



Response to proposed Aquaculture & Fisheries Bill

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Summary and Conclusions

Genetic purity

Investigations using genetic markers have identified distinct populations of wild salmon in Scottish rivers. These discrete populations have been attributed to thousands of years of natural selection that adapts the salmon to the specific conditions of the rivers in which they breed.

Sadly, this romanticised view of the iconic salmon may well be misplaced. The variation identified in genetic markers is more likely to be the result of Genetic Drift than natural selection. Genetic Drift is a form of evolution caused by random acts of selection. In the case of wild salmon, this random selection is the on-going removal of genetic material as a result of more than 150 years of unrelenting angling. The removal of this genetic material throughout all angling rivers has meant wild salmon populations have been adapted by human intervention and the natural gene pool is irrecoverable.

The concept of Genetic Drift has rarely, if ever, been applied in relation to wild salmon populations because research has been primarily directed at proving that distinct populations are the result of natural selection.

Wild salmon stocks

Salmon farming is blamed for the decline of Scotland's west coast salmon stocks. This is primarily because a collapse in salmon catches coincided with the arrival of salmon farming. Any idea that the two events were totally independent and coincidental has been given little attention.

Salmon and sea trout stocks crashed due to changes in the nature of the spate on these short west coast rivers. Higher and more aggressive flows would wash away eggs and small fry with the potential loss of generations of stocks. The loss of these generations, over just two or three breeding cycles, could have had a major impact on populations in subsequent years leading to an overall reduction in fish numbers.

Recent fishing reports have shown that the stock has largely recovered in most of the west coast rivers despite the continued presence of salmon farming. If salmon farming was to blame for the decline, it would be expected that stocks might never have recovered. Salmon farming remains an easy target for anglers to blame for anything that might affect their fishing activities.

Re-stocking

Re-stocking is a contentious issue. Many in the wild salmon community object to re-stocking alleging it is not natural and that re-stocking with hatchery fish can affect the gene pool. Removing fish by fishing is not 'natural' and if too many fish are removed from the river, it makes sense to replace lost breeding potential by re-stocking. The issue of genetics has already been identified as a distraction from the real issue. Re-stocking is about ensuring that there are plenty of fish for anglers to catch.

Re-stocking is sometimes discounted with instances where it has not been a great success being cited. This could be due to the use of the wrong re-stocking strategy focussing on eggs and newly hatched fry which have a low chance of survival. There is a view that larger fish become domesticated and therefore will not survive but work on the River Carron in Wester Ross has shown that re-stocking is most successful with 5g fish reared in covered tanks.

Catch & release

There is an increasing concern about the state of wild salmon stocks throughout the world with reports of fishing dying at sea. In response, most rivers now impose a Catch & Release policy in one form or another. The absence of a consistent policy on Catch & Release means that the system is open to abuse in some river systems. The record high catch reported for 2010, at a time when wild stocks are considered under threat, might suggest that records do not reflect the actual fish caught.

Early spring salmon are considered to be especially at risk. It would seem to make more sense if these fish were left undisturbed in the river and the fishing season delayed until the later-running fish reach the rivers.

Conservation

The Salmon & Trout Association promote the fact that they have designated themselves as a conservation charity. They will therefore be expected to support any measures to help conserve wild salmon. Their support of 'Special Areas of Conservation' is documented in two different complaints to the EU about breaches of the Habitats Directive.

Scotland has 17 rivers that are recognised as Special Areas of Conservation for salmon. These SAC's protect the environment to ensure that salmon can continue to breed. However, it seems to make for a weak conservation strategy when the breeding stock of salmon can be caught and killed. Perhaps the correct strategy should be more stringent measures imposed to protect the fish along with the habitat in these rivers.

Escapes

There is increasing concern that escapes of farmed salmon will breed with wild fish and dilute the gene pool. Whilst it is already clear that the existing gene pool is not natural but the result of interference by anglers who have removed genetic material from the rivers. Evidence of widespread interbreeding between wild and farmed salmon is inconclusive.

If populations of salmon that live in the same river do not interbreed because of genetic differences, why would they breed with escaped farmed salmon that exhibit similar differences?

Sea Lice

Sea lice are a management issue for salmon farming. However the evidence is inconclusive to what extent the spread of sea lice to and from wild salmon is responsible for the decline of wild salmon stocks.

Conclusions

The prerequisite for tighter controls on a salmon farming industry that is already well regulated needs to be supported with **hard data** to demonstrate that any such action will tackle real problems and bring real benefits. The apparent basis for this proposed legislation is that farmed salmon impact on wild salmon stocks. This not only remains unproven but much of the 'evidence' is based on perception not fact.

Before any further legislation is imposed on either the aquaculture industry or the wild salmon sector, **certain questions need to be answered** to avoid significant, misdirected effort and financial costs, all to no benefit to either farmed or wild stocks. **First clarification is required whether the wild salmon sector's aim, using the conservation argument, is to protect wild salmon in the same way that other animal species are afforded protection. Second, whether the aim is to protect the fish in order that anglers can catch them for sport. The intention is to bring proper research to analyse the disputes between farmed and wild salmon interests and not to prevent salmon anglers from pursuing their sport. It is essential to clarify the muddied waters between conservation and sport and ensure that any legislation is imposed for the right reasons.**

Introduction

In the press release that launched the consultation to support a sustainable future for aquaculture and freshwater fisheries, Minister for the Environment and Climate Change, Stewart Stevenson highlighted the need for both aquaculture and freshwater fisheries sectors to develop and co-exist harmoniously. The news that farmed salmon production increased its value to the economy to £540 million and that the 2010 figure for rod catches of wild salmon were the highest on record at 110,496 fish caught illustrates that the two sectors can grow and thrive together. Mr. Stevenson suggests that the sectors cannot be complacent and hence the need for consultation to ensure continued and improved high standards of management in both sectors. He argues that the right balance must be struck without the imposition of unnecessary or disproportionate regulatory burden.

Whilst Mr. Stevenson might suggest that the reason for this consultation is that neither sector can be too complacent, it could be argued that the stimulus for this consultation is actually the absence of the harmonious co-existence that he is so keen to see.

The lack of harmony is very much one-sided. The angling sector blame the demise of wild salmon stocks on the presence of salmon farms along the west coast of Scotland. They have repeatedly demanded the removal of salmon farms from areas where wild salmon can be found. Given that 2010 was a record year for rod caught salmon in Scotland, their demands seem to be rather excessive and appear to disregard any thoughts of co-existing together, let alone in harmony. It could be argued that any negative impact of one sector on the other is a price worth paying for such co-existence. However, the angling sector has shown that whilst the removal of salmon farming is their main target, they are also unwilling to tolerate the presence of other users of the Scottish river environment. They have launched attacks against rafting and canoeing, wild salmon nets-men and even the siting of wind turbines, all of which are blamed for disrupting wild salmon populations.

The main salmon representative organisation have registered themselves as a charity with the aim of conserving and protecting stocks of wild salmon. However, even the most dispassionate conservationist might view the catching and killing of wild salmon as an unusual way of conserving wild salmon.

Although the Minister has said that the consultation is aimed at avoiding any future complacency, the consultation document implies that there are issues that need to be addressed. Yet, there is a possibility that some issues are simply the result of hearsay and rumour rather than fact. Although the Scottish Executive are extremely diligent in their efforts to ensure correctness and fairness, they may have been exposed to repeated messages that may not be based on fact.

One such example is the view that aquaculture is detrimental to wild catch fisheries. Yet whilst the salmon farming industry has been in operation for over 40 years, there is very little evidence to support this claim. As the Minister has rightly pointed out, the annual rod catch of salmon for 2010 was a record high. This statistic does not seem to support the view that salmon farming is having a damaging effect on wild catch salmon fisheries.

The idea that salmon farming has a detrimental effect on wild catch fisheries has been able to gain such momentum due to the activities of the large US foundations such as Packard, Moore and Pew. These foundations have pumped huge amounts of funding into the fight against salmon farming in Canada's state of British Columbia. At the same time they have actively supported the Alaskan wild salmon fisheries industry.

This multi-million dollar funding has found many uses from paying for 'scientific studies' to supporting anti-salmon farming groups (David Suzuki Foundation anti-salmon farming leaflet ¹) and most importantly, paying for a well-developed publicity machine which has gained open-access to the mainstream press. This resulted in the appearance of many anti-salmon farming stories, which have given credibility, without genuine scientific scrutiny, to the perception that salmon farming negatively impacts on wild salmon populations. The funding provided by these US Foundations to fight against salmon farms has been extensively documented by researcher Vivian Krause².

It would seem that these US Foundations have recently reviewed their activities and have withdrawn from the frontline fight against salmon farming in Canada even though the battle continues. The leading activist in British Columbia is former US citizen Alexandra Morton whose dire warnings about the fate of wild salmon stocks in the Fraser River led to a judicial review which is underway. This is despite salmon returning to the Fraser River in record numbers last year. Ms Morton continues to attack the salmon industry which she blames for the appearance of the disease Infectious Salmon Anaemia (ISA) in wild Pacific salmon even though there is no evidence that Pacific salmon, or indeed any farmed salmon, have the disease.

¹ <http://fairquestions.typepad.com/files/whyyoushouldnteatfarmedsalmon-1.pdf>

² http://fairquestions.typepad.com/rethink_campaigns/

The significance of the Canadian battle between environmentalists and salmon farmers is that much of the so-called 'evidence' showing the alleged negative impact of salmon farming on wild stocks is being used by the Salmon & Trout Association to support their claims of similar impacts along the Scottish coast. The STA have even included a video featuring Alexandra Morton on their website³. Some of the scientific papers quoted by the STA have been examined by Vivian Krause, especially the case against salmon farms and sea lice and her critique can be found on her website⁴.

This document will consider some of the key issues in more detail.

³ <http://www.youtube.com/watch?v=yTYhQAN9BW0&NR=1>

⁴ http://fairquestions.typepad.com/rethink_campaigns/ten-reasons-why-some-sea-lice-research-claims-are-false.html

1. Genetic purity

Columnist Gerald Warner wrote in the Scotsman in 2009 that:

“The genetic purity of wild salmon is being diluted by interbreeding with fish escaped from salmon farms.”⁵

Whilst not an expert on salmon farming or fish genetics, Mr Warner was simply repeating a view that has been expressed by many of those who are concerned about the future of wild salmon stocks. Wild salmon have a unique genetic heritage that has been formed over many thousands of years. The Salmon & Trout Association (STA) sum this up on their Stand Up for Wild Salmon website:

• escaped adult farmed fish run from the sea into salmon rivers and breed with wild fish, diluting natural gene pools which have become established since the end of the Ice Age. This will, in time, destroy the gene lines which are best suited to salmon within individual river systems. In Norway, farm-origin fish can constitute up to 20% of salmon found on the spawning grounds.

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The Atlantic Salmon Trust (AST) suggests that distinctive natural gene pools formed even longer ago than the Ice Age. They say that the populations from the East and West Atlantic separated at least 600,000 years ago and whilst they may mix in the feeding grounds, they do not interbreed. In Europe, the Atlantic and Baltic populations have become genetically and geographically isolated and biologically distinct from the time of the last Pleistocene glaciation.

However, whilst geographic isolation will account for differences in these populations in the same way that Darwin observed a transformation in isolated populations of finches, the AST also argue that similar differentiation can be identified in different or even the same river system.

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<http://www.scotsman.com/news/gerald-warner-all-talk-and-no-action-as-fish-farms-kill-off-our-wild-salmon-1-1355202>

⁶ <http://www.standupforwildsalmon.org/Problems.html>

Atlantic salmon in different rivers and tributaries within rivers are organised by their homing tendency into distinct groups of breeders, representing distinct genetic populations. These genetic populations evolve over time to be distinct, across geographical regions, between river systems, and even within the same river system. Indeed, the resulting genetic distinctiveness means individual salmon can often be traced back to the river or tributary where they were born.

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The Rivers and Fisheries Trusts of Scotland (RAFTS) even suggest that these populations may be separated by a only a waterfall.

Recent genetic analysis of salmon populations in other rivers has indicated that river stocks may be structured on fine scale into multiple distinct breeding populations. For example, salmon breeding above and below waterfalls or other natural features may often be heritably different in ways that affect their behaviour, survival and reproductive success.

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The AST state that: “These distinctive populations, formed variously over decades, centuries and millennia, are the basic biological units controlling local species characteristics and abundance and they must be the central focus of management and conservation.”

They explain that:

The principal reason for this is simple: genetic variation (at individual and population level) is crucial to survival and reproductive fitness in a salmon's local environment, and ensures that each population is best suited to the particular environmental conditions it encounters in its river or tributary, and at sea.

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It is for this reason that the organisations representing the wild salmon interests have expressed concern about the issue of escapes of farmed salmon. The Norwegian Salmon Rivers (Norske Lakseelver) argue most succinctly that:

⁷ <http://www.atlanticsalmontrust.org/research/why-the-genes-should-fit.html>

⁸ <http://www.rafts.org.uk/focussing-atlantic-salmon-management-on-populations/>

⁹ <http://www.atlanticsalmontrust.org/research/why-the-genes-should-fit.html>

“Farmed salmon are genetically different after several decades of inbreeding. Mixing farmed with wild fish will over time lead to diluted quality fish with less ability to adapt to changing river conditions. The result is that fewer fry, parr and smolt develop weakening stocks of wild salmon. The worst scenario is the extinction of the unique genetic material carried by wild salmon.”¹⁰

Forty years ago, the stocks of salmon taken for farming were genetically identical to the wild fish. However, the Norwegian Research Organisation Nofima say that “after ten generations farmed salmon have developed a genetic composition that is favourable for the farmed environment but probably less favourable for conditions in the wild but because the fish originated from wild stock, the farmed fish do not have one single gene that cannot be found in the genetic make-up of wild salmon.”¹¹

The general view expressed by those interested in wild salmon stocks is that should escaped salmon interbreed with wild stocks, they will dilute the gene pool and the resulting fish will be less fit and less able to adapt to the conditions in the local rivers. This is apparent from the previously highlighted statement from the STA.

In a nutshell, wild salmon stocks are thought to have genetically diversified over hundreds and thousands of generations to become adapted to the specific conditions in the differing and varied rivers throughout northern Europe whilst maintaining their genetic purity.

By comparison, farmed salmon, whilst originally of wild stock, have been selectively bred over a handful of generations to produce fish that are ideally suited to the conditions found in salmon farms.

The changes in farmed salmon over the past forty years are now considered undesirable by those involved in the management of wild salmon fisheries and thus they are keen to introduce stricter regulation on salmon farms to prevent the risk of dilution of the wild salmon gene pool.

However, the idea that wild salmon have evolved over many generations maintaining a genetic purity is simply a myth that since the introduction of salmon farming has deluded the wild salmon sector.

The reality is that wild Atlantic salmon have been subjected to as much genetic meddling as farmed salmon, if not more. Wild Atlantic salmon can no longer be considered genetically pure and have not been for many generations.

¹⁰ <http://www.lakseelver.no/Engelsk/Escaped%20villain.htm>

¹¹ <http://www.thefishsite.com/articles/686/gene-flow-from-farmed-to-wild-salmon>

The reason is that for the last 150 years or so, a major part of the gene pool has been removed indiscriminately from all rivers, not just in Scotland but almost everywhere that wild salmon can be found. This explains why wild salmon may seem to have developed into distinctive populations.

The responsibility for the loss of this genetic material from the overall gene pool lies clearly with those who engage in recreational angling for salmon in Scottish and other salmon rivers. The repeated removal of the part of the salmon population during its migration to its breeding grounds means that the gene pool has dramatically contracted.

Whilst those involved in wild fisheries management express repeated concern about the possibility of interbreeding between wild salmon and farmed escapees, they prefer to ignore the damage that their own activities have on the wild salmon's gene pool. Yet, it is not something of which they are unaware. The AST have posed this question on their website.

Does fishing affect genetic variation?

Fishing targets fish non-randomly (on a seasonal basis). This causes loss of genetic diversity, both directly by selectively removing a particular genetic population and indirectly by reducing population size

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It seems clear that the Atlantic Salmon Trust obviously recognise the damage to the gene pool caused by recreational fishing for salmon and this awareness cannot be limited to this single organisation. This must be something of which the STA, the Association of Scottish Fishery Boards (ASFB) and RAFTs must be aware but seemingly have chosen to turn a blind eye preferring to blame farmed salmon for any damage to the gene pool.

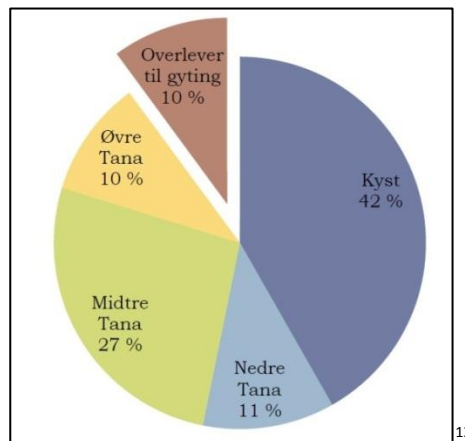
The scale of the damage is apparent by consideration of the catch figures from Marine Scotland for all Scottish rivers. Over the last decade about 350,000 breeding salmon have been caught and killed by salmon anglers. Over the same period 455,000 have been caught and released, which equates to about 43% of the fish caught. However, it should be noted that Catch and Release rates have increased over the past five years and currently stand at around 70%. This increase has meant that the average figure is probably much higher than in preceding years and that catching and killing salmon occurred at an even greater rate. It should be stressed that these figures relate to breeding fish and not the total population.

¹² <http://www.atlanticsalmontrust.org/research/why-the-genes-should-fit.html>

The effect on the gene pool of the removal of such large numbers of breeding fish will however ultimately depend on the total number of fish actually in the river. This is a complete unknown with the exception of the River North Esk which is monitored with a fish trap. The data for this trap has not been published but a figure of 12,000 fish has been rumoured for last year with an exploitation rate of about 10% i.e. the difference of the number of fish passing up and then down the river. This would put the number of fish caught and released at about 1,200 fish which compares with 1,328 for 2010 together with 509 fish that were caught and retained. This might indicate that there is still a healthy gene pool within the river, yet because the river is so closely monitored, it could be suggested that it is not necessarily representative of other Scottish rivers.

More extensive data is available from Norway where exploitation rates are at an average of 40% but with a range of 20% to 95% (Jan Gjørvik personal communication). These figures suggest that the effect on the gene pool might be more damaging than might be immediately apparent.

The data for Norway's river Tana, reportedly the largest river for salmon in the world, shows a worrying level of decline that clearly must impact on the gene pool. Ninety per cent of all fish returning to the river to breed are caught in various fisheries with only 10% remaining to spawn. 42% are caught at sea whilst 48% are caught in the three sections of the river. The Tana used to contribute about a third of all salmon caught in the catch statistics. This is now down to just 8%.



¹³ Verdens største laksevasdrag minker raskt – kan utviklingen i Tana snus? Morten Johansen University of Tromsø/NINA

This genetic loss from the gene pool is fundamental to one of the ways in which fish can evolve. The accepted view of evolution is through natural selection but this is not the only mechanism for change. There are three other identifiable routes of evolution. These are migration, mutation and Genetic Drift. It is Genetic Drift which is relevant to the contraction of the gene pool.

Genetic Drift is a random form of evolution that is defined by the University of Berkley (Evolution 101)¹⁴ as being when by chance some individuals leave behind a few more genes than might be expected. The genes in the next generation will be of those of the 'lucky' individuals rather than those of the healthier ones that might be expected to excel over the others. It happens to all populations because there is no way of avoiding the vagaries of chance. Such chance happenings would be for example if an industrial plant accidentally released a chemical pollutant into the river and killed all the fish locally. All the genetic potential in those fish would have been destroyed. As a result, the genes of fish that might not have been expected to become dominant do so.

The following image is taken from a presentation given by Erik Sterud of the Norwegian Salmon Rivers Organisation.¹⁵ It is his idea of illustrating the difference between the gene pools of wild and farmed salmon and it is both wrong and misleading.

