. From 2006 to 2009 inclusive, much smaller numbers of fry were stocked (between 6,000 and 16,000) in association with a 'Salmon in the Classroom' education project. In 2011, the River Naver Salmon Stocking Strategy 2011-2022 commenced with the stocking of 22,000 fry. Electro-fishing has been carried out each year to monitor the effectiveness of the stocking activity.

4. Barriers to fish passage

There are no man made weirs, dams or impoundements known to be preventing or partially preventing the passage of Atlantic salmon to their natural range.

10. North Harris

1. Juvenile, smolt and adult surveying

This section sets out the extent of juvenile, smolt and adult survey work that has taken place in the North Harris SAC since the year of designation. The survey effort is summarised in Table 10.1.

i. Juvenile survey

Electro-fishing surveys were carried out within the North Harris SAC in 2006 (Ulladale), 2009 (Leosaid) and 2010 (Voshimid) for the purposes of general stock assessment. A total of 15 sites were surveyed (mainly timed).

ii. Smolt survey

In 2007 and 2009, sweep netting was employed to attempt to assess smolt numbers, but was unsuccessful as no Atlantic salmon smolts were caught.

iii. Adult survey

No adult salmon survey work has been carried out since designation.

Table 10.1 - Summary of the extent of survey work of each type in the North Harris SAC.

Survey effort since designation	High	Moderate	Low	No. surveys/ projects since designation
Juvenile survey			X	15
Smolt survey		X		2
Adult survey			X	0

2. Biosecurity

Rhododendron, giant hogweed and rainbow trout have been identified as the major biosecurity risks within the SAC, although their distributions are all restricted or unverified. They are considered to be of low impact and are not currently being managed.

Table 10.2 - Summary of the impact of the three main INNS in the North Harris SAC

Species of greatest concern	Impact on Atlantic salmon
Rhododendron	Low - Impact not yet demonstrated - no management

	action.
Giant hogweed	Low - Impact not yet demonstrated - no management action.
Rainbow trout	Low - Impact not yet demonstrated - no management action.

3. Stocking and fish movements

In 2006, 50 adult rainbow trout and 50 adult brown trout from outwith the catchment were stocked into a land locked loch within the North Harris SAC in order to create a new fishery. No monitoring has been carried out.

4. Barriers to fish passage

There are no man made weirs, dams or impoundements known to be preventing or partially preventing the passage of Atlantic salmon to their natural range.

11. River Oykel

1. Juvenile, smolt and adult surveying

This section sets out the extent of juvenile, smolt and adult survey work that has taken place in the River Oykel SAC since the year of designation. The survey effort is summarised in Table 11.1.

i. Juvenile survey

Each year since 2000, approximately ten sites have been surveyed for the purposes of general stock assessment. In each case, the electro fishing surveys have been fully quantitative.

ii. Smolt survey

No smolt survey work has been carried out on the River Oykel SAC since designation.

iii. Adult survey

Floy tagging was carried out in the early 2000's in order to establish rod and line recapture rates.

Table 11.1 - Summary of the extent of survey work of each type in the River Oykel SAC.

Survey effort since designation	High	Moderate	Low	No. surveys/ projects since designation
Juvenile survey		X		100
Smolt survey			X	0
Adult survey		X		2

2. Biosecurity

No biosecurity risks have been identified for the River Oykel SAC, and no management activities are currently in place.

3. Stocking and fish movements

From 2000 to 2005, the Kyle of Sutherland DSFB stocked approximately 3,000 Atlantic salmon smolts each year into the River Oykel. These were sourced within the catchment and the aim was to help restore depleted stocks. Rod catches were recorded to monitor the effectiveness of the work.

4. Barriers

There is one weir that is known to be an influence on fish passage (Table 4.3).

Name of Watercourse	Name of Barrier	Notes
Tutim Burn	Not named	Man made strucure no fish present upstream in limited (in area) but good habitat.

