

TAY DISTRICT SALMON FISHERIES BOARD

29 October 2015

Fiona Hepburn
Marine Scotland
Salmon and Recreational Fisheries Team
Area 1B North
Victoria Quay
Edinburgh
EH6 6QQ

Dear Ms Hepburn,

BAN ON THE KILLING OF WILD SALMON EXCEPT UNDER LICENCE AND ACCOMPANYING CARCASS TAGGING SCHEME

The Tay District Salmon Fisheries Board welcomes the opportunity to comment on the above proposals, as recently advertised. Broadly speaking, TDSFB supports the proposals insofar as they might apply to rivers that are clearly underperforming because of a demonstrated level of exploitation that is too high.

The measures proposed under such circumstances should be sufficient to control exploitation and are both workable and proportionate.

In particular we welcome the fact that Scottish Ministers have decided to abandon the unworkable quota/carcass tagging proposals which would have been applied to rivers with healthy as well as unhealthy stocks. We welcome Scottish Ministers recognition for the need to require minimal additional bureaucracy and cost.

In terms of the proposals listed in the advertisement

- We support the proposed prohibition of taking salmon outwith inland waters
- We support the proposal to permit the killing of wild salmon within inland waters where stocks are above a defined conservation limit
- We support the proposal to introduce mandatory catch and release in areas which fall below their defined conservation limit following the annual assessment of salmon stocks

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- We support the proposal to require the production of a conservation plan in conjunction with Marine Scotland in areas which fall below their defined conservation limits following the annual assessment of salmon stocks.
- We support the proposal for carcass tagging of net caught fish.

However, we are unclear as to how conservation regulations can be described as a “licensing system”. If the “killing of wild salmon - a protected species – must be licenced”, who is to be licenced? We would welcome more information.

Concerns regarding the estimation of conservation limits and their compliance

While we support the principles outlined above, we have in practice serious concerns regarding the methodology used to estimate conservation limits and compliance with conservation limits. We are especially concerned at some of the results of this exercise and the categorisation results presented.

In the Tay district, all of the part that is not within the Tay SAC has been estimated to be in category 3 (in practice the rivers Earn and Eden). We suspect that the methodology used is likely to have overestimated the conservation limit required for these rivers and underestimated the likely egg deposition levels. This may have resulted in these rivers having been unfairly identified as category 3 resulting in the introduction of an unnecessary mandatory catch and release scheme which we believe, from representations made to us, is likely to be very unpopular and may lead to unnecessary difficulties for salmon fisheries on those rivers.

Our concerns regarding the conservation limits and compliance are set out in detail in the Appendix to this letter.

Suggested way forward

As we believe the rivers Earn and Eden have been wrongly classified, as may some other rivers elsewhere, we request that Scottish Ministers consider delaying the implementation of measures proposed for 2016 until at least 2017. This should allow time for some review and refinement of the methodologies. We do not think this is an unreasonable request under the circumstances, particularly for rivers that are not SACs.

Yours sincerely



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Fisheries Director

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Appendix

Concerns regarding the proposed methods of estimating salmon conservation limits in Scotland and their compliance

What follows are some of the concerns identified by the Tay DSFB regarding the methodologies set out in the document titled *The Application of Conservation Limits for Atlantic Salmon in Scotland*.

1. Separate rivers should be considered individually

While the logic for considering the entire catchment of the River Tay upstream of the tidal limit is appreciated (i.e. not to divide the river by individual tributaries for example), there is no reason why rivers with separate estuaries should not be considered individually. Thus, in this district, the rivers Earn and Eden should be considered individually and should not have been lumped together in a single “non SAC” category. In this way a badly failing river might pull down one that might just pass. Taking the Earn and Eden as examples, we are unaware of any proprietors who report catch figures jointly for both rivers and therefore there is no reason why Marine Scotland Science cannot separate out the two rivers. Indeed we have done so on the basis of figures supplied to us by MSS in the past. MSS clearly separated SAC fisheries from non SAC fisheries so there is no reason why the Earn and Eden cannot be split.

2. Grilse error

On page 5 of the guidance it states that a grilse error correction is based on results from two Spey beats in a paper from 1996. We question whether those data are still applicable. As further explained in section 4 below, it would appear that later in the season both grilse and MSW salmon are now smaller than they were in the 1990s, therefore grilse error might be less of an issue. Indeed, some female MSW salmon might even be classified as grilse not the other way round. Given that the grilse error correction may influence the estimated number of female fish in a population, it is important that this issue is revisited with more recent data.