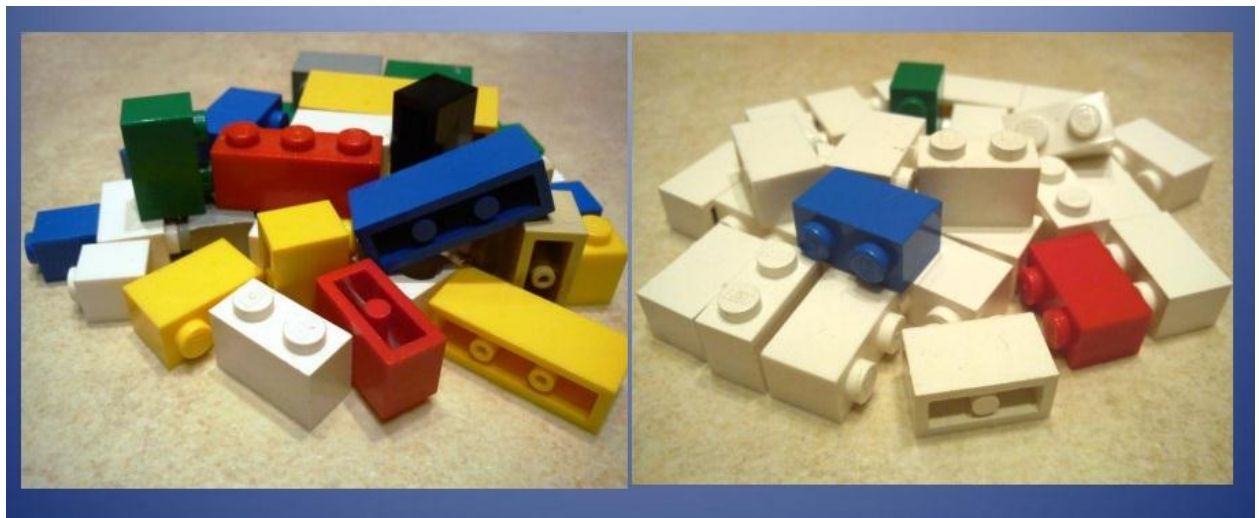


Fig 1. A representation of genetic drift?

¹⁴ <http://evolution.berkeley.edu/evosite/evo101/index.shtml>

¹⁵ <http://www.aqkva.no/foredrag2011.html>

Instead, the image better represents the effects of Genetic Drift in which parts of the gene pool can be lost by the random events such as angling. For example, if the 'yellow' gene is removed by random selection of fish carrying this gene then it can no longer feature in the wider gene pool.

The most quoted example to illustrate the effects of Genetic Drift on a population relates to the elephant seal. These are divided into two distinct populations, Northern and Southern elephant seals. The Northern population was decimated by hunting during the 1890's so that by the end of the nineteenth century there were just twenty individuals remaining. The population has since rebounded to as many as 30,000 animals but the genes still carry the mark of this 'chance' destruction since compared to their southern relations they have much less genetic variation in their population.



Fig 2. An elephant seal

Salmon populations have not been butchered in the same way as elephant seals but for the last hundred years and more, they have been systematically culled by intensive angling, removing in some cases a significant proportion of the population. This can affect the ratio of genes in the population (or area) because the way that the fish are removed is totally random. It is simply a question of luck whether an angler hooks a fish, irrespective of its genetic impact on the population. The way Genetic Drift operates means that it occurs faster and with more dramatic impact in smaller populations than larger ones which may explain why researchers have identified distinct populations of salmon even within the same river.

A great deal of research has been directed towards the identification of different populations of wild salmon. Much of the work in Scotland has been through the SALGEN project¹⁶ and more recently a Scottish Government funded FASMOP (Focusing Atlantic Salmon on Management Project). The aim is to support management of the rivers through a better understanding of the genetic populations and variations.

The first report from the FASMOP project relates to rivers in Argyll however a summary of work done on the River Spey was published in the July 2011 monthly report from the Spey Fisheries Board with regard to how the work applies to their river system.

Initial Results

Initially, the project used a series of 17 Microsatellites as the basis for the genetic analysis. This followed a similar project which genetically mapped the Salmon stocks throughout Ireland. With regard to FASMOP's primary aim – producing genetic “maps” of catchments - early results were mixed; some Rivers showed distinct breeding populations within their stock, while other Rivers (including the Spey and other larger, East Coast Rivers) demonstrated a weaker degree of population distinction and defining distinct population boundaries was much less certain.

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The fact that early results were mixed may be a reflection of the reality that variation in the salmon populations is not due to a gradual evolution of the salmon populations. Instead, it could be better explained by Genetic Drift especially as the definition of the populations in the larger rivers was less distinct, which could be due to a much larger population of fish. Genetic Drift is known to affect smaller populations quicker and more radically. According to the Spey Fisheries Board newsletter, the researchers are attempting to refine the detection methods but if Genetic Drift is responsible for the variations, this may not be sufficient to prove that various distinct populations have evolved in response to the different conditions in different rivers.

Another reason for the mixed results may be due to the methods used to determine genetic differences. These are based on micro-satellites which are simply markers in the genetic code rather than genes with specific genetic instruction. Most of the genetic work on salmon has used micro-satellites but now questions have emerged as to their reliability.

¹⁶ The Atlantic Salmon, genetics, conservation and management. Eric Verspoor et al (eds) 2007. Blackwell Publishing

¹⁷ <http://www.scotland.gov.uk/Resource/Doc/295194/0121856.pdf>

As part of the recent Salmon Aquaculture Dialogues (SAD), the Norwegian Institute for Nature Research (NINA)¹⁸ and others were commissioned to review the incidence and impacts of escaped farmed salmon. This includes the possible impact of farmed salmon on the wild salmon gene pool. One of the key points the researchers make about the use of micro-satellites is that they believe that there is no marker available that definitely distinguishes between farmed and wild fish.

If researchers cannot distinguish with certainty between farmed and wild salmon, then questions must be raised whether they can distinguish between fish of so called different populations. After all, it is claimed that farmed salmon are sufficiently different to wild salmon to be of concern. If this difference cannot be identified, then what certainty can there be that any differences between populations can be also identified with confidence and if they are detected that they are the result of long-term natural selection and not Genetic Drift?

Unfortunately, the latest research would seem to endorse the belief that any differences are random and are the result of Genetic Drift rather than natural selection. The FASMOP team have recently published the results of studies from four rivers and these are available on the Marine Scotland Science Reports website.

The first report from the Argyll area was encouraging but covered more than one river system:

Summary of findings

The analysis showed that, in the majority of cases, there are significant but variable levels of genetic differences between the sites examined. The Awe in particular exhibits large differences to all other systems as well as among sites within the Awe system. This is particularly true above and below Loch Awe. Other sites around the Trust show lower levels of genetic differences among them, with the rivers Creran and Ba being the most distinct.

The differing scale of genetic differentiation observed within Argyll is largely reflected by the ability to predict where a sample is from using only genetic information (genetic assignment); where genetic signatures are strongly related to location, individuals are more likely to be assigned to the location from which they were originally sampled. The average value of correct assignment to system is 65%, which is much higher than you would expect if there was no genetic structure in the data. However, the ability to assign individuals correctly varied considerably across the geographic range studied.

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¹⁸ NINA special report no 36 Incidence and Impacts of escaped farmed salmon in nature. Thorstad et al. 2008

¹⁹ <http://www.scotland.gov.uk/Topics/marine/science/Publications/publicationslatest/Science/MSSR>

However, the findings from three others rivers show remarkable similarity with little evidence of genetic differentiation.

The River Deveron

Summary of findings

The analysis showed that, most sites exhibited weak genetic differences from one another with the current set of markers used. The Allt Deveron, Upper Bogie, Upper Isla and King Edward Burn sites were the most different from all other locations. These remaining locations showed a mixture of results when compared to each other. For three locations, which were sampled in different years, there appeared to be mixed evidence of stability in the genetic signatures over time. Overall the results suggest a weak level of meta-population genetic structuring within the Trust using the current genetic markers. A number of locations were severely affected by the presence of full-sibling families which may be due to fewer numbers of breeders at those sites.

This weak degree of genetic differentiation observed within the Deveron is largely reflected by the poor ability to predict where a sample is from using only genetic information (genetic assignment); where genetic signatures are strongly related to location, individuals are more likely to be assigned to the location from which they were originally sampled. The average value of correct assignment to site was only 38%, which is higher than one would expect if there was no genetic structure in the data. However, the magnitude of differences observed with the current markers is not large enough to assign fish with higher accuracy.

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The River Annan

Summary of findings

The analysis showed that, most sites exhibited weak to no genetic differences from one another with the current set of markers used. The Birnock site was the most different and was the only location differentiated from all others. The remaining locations showed a mixture of results when compared to each other. For three locations, which were sampled in different years, there appeared to be stable genetic signatures over time. Overall this suggests a stable, but very weak level of population genetic structuring within the Annan using the current genetic markers.

This weak genetic differentiation observed within the Annan catchment is largely reflected by the poor ability to predict where a sample is from using only genetic information (genetic assignment); where genetic signatures are strongly related to location, individuals are more likely to be assigned to the location from which they were originally sampled. The average value of correct assignment to site was only 27%, which is higher than one would expect if there was no genetic structure in the data. However, the magnitude of differences observed with the current markers is not large enough to assign fish with higher accuracy

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²⁰ <http://www.scotland.gov.uk/Topics/marine/science/Publications/publicationslatest/Science/MSSR>

²¹ <http://www.scotland.gov.uk/Topics/marine/science/Publications/publicationslatest/Science/MSSR>

The River Don

Summary of findings

The analysis showed that, most sites exhibited weak to no genetic differences from one another with the current set of markers used. Upstream sites generally were the most differentiated, with the exception of the Cockbridge site. The remaining locations showed a mixture of results when compared to each other. For two locations, which were

sampled in different years, there appeared to be stable genetic signatures over time. Overall this suggests a stable, but very weak level of population genetic structuring within the River Don using the current genetic markers.

This weak degree of genetic differentiation observed within the Don is largely reflected by the poor ability to predict where a sample is from using only genetic information (genetic assignment); where genetic signatures are strongly related to location, individuals are more likely to be assigned to the location from which they were originally sampled. The average value of correct assignment to site was only 32%, which is higher than one would expect if there was no genetic structure in the data. However, the magnitude of differences observed with the current markers is not large enough to assign fish with higher accuracy

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The common finding that most sites exhibited weak to no genetic differences could be simply because anticipated genetic differences do not exist and that the weak differences identified are more likely due to the effects of Genetic Drift caused by intensive angling activity. The researchers imply that the lack of differences may be due to the ineffectiveness of the genetic markers they used in which case, the question must be asked why these markers were used.

They also make the suggestion that the fish could have mixed in the river possibly due to incidences of re-stocking in the past. However, this seems to be just an excuse to justify the continuation of this programme despite its high cost. The Scottish Government have recently awarded a further £250,000 to bolster the £1.2 million already given to RAFTS to pursue a modern strategic approach to fisheries management or in other words to preserve the angler's romanticised view of wild salmon in Scotland.

²² <http://www.scotland.gov.uk/Topics/marine/science/Publications/publicationslatest/Science/MSSR>

Even though the FASMOP project persists with the view that salmon have evolved into different populations, they are aware of the influence of Genetic Drift. The River Tweed News website reported on progress in June 2010:

Over time a random evolutionary process called "genetic drift" causes some of the variants of each microsatellite to be lost at random from populations causing each population to have unique variant types and frequencies that give each population a distinct genetic character. This allows the study of the origins of populations and can also be used to detect the population of origin of individual fish.

Genetic drift has its greatest effects where populations are small, have existed for a long time, or where there is little or no mixing of spawning populations. This is most likely in undisturbed rivers, smaller tributaries where numbers of breeders are small, and where rivers are broken up by physical obstacles such as waterfalls or lochs so that their spawning areas are also fragmented.

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They don't say how this random evolutionary process actually works in practice in salmon rivers but probably because they would have to highlight the destructive effect of angling on the salmon gene pool. Instead, they focus attention towards the effect of Genetic Drift on the micro-satellite markers rather than the actual genes as a way of explaining how these genetic markers apply to their study.

Genetic Drift is also widely used as a way of explaining the effects of escaped farmed salmon on wild populations. Several studies highlight that selective breeding (although not necessarily random) means that the genetics of farmed salmon have 'drifted' away from that of the wild fish. However, as already indicated, if farmed salmon have drifted away from wild fish then in the 150 years since the Victorians were bitten by the angling 'bug' wild salmon have 'drifted' much further from the 'imagined' vision of wild fish.

One of the arguments about the genetic purity of wild salmon is that the salmon populations found in different rivers must be different to ensure that the fish are sufficiently programmed to find their way back to their home river to breed. The AST pose the question:

Q. Do salmon always return to their own river?

Atlantic salmon return to their native river with amazing accuracy. Although some may stray to other rivers, the majority ascend their home river.

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²³ <http://news.rivertweed.org.uk/blog/archives/2010/6/17/4555650.html>

²⁴ <http://www.atlanticsalmontrust.org/questions-and-answers.html>

Whilst they admit that some salmon may 'stray' to other rivers, the use of the word stray suggests that this is not a regular occurrence. Yet it would make sense, in terms of invigorating the genetic stock, if some salmon naturally found their way into other rivers. Since most salmon stocks have been manipulated by human interference, it can be difficult to assess the extent to which fish move away from their natal rivers. However, there is one river where it has been possible to assess the extent to which salmon diverge away from their native range. Salmon stocks in the River Mersey had been completely obliterated by many years of industrial pollution but with the decline of industry and improvements to the river system, the water quality has improved sufficiently to enable salmon to recolonize the river. This is a unique occurrence since no other river has been recolonized in this way. The River Tyne has been in the news regarding repopulation by salmon but this is the result of re-stocking with hatchery reared fish not natural re-colonisation.

The researchers on the River Mersey study²⁵ had expected to find salmon from other local rivers such as the Dee, Lune or Ribble but they actually found fish whose genetic markers had indicated that they had originated from a total of 36 different rivers including from as far north as Scotland and as far south as France. This natural colonisation demonstrates that salmon populations are not as isolated as indicated and that salmon do interbreed with fish from other rivers and populations.

²⁵ <http://www.environment-agency.gov.uk/news/132914.aspx>

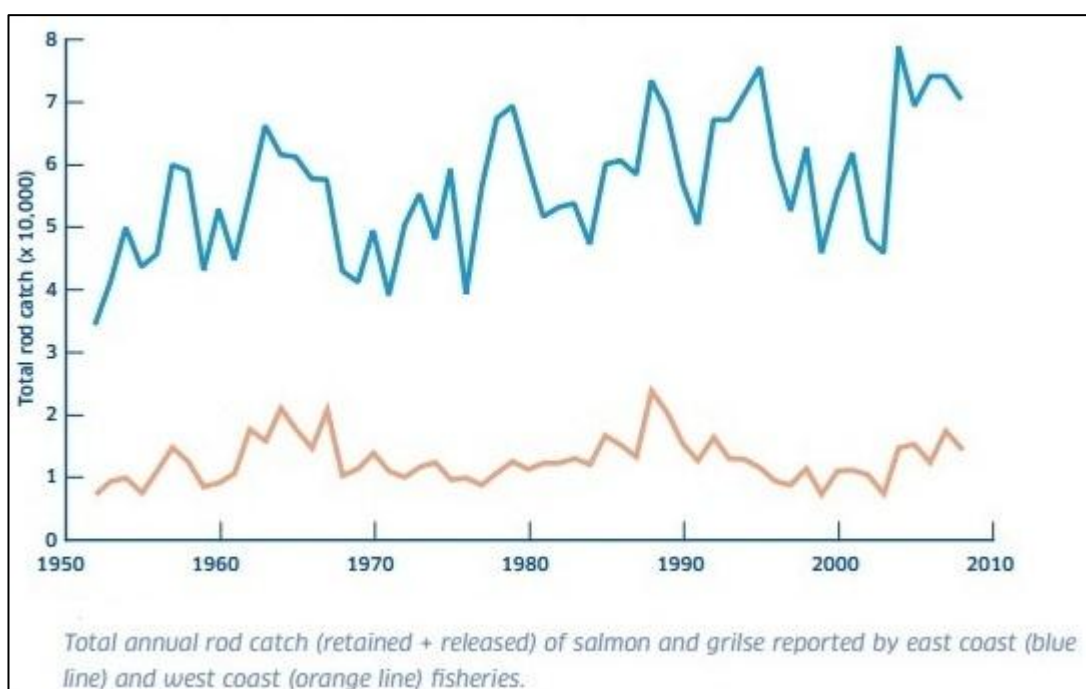
2. The effects of salmon farming on wild salmon stocks

In June 2010, Lawson Devery, a Field Officer for the Salmon & Trout Association in Scotland submitted a petition (1336) to the Scottish Parliament aimed at protecting salmon and sea trout stocks from inappropriate salmon farming activities. The petition argues for stricter controls on salmon farming on the west coast but doesn't really explain why other than to state that the effects of salmon farming on wild stocks has been an issue for more than fifteen years. The only reference to what this impact might be is the statement that:

In the great majority of the river systems in question there is absolutely no sign of any resurgence in salmon; and the situation with sea trout is simply dire.

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Since Mr Devery is actually a Field Officer for the STA, his assertion seems to be one based more on passion rather than fact. Comparison of the total annual rod catch for both the east and west coasts of Scotland show that the west coast catch has remained relatively stable since the 1950's according to data from Marine Scotland.



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²⁶ http://www.scottish.parliament.uk/Petitions_Archive/PE1336.pdf

²⁷ <http://www.scotland.gov.uk/Uploads/Documents/SCSB08.pdf>

Mr Devery and the STA will undoubtedly argue that this graph shows the catch for the whole of the west coast whereas the effects of salmon farming are felt in only parts of the coast. A more detailed look at individual rivers will be considered later in this document. In his petition, Mr Devery poses the following question:

I would like the PPC to ask the Scottish Government why it is allowing—

1 the destruction of salmon and sea trout stocks on the west coast of Scotland by continuing to allow salmon farms to operate to a standard that scientific research shows is extremely damaging to wild fish stocks and the environment?

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It is unclear to which scientific research Mr Devery refers. However, the briefing documents against salmon farming compiled by the STA include reference to many pieces of research emanating from the west coast of Canada much of which has been funded by large US foundations such as Packard, Moore and Pew. These foundations have pumped huge amounts of funding into fighting the development of salmon farming in Canada's state of British Columbia. The motivation for doing so may be linked to their support for the Alaskan wild salmon fisheries industry.

This multi-million dollar funding has found many uses from paying for 'scientific studies' to supporting anti-salmon farming groups and most importantly, paying for a well-developed publicity machine which gained free access to the mainstream press. This resulted in the appearance of many anti-salmon farming stories, which have allowed the issue of the influence on farming on wild stocks to gain credibility without genuine scientific scrutiny. The funding provided by these US Foundations to fight against salmon farms has been extensively documented by researcher Vivian Krause on her website²⁹.

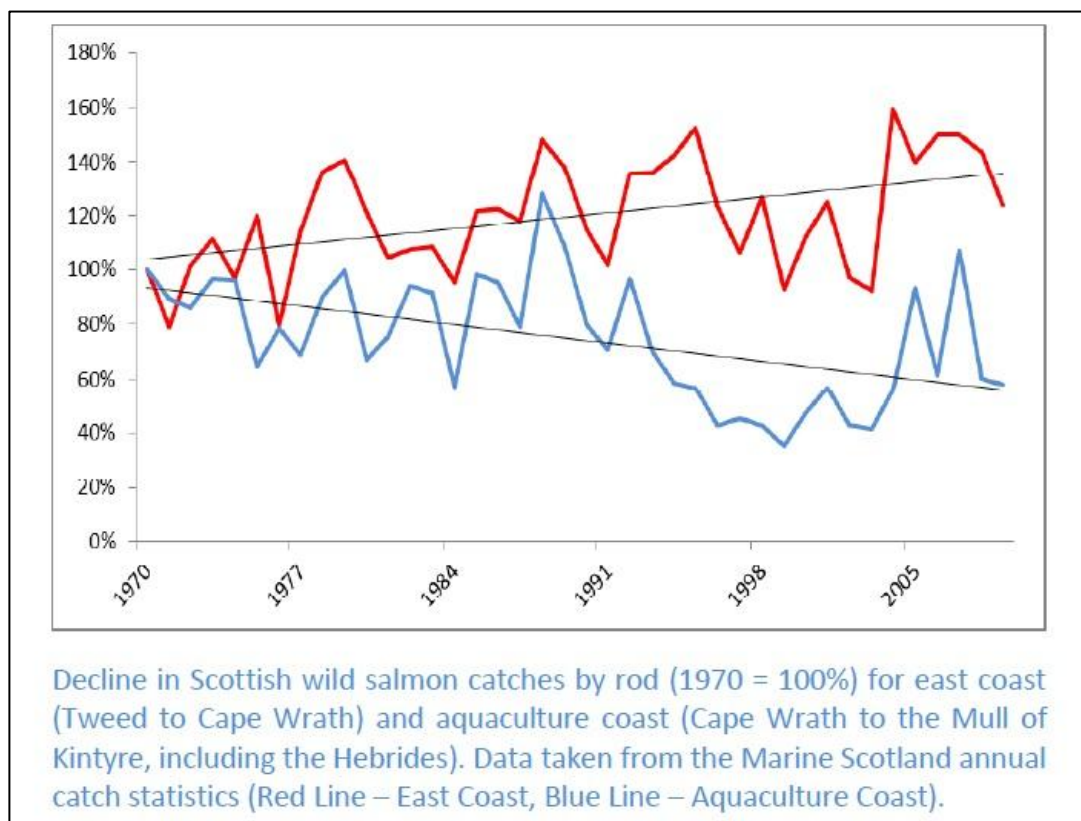
It would seem that these US Foundations have recently reviewed their activities and have withdrawn from the frontline fight against salmon farming in Canada even though the battle continues. The leading activist in British Columbia is former US citizen Alexandra Morton whose dire warnings about the fate of wild salmon stocks in the Fraser River led to a judicial review which is currently underway. This is despite Fraser River salmon returning in record numbers last year. Ms Morton is currently continuing to attack the salmon industry which she blames for the appearance of the disease ISA in wild Pacific salmon although there is no evidence that Pacific salmon have the disease nor is there any evidence that any farmed salmon have either.