12. River South Esk

1. Juvenile, smolt and adult surveying

This section sets out the extent of juvenile, smolt and adult survey work that has taken place in the River South Esk SAC since the year of designation. The survey effort is summarised in Table 12.1.

i. Juvenile survey

A total of 128 sites have been electro-fished within the River South Esk SAC since 2001 for the purposes of general stock assessment on the main river channel and its tributaries. The majority of surveys were semi quantitative, but some timed surveys were also carried out.

ii. Smolt survey

No smolt survey work has been undertaken on the River South Esk since designation.

iii. Adult survey

No adult survey work has been undertaken on the River South Esk since designation.

Table 12.1 - Summary of the extent of survey work of each type in the River South Esk SAC

Survey effort since designation	High	Moderate	Low	No. surveys/ projects since designation
Juvenile survey		X		128
Smolt survey			X	0
Adult survey			X	0

2. Biosecurity

Invasive non-native species have been identified as being important pressures on the River South Esk. Giant hogweed and American mink are considered to have the highest impact, with extensive distributions and management actions in place. Japanese knotweed is moderately distributed, but still regarded as a high impact species. Himalayan balsam is extensively distributed, but viewed as slightly less of an issue. Rainbow trout, European minnow and rhododendron are moderately distributed with a moderate to low impact. North American signal crayfish and piri piri are rare, but with a high impact locally.

Table 12.2 - Summary of the impact of the nine main INNS in the River South Esk SAC.

Species of greatest concern	Impact on salmon

Giant hogweed	High - A high impact demonstrated - current and quantifiable active management.
American mink	High - A high impact demonstrated - current and quantifiable active management.
Japanese knotweed	High - A high impact demonstrated - current and quantifiable active management.
Himalayan balsam	Moderate - Impact strongly suspected - no current management action.
Rainbow trout	Low - Impact not yet demonstrated - no management action.
European minnow	Low - Impact not yet demonstrated - no management action.
Rhododendron	Moderate - Impact strongly suspected - no current management action.
American signal crayfish	High - A high impact demonstrated - current and quantifiable active management.
Piri piri	High - A high impact demonstrated - current and quantifiable active management.

3. Stocking and fish movements

There has been no stocking carried out in the River South Esk since designation.

4. Barriers

There are six weirs/impouindements that is known to be an influence on fish passage (Table 4.3). A fish pass was installed on a structure that was restricting migration, Whalan Weir, in 2010.

Name of Watercourse	Name of Barrier	Notes
Melgund Burn	Not named	Impoundment on farm pond
Noran Water	Not named	Den of Ogil Reservoir
Prosen Water (Source(s) to Burn of Lednathie Confluence)	Not named	
River South Esk (White Burn Confluence to Estuary)	ALDBAR WEIR	
River South Esk (White Burn Confluence to Estuary)	Not named	
Loch Lee	Not named	Loch Lee Reservoir

13. River Spey

1. Juvenile, smolt and adult surveying

This section sets out the extent of juvenile, smolt and adult survey work that has taken place in the River Spey SAC since the year of designation. The survey effort is summarised in Table 13.1.

i. Juvenile survey

Since 2001, a great deal of electro-fishing survey has been carried out within the River Spey catchment. In all, 1,224 sites have been surveyed for the purposes of general stock assessment and to inform local management activities undertaken by the River Spey DSFB and the Spey Foundation. Semi or fully quantitative surveys were carried out at 724 of the sites, mainly on tributary locations, with the remaining 500 sites being timed and completed largely on main stem locations.

This data, although not part of this strategic assessment of the SAC as a whole, is able to identify at finer resolution areas the variable juvenile productivity across the entire catchment than has been shown in the present study.

ii. Smolt survey

A substantial volume of smolt survey work has been carried out on the River Spey since 2001, with Rotary Screw Traps and Wolf Traps installed every year since 2005. The Wolf trap was put in place at the Spey Dam, and Rotary Screw Traps has been used in tributaries of the upper river, as well as in the main stem.

iii. Adult survey

In 2004, 2005 and 2006, floy tagging was carried out to examine numbers and stock characteristics of Atlantic salmon ascending the River Spey after September. In 2008 and 2009, a fish counter was installed in the River Dullan to gather data on Atlantic salmon and trout passage. In 2010, an adult fish trap was installed at the Spey Dam, to obtain data on the age structure of Atlantic salmon ascending through the dam.