3. Proportions of male and female salmon

Section 2.1.4 of the guidance states that it is taken that 55% of MSW salmon are female and 50% of grilse are female although it cites Shearer (1992) that grilse runs can be male dominated in some places. Indeed, it is our understanding that on the North Esk where Shearer principally worked, the “early” grilse (which spawn in the same areas as “spring salmon”) are mainly male while later in the year the sex ratio of grilse becomes closer to 50:50.

Our admittedly unscientific observations from broodstock collection over the years would indicate that in upland populations of the Tay, grilse are largely male while 2SW salmon are largely female. Trapping over the period 1983 -1985 at Clunie Dam on the River Tummel by Struthers and Smith of what is now Marine Scotland Science, found that in those years between 89.3% and 94.4% of grilse were male and 72% to 81.7% of 2SW salmon were female. A detailed analysis of Tay net and rod catches in 1991 (Lyons) also found summer grilse to be dominated by males and salmon to be dominated by females prior to 1 July.

Therefore we question whether the 55% used for female MSW is appropriate for the Tay catchment. The 55% figure is apparently based on the long term findings from the Girnock Burn, a Dee tributary. However, it is understood that the Girnock "run" is formed of two components, a main spawning run and a later entrance of straggler males that may have tried to spawn elsewhere. If the latter are a significant group, the percentage of females in the true population will appear reduced. Furthermore it might also be the case that, in the longer term, the Dee has been a river that has had a less significant summer grilse component compared to say the Tay or the North Esk and a sex ratio that may apply to the Dee might not be applicable on the Tay.

We consider this is an area that should require more consideration. This is particularly the case because at least for "upland" populations of salmon in the Tay, there appears to have been something of a shift from grilse domination towards a greater proportion of salmon in recent years. If MSW salmon now make up a greater proportion of the spawning population it is essential that the ratio of females to males used reflects reality.

4. Fecundity of female salmon

Section 2.1.5 of the guidance provides information on the numbers of eggs produced by female salmon of any given size. The guidance notes that "upland" salmon (i.e. early grilse and spring salmon) produce fewer eggs (but these are bigger) than "lowland" late running populations. As a compromise, a relationship is used that averages lowland and upland fish (see Figure 10 in the guidance). At least it does for fish under *ca.* 80cm. As there were no large upland salmon sampled, the relationship for large fish is based purely on lowland fish.

In a unit like the Tay SAC, such a relationship might have some validity on the basis that the Tay has both significant upland and lowland populations and so errors might cancel each other out. However, in rivers that are almost completely dominated by lowland type fish (as we would expect to be the case in the rivers Earn and Eden) the fecundity of the grilse component (i.e. fish between approx 60cm and 75cm) is likely to be underestimated by perhaps over 25% on the basis of Figure 10 in the guidance.

Figure 10 also shows something of a relative lack of lowland fish sampled in the region of 75 to 80cm. The data for lowland salmon behind Fig. 10 were obtained around 1990 and at that

time show a clear demarcation between the average size of late running female grilse and late running 2SW female salmon in the North Esk. However, we question whether such a pattern is still valid.

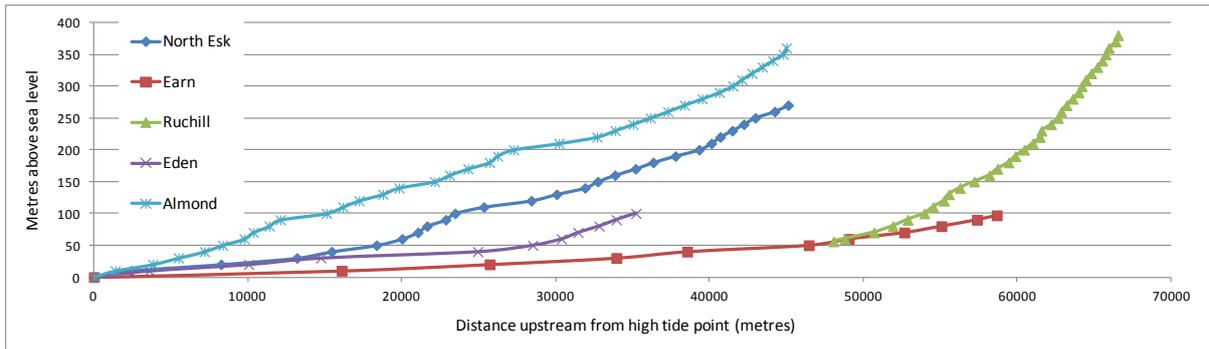
During the years 2011 to 2014 anglers fishing the lower and middle Tay were asked to record information on fish caught during a trial season extension between 16 and 31 October. Figures 19d to 19f of this [linked report](#) provide weight frequency graphs of fish caught in the years 2011 to 2013 according to the colouration of fish (an approximate indication of run timing). In all three years the weight frequencies of females did not exhibit a clear grouping of grilse sized fish and a separate grouping of larger 2SW fish. Instead there would now appear to be a continuum of size between grilse and 2SW salmon. Fish of the 70+cm to 80cm range, missing from the early 1990s North Esk data, would be fish in the 11 to 13 pounds category which would now appear to be among the most numerous of 2SW fish, with a distinct reduction of females in the high teens of pounds which dominated in the past. If this is the case, the relationship shown in Figure 10 of the guidance document will also underestimate the fecundity of the majority of lowland female 2SW salmon.