²⁸ http://www.scottish.parliament.uk/Petitions_Archive/PE1336.pdf

²⁹ http://fairquestions.typepad.com/rethink_campaigns/

The significance of the Canadian battle between environmentalists and salmon farmers is that much of the so-called evidence showing the alleged negative impact of salmon farming on wild stocks is being used by the Salmon & Trout Association to support their claims of similar impacts along the Scottish coast. The STA have even included a video featuring Alexandra Morton on their website³⁰ despite her recent loss of credibility.

Whilst the rod caught data from Marine Scotland indicates a relatively stable catch over the years, the STA have represented the data as a percentage of the rod catch from 1970. This could be misleading since salmon fisheries would normally fluctuate from year to year for a whole variety of reasons. It is not clear whether 1970 was a bumper or poor year for rod caught salmon, altering the overall picture.



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However, if the data in this representation of the catch data is accepted as being correct, then it doesn't necessarily support the link between salmon farming and a decline in wild stocks.

³⁰ <http://www.youtube.com/watch?v=vTYhQAN9BW0&NR=1>

³¹ <http://www.standupforwildsalmon.org/News/2011/June/RAFTS.html>

Firstly, it is clear from the data that the salmon stocks were in decline even in 1970. This is only three years after the first salmon smolts were put to sea by Unilever at Lochailort. There simply was no salmon farming industry at that time.

Even fifteen years later in 1986, the Scottish salmon industry was only producing just over 10,000 tonnes yet wild salmon catches had already declined to about 80% of the 1970 catch. Clearly, salmon farming was not the main cause of this decline.

Year	Tonnes	Year	Tonnes
1986	10,337	1994	64,066
1987	12,721	1995	70,060
1988	17,951	1996	83,121
1989	28,553	1997	99,197
1990	32,351	1998	110,784
1991	40,593	1999	126,686
1992	36,101	2000	128,959
1993	48,691	2001	138,519
		2002	159,060*

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In fact whilst graphical evidence provides one picture of fate of wild catch fisheries, another is available through the personal testament of people who were working along the coast during the 1960's to 1980's.

One estate worker from Loch Ewe³³ has related how he was assigned to work the salmon nets along the coast around Loch Ewe. During the 1980's there was a significant decline in catches so that by 1985, the netting operation was abandoned. This was two years before the arrival of the first salmon cages in Loch Ewe. One of the reasons that this worker attributes to the decline was the regular appearance of mackerel boats in the loch sweeping up large quantities of fish.

Loch Ewe is significant because it is the outlet for the River Ewe which connects to Loch Maree once renowned for its recreational sea trout fishing. The Loch Maree sea trout fishery also collapsed during the 1980's, again before the arrival of the salmon cages in Loch Ewe. The sea trout fishery will be considered later in this document.

³² Fisheries Research Services. Scottish Fish Farms Annual production survey 2001. Scottish Executive.

³³ Name and contact details available on request.

Both the Marine Scotland and the STA graphs show data that relates to the number of salmon caught. The STA suggest that these figures are a reflection of the number of salmon actually in the river because they say that anglers will continue to fish even if they don't catch anything.

They argue that the decline in rod caught fish will therefore be in proportion to any decline in the numbers of fish returning to the rivers.

However, there is one important factor that has been omitted by the STA. They assume that the fishing effort catching less fish has remained the same and that the same number of anglers continues to fish for salmon over the same period. This is unlikely. Although, there will always be some members of the local community who fish for salmon in the locality, many of those angling for salmon come to Scotland specifically for a holiday and therefore will fish for a whole week. Even the STA acknowledge the importance of salmon holidays to the Scottish economy. Salmon fishing is not cheap and thus anyone heading to Scotland to fish is likely to closely scrutinise the best opportunities for catching fish. The salmon angling press has repeatedly featured articles and editorials about the effects of salmon farming on wild salmon stocks and thus anglers hoping for a good week's fishing are more likely to head for an East Coast river rather than risk a barren week on the West Coast. If the STA figures are correct and salmon catches are down more on the West Coast than they are on the East, could this be simply due to a decline in fishing activity as anglers chose those rivers where they might expect a better chance of a bite.

The STA rod catch data shows that catches have continued to fall throughout the 1990's and beyond. It is likely that the negative attitude to the presence of salmon farms has continued to encourage more anglers to stay away from fishing the west coast. However, this alone cannot explain the on-going decline observed by the STA (but not necessarily by Marine Scotland).

Salmon are not the only species of fish experiencing declines. The sea trout fishery on the west coast has also experience a significant decline in catches. This has been extensively reported especially in relation to Loch Maree, which once had a world-renowned sea trout fishery.

According to the Wester Ross Fisheries Trust³⁴, the northwest sea trout fisheries have been in slow decline since 1952 but the pace of the decline accelerated with the rapid growth of salmon farming from the end of the 1980's. This decline is not unique to Loch Maree but has been observed in most rivers along the West Coast. The Scourie Hotel³⁵, a hostelry that offers salmon and sea trout fishing to its guests, notes that 'in common with most West Coast sea trout fisheries, catches fell to an all-time low during the early 1990's.

The decline of sea trout stocks may have been part of a natural cycle for as the Atlantic Salmon Trust acknowledges it is wrong to believe that sea trout stocks should remain stable. The AST provide a list of factors that could influence the state of sea trout stocks most notably the impact of droughts and spates.

Q. What are the main causes of the wider declines in sea trout stocks?

It is wrong to believe that sea trout stocks should remain stable. Clearly, this is not the case in natural ecosystems. Also, there are some doubts about how accurately we can assess the level of stocks. The main indicator of sea trout stock abundance remains reported catches and, while these provide a broad picture of stock abundance, they are affected by levels of reporting accuracy, weather conditions, fishing effort and new regulations etc. More importantly, the stocks upon which the catches are based are vulnerable to a wide range of habitat impacts, notably from droughts and spates, water abstraction and pollution, hydro power schemes, land drainage, nutrient enrichment and siltation and other effects of intensive farming and forestry, urbanisation, road improvements and even aggressive flood defence schemes, together with other creeping anthropogenic development of large parts of river catchments. Increases in predation pressure on sea trout stocks by growing numbers of fish-eating birds and seals, both at sea and in our rivers, also may be an important factor. Superimposed on all of these concerns are potentially serious effects of climate change, of increases in ambient air and water temperatures, frequency and severity of drought events and localised flash-flooding, rising sea temperature, levels and current patterns and inter-related effects on marine ecology, including changes in fish species composition and abundance.

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West Coast spate rivers tend to be sparsely vegetated, nutrient poor and prone to sudden increases in flow due to snow melt or heavy downpours. This can significantly affect the growth and survival of young fish. There is a suggestion that one reason why sea trout stocks have declined is due to changes in the water flow when rivers are in spate which has adversely affected survival of the young fish. The changes to rivers in spate will also adversely affect salmon stocks and may help explain their decline on the west coast too.

³⁴ <http://www.wrft.org.uk/home.cfm>

³⁵ <http://www.scouriehotel.co.uk/fishingreports.html>

³⁶ <http://www.atlanticsalmontrust.org/knowledge/sea-trout-facts.html>

The blog of the River Carron Restoration Project details a particular example of spate conditions on the river that occurred in April 2011 following 24 hours of heavy rainfall³⁷.



Fig 3. River Carron (Wester Ross)

The river quickly rose from its usual state (pictured above) spilling over the banks bringing some very large debris with it as in the second picture.



Fig 4. River Carron in flood

³⁷ <http://www.rivercarron.org.uk/river-blog.aspx>

The blog states that 'the loose gravel and cobbles that make up most of the river bed of the Carron provide excellent spawning and nursery habitat for both salmon and trout but are also highly mobile during spate flows, displacing un-hatched eggs and young fry'.



Fig 5. River Carron river bed

The blog continues that 'it is thought that a number of large spates during the 1990s may have contributed to the collapse in the Carron's fish stocks, and that the flood detailed above was certainly large enough to displace large quantities of gravel. It was hoped that last year's excellent rod-catch was indicative of an excellent spawning season for the wild fish. However, as this spate came at a time when young fry had not yet developed sufficient swimming capability to find shelter, many may have been lost. Similarly, un-hatched eggs may have been crushed by shifting gravels or washed out of the river'.

Clearly, similar spates in other West Coast rivers could have had a significant impact on the overall states of fish stocks, especially of sea trout and this, not salmon farming, may be the reason for the decline.

However, the Salmon & Trout Association do not seem to agree with the idea that more aggressive spates might be implicated in the decline of wild salmon and sea trout stocks on the west coast. Their environmental lawyer, Guy Linley- Adams wrote the following in Trout and Salmon magazine:

“The minister failed to notice that suggesting the disproportionate decline in sea trout on the west coast is attributable to factors that are similar on both coasts is nonsensical. Of course some environmental factors have indeed changed since the 1980s but by and large, they have changed similarly on both coasts. The only significant difference between the two coasts over the period of the west coast decline in sea trout is the presence of salmon farms”³⁸

Mr Linley-Adams seems to believe that any environmental factors have changed similarly on both the west and east coast and that the only difference between the two coasts is the presence of salmon farms. Clearly, he has never visited any west coast rivers because he would then be aware that they tend to be very short spate rivers whilst those on the east coast are much longer with a much less vigorous flow. The changes in the time and strength of the spates on the west coast are not reflected in similar changes to the east coast. Mr Linley Adams is simply wrong in this assertion, which has allowed his conviction that salmon farms are to blame for all the problems in the wild salmon fisheries with the exclusion of any other possible explanation.

³⁸ Guy Linley Adams ‘Trout and Salmon’ magazine April 2011 Page 23

As already discussed, there is plenty of evidence to suggest that west coast salmon and sea trout stocks were already in decline before the spread of salmon farming. In a paper published at the end of 2011, the ASFB commented on one important fishery – sea trout in Loch Maree.

Salmon and Sea Trout Fisheries

The River Ewe, the principle river flowing into Loch Ewe, has historically supported significant salmon and sea trout populations. Until the 1990s, the River Ewe - Loch Maree system supported the most important freshwater fishery within Wester Ross. Unlike other major fisheries in the area, the Loch Maree fishery depended primarily upon sea trout with an annual catch of 1,500 – 2,000 sea trout per year. These fisheries provided substantial employment and benefit to the local economy as well as amenity for local people. During the 1970s and 1980s, up to 18 boats, each with a ghillie, provided angling for sea trout on the loch - nine ghillies were employed by the Loch Maree hotel alone. For sea trout fisheries, Loch Ewe is the most important sea loch in the area.

Salmon and sea trout stocks remained healthy until the 1980s. Rod catches of salmon declined during the 1990s reaching their lowest levels within the early years of the 21st Century. Subsequently, rod catches of salmon have recovered to near historic levels by 2011. The sea trout fishery collapsed in the 1990s (Butler & Walker 2006), with the loss of many jobs. This fishery has not recovered.

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Loch Maree is often highlighted as one of the most important fisheries on the west coast and its collapse is often perceived as the main battleground between salmon farms and the recreational anglers. During questioning by the Scottish Parliament’s public petitions committee, the STA stated raised the question of Loch Maree (enlarged text follows):

I do not want to digress too much, but let us take the example of the Loch Maree and Loch Ewe system. There is a big fish farm in Loch Ewe. Loch Maree used to be the finest sea trout fishery in the world. We have about 15,000 members and, if I am at a game fair, the biggest issue that members raise when they come to my stand is still, "My goodness—I wish we could still go to Loch Maree." People used to come from all over the world to fish Maree, but it is now not worth fishing. The hotel there used to employ nine boatmen; it now employs one. Yes, the fish farm employs people—that is all that we hear about in the press: that the fish farm is the big employer. However, nobody talks about the eight boatmen who lost their jobs.

We are saying that, if the fish farm operation were moved out to a safe distance, so that fishing at Loch Maree returned and the hotel could start to employ staff and boatmen as a result, that would be a fantastic benefit to the whole community. We should not pass one off against the other—let us have both operating sustainably together.

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Let us take the example of the Loch Maree and Loch Ewe system. There is a big fish farm in Loch Ewe. Loch Maree used to be the finest sea trout fishery in the world. We have about 15,000 members and if I am at a game fair, the biggest issue that members raise when they come to my stand is still "My goodness – I wish we could still go to Loch Maree." People used to come from all over the world to fish Maree but it is now not worth fishing. The hotel there used to employ nine boatmen; it now employs one. Yes, the fish farm employs people – that is all we hear about in the press: that the fish farm is a big employer. However no-one talks about the eight boatmen that lost their jobs. (cont...)

³⁹ <http://www.asfb.org.uk/wp-content/uploads/2011/04/ASFB-response-to-Loch-Ewe-Aquaculture-Framework-Plan.pdf>

⁴⁰ <http://archive.scottish.parliament.uk/s3/committees/petitions/or-10/pu10-1202.htm>

We are saying that if the fish farm operation were moved out to a safe distance so that fishing at Loch mare returned and the hotel could start to employ staff and boatmen as a result, that would be a fantastic benefit to the whole community. We should not pass one off against the other – let us have both operating sustainably together.

The premise that the STA seem to be putting forward is that if the fish farm in Loch Ewe should be moved away from the loch then sea trout will return and everything will be alright again.

However, there is already evidence that the presence of salmon farming does not have a negative impact on a sea trout fishery.

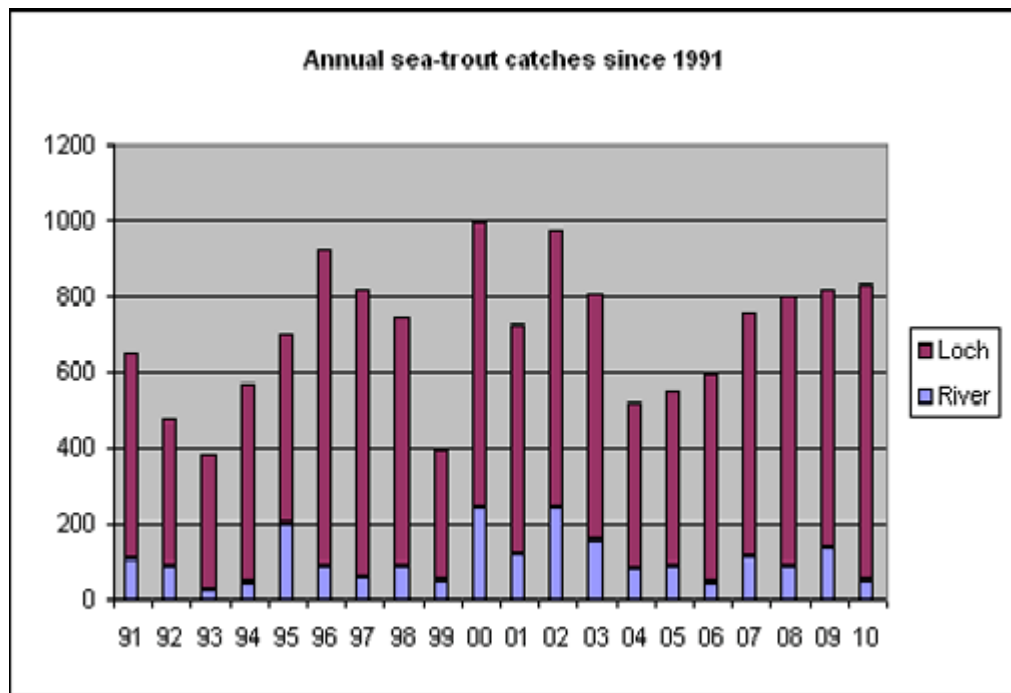
As the STA rightly point out a salmon farm is present in Loch Ewe. This sea loch is connected to Loch Maree by the short river Ewe. Whilst the decline in Loch Maree fishing is blamed on the presence of the salmon farm, a similar arrangement of a small sea loch containing a salmon farm, being fed by a short river from a freshwater loch renowned for sea trout fishing can be found at Loch Hope. However, the sea trout fishing in Loch Hope is not in decline despite the presence of the salmon farm in Loch Eriboll (although the river does emerge higher up the sea loch than in Loch Ewe.) but rather it is extremely healthy.



Fig 6. Maree & Hope

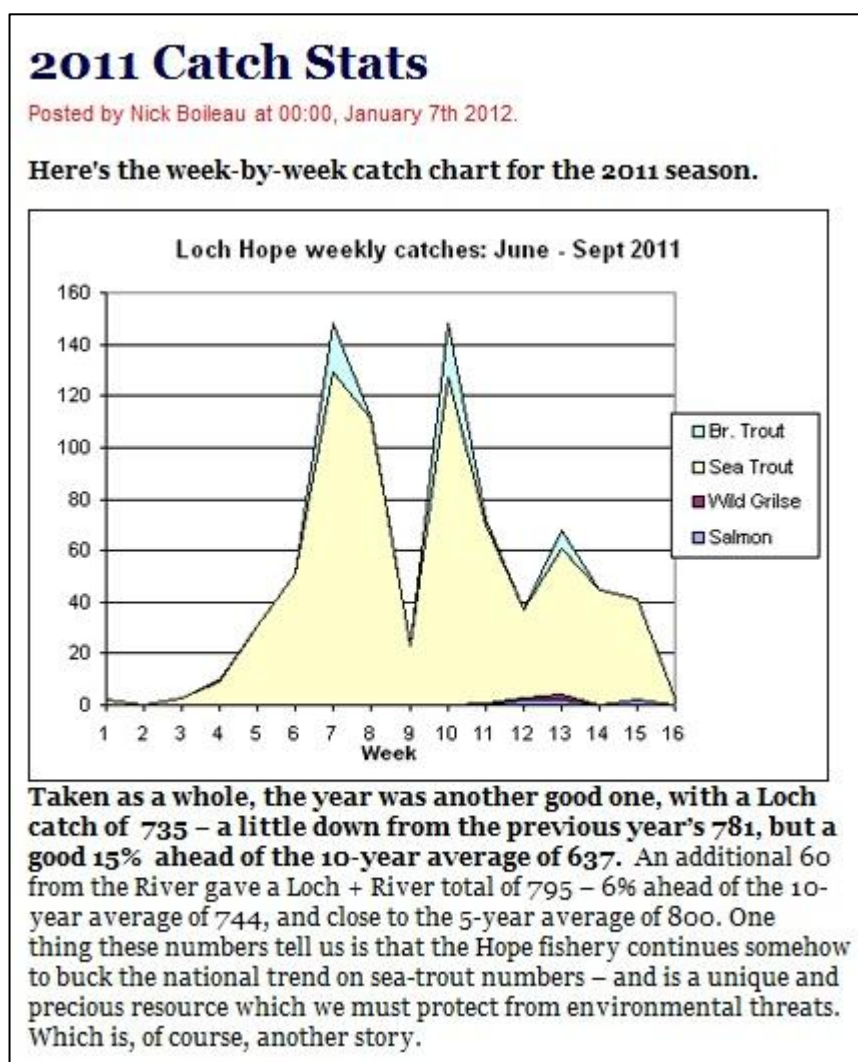
The Loch Hope website⁴¹ states that Loch Hope is remarkable for the consistency of its long-term sea trout catch. They say that whilst salmon catches elsewhere have declined markedly, the Hope sea trout figures have changed little. 'The 20-year average from 1964 to 1983 was 757. For the following decade (1984 to 1993) the average dropped to 707; but then rose to 759 for the 10 years to 2004. As the 2011 season starts, the 10-year average stands at 736.'

The following graph shows the sea trout catches since 1991 for both the Loch and the river.



⁴¹ <http://lochhope.co.uk/catchstats.html>

The 2011 statistics also show a good season.