Table 13.1 - Summary of the extent of survey work of each type in the River Spey SAC.

Survey effort since designation	High	Moderate	Low	No. surveys/ projects since designation
Juvenile survey	X			1,224
Smolt survey	X			17
Adult survey		X		6

2. Biosecurity

Eight invasive non-native species have been identified as being of concern within the River Spey catchment.

Giant hogweed, Japanese knotweed, Himalayan balsam and *Ranunculus* spp. are all extensively distributed and exert a high impact within the catchment. Control measures are currently in place for all. Roach (*Rutilis rutilus*), rudd (*Scardinius erythrophthalmus*) and orfe (*Leuciscus idus*) are all moderately distributed while tench (*Tinca tinca*) are less common. All four fish species are thought to be low in impact upon Atlantic salmon and are not controlled.

Table 13.2 - Summary of the impact of the eight main INNS in the River Spey SAC.

Species of greatest concern	Impact on salmon
Giant hogweed	High - A high impact demonstrated - current and quantifiable active management.
Japanese knotweed	High - A high impact demonstrated - current and quantifiable active management.
Himalayan balsam	High - A high impact demonstrated - current and quantifiable active management.
Ranunculus spp.	High - A high impact demonstrated - current and quantifiable active management.
Roach	Low - Impact not yet demonstrated - no management action.
Rudd	Low - Impact not yet demonstrated - no management action.
Orfe	Low - Impact not yet demonstrated - no management action.
Tench	Low - Impact not yet demonstrated - no management action.

3. Stocking and fish movements

Each year since 2003, between 700,000 and 2,600,000 0+ salmon have been stocked into the River Spey from within the catchment, for the purposes of stock enhancement. Electro-fishing and smolt trapping at the Spey Dam have both been used to monitor effectiveness of the stocking programme, and to direct and improve the location and extent of the stocking undertaken.

More recently the hatchery programme has been part of a major genetics study to further assess its contribution to the rod catch of the river. Although this work is not yet completed or finalised initial findings of this study have been used by the DSFB and Spey Foundation to reduce and re-assess the stocking activities from 2011. Numbers of salmon stocked by the DSFB has declined annually since 2007 and numbers are currently approximately 10% of that stocked in 2007.

4. Barriers

There are a total of 23 weirsor impoundments that are known to be an influence on fish passage on the Spey SAC (Table 4.3).

Table 4.3 – Weirs and impoundments where fish passage is known to be an issue

Name of Watercourse	**Notes**
Allt na Criche	Further investigation required
Broad Burn	Lower distillery weir
Burn of Carron	Concrete modification just above road
Burn of Corrie	Old weir
Knockando Burn	Tamdhu Distillery intake
River Mashie	RioTinto struture
Markie Burn	Sediment trap - impassable
Cromdale Burn	Balmenach Distillery intake
Allt Laraidh	SW abstraction
Burn of Carron	Glenfarclas Distillery
Burn of Ringorm	Falls/weir below distillery
Burn of Ringorm	Macallan Intake weir
Crunachdan tunnel	Licenced structure
Crunachdan tunnel	Licenced structure
Cuaich	Impoundment licenced
Loch Cuiach	Licenced impoundment
Millstoneford Burn	Weir on map, Rothes House
Spey Dam	
Tromie	Impoundment licenced
Tromie	Impoundment
Tromie	Impoundment
Tromie	Impoundment
Rothes Burn	Upper distillery intake

14. River Tay

1. Juvenile, smolt and adult surveying

This section sets out the extent of juvenile, smolt and adult survey work that has taken place in the River Tay SAC since the year of designation. The survey effort is summarised in Table 14.1.