5. Conservation Limits

A fundamental element of the proposed approach is the conservation limit that is set for each river. The guidance acknowledges that there is limited information on which to base these. The only river in Scotland where the necessary data to estimate a CL is considered to exist is the River North Esk. However, the guidance states that applying a figure from the North Esk across the whole of Scotland would be “unreasonable and likely to give spurious results”.

We agree.

The River North Esk is a particularly productive salmon river perhaps due in large part to being dominated by relatively good habitat for salmon spawning and rearing. Salmon production is highest in relatively shallow rivers with mixed gravel / cobble / boulder substrates. It is less good in lowland silty rivers or even in very steep rocky rivers. The North Esk represents a good compromise between these two extremes. This is illustrated by the Figure below. It plots the elevation of the North Esk with distance along the channel of the main river between sea level and Loch Lee in its headwaters. For comparison we have also included the River Earn (sea level to Loch Earn) and a tributary called the Ruchill Water (joins the Earn at Comrie), the River Eden (Fife) and the River Almond (from Perth to highest limit of salmon).



Overall, the North Esk has a higher gradient than the main stem of the River Earn. While initially less steep, the North Esk over much of its length has a similar gradient to the River Almond. Interestingly, the North Esk has a similar gradient to the Eden in its lowest reaches but soon outstrips the Eden. Although the Eden probably flows through just as flat a valley, part of the reason parts of it appear steeper than the Earn will be due to the fact that much of the Eden has been straightened in the past and therefore is shorter and steeper, while meandering is a significant feature of the Earn.

The photo below shows the North Esk just a few hundred metres above the tidal limit. Even here it is still relatively shallow with coarse gravel and cobbles.



The lower Earn (below) is a much more placid affair.



In some countries, attempts have been made to attune conservation limits to different levels of potential productivity between rivers. In England, for example, this has involved giving different altitude bands different rankings, low altitude reaches being considered relatively poor. Other features are considered in Norway.

The estimated conservation limit used for the North Esk in this process is 9.8 eggs/sq. metre. This figure was presented in Table 9.2 on page 206 of Crozier *et al* (2003). It is noted that in Figure 9.9 (page 208) of the same report, this equates to a total egg deposition of 20.66 million eggs in the North Esk. However, we also note that in a more recent report (MacLean 2007) a figure of 18.14 was estimated.

In order to accommodate the fact that the North Esk is a relatively productive river (the Girnock Burn, a monitored tributary of the Dee has a CL of 3.27 eggs per sq/m by comparison (Table 9.2 of Crozier report)), the guidance report states that a range of CL limits is used as part of a simulation based on CLs identified in other countries as well as the North Esk. This gave a range of 1.1 to 9.8. However, in effect, using this range in a Monte Carlo simulation appears to be much the same as using just the mid point of the range (5.45) and not using a Monte Carlo simulation at all (based on recent discussions with MSS staff).

So, how representative of Scottish rivers is a CL of 5.45?

Unfortunately, the only other waterbody in Scotland with sufficient information to estimate the CL is the Girnock Burn, mentioned above. The other UK river with data for this type of

exercise is the River Bush in Northern Ireland. There the conservation limit is given as 3.06 eggs/sq. m (Table 9.2, Crozier report). Why might it be so different from the North Esk?