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The writers of the Loch Hope blog have posed the question⁴³: "*Why are Loch Hope's sea-trout bucking the trend? Why, in other words, have catches not declined like those of other Highland fisheries over the past 20 years?*"

⁴² <http://www.lochhope.co.uk/news.htm>

⁴³ <http://www.lochhope.co.uk/news.htm> The Fish Farm Question.

Their response is *'Good question. The trouble is, I don't know the answer. And nor, I suspect, does anyone else - not for certain, anyway. Like many others, though, I do have a feeling that Aquaculture - or rather its relative absence, hitherto, in and around the Hope estuary - may have something to do with it.'*

Yet, salmon farming is already present in Loch Eriboll. The Loch Hope blog even includes a photo of the farm on their website.



Fig 7. Farm in Loch Eriboll

Although the farm is not sited in the small Hope estuary, its location is close enough to raise questions as to the claims that the presence of salmon farms is detrimental to wild stocks.

Loch Hope has exhibited some bumper catches of fish, but it is not the only river or loch to show a good catch of salmon or sea trout. Yet the angling lobby continue to give the impression that salmon farming has destroyed recreational salmon fishing along the west coast. The STA website states:

Time and water are running out

Read the papers, lately? Watched documentaries about it on TV? The facts are chilling. What you most feared is happening.

- Less than 30% of rivers are in a healthy ecological state
- Water abstraction is up to 50 times greater than 40 years ago
- More than a million tonnes of silt enters our rivers every year destroying spawning habitat
- 250,000 lakes and ponds have disappeared in the past 50 years
- Salmon levels have collapsed by as much as 80% of historic levels
- Some aquatic fly populations are down by 70%
- Fish farming is destroying wild salmon and sea trout stocks
- 5,000 sites had been earmarked for low-head hydropower schemes threatening fish passage
- Every year, 12,000 Scottish salmon are still killed in coastal nets.

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This message has reached a wider audience than the angling community. Food writer Joanna Blythman recently wrote in the Grocer magazine:

A dirty industry in a clean land

Published in The Grocer 5th November 2011

Regulators have been in denial about the environmental catastrophe that salmon aquaculture has visited on West Highland lochs and rivers. Now, and not before time, the Scottish Government is considering banning salmon farms from some sensitive coastal areas and forcing salmon farmers to publish information about lice levels on specific farms.

Why the tentative rethink when traditionally Scottish politicians and civil servants have been bullish in defence of this dirty industry? The circumstantial evidence that lice and chemicals from salmon farms have decimated wild stocks is hard to ignore. Even SEPA, the environmental 'watchdog' that has in the past adopted a laid-back attitude to the pollution and disease caused by salmon farms, appears to be waking up. It's no coincidence that stocks of wild fish are quite healthy on Scotland's east coast, where there are no salmon farms, and in a parlous state on the west coast, where all the salmon farms are located.

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It is interesting that Ms Blythman uses the word 'circumstantial' in her attack on salmon farming saying that: **'The circumstantial evidence that lice and chemicals have decimated wild stocks is hard to ignore.'**

⁴⁴ <http://www.salmon-trout.org/>

⁴⁵ http://www.joannablythmanwriting.com/Joanna_Blythman_Writing/Fish.html

The circumstantial evidence is hard to ignore because the angling lobby keep repeating it at every opportunity they have. The crucial question is whether the evidence is only circumstantial or whether it is based on hard fact.

In Petition 1336⁴⁶, the STA state 'in the great majority of the river systems in question there is absolutely no sign of any resurgence of salmon'. The Salmon Atlas⁴⁷ includes the catch data for most Scottish rivers using Marine Scotland figures covering a period of ten years from 2000 to 2009. The ten year figures for those rivers located in the vicinity of salmon farms shows that they all exhibit a positive trend with healthy catches.

River	Rank	Avg 10yr	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Trend	2009 v Avg
Lochy -	27	595	211	578	280	440	273	1,390	462	1,446	498	369	113%	-38%
Awe	28	515	461	598	400	306	503	788	568	840	395	290	3%	-44%
Inver	43	169	178	116	108	119	136	188	182	246	124	289	95%	71%
Ewe	44	155	113	96	114	144	169	191	135	200	225	162	90%	5%
Kirkaig	46	151	170	147	130	79	137	210	159	256	111	114	7%	-25%
Hope	48	133	118	62	67	146	124	171	92	203	133	213	130%	60%
Gruinard	38	242	142	203	158	154	252	293	181	496	180	357	136%	48%

The picture is perhaps not so clear when the catch for 2009 is compared with the ten year average but as 2010 was a record year, 2009 may not be the beginning of a changing trend.

Many of the West Coast rivers are extremely short in length and thus do not warrant the angling infrastructure of the much larger rivers. This means that regular fishing reports are not available for these rivers in the same way they are for the main salmon rivers. The angling magazine 'Trout and Salmon' publishes a regular fishing report for most of the main west coast rivers throughout the year and those for the 2011 season can be found together with this document.

⁴⁶ http://www.scottish.parliament.uk/Petitions_Archive/PE1336.pdf

⁴⁷ <http://www.salmonatlas.com/index.php>

However other examples of recent fishing reports include the season end report produced by those working on the River Lochy⁴⁸. This states:

'Season End 2011

The season has ended for 2011. October produced a total of 75 fish for the beats. It was another month of excessive rain and high, fluctuating water levels but these conditions can be, at times, conducive to good backend fishing. Fresh grilse and salmon were still entering the system during the first 2 weeks of the month which provided some exciting sport to the anglers. We also encountered a few of our own hatchery reared (fin-clipped) fish, up to a whopping 18lbs, which was also most encouraging. I am optimistic we may see quite a number of these hatchery reared smolts returning as MSW fish during the early season of 2012. Fingers crossed!

As for 2011 as a whole, I am delighted to say we managed over 400 fish with a C&R rate of 94%. Salmon predominated over the grilse and the overall quality of our fish was excellent. Let's hope we do not experience any major flooding this winter ensuring another good spawning year. I'd like to thank all our tenants and owners for making this a great season and I look forward to welcoming you back in 2012.'

This report does not give the impression of a river in crisis as the STA have implied. The annual report for the River Lochy also suggests a good year⁴⁹. The summary states:

'2011 was a good season in many ways. Our total for the whole catchment totalled 575 (salmon & grilse), making it the 2nd best year in the last 10. We had fresh fish running off every tide from May right through to October and many of these were good sized multi-sea winter salmon. In fact it was best MSW salmon year since 1988. Our average salmon weight was just under 13lbs with 70+ fish at 15lbs and over. Grilse numbers were also encouraging just topping that of the MSW fish. Our grilse averaged 4.6lbs, which by today's standards is very good'.

The River Lochy is not a river that is highlighted by the angling community as one that has been damaged by the effects of salmon farming so the good fishing has not received much publicity. However, the Wester Ross Fisheries Trust have reported to the ASFB that even the River Ewe has produced a reasonable catch as reported and this information has been included in the ASFB annual report⁵⁰.

⁴⁸ <http://www.riverlochy.co.uk/monthly-report/>

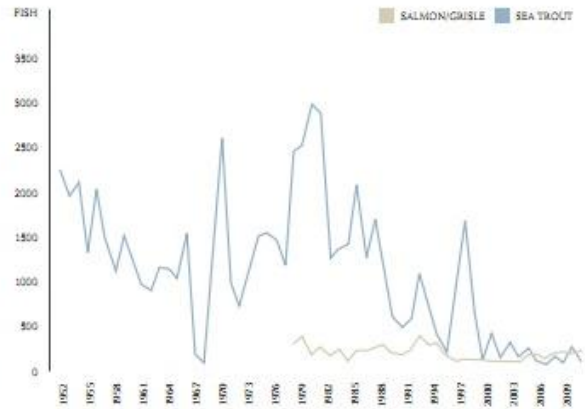
⁴⁹ <http://www.riverlochy.co.uk/downloads/>

⁵⁰ http://79.170.44.155/asfb.org.uk/wp-content/uploads/2011/05/ASFB-RAFTS_Review_2011.pdf

Ewe & Loch Maree

Peter Cunningham - Biologist, Wester Ross Fisheries Trust

Although the official figures for 2010 are not yet available, the final salmon and grilse total is likely to be around 240 fish – about double that of ten years ago. The vast majority of these were returned, and included one of 21lb, while a kelt carcass of 48 inches was reported this January. In recent years few boats have fished Loch Maree so sea trout catch figures are not comparable with those of the past. Sea lice levels in Loch Ewe were low, with no reports of heavily lice-infected fish. WRFT and Ewe proprietors have for several years supported a programme to restock a large area of nursery habitat for salmon in the Bruachaig, using progeny of native salmon taken from the Kinlochewe River nearby, and this year we anticipate the largest smolt run from this part of the system for over a decade.



RIVER EWE SALMON ROD CATCH STATISTICS 1978-2010
LOCH MAREE SEA TROUT ROD CATCH STATISTICS 1952-2010
SOURCE - WESTER ROSS FISHERIES TRUST

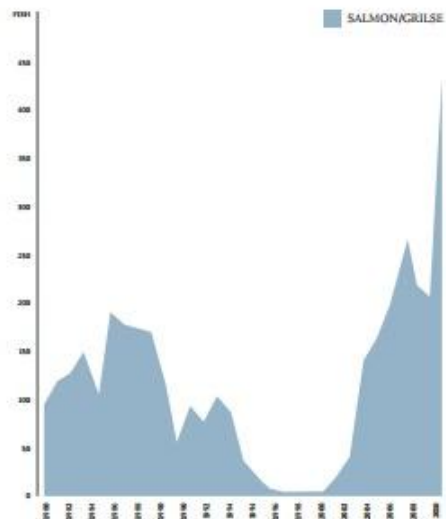
On the graph the yellow line refers to salmon stocks. It is also worth repeating one sentence in the report – **Sea lice levels in Loch Ewe were low with no reports of heavily lice-infected fish.**

It is also worth considering the report from the River Carron although this will be discussed in more detail later in this document.

Carron (Wester Ross)

Bob Kindness - Carron River Manager

The 2010 season was outstanding, although it got off to a slow start, and July, August and most of September saw fresh salmon entering the river continuously. Catches held up well until the end of October, by which time 419 salmon and grilse had been caught (at close to one fish per full rod day), eclipsing the previous record catch of 262 in 2007. The 5-year average has now risen to 261 (6 in 2001) and the biggest salmon caught was 28lb. Full catch and release is still practised, although a small harvest was taken of tagged (stocked) fish. Sea trout catches were on a par with last season, at 195, representing another excellent year. The salmon stocking strategy developed over the last 10 years has not only restored the river but has taken rod catches to a level never experienced before.



CARRON (W.COAST) SALMON/GRILSE ROD CATCH 1980-2010
SOURCE - RIVER CARRON MANAGEMENT

The key sentence in this report is **'The salmon stocking strategy developed over the last ten years has not only restored the river but taken rod catches to a level never experienced before.'**

3. Catch and Release

The Salmon & Trout Association state on their website:

Declining wild fish stocks

What is the issue?

Wild fish stocks in the UK are under pressure, often severely so. There are a few good news stories but the stark fact is that many of the rivers failing to meet European designation of good ecological status do so because of degraded wild fish stocks. The reasons are numerous and complex - over exploitation by commercial fishermen and anglers; degraded freshwater, intertidal and marine habitats; pollution from various sources; barriers to migration; predation. In most cases it is human impact that requires management, rather than fish stocks. Fish can look after themselves very well, given freedom from human interference.

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Interestingly, they do not include fish farming in the list of reasons why stocks are in decline, but that is another issue for discussion. They say that to help address the problem of declining fish stocks they have been instrumental in gaining a gradual acceptance and move towards Catch and Release as a conservation tool for salmon and trout although they say in their guide for anglers that many anglers already choose to voluntarily release salmon as part of the wider conservation measures⁵².

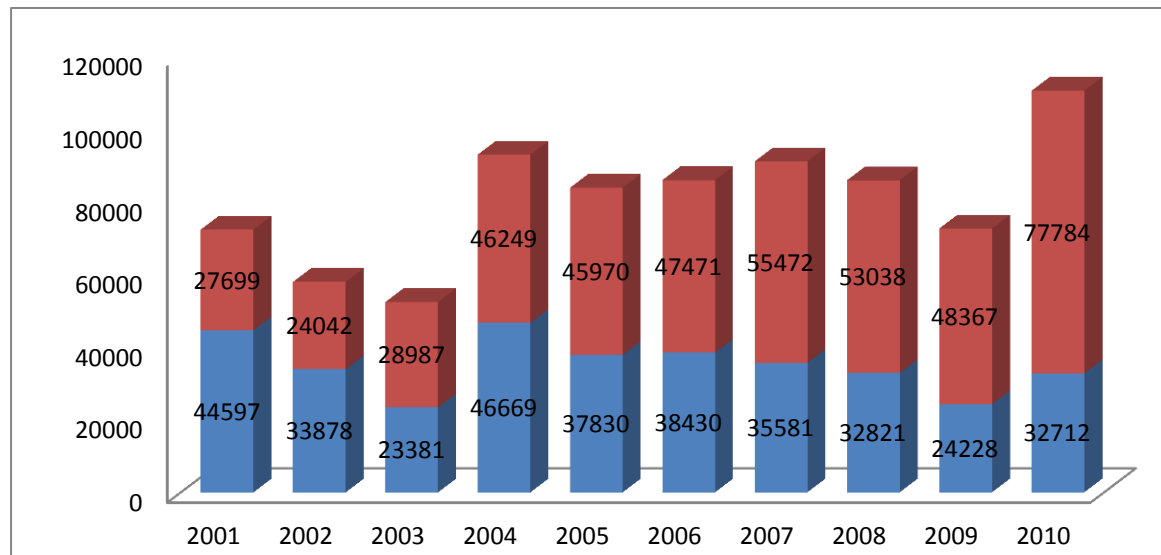
There have been several high profile successes in halting declining fish stocks:

- The buy-out of the majority of the North East Drift Nets in 2003
- The closure of the Irish Drift Net Fishery in 2006
- The banning of cypermethrin sheep dips in 2009, protecting trout and salmon upland spawning and juvenile habitat
- The inclusion of brown and sea trout as Biodiversity Action Plan species in 2010
- The gradual acceptance and move towards catch and release as a conservation tool for both trout and salmon
- The inclusion of fisheries organisations within the Blueprint for Water team, putting fisheries firmly in the influential environmental lobby with this ten-point demand of Government for the future management of the water environment

⁵¹ http://www.salmon-trout.org/declining_wild_fish_stocks.asp

⁵² http://www.gethooked.co.uk/files/Salmon_Catch_and_Release_Advice_1.pdf

The total rod catch of salmon for 2010 was the highest on record, an increase of 31% from the previous five year average. Data from Marine Scotland also showed that the proportion of salmon accounted for through Catch and Release continues to increase with 70% of the total salmon and grilse catch returned to the water. The percentage of fish caught and then released over the last ten years has been steadily increasing as can be seen from the following graph:

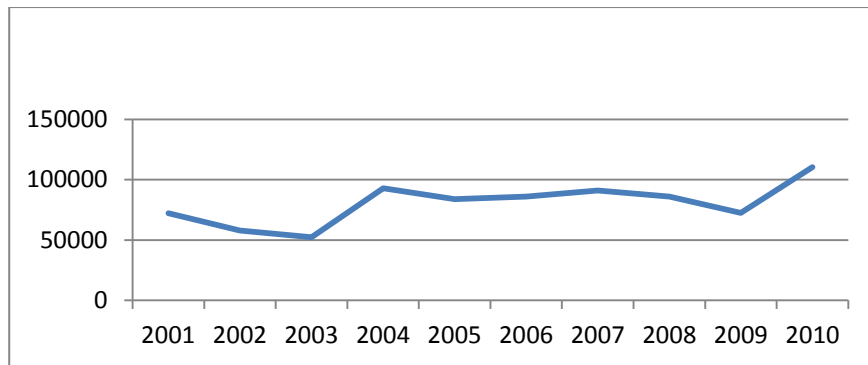


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The red bars are the number of fish released whilst the ones in blue are the numbers of fish retained. Whilst the percentage of fish released has increased from 38% in 2001 to 70% in 2010, the number of fish retained has remained relatively constant with an average retention of about 35,000 fish a year. This is surprising as with an active Catch and Release policy advocated by the angling associations, it might be expected that the number of fish retained would have decreased as more of the fish being caught were subsequently released. Yet, the number of fish retained in 2010 was just under 33,000 fish, not that much different from the 10 year average.

Reports of the annual salmon catch have tended to focus on the salmon released rather than those retained therefore there has not really been an examination as to why the number of fish retained has not changed much over the last ten years. Equally, it might be considered rather surprising that the number of fish caught (both retained and released) has continued to increase to the current peak of 110,496 in 2010.

⁵³ <http://www.scotland.gov.uk/Uploads/Documents/SCSB08.pdf>



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Fig 8. Rod caught salmon

This increase is even more surprising given that there are concerns that the survival rate of wild salmon whilst out at sea is in decline. Research by the North Atlantic Salmon Conservation Organisation (NASCO) has found that there has been a doubling of the number of salmon deaths at sea. Currently, the reason for these deaths is unknown but further investigation is underway.

One explanation why rod catches have increased might be the reduced number of commercial netting operations. This is because some nets-men have found it no longer viable to catch salmon due to poor returns and because some netting operations have been bought out by angling interests. It could therefore be argued that salmon which might have been once caught by netting are now free to swim up the rivers and hence why anglers are now catching (and releasing) more.

Whilst there has been a slight decrease in net caught salmon from 2005 to 2009, the number of salmon increased again in 2010 suggesting that the increase in rod caught salmon may not be just the result of reduced netting activity. Other factors may be having an influence too.

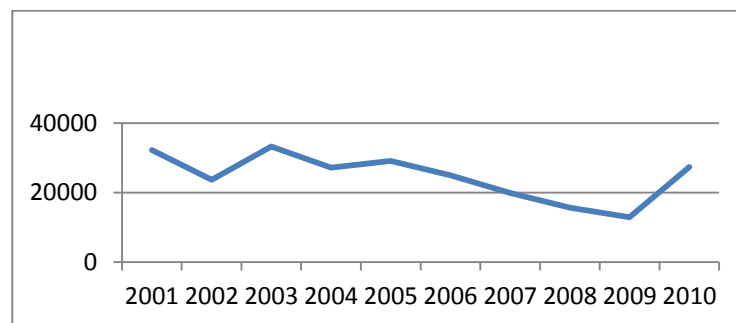


Fig 9. Net caught salmon

⁵⁴ <http://www.scotland.gov.uk/Uploads/Documents/SCSB08.pdf>

One of these is multi-capture angling. Research from the River Carron Restoration Programme⁵⁵ has identified that there could be a much greater degree of multi-capture fishing than previously thought. All fish caught in the River Carron (West Coast) were retained in keep nets after capture. This not only gave the fish a better chance of recovery but each fish was assessed for its future breeding potential and marked with a panjet as can be seen in the following photograph taken by those running the restoration project.



Fig 10. Panjet marked salmon from the River Carron (Wester Ross)

The marking of salmon has established that fish are being recaptured more than once and that not every successful bite comes from a new uncaught salmon. The results of the River Carron marking project are as follows:

- 2005 – 34 marked, 3 caught twice
- 2006 – 79 marked, 11 caught twice
- 2007 – 120 marked, 13 caught twice, 1 caught 4 times
- 2008 – 75 marked, 11 caught twice, 5 caught 3 times
- 2009 – 54 marked, 15 caught twice, 2 caught 3 times

It is evident from the marking programme that about 15% of the salmon caught have been caught twice and some three times and one on at least four separate occasions. Thus the total rod catch is not indicative of the number of fish that are being caught in the river but rather the number of successful bites. These are not the same. If the same recapture rate is extended across all Scottish rivers, then about 16,500 fish less than those declared have been caught bringing the total catch down to 94,000 fish for 2010 and a catch and release rate of around 65%.

⁵⁵ <http://www.attadale.com/river-carron>

It is expected that anglers fishing for salmon in Scotland will declare all the fish they catch to the relevant proprietors or fishery managers. However, whilst rod fisheries expect that anglers record every fish they catch, the system is not policed on many rivers. It is up to the individual anglers to provide correct details of their catch but unless they hire the services of a ghillie, their activities are not monitored.

Although the salmon fishing community are keen to promote the policy of Catch and Release, different rivers operate different rules as to how the Catch and Release should be applied. This ranges from rivers that have no policy to those that demand every fish caught be released. In between the two extremes are a whole range of differing combinations that include releasing the 1st, 3rd and 5th fish caught but retaining the 2nd, 4th and 6th. A selection of the Catch and Release rules for different Scottish rivers are detailed below⁵⁶:

River Tweed

The Spring season is defined as 1st February to 30th June inclusive. Total Catch-and-Release applies to the whole of the Tweed River system during this time from 2011 to 2015 inclusively. The Tweed Guide states that one fish can be taken although they do encourage Catch and Release.