i. Juvenile survey

Since 2007, approximately 150-200 electro fishing surveys have been carried out on a wide variety of tributaries of the River Tay. The vast majority were carried out for the purposes of general stock assessment, with a small proportion also being project related or part of an impact investigation or assessment of hatchery operations. Of these surveys at least 141 were semi or fully quantitative while ten were time delineated.

ii. Smolt survey

In 2008, 20 smolts from the River Lochay were radio tracked to study their behaviour around a power station.

iii. Adult survey

A tagging programme commenced in August 2011 with the aim of studying exploitation rates of the autumn run component and to inform an assessment of the potential to extend or revise the fishing season of the River Tay. However, this programme was not successful due to practical difficulties in adult fish capture from necessary locations and only a very small number of fish were included in the work which was not continued.

Table 14.1 - Summary of the extent of survey work of each type in the River Tay SAC.

Survey effort since designation	High	Moderate	Low	No. surveys/ projects since designation
Juvenile survey		X		151
Smolt survey			X	1
Adult survey			X	1

2. Biosecurity

Eleven invasive non-native species have been identified as of concern in the River Tay catchment.

Whist not strictly an non-native species, the River Tay is the only SAC for which European beavers (*Castor fiber*) have been highlighted as being present/a concern. Having escaped from captivity, or been illegally released into the wild, the actual number of feral animals and their detailed distribution is unknown.

American mink and Himalayan balsam, are extensively distributed in the Tay, and Japanese knotweed, Giant hogweed, rainbow trout and other non-native fish species are all present in the catchment. These have been identified as being likely to have an impact on Atlantic salmon. However, the species thought likely to have the greatest potential impact are the North American signal crayfish, currently present and of limited distribution but likely to be impossible to remove and with further spread inevitable, and *Argulus spp*. The parasitic nematode*, Anasakis* spp. is thought to be present and is considered by the Tay Foundation to have a relatively high potential impact.

Currently there are active programmes of management and control for American mink, giant hogweed, Japanese knotweed and North American signal crayfish although it is unlikely to be technically feasible or practically possible to fully remove these species from the catchment. In the case of American signal crayfish their rate of spread may be reduced to a degree by control and management but further spread in the catchment is likely.

Table 14.2 - Summary of the impact of the 11 main INNS in the River Tay SAC.

Species of greatest concern	Impact on salmon
American Mink	High - A high impact demonstrated - current and quantifiable active management.
Japanese Knotweed	Moderate - Impact strongly suspected - current and quantifiable active.
Himalayan Balsam	Moderate - Impact strongly suspected - current and quantifiable active management.
Giant Hogweed	Low- Impact not yet demonstrated - current and quantifiable active management
North American Signal Crayfish	High - A high impact demonstrated - current and quantifiable active management.
Rainbow Trout	Moderate - Impact strongly suspected - no current management action.
Minnow	Low - Impact not yet demonstrated - no management action.
Other non-native fish species	Moderate - Impact strongly suspected - no current management action.
Anasakis sp. - nematode worm	Moderate - Impact strongly suspected - no current management action.
Argulus - fish louse	Moderate - Impact strongly suspected - no current management action.
Beaver	Moderate – Not strictly INNS, but impact strongly suspected - no current management action.

3. Stocking and fish movements

The Tay DSFB has stocked between 1.5-2.3 million eyed Atlantic salmon ova and unfed fry, sourced from within the catchment, each year since 2004. Stocking is undertaken to enhance existing stocks and increase juvenile production. Electrofishing has been carried out on some stocked tributaries to monitor the success of the project. In addition, in 2011, 80,000 fed parr were stocked as part of a project to compare the survival of fed parr with unfed fry.

4. Barriers

There are a total of 37 weirs or impoundments that are known to be an influence on fish passage on the Tay SAC (Table 4.3).