While we do not have maps immediately to hand to show the gradient profile of the River Bush in comparison to Scottish rivers, visual inspection of the river from bridges along its length on Google Street View shows that it is largely very much a lowland river.

The conclusion to this is that if, in effect, a CL of 5.45 eggs/sq m is applied to all Scottish rivers, then any which have a character more like the River Bush may be trying to attain an impossibly high bar.

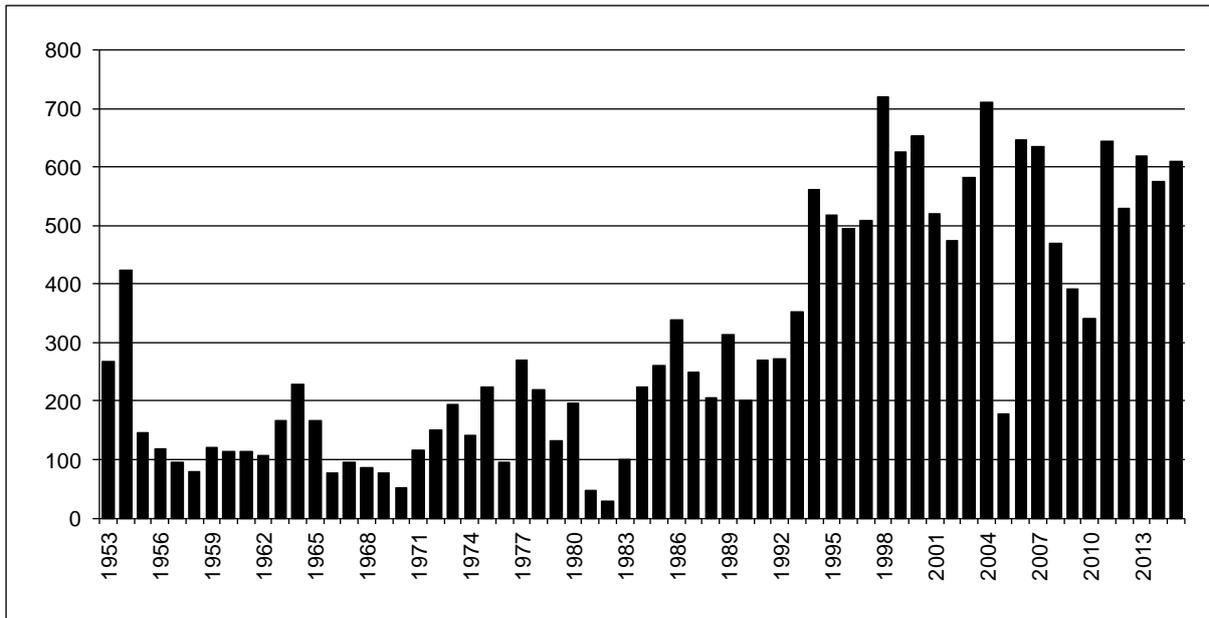
We suggest that rivers like the Earn and Eden have the potential to fall into this category.

6. Lochs

The guidance states that it is assumed that salmon production takes place in lochs for the purposes of estimating an egg deposition requirement. In the absence of better information, it is assumed that the target egg deposition is applied to a strip 10m wide around the circumference of lochs. In order to deal with uncertainty, simulations are made between 0 and 10m wide. In effect, leaving out the Monte Carlo simulation (does it really add anything given the quality of the data, other than creating an air of unjustified sophistication?) this would actually seem to be similar to applying a figure of 5.45 eggs per sq m to a strip 5m wide around the circumference of lochs.

While it may be that some salmon production does take place in lochs, we do not think such figures are justified.

For example, we have tried to apply this to the upper River Tummel upstream of Clunie Dam near Pitlochry. The upper Tummel consists of a series of interlinked lochs, some quite large, with short stretches of river between. The catchment is extensively exploited for hydro with several dams in a chain. This area has been quite well studied by MSS in the past and SSE operates a fish counter at Clunie Dam at the bottom of the chain. Ever since some improvements were made to smolt passage at Clunie Dam in the 1980s, the annual count increased over a period of years but now appears to have more or less stabilised in the region of 500 to 600+ (see figure below).



Annual counts of salmon ascending Clunie Dam on the River Tummel. Data courtesy of SSE. (Note there was a malfunction in 2005).