River Tay

Anglers are urged to adopt a catch-and-release culture and never to kill any fish which they do not require.
From the start of the Season to 31st May
All fish are to be released.
From 1 June to end of Season:
All hen fish of any size and all cock fish over 10 pounds should be released.
All coloured and gravid fish should be released.
No more than one clean fish weighing less than 10 pounds should be retained per angler per day.

River South Esk

Conservation measures are voluntary.
Anglers are requested to return all early-running spring salmon to conserve this valuable stock component. However, if an angler has to kill a salmon then the 2nd may be killed after releasing the 1st. These measures should operate until the 31st May. Currently the Board encourages anglers to fish by 'catch and release' especially with regard to early-running salmon and any coloured fish taken in the autumn

River Spey

Each angler must return the 1st, 3rd, 5th, etc, fish caught.
All hen salmon and hen grilse must be released.
Throughout the season all stale or gravid fish must be released.
Escaped farmed salmon must be retained.

⁵⁶ Information from the relevant Fishery Boards or <http://www.fishpal.com/>

River Deveron

The voluntary code now requests that all Salmon caught before 1 June are returned. In return anglers will be given a side of smoked Salmon from Sutherlands in Portsoy or an engraved metal fly box. Some beat owners are also going to give the angler a day fishing the house rod later in the season if they return a fish in the spring.

River Dee

Salmon and Grilse: There should be 100% catch and release for the entire season.

River Findhorn

Anglers are requested to release: -

All salmon over 9 lbs / 28 inches (4 Kg / 72 cm)

All stale and gravid fish

As many hen fish as possible

RELEASE RATE - Anglers are asked to achieve a minimum of: -

70% of salmon under 9 lbs and 50% of grilse (any fish of 4 lbs or less) caught.

KEEP RATE Guidance only: - Release Rate above should take priority

1 salmon (under 9 lbs) or 4 grilse per rod per 6 days

Further grilse can be taken provided the required release rate is achieved and maintained.

River Nith

Nith District Salmon Fishery Board promote the conservation policies of returning all Spring Salmon caught up to the 1st May in any year

River Forth

All salmon caught before 1st June should be released

All coloured fish should be released throughout the season

No angler should kill more than 1 salmon/grilse on any given day

Salmon of 15lbs or over should be returned

All hen salmon should be returned in September and October

River Don

All coloured fish to be returned carefully to the water

All foul hooked fish to be returned

Recommended that all hen fish and all cock fish over 14lbs, whether coloured or not, are returned

All fish caught before 31st May to be returned

After 31st May, the following limits will apply to each individual angler:

Maximum of 1 salmon per week throughout the River

Maximum of 4 salmon per season throughout the River

River Beaully

ALL SEASON

Each rod should RELEASE 1st, 3rd, 5th etc fish caught. They may retain their 2nd, 4th, 6th fish etc.

AFTER 30th JUNE

Anglers should also release: - All fish over 10 lbs. / 30 inches.

River Conon

Voluntary catch & release is the single most important conservation contribution that individual salmon anglers can make to the protection of future salmon stocks.

River Ness

Anglers must observe a daily catch limit of two fish. Thereafter, anglers may continue fishing on a catch and release basis. All heavily coloured or gravid fish must be returned to the water unharmed.

River Naver

There is a two fish limit on salmon on the river.

River Thurso

We do not operate a compulsory catch and release policy

River Annan

It is compulsory to return all the fish that you catch before 1st June. Clean fish can be caught right to the end of the season throughout the river but anglers should make sure, particularly as the season draws to the end that they return all coloured fish. Be careful as hen fish in particular may not always colour greatly but will be very soft and unpalatable come late October and November. These should also be returned.

River Doon

Guests are not permitted to kill more than one fish per day. Thereafter all fish should be returned as soon as possible. All stale fish must be returned as must all hen fish in October.

A conservation code is in place in order to protect and enhance stocks. All fish are to be returned to 31 May and all hen fish should be returned in September and October. Anglers who fish for 4, 5 or 6 days may retain two fish if they wish while anglers who fish for 1, 2 or 3 days may retain only one fish

River Ayr

All salmon caught before the end of May should be returned

Catch and release for salmon is encouraged at all times.

A bag limit of 2 salmon per angler per day is proposed

Unseasonable salmon such as kelts and gravid fish must be returned

If escapee farm salmon are caught they should be killed.

River Girvan

The practice of Catch and Release is recommended. In particular: All salmon prior to the 31st May. Hen salmon caught during October.

River Stinchar

Salmon season: 25th Feb to 31st Oct

All salmon caught before the end of May must be returned.

At least 50% of all salmon and grilse should be returned

The first fish caught by any angler each day should be returned.

There is a limit of one salmon killed per anglers per day.

All Hen fish must be returned in October.

River Lochy

All season – any salmon or grilse of any size with missing adipose fin must be killed and reported

1st May-15th June – 100% Catch and release of all wild migratory fish

16th June-15th Oct – 1 cock grilse per rod/week – 10lbs (30 inches) and under may be retained if desired. A maximum of 4 grilse per party

Any cock grilse 4lbs (22inches) and under may be retained

River Alness

Voluntary catch & release is the single most important conservation contribution that individual salmon anglers can make to the protection of future salmon stocks.

River Snizort

There is a catch and release policy but the ghillie may let a fish be taken for the table at his discretion and dependent on the time of the year

River Kyles of Sutherland

You must ensure that you understand and follow the Associations' rules regarding catch and release and release.

If you kill one salmon, you must immediately stop fishing for that day.

All coloured fish must be returned.

All fish caught before June 15th must be returned

All fish over 65 cms must be returned.

River Orchy

The River Orchy is one of the most picturesque salmon rivers in the country. The salmon season runs from February 11th to October 31st.

No fish are to be taken over 7lbs in weight or 26 inches long throughout the season

All stale and gravid fish to be returned

Weekly tenants and syndicate members are allowed to keep two fish per beat per week

Day ticket anglers are allowed to keep no more than one fish per visit.

Whilst many anglers probably follow the rules to the letter, there is undoubtedly a difference between the response to Catch and Release by those anglers who regularly fish the rivers and those who only manage to fish for salmon as part of their annual vacation. Local residents, especially if they are part of an angling club will be able to fish for salmon throughout the season. Whether they can retain every fish they catch is probably not an issue for they will probably have many other opportunities to catch and retain a fish. By comparison, those anglers visiting Scotland for a single week of the year and paying a significant amount of money to have the privilege of doing so are more likely to want a memento of their week's experience, especially if they catch a specimen fish. Who is to say whether the specimen fish they caught is actually the first fish they caught or the second or whatever ruling that they must adhere to. If the policy of the fishery is, for example, to release the first fish caught and retain the second but the angler reports the fish he or she has retained as the second, then the catch record is suddenly inflated. Could the increasing rate of fish that have been released simply be due to inaccurate catch records? This is a distinct possibility.

It is likely that it will be argued during the consultation process that as false reporting has been put forward by a respondent with known sympathies to the aquaculture industry, that it will be dismissed as unproven nonsense. Yet, in November 2010, an article was published in the angling magazine 'Trout and Salmon' that highlighted unrest by anglers to the imposition of more stringent 'Catch and Release' rules on some Scottish rivers. Whilst it does not confirm false reporting, it does highlight the issues raised here⁵⁷.

⁵⁷ Trout and Salmon magazine (Article subject to copyright)

Article subjected to copyright

Article subjected to copyright

Article subjected to copyright

Clearly, not all anglers support the Catch and Release programme and whilst Andy Renwick chooses to switch to a more accommodating fishery, others may find different ways to retain a fish to take home. Of course, no-one is likely to admit to such practices and thus it remains simply a possibility. Yet, the increasing number of fish caught by rod and line cannot be explained just by improved stocks, if organisations such as the STA are to be believed.

Whilst no-one is likely to admit taking fish when they shouldn't, there does seem to be evidence that it occurs because Fishery Boards such as that for the Tay have had to 'strengthen' the regulations.

The Tay District Salmon Fisheries Board website (and the fishing site FishPal) supplies the following information relating to conservation of salmon stocks:

'Numbers of salmon entering the Tay in most months of the year have tended to fall in recent decades. The decline has been most marked among the really early fish, the "springers" which come in during the winter and early spring. Studies in a number of rivers have shown that spring salmon are most vulnerable to angling exploitation because they are exposed to angling for many months as they pass upstream into higher tributaries. Significant rates of exploitation may occur, as high as 40% in some rivers.

It is essential therefore that exploitation of all salmon, but especially spring salmon, must be reduced as much as possible. Consequently the Board **strengthened** its Conservation Code in 2010 and this has been continued for 2011. The following is recommended:

Start of the Season to 31 May:

- * All salmon should be released alive.

From 1 June to end of Season:

- * All hen fish of any size and all cock fish over 10 pounds should be released.
- * All coloured and gravid fish to be released.
- * No more than one clean fish weighing, where possible, less than 10 pounds should be retained per angler per day.⁵⁸

⁵⁸ <http://www.tdsfb.org/conservation2008.htm>

This is a clear statement of the rules governing anglers fishing the River Tay. Until the end of May, all salmon caught by anglers must be returned to the river and thus no salmon must be retained.

The Scottish Executive's catch figures for the record year of 2010 are broken down into fish released and fish retained. The information for both is provided on a month by month basis on separate spread sheets. The spread sheet for retained fish is as follows⁵⁹:

			January	February	March	April	May	June	July
1									
2									
3	Tweed	1 East							
4	Forth	2 East							
5	Tay	3 East	4	3	26	22	43	68	117

This shows that salmon were caught and retained for all the months from January to May 2010 indicating that fish were retained in defiance of the rules. The figures showing the number of fish caught and released over the same period are as follows:

			January	February	March	April	May	June	July
1									
2									
3	Tweed	1 East							
4	Forth	2 East							
5	Tay	3 East	58	70	213	348	322	195	303

If some anglers have admitted retaining salmon despite rules to the contrary, it must be assumed that there are others who do so without any declaration of doing so.

Added together, fish that have been caught more than once and fish that have been retained by false declaration must account for a significant part of the catch. This could explain why the rod catch of salmon has reached a record high. The concern must be that this evaluated figure is masking the true catch figures and thus misleading the authorities as to the true state of their fisheries.

Whilst some Fisheries Boards implement their own Catch and Release policy, it would seem that some fisheries are dependent on Government legislation to enforce changes to Catch & Release policy. On January 12th 2012, the Scottish Government drew up new legislation for the Conservation of Salmon (River Annan Fishery Board) 2012 regulations that came into force on February 25th. This legislation prohibits the retention of any salmon caught by rod and line between 25th February and 31st may every year. The aim is to protect spring salmon⁶⁰.

⁵⁹ <http://www.scotland.gov.uk/Topics/marine/science/Publications/stats/SalmonSeaTroutCatches>

⁶⁰ <http://www.legislation.gov.uk/ssi/2012/6/made>

SCOTTISH STATUTORY INSTRUMENTS

2012 No. 6

RIVER

SALMON AND FRESHWATER FISHERIES

The Conservation of Salmon (River Annan Salmon Fishery District) (Scotland) Regulations 2012

<i>Made</i>	<i>12th January 2012</i>
<i>Laid before the Scottish Parliament</i>	<i>16th January 2012</i>
<i>Coming into force</i>	<i>25th February 2012</i>

The Scottish Ministers make the following Regulations in exercise of the powers conferred by section 38(1), (5) and (6)(b) and (c) of, and paragraphs 7(a)(i) and 14(1) of schedule 1 to, the Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003(1) and all other powers enabling them to do so.

In accordance with paragraphs 10, 11, 12 and 14(1) of schedule 1 to that Act, they have consulted such persons as they considered appropriate, directed that notice be given of the general effect of these Regulations and considered objections made.

Surely if the Scottish Government is sufficiently concerned about the state of salmon stocks to introduce new legislation to protect them in the River Annan, then there must be a case for similar legislation to include all Scottish salmon rivers, with consistency throughout so Catch & Release policy is the same for all rivers.

It could even be argued that if the early running salmon stocks are in such a fragile state then perhaps the angling season should be delayed until the end of May. The Scotsman newspaper has reported that commercial salmon netters have delayed the start of their season until April for the 12th year in succession in response to 'perceived conservation concerns'⁶¹. By comparison, the season on the River Tay got underway on January 16th⁶².

⁶¹

http://www.scotsman.com/news/environment/fishermen_delay_start_of_salmon_season_again_season_1_2_124622

⁶² <http://www.dailyrecord.co.uk/news/scottish-news/2012/01/16/salmon-fishing-season-gets-underway-on-banks-of-the-river-tay-86908-23702751/>

4. Salmon Conservation

The Salmon & Trout Association (STA) promote themselves actively as conservationists. However what they mean is that they are keen to conserve their member's rights to fish for salmon often with total disregard to other users of the Scottish river systems. In addition to their attempt to remove salmon farms from the Scottish coast, anglers have fought to prevent rafters and canoeists using salmon rivers; to prevent the development of green hydroelectric schemes; to prevent the development of off-shore wind farms and to eliminate all commercial netting of wild salmon from around the Scottish coastline.

In this last role, the Salmon & Trout Association have recently supported the Brechin Angling Club to submit a complaint to the European Commission regarding the lack of Scottish Government action to protect wild salmon in the River South Esk. This river has been designated a 'Special Area of Conservation' under the EC Habitats Directive. The STA press release detailing their support for the Brechin Angling Club is as follows:

In an unprecedented move Brechin Angling Club (Brechin AC), supported by the Salmon & Trout Association (S&TA), has submitted a formal complaint to the European Commission over the Scottish Government's failure to protect salmon stocks in the River South Esk Special Area of Conservation (SAC). This follows the Government's refusal, contrary to the advice of its own scientists, to back the Esk District Salmon Fishery Board's application for conservation measures restricting salmon netting in the spring.

The complaint, prepared by lawyer Guy Linley-Adams, cites numerous breaches by Scottish Government in relation to the requirements of the EC Habitats Directive in protecting salmon in the South Esk – not only in relation to spring salmon stocks, which are in long-term decline, but also later running fish that will be impacted by the unparalleled proposal by Scottish Government to extend netting into September. In addition the complaint identifies Scottish Government's general failure to "establish appropriate management plans specifically designed for those SACs designated for Atlantic salmon to address the particular threat posed by mixed stock fisheries".

Byron Pace, spokesman for Brechin AC, said: "From our perspective, we could not in all good conscience sit on our hands, as the sustainable future of the South Esk came under this increased threat; to do so would have been irresponsible and unforgivable. Due to the Scottish Government's dismissal of the proposed conservation measures, we have been forced to take this to Europe, in the hope we can prevent the damaging effects of increased netting on an already fragile water course".

The complaint has been filed in conjunction with the Salmon & Trout Association and further details are available at www.salmon-trout.org Paul Knight, S&TA CEO, commented: "We view the Esk's case as an example of a national malaise. It is indicative of a lamentable lack of political commitment to protect a wild natural resource in line with our international obligations".

Guy Linley-Adams added: "The Scottish Government has placed far too much emphasis on the interference in the property rights of the netsmen and not enough on its obligations to protect the South Esk SAC's spring salmon stocks. I believe the European Commission will follow long-established European and indeed UK law that has repeatedly confirmed that the private property rights of individuals are subject to the wider need to conserve species and habitats in the wider public interest.

The proposal to extend the netting season into September appears to be a 'gift' to the netsmen and will itself require appropriate assessment under the Habitats Directive".

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⁶³ http://www.salmon-trout.org/news_item.asp?news_id=201

All EU nations have signed up to the EC Habitats Directive in which there is a commitment to establish Special Areas of Conservation to protect vulnerable habitats. In Scotland, a number of SAC's have been created that protect the spawning grounds and surrounding habitat of Atlantic salmon. These cover all the different types of habitat in which Atlantic salmon are found including the River South Esk.

River South Esk


Site details

Country	Scotland
Unitary Authority	Angus
Centroid*	NO450567
Latitude	56 42 10 N
Longitude	02 55 00 W
SAC EU code	UK0030262
Status	Designated Special Area of Conservation (SAC)
Area (ha)	478.62

* This is the approximate central point of the SAC. In the case of large, linear or composite sites, this may not represent the location where a feature occurs within the SAC.

General site character

Tidal rivers. Estuaries. Mud flats. Sand flats. Lagoons (including saltwork basins) (0.5%)
 Inland water bodies (standing water, running water) (75%)
 Bogs. Marshes. Water fringed vegetation. Fens (1%)
 Heath. Scrub. Maquis and garrigue. Phygrana (1%)
 Humid grassland. Mesophile grassland (2%)
 Improved grassland (2%)
 Other arable land (5%)
 Broad-leaved deciduous woodland (4.5%)
 Coniferous woodland (3%)
 Mixed woodland (5%)
 Other land (including towns, villages, roads, waste



Location of River South Esk SAC/SCI/cSAC

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Annex II species that are a primary reason for selection of this site

1029 Freshwater pearl mussel *Margaritifera margaritifera*

Freshwater pearl mussels *Margaritifera margaritifera* are abundant in the River South Esk, representing the south-eastern range of the species in Scotland. The pearl mussel population is most abundant in the middle reaches of the river where they attain densities > 20 m². The conservation importance of the site is further increased by the abundance of juveniles which comprise approximately 20% of the population. The presence of juvenile pearl mussels less than 20 mm long indicates that there has been successful recruitment since 1996.

1106 Atlantic salmon *Salmo salar*

The South Esk supports a large, high-quality salmon *Salmo salar* population in a river draining a moderate-sized catchment on the east coast of Scotland. It has a strong nutrient gradient along its length, rising in the nutrient-poor Grampians and flowing for half of its length through the rich agricultural lands of Strathmore. The high proportion of the South Esk which is accessible to salmon and the range of ecological conditions in the river allows it to support the full range of life-history types found in Scotland, with sub-populations of spring, summer salmon and grilse all being present.

⁶⁴ <http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/international-designations/sac/>

The specific conditions laid down for the River South Esk are:

**Conservation Objectives for
River South Esk Special Area of Conservation**

To avoid deterioration of the habitats of the qualifying species (listed below) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features; and

To ensure for the qualifying species that the following are maintained in the long term:

- **Population of the species, including range of genetic types for salmon, as a viable component of the site**
- **Distribution of the species within site**
- **Distribution and extent of habitats supporting the species**
- **Structure, function and supporting processes of habitats supporting the species**
- **No significant disturbance of the species**
- **Distribution and viability of freshwater pearl mussel host species**
- **Structure, function and supporting processes of habitats supporting freshwater pearl mussel host species**

Qualifying Species:

- Atlantic salmon
- Freshwater pearl mussel

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The complaint has been prompted by the Scottish Government's decision to allow an extension to the netting season provided that scientists can access and sample the fish as part of their investigation into the state of fish stocks. Brechin Angling Club and the STA condemned any extension saying that it will increase the decline in stocks of wild salmon. The complaint argues that the Government have a duty to protect stocks under the terms of the EC Habitats Directive and any extension of the netting would be contrary to the spirit of the SAC status.

⁶⁵ <http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/international-designations/sac/>

There can be little doubt that the netting operation removes fish from the River South Esk, although the netting does not occur in the river but outside the SAC in the open sea. The fishery is often described as a Mixed Stock Fishery as the salmon caught cannot be identified as being part of any specific river system. So although the South Esk Fishery caught 9,731 salmon and grilse in 2010 (or 35% of the total wild salmon & grilse netted around Scotland) the number of salmon destined for the River South Esk is unknown.

The STA would probably argue that even one salmon caught by the net fishery is one salmon too many and although the complaint is aimed at preventing the extension of the net fishery season, the STA would like to see the South Esk Fishery and all other net fisheries closed down. This fishery has been run by the same family since the 1960's and likely by other families before that. They operate several netting stations along the Angus Coast from Montrose to Arbroath.

In 2010, the catch figures for this fishery are shown below, the first chart for salmon and the second for grilse⁶⁶.

South Esk salmon

		February	March	April	May	June	July	August	September
1									
2									
3	Tweed 1 East								
4	South Esk 4 North East				679	611	657	652	

South Esk grilse

		February	March	April	May	June	July	August	September
1									
2									
3	Tweed 1 East								
4	South Esk 4 North East				3	218	1500	1845	

These figures are quite high following three years of much lower catches for all Scottish net fisheries. The total catch in 2010 has been 27,315 fish whilst it was down to 12,855 in the previous year. Total Scottish net catch for 2008 was 15,660 and 19,897 for 2007. It was as far back as 2006, that the net fisheries surpassed 20,000 fish with a total of 24,961 and 2003 when it was over 30,000 fish (33,247 in total).