Table 4.3 – Weirs and impoundments where fish passage is known to be an issue

Name of Watercourse	**Name of Barrier**	**Notes**
Coupar Burn/Kinochtry	Not named	Weir has been opened up recently with WEF funding, subsequently an Archimedes turbine introduced with fish pass whose effectiveness is to be established.
Lunan Burn (Loch of Clunie to Loch of Drumellie)	Newmill eel trap	Although there are passages through which fish might migrate, there is bascially a weir complex which by following main flows fish are likely to be attracted to dead ends
Cloan Burn	Not named	Hydro constructed.
Millhole Burn	Not named	Impassable weir but there is a bigger impassable weir not far upstream.
Ruthven Water	Not named	Not passable and a priority for action
Glamis Burn	Not named	Not passable but not a large length of accessible habitat until reach a fall.
River Earn (Loch Earn to Water of Ruchill confluence)	Earn weir	Hydro power off take. Not sure whether fish densities above reflect fish passage or habitat quality.
Ruthven Water	Not named	Weir is partially passable. Above weir very good trout densities (possibly sea trout) and less salmon, below weir almost all salmon. Weir may to some extent hinder salmon, to the benefit of sea trout.
Alyth Burn	Not named	Low weir, passable under certain conditions only.
River Garry from Garry Intake to Errochty Water confluence	Not named	Local reports suggest salmon may get over weir, but has been stocked recently so electrofishing not reliable

Name of Watercourse	Name of Barrier	Notes
Turret Burn (Turret Loch to River Earn confluence)	Mcrosty weir	Weir has fish pass but is not always attractive. Weir needs work to improve it. However electrofishing suggests presence of weir might favour sea trout. Salmon dominated downstream.
Kerbet Water	Not named	2.5m height with fish pass that is suspect under certain flows as fish are attracted to the weir instead of pass. Better if weir was removed but owners like the impoundment as a feature.
River Lyon	Stronuich dam	Stronuich Dam, has borland fish lift. There are however problems with invertebrate productivity because of hydro flows.
Dall Burn	Dall burn weir	Impassable old weirwirth no salmon recorded above and below. The latter reflects other historic problems lower down Tummel catchment which is being slowly recolonised.
Loch Eigheach	Gaur dam	
River Tummel (Loch Tummel to Loch Faskally)	Clunie dam	Clunie dam, are issues here regarding smolt passage. Smolts have to go through turbines as smolt screening proved ineffective in diverting smolts into fish pass. Loss of smolts may have a general depressing effect on overall Tummel salmon population, reflected in poor numbers in upper reaches of catchment. Cumulative effects of barriers to upstream moving adults may also contribute
Allt Chaldar	Not named	Diversion weir for hydro. No compensation or hof downstream. Were a flow to be introduced below and passage allowed, the amount of river made accessible would be ca. 1.75km as opposed to the 1km only above the dam.
Eassie Burn	Not named	Weir built on top of low waterfall. May be passable in high flows, but likely difficult.
Fithie Burn	Not named	Weir with no fish pass.
Shochie Burn (Ordie Burn Confluence to R Tay)	Luncarty weir	Weir has fish pass which does function seemingly well, though under certain conditions may deter fish. Fish pass subject to clogging and requires maintenance. Would be better removed if possible.

Name of Watercourse	Name of Barrier	Notes
Stormontfield Lade	Not named	Passability flow dependant as needs to be enough flow to attract fish up for Cambusmichael Burn.
Glassart Burn	Not named	Old weir
Kerbet Water	Not named	Weir with low central section. Should pass fish if maintained. Some years ago was blocked but requires regular maintenance.
Motray Water	Not named	Weir 2m. Water abstraction can prevent fish reaching this point.
R Ericht	Not named	Weir is passable, although fish pass is deteriorating and in time may need to be rebuilt. If it ceases to pass fish effectively this could be serious problem.
River Almond (Freedoch Burn to R East Pow Confluences)	Horseshoe weir	Large weir, may be problem late in year when water temperatures are low and flows low. Exacerbated by water abstraction for a private hydro which has no hands off flow arrangement.
River Earn (Loch Earn to Water of Ruchill confluence)	Not named	Suspect burn may become impassable upstream.
River Eden (Source to confluence with Rossie Drain)	Not named	Sloping weir passable in some conditions but possibly difficult under certain flows
River Garry from Loch Garry to Garry Intake	Garry offtake	River Garry hydro intake
Errochty Water	Not named	This stream is abstracted for hydro.
Errochty Water	Not named	Weir just below Trinafour power station. Presumably built to prevent upstream fish passage as above the power station, the river is dry. Probably <50m between weir and power station.
Killichonan Burn	Not named	This stream is totally abstracted upstream, hence flows in lower reaches are much depleted.
River Tay (R Tummel to R Isla Confluences)	Not named	Concrete weir likely to be impassable, however, because of waterfall downstream, it may be that migratory fish do not always or even frequently get this far
Loch Lyon	Lubreoch dam	Lubreoch dam on Loch Lyon reservoir

Name of Watercourse	Name of Barrier	Notes
River Lyon	Lunn weir	Small diversion dam, no compensation or hands off flow downstream.
Loch Errochty	Not named	Loch Errochty dam impassable.
Loch Rannoch	Rannoch weir	Rannoch weir
Lornty Burn	Not named	Very large weir. There is question whether there might be impassable waterfall if weir was removed. Supplies private hydro.

15. River Teith

1. Juvenile, smolt and adult surveying

This section sets out the extent of juvenile, smolt and adult survey work that has taken place in the River Teith SAC since the year of designation. The survey effort is summarised in Table 15.1.

i. Juvenile survey

A total of 45 electro-fishing surveys were carried out on the River Teith and tributaries in 2002/2003 and in 2010/2011. Of these 41 surveys were timed, and four were fully quantitative. Many of the surveys were carried out for the purposes of SAC monitoring, but there were also impact assessment surveys for hydro schemes and settlement pond lowering.

ii. Smolt survey

There has not been any smolt survey work on the River Teith since designation.

iii. Adult survey

There has not been any adult survey work on the River Teith since designation.

Table 15.1 - Summary of the extent of survey work of each type in the River Teith SAC.

Survey effort since designation	High	Moderate	Low	No. surveys/ projects since designation
Juvenile survey			X	45
Smolt survey			X	0
Adult survey			X	0

2. Biosecurity

Giant hogweed, Japanese knotweed, Himalayan balsam and American mink are all extensively distributed throughout the River Teith catchment and are all currently subject to management control projects. North American signal crayfish are present in the River Teith. Although their distribution is thought to be relatively restricted, they are considered to have a high impact on Atlantic salmon, and are subject to active monitoring.

Table 15.2 - Summary of the impact of the four main INNS in the River Teith SAC.

Species of greatest concern	Impact on salmon
Giant hogweed	High - A high impact demonstrated - current and quantifiable active management.
Japanese knotweed	High - A high impact demonstrated - current and quantifiable active management.
Himalayan balsam	High - A high impact demonstrated - current and quantifiable active management.
American mink	High - A high impact demonstrated - current and quantifiable active management.
American signal crayfish	High - A high impact demonstrated - current and quantifiable active management.

3. Stocking and fish movements

There has been no known stocking of the River Teith since designation.

4. Barriers

There are a total of 37 weirs or impoundments that are known to be an influence on fish passage on the Tay SAC (Table 4.3).

Name of Watercourse	**Name of Barrier**	**Notes**
Ardoch Burn	Not named	Possible problem for migration
Calair Burn	Calair Burn Weir	Complex weir, falls, island. Partially impassable, very low densities of salmon upstream. Vast system of prime spawning habitat upstream, not being fully utilised. SAC for salmon. Very high priority
Achray Water	Loch Katrine Dam	Good fish pass - channel below pass may get clogged with gravel which could affect passability
River Teith	Deanston Weir	Problems with poaching and abstraction at this weir. It is passable but not completely and any further abstraction would be severely detrimental

16. River Thurso

1. Juvenile, smolt and adult surveying

This section sets out the extent of juvenile, smolt and adult survey work that has taken place in the River Thurso SAC since the year of designation. The survey effort is summarised in Table 16.1.