⁶⁶ <http://www.scotland.gov.uk/Topics/marine/science/Publications/stats/SalmonSeaTroutCatches>

The changing number of wild salmon caught is relevant only in the context of the following appeal that appears on the Salmon & Trout Association website. It highlights the fact that 12,000 Scottish salmon are still killed in coastal nets (2009 figure – 12855 fish).

Time and water are running out

Read the papers, lately? Watched documentaries about it on TV? The facts are chilling. What you most feared is happening.

- Less than 30% of rivers are in a healthy ecological state
- Water abstraction is up to 50 times greater than 40 years ago
- More than a million tonnes of silt enters our rivers every year destroying spawning habitat
- 250,000 lakes and ponds have disappeared in the past 50 years
- Salmon levels have collapsed by as much as 80% of historic levels
- Some aquatic fly populations are down by 70%
- Fish farming is destroying wild salmon and sea trout stocks
- 5,000 sites had been earmarked for low-head hydropower schemes threatening fish passage
- Every year, 12,000 Scottish salmon are still killed in coastal nets.

Put bluntly, the Salmon & Trout Association is the only charity at the sharp end when it comes to protecting and preserving the aquatic environment of all inland and coastal waterways. From rivers to rivulets, lakes to lochans.

With our influence, Government departments listen to us. With our resources, we put policies in place and change things. With our own scientific department, we don't say something is wrong.

We can prove it. By focussing on the health of our fish stocks, we're the only hope you have of preserving the aquatic environment in which our wild fish live - and on which your fishing depends.

Conversely, YOU are our only hope.

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Their website also highlights how wild salmon stocks must be protected legally, in much the same way as some animals that have more public appeal than 'invisible salmon', especially in rivers that are protected as Special Areas of Conservation.

⁶⁷ <http://www.salmon-trout.org/>

What is the issue?

S&TA believes that, in a closely management environment such as the United Kingdom, all water-dependent wildlife should, where necessary, be managed on an ecosystem basis under catchment management plans, and not, as is common today, because one group of species has more attraction to, or support from, humans than another. An example would be that, in a river protected as a Special Area of Conservation, in which salmon are a designated conservation species, the fish require just as much legal protection as their potential predators, such as otters and cormorants, even though the latter have more public appeal than the 'invisible' salmon.

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There are at least nine Scottish rivers that are afforded protection of a 'Special Area of Conservation', specifically because of their populations of wild Atlantic salmon. These include the Bladnoch, Dee, Moidart, Naver, South Esk, Spey, Tay, Thurso and the Tweed. Despite this special protection given by the Special Area of Conservation, wild salmon are being killed, not because of net fisheries but by members of the Salmon & Trout Association and other anglers. During 2010, a total of 15,662 salmon were caught and retained by anglers in just these nine rivers. That figure exceeds the 12,000 salmon killed by net fisheries claimed by the STA. Clearly, anglers are harming wild salmon stocks to a greater extent than all the net fisheries put together. The total number of salmon retained by anglers in Scotland in 2010 was 32,712 fish. Over the last ten year, net fisheries have caught 246,167 fish compared to over 350,000 caught and retained by anglers. The catch data specifically for the River South Esk for 2010 was:

	January	February	March	April	May	June	July	August	September	October	November
Salmon released											
South Esk	4		2	12	38	7	2	32	44	151	272
North East											
Grilse released											
South Esk					3	1	1	30	55	113	110
North East											
Salmon retained											
South Esk					4	1	9	24	32	112	113
North East											
Grilse retained											
South Esk								30	78	88	65
North East											

⁶⁸ <http://www.salmon-trout.org/>

The totals are

Salmon released - 560

Grilse released - 313

Salmon retained - 295

Grilse retained - 261

Therefore out of a total salmon and grilse caught by rod and line from the River South Esk in 2010, 873 were released and 556 were killed and retained. This equates to a cull of 39% of the fish caught. This is a much higher rate than the national average with a Catch and Release rate of just 61% as compared to 70% for the whole of Scotland. However, the River South Esk is a river protected as a 'Special Area of Conservation' and it might be expected that salmon in this river would be afforded extra protection. This is apparently not the case.

Undoubtedly, if the Salmon and Trout Association are concerned about the state of wild salmon stocks and are keen to demonstrate their conservation credentials then they should impose a complete ban on fishing for wild salmon in the nine rivers that are 'Special Areas of Conservation'.

5. Conserving (preserving) salmon

Preserving salmon for future generations is not the only form of conservation of interest to anglers. There is another form of preservation that is regularly used by anglers and that is smoking to preserve their catch. There are a number of smokehouses that cater for anglers, for example Dunkeld Smokehouse⁶⁹.

Springwells is a traditional and artisan smokehouse situated in the ancient cathedral town of Dunkeld on the banks of the River Tay, one of Scotland's most famous salmon rivers. The smokehouse was established over 30 years ago primarily to smoke anglers' own fish. We still provide that service today and on Sundays during the season there is a steady stream of anglers bringing in the fish they have caught during the week.



Fig 11. Salmon smoking

Whilst retaining fish for home consumption may be increasingly frowned upon by the angling authorities, the practice is widespread as confirmed by separate data for retained salmon in the Scottish Executive's catch statistics.

⁶⁹ <http://www.dunkeldsmokedsalmon.com/>

The smoking of rod-caught salmon may be something that the authorities would prefer to keep hidden but it is so widely accepted that the leading industry magazine 'Trout and salmon' continues to provide space to promote the activity with an article on the new Ettrick Valley Smokehouse. This smokehouse aims to cure and smoke the catch within three days even offering to collect the fish from the fishing beat.

Article subjected to copyright

In addition to the guidance about finding smokers, 'Trout and Salmon' supply information for those anglers who are unable to have their catch smoked. The magazine publishes a monthly recipe presumably for those salmon 'caught and retained' rather than those that were 'caught and released.'

Pan fried fillet of salmon marinated in molasses whisky and ginger
Subject to copyright

Smoking and cooking are not the only forms of preservation advocated by those who promote the sport of salmon angling. 'Trout and Salmon' also provide details of a more permanent form of preservation.

Article about Chris Elliot, Britain's finest fish taxidermist subject to copyright

6. Escaped farmed salmon

The Atlantic Salmon Trust has stated that salmon have developed into distinct populations even within the same river system.

Atlantic salmon in different rivers and tributaries within rivers are organised by their homing tendency into distinct groups of breeders, representing distinct genetic populations. These genetic populations evolve over time to be distinct, across geographical regions, between river systems, and even within the same river system.

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Eric Verspoor from the Freshwater Fisheries laboratory in Pitlochry and a leading scientist in the SALGEN project writes⁷¹:

“That many river systems contain multiple genetic populations of salmon is now widely accepted.”

These observations indicate that there are distinct populations of wild salmon in Scottish rivers. If these populations are distinct, it means that they do not interbreed. If wild salmon that live in the same river system do not interbreed with each other despite being effectively the same fish, then why would farmed salmon, that are considered to have been separated by at least nine or ten generations from the wild fish, interbreed with wild salmon?

This is a fundamental question in the issue of escaped farmed salmon.

The Salmon & Trout Association state on their website that **‘Scientific evidence suggests a clear link between salmon farms and adverse impacts on wild salmon from the interbreeding of escaped farmed stocks with wild salmon thus potentially jeopardising gene pools.’**⁷²

Unfortunately, the scientific evidence is not conclusive and even though the STA highlight that the number of salmon escaping from farms continues to be unacceptable, there is very little new data available to illustrate the effect of farmed escapes on wild stocks. This is also the view of Annelise Leonczek of the Norwegian environmental organisation ‘Bellona’ whose response to an enquiry about the latest work on escapes from the Norwegian salmon farming industry was:

⁷⁰ <http://www.atlanticsalmontrust.org/>

⁷¹ SALGEN The Atlantic Salmon, Genetics, Conservation and management, Blackwell Publishing 2007 page 156

⁷² http://www.salmon-trout.org/fish_farming.asp

“It is difficult to come up with any conclusion since the data material on the subject is quite poor.” 20th February 2012.

Observations on interbreeding between escaped farmed salmon and wild salmon are not made any easier given that Thorstad and others writing for the Salmon Aquaculture Dialogue⁷³ argue that there is no genetic marker available that can definitely distinguish between farmed and wild salmon.

Despite the inability to be totally sure of the origin of the fish, there has been work to investigate interbreeding between farmed and wild salmon with limited success. This is in part due to much of the work being experimental or based on simulation. It is still unclear whether escaped farmed salmon interbreed with wild fish other than as a rare occurrence.

The consensus of opinion appears to be that if farmed salmon do breed with wild fish then the rate of success is very low; any resulting offspring will have poor viability and that any genetic material that is passed on that favours the farmed environment will be quickly bred out of the fish in subsequent generations through natural selection or lost because the resulting fish are unlikely to breed (Jan Gjøvik Personal Communication)⁷⁴.

Concerns by the Salmon & Trout Association about dilution of the gene pool due to interbreeding with escaped farmed are largely misplaced. The likelihood is that sustained angling pressure on wild stocks has resulted in greater changes to the gene pool that could ever be incurred by the limited occurrence of interbreeding with farmed escapes.

⁷³ Thorstad et al. 2008. Nina special report no 36. Incidence and impacts of escaped farmed salmon on nature . Page 41.

⁷⁴ Jan Arve Gjøvik. Er villaks truet av lakseoppdrett? Fiskeri- og havbruksnæringens forskningsfond. 2011

7. Sea lice

The Salmon & Trout Association claim that sea lice emanating from salmon farms are effecting populations of wild salmon and sea lice:

The principal threats to wild salmon and sea-trout are:

- parasites, especially sea lice, establish unnaturally large populations in open net fish farms and, when they breed, their young are easily transferred to juvenile wild salmon and sea trout as they migrate to sea. There is strong scientific evidence that significant death can result from sea lice infestation on these wild fish and that fish farms are struggling to control sea-lice problems.

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There is no doubt that sea lice can be a problem for salmon farms. Yet, although the STA claim that there is 'strong scientific evidence' to show that significant death from sea lice infestation can result in wild salmon, this evidence is not conclusive.

Wild salmon and sea trout populations did decline on the west coast of Scotland at about the same time as the arrival of salmon farming. However, it would seem that this relationship is more coincidental than being linked directly. The decline of wild fish population may have more to do with changes in river spates that have washed away eggs and young fish than the arrival of fish farming.

The angling representative organisations such as the STA continue to suggest that wild salmon populations are threatened by the presence of salmon farms and the link to sea lice, yet as previously discussed, rod catches have continued to increase on west coast rivers despite claims from RAFTS otherwise.

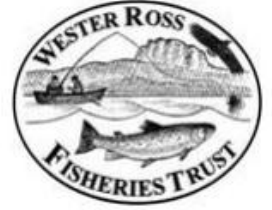
The fishing reports from some of the west coast rivers indicates that anglers are catching plenty of fish and that catch numbers are good. There is however no mention of sea lice. This also applies to the monthly catch reports published in 'Trout and Salmon' magazine that accompany this response document.

The Wester Ross Fisheries Trust, that administers a number of rivers in the Wester Ross area has just published their latest newsletter and this includes details of the rod catch for 2011. Again there is no mention of problems with or caused by sea lice.

⁷⁵ <http://www.standupforwildsalmon.org/Problems.html>

WESTER ROSS FISHERIES TRUST

Conserving, restoring & developing wild fisheries in Wester Ross



NEWSLETTER

January 2012, no 27

2011, a record year for multi-sea winter salmon. Why?

The salmon fisheries of Wester Ross experienced somewhat contrasting fortunes in 2011. Overall, it was another good year. The River Ewe system recorded its highest total rod catch of salmon and grilse since 1992, of about 340 fish (final figures to follow). However, total catches of salmon and grilse from the Gruinard River, Little Gruinard River & River Carron were down on those of 2010.

To investigate further, records of individual rod caught fish for years 2010 and 2011 were provided by Graeme Wilson and Ray Dingwall (keepers for the Little Gruinard River and River Ewe respectively), and Bob Kindness of the River Carron.

The three rivers' catches tell a similar story. In 2010, grilse catches were the highest on record for the Carron and both the Ewe and Little Gruinard also enjoyed a very good year for grilse (see Newsletter 26) However, in 2011, catches of multi-sea winter salmon for all three rivers were the highest since at least 1992; even though the combined total catches (grilse and salmon together) for the Little Gruinard and Carron were slightly less than in 2010.

From a comparison of individual fish data for these rivers, it is already clear that the 2 sea-winter salmon, the survivors of the smolt-year class that emigrated in 2009 from the river systems of Wester Ross, have been unusually



Bob Kindness (trying to hide a smile) with a magnificent 20lb salmon caught and released into the River Carron on 26th May 2011. 2012 could be a good year for 3SW salmon of this size (or larger).

The abundance of juvenile fishes in the in-shore marine environment is not simply something that varies randomly in accordance with climate changes and cycles. Sandeels, herring and sprats, use the seabed as spawning habitat. Fisheries target all three. With a list of proposed Marine Protected Areas around Scotland to be published later in 2012, will the Scottish Government be far sighted and take an ecosystem approach to the protection of inshore spawning and nursery areas of

WRFT News

Trustee update

After a three year term of office, Prof Barry Blake, stood down as a trustee at the end of 2011. Barry has been one of the most active trustees, becoming closely involved with the day to day management of the Trust. Barry represented WRFT on many occasions. With a background in fisheries and natural resource management, Barry's contribution was invaluable. Barry is looking forward to pursuing other interests in his 'retirement'; though will not be too far away should a few words of wisdom be required from time to time!

We are delighted that Dr Melanie Smith of University of Highlands and Islands has accepted the invitation to join the WRFT as a new Trustee. Melanie is head of Research Development at Inverness College UHI and has special interests in long-term woodland ecology (particularly juniper), and salmon and sea trout fisheries with research associations with Beinn Eithe and the River Carron.

Herring Project interviewer

In collaboration with Two Lochs Radio, WRFT has employed a research assistant to carry out

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The complete article can be accessed through their website.

⁷⁶ <http://www.wrft.org.uk/files/WRFT%20Newsletter%20Jan%202012%20final.pdf>

The River Lochy annual report also details a good catch without reference to any sea lice problems.

River Lochy Association – 2011 River report

- **Summary**

2011 was a good season in many ways. Our total for the whole catchment totalled 575 (salmon & grilse), making it the 2nd best year in the last 10. We had fresh fish running off every tide from May right through to October and many of these were good sized multi-sea winter salmon. In fact it was best MSW salmon year since 1988. Our average salmon weight was just under 13lbs with 70+ fish at 15lbs and over. Grilse numbers were also encouraging just topping that of the MSW fish. Our grilse averaged 4.6lbs, which by today's standards is very good.

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The only references to sea lice in the monthly catch reports has been written by Andrew Graham –Stewart, a known anti-salmon farm campaigner and he mostly repeats reports made elsewhere. One of these comes from the Wester Ross Fisheries Trust and is repeated in their latest newsletter.

This details the results of sampling by the Wester Ross Fisheries Trust mainly of sea trout in various lochs. These samples were obtained by sweep netting and were of variable results. Some of the fish caught were carrying in excess of 200 pre-adult and adult lice.⁷⁸



Fig 12. Sea lice (Wester Ross Fisheries Trust)

⁷⁷ <http://www.riverlochy.co.uk/downloads/>

⁷⁸ <http://www.wrft.org.uk/files/WRFTSeaTroutintheSeaReport2009-spring2011.pdf>

Sweep netting for sea trout is probably not the most effective way of catching fish as fish have plenty of opportunity to swim out of the closing net. It could be suggested that this method of sampling catches the weakest and most easily trapped fish. Equally, it might be suggested that weaker fish may be more susceptible to attack by parasites and this is why they have such a high loading.

Sea trout monitoring update

Levels of infection by parasitic sea lice (*Lepeophtheirus salmonis*) on sea trout sampled by WRFT sweep netting teams were variable in 2011.

In early June, lice numbers on small sea trout sampled in Loch Ewe were low (less than 10 lice per fish). Towards the end of June sea trout taken from the Kanaird estuary and Gruinard Bay had moderate to high numbers of small chalimus lice. Several small sea trout taken in a fyke net at Dundonnell in early July also carried over 100 lice.

Six sea trout were caught in Loch Gairloch on 4th August. The two largest fish were over 450mm & 1kg in weight; one of these fish carried over 200 pre-adult and adult lice and had a raw eroded dorsal fin. This was the odd one out: the other trout had only 12 lice and was in much better condition. This fish was recognised as one caught earlier in the year in February at the mouth of the River Kerry (visit the Trout Scale Catalogue on the 'downloads' page of WRFT website for further details).

Three of the sea trout caught on 27th September were also identified from photographs as recaptures. The fish that had over 200 lice on 04/08, had only 80 lice on 27/09, and was by far the lousiest fish in the September sample.

Sea trout of over 1kg were also taken in Gruinard Bay and Loch Ewe. None of the fish were as fat as those seen in 2009. However, terns, which also feed on sandeels and



BBC Scotland filming WRFT Biologist, Peter Cunningham counting sea lice on a sea trout by Loch Ewe in July 2011 (photo by WRFT)

'whitebait' (sprats and herring fry), bred successfully in Loch Ewe in 2011.

Lice levels were highest during periods of drier weather when there was the least discharge of freshwater into sea lochs. The relationship between sea lice levels on wild sea trout and the salmon farming industry continues to be the subject of investigation by Marine Scotland Science in collaboration with RAFTS.

The sweep netting programme in May, June and July was part-funded by the Scottish Government as part of the RAFTS Aquaculture Project. Thank you to all the estates and helpers, especially volunteers, for their support with sweep netting.

A more detailed report for 2011, including all results from the WRFT sampling area will follow on the website www.wrft.org.uk.

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The most interesting sample was a sea trout caught on 4th August with 200 lice but was recaptured just over a month later with only 80 lice. The disappearance of 160 lice is not explained.

⁷⁹ <http://www.wrft.org.uk/files/WRFT%20Newsletter%20Jan%202012%20final.pdf>

The Wester Ross Fisheries Trust have been sampling using sweep nets for a number of years and all the data can be found in their reports. What is clear is that the infestation with sea lice is very variable and that many fish carry no lice at all but when fish with lice are caught, they tend to be in groups of infested fish. The extreme level of infestation highlighted in the newsletter and the angling press does appear to be a rarity and not typical of the wider population.