i. Juvenile survey

Electrofishing surveys have been undertaken in the River Thurso regularly before and after SAC designation in 2001 by the Caithness DSFB. Generally, surveys have been completed every two years with six-eight sites fished each survey year. Surveys have been completed to gather information on the general status of juvenile stocks in the river and to inform local management and decision making. When hatchery operations were active some surveys were completed to monitor juvenile populations in stocking locations.

ii. Smolt survey

There have been no specific or general quantitative studies of smolts in the catchment. However, qualitative observations of smolt numbers are reported as being made by local managers, ghillies and bailiffs.

iii. Adult survey

There have not been any fully quantitative studies of adult numbers in the catchment and no fish counters exist or are operational. Local managers undertake annual semi-quantitative counts of numbers of spawning pairs of fish which provide general indications of numbers of fish spawning in locations across the catchment.

Table 16.1 - Summary of the extent of survey work of each type in the River Thurso SAC.

Survey effort since designation	High	Moderate	Low	No. sites or projects since designation
Juvenile survey		X		six-eight every two years
Smolt survey			X	0
Adult survey			X	Spawning fish counts across catchment

2. Biosecurity

There are no records advised of any invasive non-native species being present in the catchment and, therefore, no management action is undertaken (see Table 16.2).

Table 16.2 - Summary of the impact of the main INNS in the River Thurso SAC

Species of greatest concern	Impact on salmon
None	None

3. Stocking and fish movements

The hatchery on the River Thurso was closed in 2011 and not used in that year (or 2012). There are no current plans to bring it back into operation as the river managers consider that natural juvenile production is sufficient and a more effective means of sustaining the river stocks.

From 2000-2007 (approximately) the hatchery operated with an maximum output of 100,000 unfed fry per year. Fish used in the stocking operation were native to the Thurso and the purpose of the stocking work was to support in-river juvenile production.

4. Barriers to fish passage

There are no man made weirs, dams or impoundements known to be preventing or partially preventing the passage of Atlantic salmon to their natural range.

17. River Tweed

1. Juvenile, smolt and adult surveying

This section sets out the extent of juvenile, smolt and adult survey work that has taken place in the River Tweed SAC since the year of designation. The survey effort is summarised in Table 17.1.

i. Juvenile survey

Since 2006, there have been 91 fully quantitative surveys and 971 timed surveys on the upper River Tweed and tributaries. These have all been carried out for the purposes of general stock assessment and as part of the Fifth edition of the Fisheries Management Plan for the Tweed & Eye Fisheries District.

ii. Smolt survey

Since 2006, smolt trapping has been carried out on the Yarrow Water to record sizes, ages and date of run start. Smolt age is also monitored through an ongoing problem of adult scale reading.

iii. Adult survey

From 2006 to 2009, Atlantic salmon tagging has been carried out in the estuary and the lower river to determine angling exploitation rates upstream. In 2010 and 2011, sub-samples of these fish were acoustically tagged to check if any returned to the sea or went downstream to the lowest tributary after tagging. Scale samples are collected from every fish killed at seven rod fisheries and a net fishery each year in order to monitor structural changes within the population, including trends in smolt ages.

Table 17.1 - Summary of the extent of survey work of each type in the River Tweed SAC.

Survey effort since designation	High	Moderate	Low	No. surveys/ projects since designation
Juvenile survey	X			1,062
Smolt survey		X		5
Adult survey		X		6

2. Biosecurity

North American signal crayfish and bullhead (*Cottus gobio*) have been identified as the major invasive non-native species affecting Atlantic salmon within the Tweed catchment. The crayfish have been confirmed as being moderately distributed in three tributaries whilst bullhead have a restricted distribution in two tributaries. There is no current management activity as currently there are no effective control methods available for these populations in these locations, although trials are being planned.

Table 17.2 - Summary of the impact of the two main INNS in the River Tweed SAC.

Species of greatest concern	Impact on Atlantic salmon
North American signal crayfish	Moderate - Impact strongly suspected - no current management action.
Bullhead	Moderate - Impact strongly suspected - no current management action.