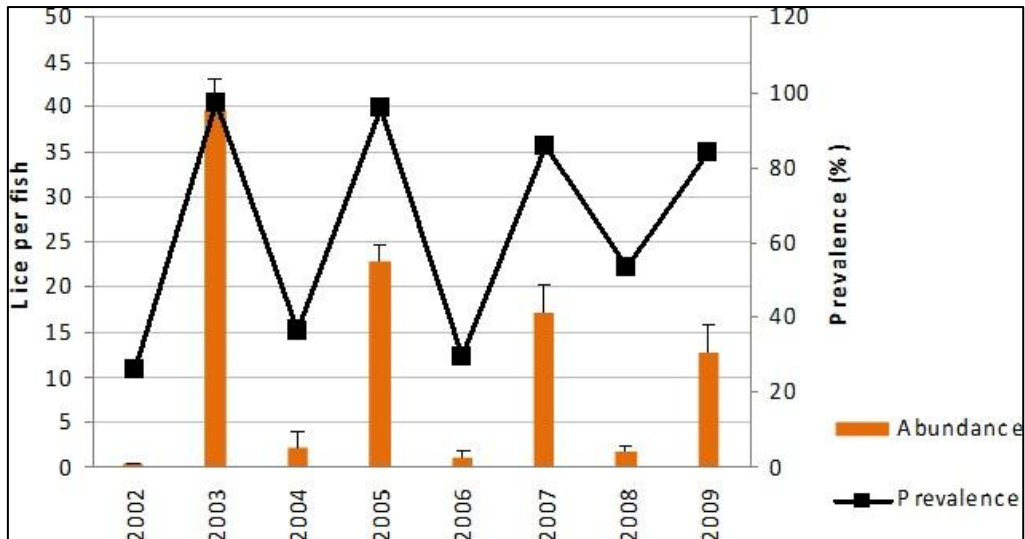
Appendix 1: Sea lice data for trout sampled by WRFT in 2009 - 2011 (sweep netting funded by the Scottish Government via the TWG)

Fish no.	Location	Date	Method	Riv / Est / Beach	Length (mm)	Weight (g)	Condition factor	Caligus		Lepeophtheirus salmonis						Cryptocotyl lingua	Predator damage	Comments
								total	copepodid & chalimus	Pre-adult & adult	Ovigerous female	Total L salmonis	Dorsal damage	Lice scars				
1	River Carron	20-May-09	Sweep	Estuary	405	660	0.99	0	0	0	0	0	0	0	n			
2	River Carron	20-May-09	Sweep	Estuary	261	220	1.24	0	0	0	0	0	0	0	n			
3	River Carron	20-May-09	Sweep	Estuary	321	355	1.07	0	0	0	0	0	0	0	n			
4	River Carron	20-May-09	Sweep	Estuary	378	535	0.99	0	0	0	0	0	0	0	n			
5	River Carron	20-May-09	Sweep	Estuary	373	440	0.85	0	0	0	0	0	0	0	n			
6	River Carron	20-May-09	Sweep	Estuary	300	300	1.11	0	0	0	0	0	0	0	n			
7	River Carron	20-May-09	Sweep	Estuary	340	387	0.98	0	0	0	0	0	0	0	n			
8	Boor Bay	22-May-09	Sweep	Beach	230	122	1.00	0	0	0	0	0	0	0	n	no	0	no Cryptocotyl - fresh smolt
9	Boor Bay	22-May-09	Sweep	Beach	360	470	1.01	0	4	15	2	21	1	n		yes		orange mark under chin
10	Poolewe	08-Jun-09	Gill	Estuary	345			0	0	0	0	0	0	n		n		
11	Charleston Bay	10-Jun-09	Sweep	Beach	147	40	1.26	0	0	0	0	0	0	n		n		tail eroded
12	Kerry Bay	16-Jun-09	Sweep	Beach	163	52	1.20	0	0	1	0	1	0	n		yes		
13	Kerry Bay	16-Jun-09	Sweep	Beach	192	83	1.17	0	0	2	2	4	0	n				
14	Kerry Bay	16-Jun-09	Sweep	Beach	196	100	1.33	0	0	0	0	0	0	n	yes			
15	Kerry Bay	16-Jun-09	Sweep	Beach	315	342	1.09	0	0	4	1	5	0	n		N		
16	Boor Bay	22-Jun-09	Sweep	Beach	147	35	1.10	0	0	0	0	0	0	n		n		
17	River Carron	23-Jun-09	Sweep	Estuary	161			0	0	0	0	0	0	n				
18	Charleston Bay	24-Jun-09	Sweep	Estuary	163	57	1.32	0	0	1	0	1	0	n	yes	N		
19	Kerry Bay	29-Jun-09	Sweep	Beach	172	63	1.24	0	5	2	0	7	0	n		n		
20	Kerry Bay	29-Jun-09	Sweep	Beach	197	96	1.26	0	12	5	0	17	1	n		y		
21	Kerry Bay	29-Jun-09	Sweep	Beach	203	106	1.27	0	2	1	0	3	0	n		n		
22	Kerry Bay	29-Jun-09	Sweep	Beach	213	127	1.31	0	2	4	4	10	0	n		n		
23	Kerry Bay	29-Jun-09	Sweep	Beach	221	134	1.24	0	12	8	1	21	1	n		n		
24	Kerry Bay	29-Jun-09	Sweep	Beach	222	130	1.19	0	23	12	5	40	1	y		n		
25	Kerry Bay	29-Jun-09	Sweep	Beach	255	230	1.39	0	10	15	4	29	0	n		y		
26	Kerry Bay	29-Jun-09	Sweep	Beach	370	727	1.44	0	6	17	13	36	1.5	n		n		
27	Kerry Bay	29-Jun-09	Sweep	Beach	373	655	1.26	0	28	13	11	52	1	n		n		
28	Kerry Bay	29-Jun-09	Sweep	Beach	395	695	1.13	0	8	4	4	16	0	n		y		
29	Boor Bay	30-Jun-09	Sweep	Beach	160	38	0.93	0	4	1	0	5	0	y		n		
30	Boor Bay	30-Jun-09	Sweep	Beach	215	118	1.19	0	4	6	0	10	0	y		n		
31	Inverasdale	30-Jun-09	Sweep	Beach	178	63	1.12	0	11	7	0	18	0	y		n		
32	Dundonnell	30-Jun-09	Fyke	Estuary	425			0	0	12	0	12	0	0		y		scale damaged
33	River Ewe	09-Jul-09	Rod	River	230			0	10	5	0	15	0.5	n		n		
34	River Ewe	09-Jul-09	Rod	River	235			0	1	10	0	11	0	n		n		
35	River Ewe	09-Jul-09	Rod	River	240			0	5	6	1	12	0	n		n		
36	River Ewe	09-Jul-09	Rod	River	243			0	0	12	0	12	0	n				scale damage
37	River Ewe	09-Jul-09	Rod	River	250			0	2	5	0	7	0	n		n		
38	River Ewe	09-Jul-09	Rod	River	250			0	0	13	0	13	0	y		n		

80

Wester Ross Fisheries Trust is not the only organisation sampling for sea lice on post smolt sea trout. Lochaber Fisheries Trust has also been undertaking similar work in Loch Linnhe and around the Lochaber region. They claim to have found a relationship between detected sea lice levels and farm production on a biennial cycle.

⁸⁰ <http://www.wrft.org.uk/files/WRFTSeatroutintheSeaReport2009-spring2011.pdf>



81

Prevalence refers to the number of sea trout smolts infected and abundance to the number of sea lice per fish. The data refers to samples caught by seine net at Camus na Gaul.

The significance of this data can be found in the Association of Salmon Fisheries Boards annual report for 2009.

However, one clear threat remains to the full recovery of the Lochy. As can be seen from the graph, the grilse run can fluctuate by up to a massive 1200 per cent. The only saving grace is that a poor grilse year usually means a good season for big MSW fish.

From the sterling work of the Lochaber Fishery Trust, as part of the Tripartite Working Group (TWG) initiative, we now know these swings relate to sea lice numbers on fish farms. Every other year, when the local farms are in the second year of their two-year production cycle, the available chemicals are incapable of controlling sea lice sufficiently to save the outgoing wild smolts from lethal infestation. The result is a collapsed grilse run. The graph also clearly shows that smolts passing the fish farms in the lice-free first year of farm production will return in numbers not seen since the heady days of the 1960s.

It is now very clear that not until the two fish farms at the mouth of the river are relocated to a more suitable site for fish farming will 'The Queen of Scottish Salmon Rivers', as the late John Ashley-Cooper described her, be truly restored to her throne.

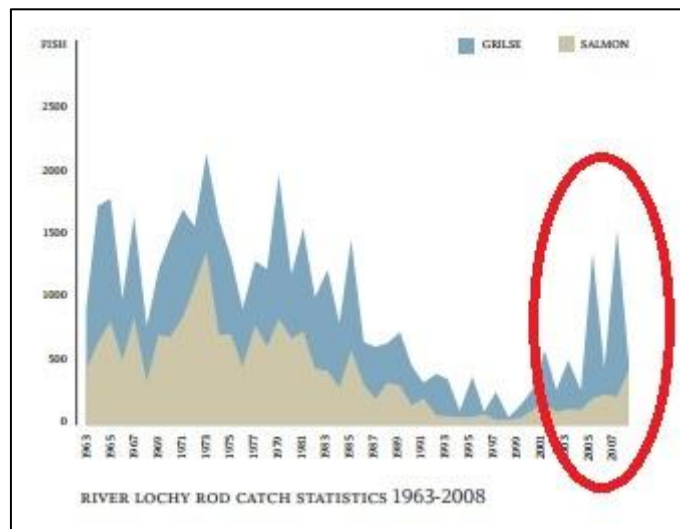
82

The report states that the work of the Lochaber Fisheries Trust means that they now know that swings in the grilse run can fluctuate by up to 1200%.

⁸¹ <http://www.lochaberfish.org.uk/twg.asp>

⁸² http://79.170.44.155/asfb.org.uk/wp-content/uploads/2011/05/ASFB_Review_2009.pdf

The graph shows these large swings:

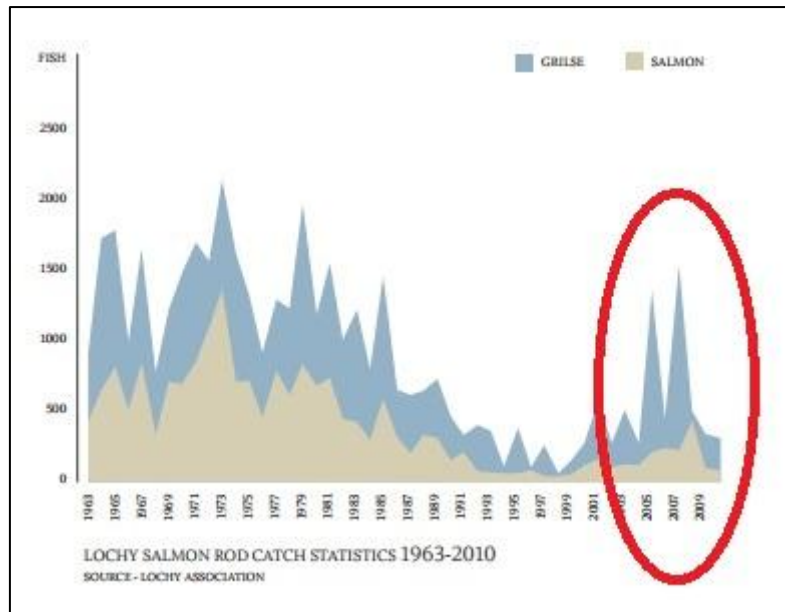


83

The two peaks on the right hand side of the graph are the fluctuations referred to in the ASFB annual report. John Gibb, the fishery manager on the River Lochy says in the ASFB annual report that “we now know that these swings relate to sea lice numbers on fish farms. Every other year when local farms are in the second year of their two year production cycle, the available chemicals are incapable of controlling the sea lice sufficiently to save the out-going smolts from lethal infestation. The result is a collapsed grilse run.”

However, this so-called pattern did not continue past 2008 as the graph from the ASFB’s 2011 annual report shows:

⁸³ http://79.170.44.155/asfb.org.uk/wp-content/uploads/2011/05/ASFB_Review_2009.pdf



84

The reports for the river in the AFB annual report indicate that the bumper grilse runs had vanished in the subsequent years.

Lochy

JON GIBB - Lochy Association Manager

Along with most of the western seaboard of the UK, grilse numbers were depressed, while spring and autumn MSW numbers were mediocre to poor. This has prompted continued concern about the seemingly unchecked expansion of the fish farm industry, even though wider oceanic forces may have been at work of late (numbers were also depressed in non-aquaculture zones). One more encouraging moment, however, was when local angler Sandy Walker lifted the 2009 Malloch Trophy with a fresh 32lb fly-caught fish, taken in the tidal beat in June.

85

The blame was laid firmly on aquaculture's door even though Mr Gibb acknowledges that grilse numbers had declined in areas where there was no fish farming.

⁸⁴ <http://www.asfb.org.uk/publications/>

⁸⁵ <http://www.asfb.org.uk/publications/>

In 2010, the report also recorded another disappointing season:

Lochy

John Veitch - Lochy River Manager

2010 was a disappointing season – not only did we see yet another poor grilse run but weather and water conditions conspired against us at key points in the season. This depressed catches and, indeed, anglers. We endured the driest spring in 50 years, which all but ruined the fishing in May and June. And, although July's catches beat the 5-year average for the month, August through to October saw nothing like the numbers of grilse and summer salmon we would expect. The total (Lochy beats 1-4 and club beats) accounted for only half the current 5-year average, with the grilse numbers being most affected, while MSW salmon numbers were almost on a par with our 5-year average. Many of the grilse had red vent but in general the quality and size of the fish was good – averaging 5.1lb for grilse and 12.2lb for salmon – indicating that those fish that made it back were not undernourished. Around 90 per cent of the rod catch was returned.

86

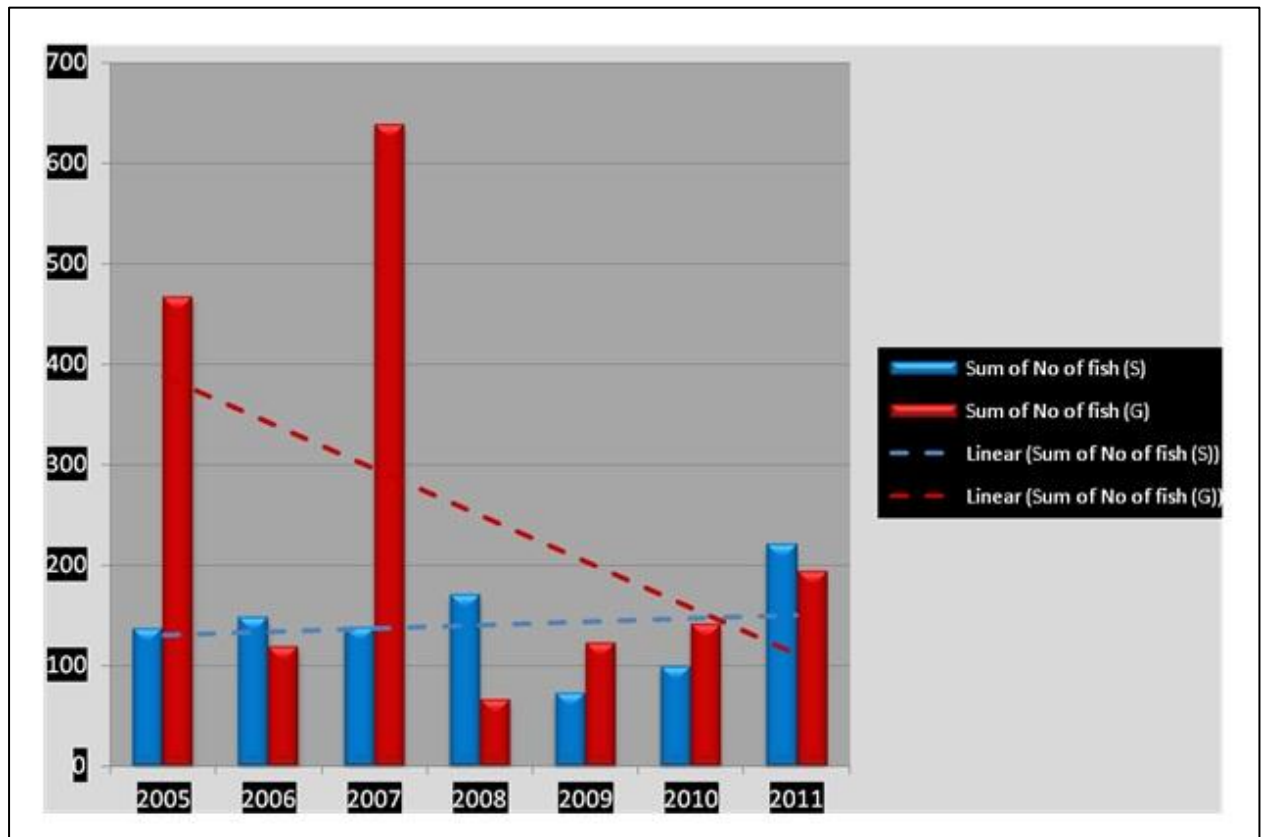
However, it was noted that the spring was the driest in 50 years and consequently, the fishing was ruined but that the quality and size of those fish that appeared was good.

The ASFB report for 2011 is not yet available but the River Lochy's annual report for 2011⁸⁷ records that the fishing was the second best year for fishing in the last ten. The report also notes that the grilse were an average weight of 4.6lbs which they say is by today's standards very good.

⁸⁶ <http://www.asfb.org.uk/publications/>

⁸⁷ <http://www.riverlochy.co.uk/downloads/>

The most interesting aspect of the report is the comparison of salmon and grilse caught over recent years. The report illustrates this with the following graph:



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The two peaks of grilse return for 2005 and 2007 can clearly seem with over 600 grilse caught in 2007. The catch for the subsequent four years has been much lower but has increased each year for both grilse and salmon. What does seem clear is the relationship between grilse rates and salmon farm production and hence the number of sea lice is not as pronounced as Lochaber Fisheries Trust has suggested, if it exists at all.

One reason why this relationship may not be questioned is the sampling procedure using seine nets. This may not be the most effective way to obtain a representative sample of fish and even Lochaber Fisheries Trust have recognised that this is a problem.

⁸⁸ <http://www.riverlochy.co.uk/downloads/>

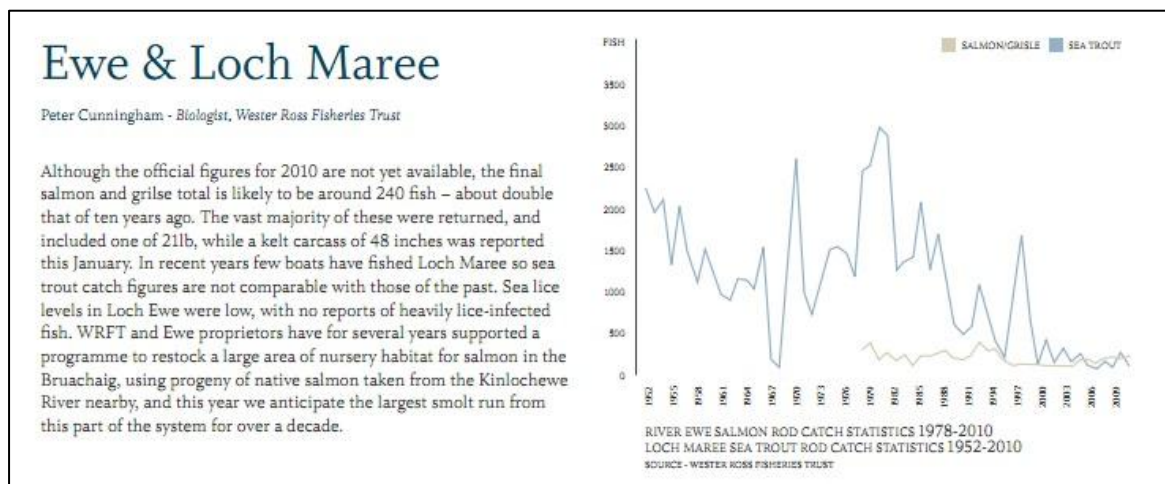
The Trust website states that they have not been so successful in sampling other areas as in Loch Linnhe.

For many years the TWG has provided funding for the Trust to monitor lice levels on wild sea trout post smolts by seine netting in sea lochs. We have collected a dataset that clearly demonstrates a biennial cycle in lice levels in Upper Loch Linnhe linked to the local fish farm production cycles. Netting in other areas has been less successful at catching fish and we are now experimenting with plankton trawls to monitor sea lice abundance. There is a pressing need to improve our knowledge of sea lice distribution and dispersal patterns from farms.

89

If sampling works in one area, then there is no reason to question the results from another, however, if the sampling is not successful in other areas, then there must be a significant element of doubt as to the validity of any samples taken using the same procedures. As the pattern of grilse returns was not repeated in subsequent years, even discounting the influence of other factors, the relationship may be unproven especially in other areas, such as the river Carron, there is no evidence of sea lice issues other than at the usual background level despite being situated close to two large farming sites.

Even the area around Loch Ewe and Loch Maree, which is considered highly contentious, appeared relatively lice free during the previous year as detailed in the ASFB annual report.



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⁸⁹ <http://www.lochaberfish.org.uk/twg.asp>


⁹⁰ http://79.170.44.155/asfb.org.uk/wp-content/uploads/2011/05/ASFB_Review_2009.pdf

The STA seem to agree that the issue is plagued by uncertainty. Their briefing document states:

The debate on the impact of lice from farmed salmon on wild populations is fuelled by two uncertainties; 1) the lack of reliable data on sea lice abundances pre-salmon farming (Beamish *et al.*, 2007) and 2) the sample bias as you can only sample fish that have survived infestation (Revie *et al.*, 2009).

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However, they are wrong. There is a third uncertainty and that is whether sea lice actually have a negative effect on wild salmon populations or whether the alleged decline in wild salmon populations can be the result of other factors. In the 2009 ASFB annual report, Tony Andrews of the Atlantic Salmon Trust highlights the fact that sea trout stocks are in trouble in most river systems in the UK and Ireland. Mr Andrews blames the collapse on the west coast of Scotland on salmon farming but cannot seem to find an answer for elsewhere. Could it be that the any decline on the west coast may have occurred for the same reasons as why stocks have decline elsewhere in the UK and Ireland or is the aquaculture too convenient a target for him to ignore. In addition, it might not be perceived to be the best policy for the wild fish interests if everyone failed to sing off the same hymn sheet?



Sea Trout: A Crisis of Our Making?

TONY ANDREWS - Director Atlantic Salmon Trust

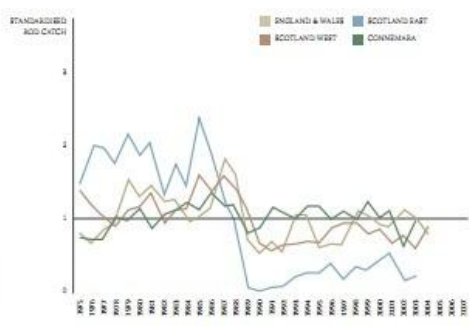
There are some species of wild animal that, above all others, can capture the imagination. Among these are the woodcock, the roe deer and the sea trout.

Wild, itinerant, indigenous - and often at their most active at dusk - these species can evoke a feeling of mystery and anticipation which connects us spiritually with both our hunter-gatherer ancestors and to our past. It is for these reasons that we must take direct responsibility for their future.


The sea trout is the ancestor of the native brown trout, *Salmo trutta*, and it is the fish that led to the colonisation of our rivers as the ice retreated ten thousand years ago. The mysterious and polymorphic migrant continues to appear suddenly and magically in the summer months but, sadly, its numbers have been diminishing for over 20 years.

There is a prevailing view amongst managers and biologists that sea trout stocks are in trouble in most river systems in the UK and Ireland. In some areas specific problems - such as the catastrophic impact of aquaculture-generated sea lice on sea trout populations - have been identified. However, in general, we lack an understanding of what needs to be done to restore stocks to pre-1980 levels.

For, despite research, our knowledge of the lives of sea trout - especially while at sea - is still limited. This reinforces concerns that public awareness of the plight of these fish is poor, despite the status of *Salmo trutta* as a Biodiversity Action Plan (BAP) species.



STANDARDISED SEA TROUT ROD CATCHES



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⁹¹ <http://www.standupforwildsalmon.org/Problems.html>

⁹² http://79.170.44.155/asfb.org.uk/wp-content/uploads/2011/05/ASFB_Review_2009.pdf

8. Replenishing stocks

Re-stocking is an extremely contentious issue.

Ronald Campbell, a fisheries biologist on the river Tweed, wrote on the River Tweed news blog in September 2011⁹³ that:

“Hatchery rearing, of course, does away with this (natural) competition with free food for all and gets much higher rates of survival - within the walls of the hatchery. Once the fish are put back in to the river, however, they have to start competing and surviving again, but have lost the instincts they need for this from "living on the dole" - and are physically unfit as well. This is why the high survival rates in hatcheries are an illusion, the gain is lost as soon as the fish return to the real world outside and the longer they spend in the hatchery, the less fit they are for life on the outside - hatchery reared smolts are only about one tenth as likely to return from the sea as wild smolts.”

This view of re-stocking is shared by Marine Scotland. Their pamphlet entitled ‘Hatchery work in support of salmon fisheries’ includes the following advice:

Paradoxically, hatchery environments are of poor overall quality. This is evident from the low survival rates of stocked parr and smolts when compared with wild fish. However, even failing stocked fish contribute to competition in streams since they take up space and use resources at the expense of other fish before they eventually die. The high quality of the physical environment provided by hatcheries is evidently counter-balanced by negative effects of other kinds that appear to accumulate with time.

94

This advice is then developed to explain why hatchery raised fish will be put at a disadvantage in the natural environment. This is attributed to the provision of feed and the subsequent domestication of the fish as they become accustomed to artificial feeds and feeding.

⁹³ http://news.rivertweed.org.uk/blog/_archives/2011/9/6/4894334.html

⁹⁴ Hatchery work in support of salmon fisheries. 2007 Scottish Fisheries Research Report no 65

Whilst this advice may make complete sense to those members of the angling community who are already adverse to the concept of re-stocking, it does seem to be significantly flawed.

- (a) Hatchery fish fed commercial diets grow atypically rapidly relative to wild fish and their growth shows less seasonal variability. This acceleration and smoothing of their growth rate may lead to developmental mismatches in hatchery parr released to forage in streams.
- (b) After a few months of feeding, most hatchery parr become much larger than any of their wild counterparts. Abnormally large parr released to live and forage in streams may be unable to obtain sufficient natural food to maintain their large body masses and they may be unable to secure sufficient cover to avoid predation.
- (c) The simple nature of the hatchery rearing environment means that reared parr and smolts lack opportunities to acquire important skills for successful stream life. For example, they cannot be skilled in the use of cover and the avoidance of predators. Or, they may lack the skills to set up and maintain individual territories as a result of previous rearing in hatchery tanks at high densities. Released fish may not acquire the necessary skills sufficiently rapidly to prevent excessive mortality rates after release.

95

Hatchery fish will only grow rapidly if they are fed in a manner that aims to achieve this outcome. For example, if the fish are fed with lots of food, then they will grow rapidly. Feed rates can be adjusted to produce fish that are in line with natural growth, if that is what is required. There is no reason why there should be any developmental mismatch in hatchery reared parr that are then released to forage. It is simply a question of adopting the appropriate management programme to produce the fish that are needed.

If hatchery raised fish are larger than their wild counterparts then this might give them the boost necessary to overcome the many obstacles that young fish face in the river. This could be an advantage. The suggestion that larger fish might not find sufficient food nor secure cover to avoid predation is flawed simply because the river will also contain fish of subsequent life-stages that are larger and must also find food and cover.

⁹⁵ Hatchery work in support of salmon fisheries. 2007 Scottish Fisheries Research Report no 65

There is a view amongst anglers that hatchery-raised fish will become domesticated and are unlikely to survive once released into the river. The work on the River Carron Restoration project shows this to be clearly untrue. Any possibility of domestication is eliminated simply by placing lids on the tanks. The success of the River Carron Restoration Project shows that hatcheries based re-stocking programmes do work.

In addition to concerns about domestication, there are now doubts in the angling community as to the overall value of re-stocking programmes. The Spey Fishery Board has announced that they are conducting a fundamental review of their stocking policy following publication of the findings of the FASMOP genetics project to identify returning hatchery raised fish. A report on the ASFB website states:

Mr Knight added: "Over 550 rod-caught fish samples were collected for analysis during 2008 and 2009, enabling us to see if their parents had been part of our broodstock during 2004 and 2005. This was where the meticulous records compiled by the Spey Board's hatchery and research staff came to the fore, allowing the geneticists to match fish with absolute confidence. From the 558 rod-caught samples analysed, three of them had originated from the Spey's hatcheries, giving a return rate to the rod fishery of 0.5 per cent. To put this into perspective, of the 8,626 fish caught during 2009, the hatcheries would have provided about 40 fish".

96

The Spey Fisheries Board say that during 2009 only 40 out of 8626 fish caught on the Spey would have originated from the hatchery. In light of this finding, the Spey Fishery Board is to decide whether it is worth spending the £120,000 it costs to run the hatchery.

One reason why hatcheries may not offer the value that Fisheries Boards expect may be due to the varied approaches to re-stocking that each Fishery Board has adopted. Because of the belief that young fish become domesticated, there is a tendency to favour stocking out eggs or newly hatched fry neither of which will not have become accustomed to human interaction and artificial feeding. This option is also cheaper as no feeding is required. However, eggs and newly hatched fry are still at a very early stage in the life cycle and are less likely to survive. This could be one reason the returns on the Spey are very low.

⁹⁶ <http://www.asfb.org.uk/river-spey-stocking-under-review/>

Those involved in the River Carron Restoration Project have been monitoring the returns various stockings over the years using salmon at different stages of the early life cycle. They have found that the optimum size at which to stock young salmon is 5g and this has consistently produced the best returns. The continued success of the Restoration Project would indicate that a similar approach to stocking might benefit other rivers. The recent award of significant funding will enable the River Carron project to continue the programme for the next few years⁹⁷.

A recent BBC news report⁹⁸ highlighted that the River Carron was not the only success story in relation to re-stocking. A project on the River Lochy has just come to an end in which wild fish caught from the river were bred and the resulting eggs were raised through to smolts at a hatchery belonging to Marine Harvest. Smolts were chosen since they would be released directly into the sea so avoiding competition with the natural wild population. A total of 54,000 smolts have now been released and as a result the river Lochy has seen the rod catch boosted to up to 1,500 fish a year.

Sadly, this project will be dismissed by the angling community due to the involvement of a salmon farming company. However, the benefits of re-stocking cannot be doubted.

Yet, according to Mark Coulson of RAFTS and leader of the FASMOP genetic s project, they have been unable to determine whether the hatcheries are doing any good. Clearly, he hasn't considered the results from the restoration projects on the west coast. Instead, he has focused on the genetic makeup of the fish produced in hatcheries and used the findings to determine the rate of return of the fish.

He says that based on his results he is confident that the hatchery is doing no harm to the fishery but has yet to determine whether it is doing any good. He hopes that the FASMOP project will provide clarification.

⁹⁷

http://www.fishupdate.com/news/fullstory.php/aid/17052/West_Coast_River_Carron_Project_Confirmed.html

⁹⁸ <http://www.bbc.co.uk/news/uk-scotland-highlands-islands-17113270>

- To date we have said that we are confident our Hatcheries are not causing any harm .
 - We have yet to be able to determine whether they are actually doing any good, rather than just not doing any harm.
- Expect FASMOP to use the unique genetic make-up of our Hatcheries' Salmon broodstock to trace their offspring and determine whether our hatcheries are benefitting the rod fishery.**

99

However, as this report has already highlighted, the genetic makeup of every river has not been determined by natural selection as those involved with FASMOP believe, but rather by Genetic Drift caused by over a hundred years of continued removal of genetic material from the river system. This has resulted in the appearance of fish with distinct genetic material appearing in different geographic areas.

Although populations have been determined by non-selective angling over many years, there is a view that if eggs and fry are planted out in a different part of the river from where the breeding fish were caught, then the distinct genetic populations will be diluted.

Marine Scotland has published a booklet 'To stock or not to stock'. They state that there can be a detrimental effect on the gene pool by interfering in the salmon's natural breeding:

⁹⁹ Mark Coulson & Roger Knight 2011: Investigating the Spey hatchery programme: what contribution does it make to the fishery and considering the management implications. Powerpoint Spey Fisheries Board.

How Can Stocking Damage Wild Populations of Fish?

Stocking can harm wild populations of fish in a number of ways, for example by:

- Modifying the genetic characteristics of wild populations to make them less suited to local conditions in the long-term;
- Causing harmful competition with wild fish;
- Spreading diseases and parasites;
- Attracting predators;
- Increasing the exploitation of natural populations.

100

This is a view also held by the Atlantic Salmon Trust whose response to whether hatcheries should be used is unequivocal:

Many readers will have heard a little about 'salmon clans', and be aware that salmon are genetically adapted to their natal river. However, the report of the SALGEN project (sponsored by the AST and funded by the European Commission) makes it clear to all fishery managers that these aspects of the species' genetics matter – indeed, taking on board the importance of genetic differences could make all the difference between saving a river's stock and losing it.

The SALGEN project, started in 2001, set out to muster and refine our understanding of the ways in which Atlantic salmon vary across their range in terms of important characteristics and behaviour. It's a sobering thought that more than 99 per cent of the Atlantic salmon which now exist are farmed, and therefore largely dependent on man for their day to day survival. Across parts of its natural range, the King of Fish is already extinct or nearly so.

So surely restocking is the answer? The SALGEN report answers this with a resounding: 'No!'

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The River Carron Restoration Project shows that re-stocking rivers with hatchery raised salmon can be undertaken with significant success. The angling community appear increasingly against re-stocking due to the romanticised view they have about wild salmon populations in Scottish rivers.

¹⁰⁰ Salmon & Sea Trout: To stock or not to stock. 2003. Fisheries Research Services. Information pamphlet no 22

¹⁰¹ <http://www.atlanticsalmontrust.org/research/why-the-genes-should-fit.html>

The simple fact is that there is increasing concern about the survival of salmon at sea and whether sufficient numbers will return to maintain the existing populations. Re-stocking offers a way to boost populations and at the same time ensure that stocks are at a sufficient level to enable anglers to fish for salmon in the same way that they have done for many generations. As salmon populations are boosted by successful re-stocking programmes, fisheries will be able to offer guests the opportunity not only to fish for salmon but also to take fish home. Without a well-planned re-stocking programme, catch and released policies could be increasingly tightened to prevent the killing of any wild salmon caught in Scottish rivers. It is incomprehensible why any fishery manager would willingly forgo the opportunity to boost stocks to improve the likelihood that anglers will actually catch a fish. This is accepted practice for some other field sports.

CONSULTATION QUESTIONS

Several of these questions have been formulated from various preconceived assumptions which may not be correct. Before this legislation is taken any further, these assumptions should be reconsidered as the questions posed here may no longer be relevant. See the document accompanying this questionnaire.

SECTION 1 - THE SUSTAINABLE DEVELOPMENT OF AQUACULTURE

Farm Management Agreements (FMAs)

1. Do you agree that we should, subject to appropriate safeguards, make it a legal requirement for marine finfish operators to participate in an appropriate Farm Management Agreement (FMA), with sanctions for failure to do so, or to adhere to the terms of the agreement? (Page 9)

NO

Appropriate Scale Management Areas (MAs)

2. Do you agree that operators should have primary responsibility for determining the boundaries (and other management arrangements) for Management Areas, but with Scottish Ministers having a fallback power to specify alternative areas? (Page 9)

NO

Management Measures and Dispute Resolution

3. Do you agree that an independent arbitration process should be put in place (with statutory underpinning) to resolve disputes related to Farm Management Agreements? (Page 10)

NO

4. How do you think such a system might best be developed? (Page 10)

Unused Consents

5. Do you agree we ought to review the question of unused consents? (Page 11)

NO

6. What do you consider are suitable options to promote use or relinquishment of unused consents? (Page 11)

7. Do you agree that Scottish Ministers should be given powers, ultimately, to revoke, or to require or request others to revoke, consents? (Page 12)

NO

8. Should any such power relate to all or to particular consents (and if the latter, which)? (Page 12)

Collection and Publication of Sea-lice Data

9. What in your view is the most appropriate approach to be taken to the collection and publication of sea-lice data? (Page 13)

Surveillance, Biosecurity, Mortality and Disease Data

10. Do you agree that aquaculture businesses ought to be required to provide additional information on fish mortality, movements, disease, treatment and production as set out above? (Page 16)

NO

11. What are your views on the timing and frequency of submission of such data? (Page 16)

Biomass Control

12. Do you agree that Scottish Ministers should have powers to require SEPA to reduce a biomass consent where it appears to them necessary and appropriate – for example to address concerns about fish health and welfare? (Page 16)

NO

Wellboats

13. Do you agree we should make enabling legislation giving Scottish Ministers powers to place additional control requirements on wellboats? (Page 17)

NO

Processing Facilities

14. Do you think Scottish Ministers should be given additional powers to place controls on processing plants? (Page 17)

NO

Seaweed Cultivation

15. Do you agree that the regulatory framework should be the same for all seaweed farms? (Page 18)

YES

16. Do you agree that the most appropriate approach to regulation of this sector would be through marine licensing? (Page 17)

NO

17. If not, what alternative arrangements would you suggest? (Page 18)

Commercially Damaging Species

18. Do you agree that we should provide for additional powers for Scottish Ministers in relation to commercially damaging native species? (Page 19)

YES

NO Depends on what it is

SECTION 2 - PROTECTION OF SHELLFISH GROWING WATERS

19. Do you agree with the introduction of provisions to protect shellfish growing waters and support the sustainable growth of the shellfish industry? (Page 21)

YES

SECTION 3 - FISH FARMING AND WILD SALMONID INTERACTIONS

Sea-lice

20. Do you agree that there is a case for giving Scottish Ministers powers to determine a lower threshold above which remedial action needs to be taken, in appropriate circumstances and potentially as part of a wider suite of protection measures? (Page 23)

NO

Containment and Escapes

21. Do you agree we should provide powers for Scottish Ministers to require all finfish farms operating in Scotland to use equipment that conforms to a Scottish Technical Standard? (The technical content of the standard would be defined separately.) (Page 25)

YES

Refer to the accompanying document.

Tracing Escapes

**22. Do you agree that there should be additional powers for Scottish Ministers to take or require samples of fish from fish farms, for tracing purposes?
(Page 26)**

NO

Refer to the accompanying document

SECTION 4 - SALMON AND FRESHWATER FISHERIES MANAGEMENT

Modernising the Operation of District Salmon Fishery Boards

23. Do you agree that we should introduce a specific duty on Boards to act fairly and transparently? (Page 29)

YES

Refer to the accompanying document

24. Do you agree that there should be a Code of Good Practice for wild salmon and freshwater fisheries? (Page 29)

YES

Refer to the accompanying document

25. If yes, should such Code of Good Practice be statutory or non-statutory? (Page 29)

YES

NO Unclear at this stage

Statutory Carcass Tagging

26. Do you agree that Scottish Ministers should have powers to introduce a statutory system of carcass tagging for wild Atlantic salmon and sea trout? (Page 31)

YES

Fish Sampling

27. Do you agree that Scottish Ministers should have powers to take or require fish and/or samples for genetic or other analysis? (Page 32)

NO

Refer to the accompanying document

Management and Salmon Conservation Measures

28. Do you agree that Scottish Ministers should have powers to initiate changes to Salmon District Annual Close Time Orders? (Page 32)

YES

Refer to the accompanying document

29. Do you agree that Scottish Ministers should be able to promote combined salmon conservation measures at their own hand? (Page 32)

YES

30. Do you agree that Scottish Ministers should be able to attach conditions, such as monitoring and reporting requirements, to statutory conservation measures? (Page 32)

YES

Dispute Resolution

31. Do you agree that we should introduce statutory provisions related to mediation and dispute resolution, to help resolve disputes around salmon conservation, management and any related compensation measures? (Page 33)

NO

Improved Information on Fish and Fisheries

32. Do you agree that there should be a legal requirement to provide comprehensive effort data for rod fisheries? (Page 34)

YES

Refer to the accompanying document

33. What additional information on the fish or fisheries should proprietors and/or Boards be required to collect and provide; and should this be provided routinely and/or in specific circumstances? (Page 34)

Should be standardisation throughout all fisheries boards – refer to accompanying document
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34. Should Scottish Ministers have powers to require Boards and/or proprietors or their tenants to investigate and report on salmon and sea trout and the fisheries in their district? (Page 34)

YES

Licensing of Fish Introductions to Freshwater

35. Do you agree that Scottish Ministers should have powers to recall, restrict or exclude the jurisdiction of Boards in relation to fish introductions, in certain circumstances? (Page 35)

YES

Refer to the accompanying document

36. If so, why and in what circumstances? (Page 35)

SECTION 5 - MODERNISING ENFORCEMENT PROVISIONS

Strict Liability for Certain Aquaculture Offences

37. Do you agree that strict liability criteria should apply – where they capable of being applied – for offences related to Marine Licensing requirements insofar as they apply to aquaculture operations and, potentially, in other situations? (Page 37)

NO

Widening the Scope of Fixed Penalty Notices

38. Do you agree that we should extend the use of fixed financial penalties as alternatives to prosecution in relation to marine, aquaculture and other regulatory issues for which Marine Scotland has responsibility? (Page 38)

NO

39. Do you agree that we should increase the maximum sum that can be levied through a fixed penalty notice to £10,000? (Page 39)

NO

40. Are there particular regulatory areas that merit a higher or lower maximum sum? (Page 39)

NO

Enforcement of EU Obligations Beyond British Fisheries Limits

NO VIEWS ON THIS SECTION

41. Do you agree that we should amend section 30(1) of the Fisheries Act 1981 as proposed? (Page 40)

YES

NO

Powers to Detain Vessels in Port

42. Do you agree that sea fisheries enforcement officers should be given specific power to allow vessels to be detained in port for the purposes of court proceedings? (Page 41)

YES

NO

Disposal of Property/Forfeiture of Prohibited Items

43. Do you agree that sea fisheries enforcement officers should be able to dispose of property seized as evidence when it is no longer required, or forfeit items which would be illegal to use? (Page 41)

YES

NO

Power to Inspect Objects

44. Do you agree that sea fisheries enforcement officers should have the power to inspect objects in the sea and elsewhere that are not obviously associated with a vessel, vehicle or relevant premises? (Page 42)

YES

NO

Sea Fisheries (Shellfish) Act 1967

45. Do you have any views on the proposals to amend the Sea Fisheries (Shellfish) Act 1967 to help make its application clearer? (Page 42)

YES

NO

SECTION 6 - PAYING FOR PROGRESS

46. Do you agree that there should be enabling provisions for Scottish Ministers to provide, through secondary legislation, for both direct and more generic charges for services/benefits arising from public sector services and activities? (Page 43)

NO

47. If you do not agree that there should be charging provisions, how do you envisage ongoing and new work to assist in management and development of the aquaculture and fisheries sectors should be resourced? (Page 43)

48. If no new way of resourcing such activity can be found, what activities do you suggest might be stopped to free up necessary funds? (Page 43)

AQUACULT

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