3. Stocking and fish movements

Stocking activities in the waters of the River Tweed are regulated by the River Tweed Commissioners. There is no stocking of Atlantic salmon or trout in to the rivers of the Tweed system as a matter of policy of the River Tweed Commission. Stocking of triploid Brown trout and Rainbow trout into closed still waters is usually permitted. Stocking of coarse fish species into closed waters in areas of the catchment where the species is already present is allowed, and for species unable to breed under the local climatic conditions, such as carp, permission is more widely given.

4. Barriers

There are a total of 11 weirs or impoundments that are known to influence fish passage on the Tweed SAC (Table 4.3). Measures have been taken on two other in stream structures to ease fish passage (Table 4.4).

Table 4.3 – Instream structures where fish passage is known to be an issue

Name of Watercourse	**Name of Barrier**	**Notes**
Allan Water (Source to Teviot Water)	Newmill Ford	Impassable obstruction
Ale Water	Alemoor Reservoir	
Caddon Water	Stantling Craig Reservoir	4m man-made waterfall (should be called a weir!)
Halter Burn	Halter Burn	Obstacle in England but most of watercourse in Scotland
Lyne Water (Source to Tarth Water confluence)	Baddinsgill Reservoir	
Polmood Burn	Palmood dam	Currently going through license registration. A fish pass needs to be installed

Name of Watercourse	**Name of Barrier**	**Notes**
Whiteadder Water	Whiteadder Reservoir	
Caddon Water	Stantling Craig Reservoir	Barrier affects Sea Trout / Brown Trout more than Salmon
Dawyck Burn. River Tweed (Talla Water confluence to Scotsmill)	Dawyck Estate	Tiny bit of burn upstream. Only suitable for Trout
Fruid Water	Fruid Water reservoir	
Megget Water	Megget Reservoir	
Talla Water	Talla Water reservoir	
Watch Water	Watch Water Reservoir	
Boondreigh Burn	Dod Mill	Rudimetary fish pass. Bigger problem is obstruction just downstream (added)
Boondreigh Burn	Dod Mill 2	Concrete apron taken up to the based of a waterfall, making fish passage very difficult
Cor Water. River Tweed (Source to Talla Water confluence)	Cor Water	Consider in tandem with ID 2237. Important area for Spring Salmon
Ettrick Water (Ramseycleuch to River Tweed)	Murray Cauld	New fish pass intalled in 2013. Expected to allow full migration
Haystoun Burn	Haystoun dam	Fish pass installed in the past but doesn't appear to work. Pond made for amenity
River Tweed (Source to Talla Water confluence)	Cor Water	Consider in tandem with ID 2239. Important area for Spring Salmon
Rule Water	Weens Cauld	Electro-fishing data suggests intermittent access
St Mary s Loch	St Marys Loch intake	Not a dam as such. Fish passage currently being investigated with a report imminent
Wauchope Burn/Harwood Water	Weens Cauld	Bonchester Bridge
Wooler Water. River Tweed (Coldstream to tidal limit)	Haugh Head Ford	Fish pass doesn't work. Complete barried to Salmon
Jed Water	Glebe Cauld	Fish pass could be improved. Fish pass report has been produced

Name of Watercourse	Name of Barrier	Notes
Leithen Water	Leithen Cauld	An access issue at the moment due to a braided channel at the bottom of the Leithen. Cauld is believed to be a partial barrier to migratory fish. Ownership . Listed structure
River Till (IN ENGLAND)	Twizel Cauld	
River Tweed (Coldstream to tidal limit)	Milne Graden Cauld	
River Tweed (Ettrick Water to St Boswells Burn confluences)	Mertoun Cauld	
Tweed	Banff Mill	

Table 4.4 – Instream structures where fish passage has been eased since 2008

Name of Watercourse	Name of Barrier	Notes
Blackadder Water (Howe Burn confluence to Whiteadder Water)	Kimmerghame Cauld	Fish pass installed by The Tweed Foundation in the past.
Earnscleugh Water	Earnsleugh water intake	Alterations carried out by The Tweed Foundation

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