Occasional electrofishing surveys have indicated that the lower half of the system, that is from Loch Tummel to Loch Rannoch, has for some time at least had a healthy population of juvenile salmon. More regular surveys above Loch Rannoch, even above Gaur Dam, indicate that salmon are now regularly penetrating that far, although the population is still a sparse one on account of the many obstacles in the way of migrating smolts and adults.

However, if we apply a CL of 5.45 eggs per sq m to the approximate area of accessible river and burn downstream of Loch Rannoch, assuming 5000 eggs per average female and a 50:50 sex ratio, we obtain a figure of 693. Given the actual counts, this would suggest the most accessible part of the upper Tummel is perhaps around its carrying capacity for flowing water. However, if 5.45 eggs is applied to a 5m strip of lochs Tummel, Dunalastair and Rannoch, the total rises to 1386 fish. And that's not including the very extensive loch systems above Rannoch. If lochs like Loch Tummel were as productive of juvenile salmon as assumed, then surely the Tummel counts should be much higher and indeed continuing on a rising trend rather than having flattened off where they have?

Furthermore, in many of the larger lochs in Tayside, most of the tributaries are only accessible to salmon in their lowest reaches. However, we do not see any obvious evidence for example that such bottom ends of tributaries attract large numbers of spawning fish, as they might do if juveniles recruited out into lochs. Indeed the opposite is rather the case.

Unless it is proven to be otherwise, we consider that the lochs should be completely removed from the conservation limit setting process.

7. Problems arising from relying on catch data

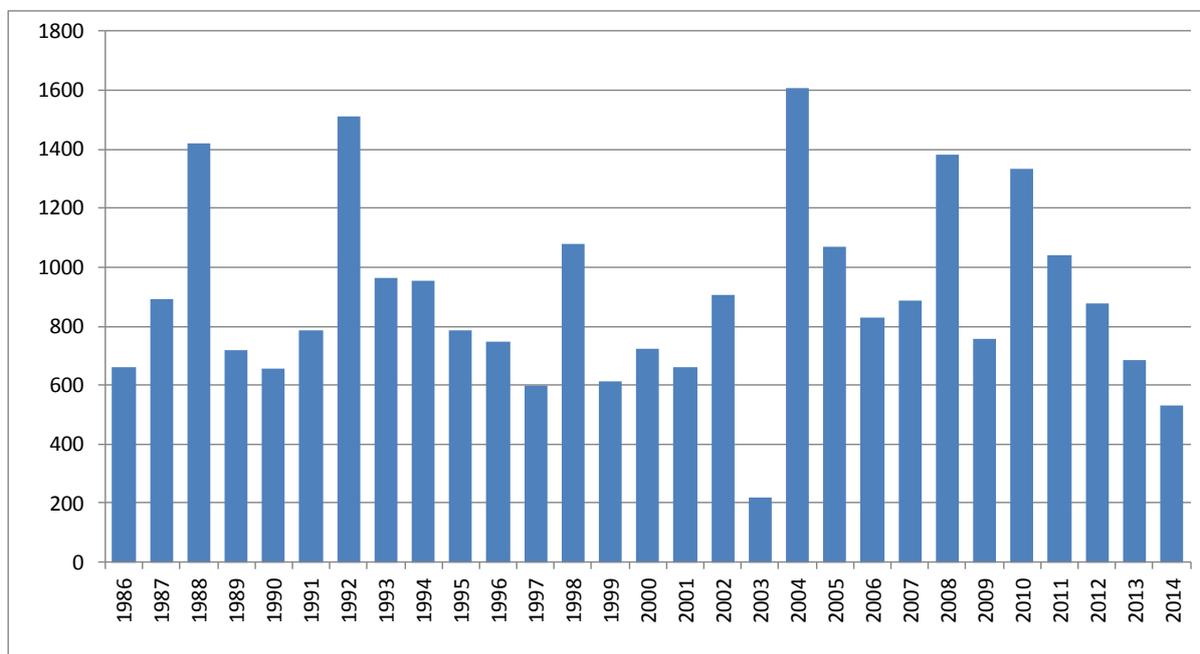
Owing to the absence of fish counters, compliance with CLs depends wholly on salmon catch data reported to MSS scaled up by national estimates of exploitation rates from four fish counters.

We need not repeat all the concerns that have been expressed on the shortcomings of this procedure. However, here are some particularly salient issues regarding our local situation.

7.1 The dependence of catches on weather conditions

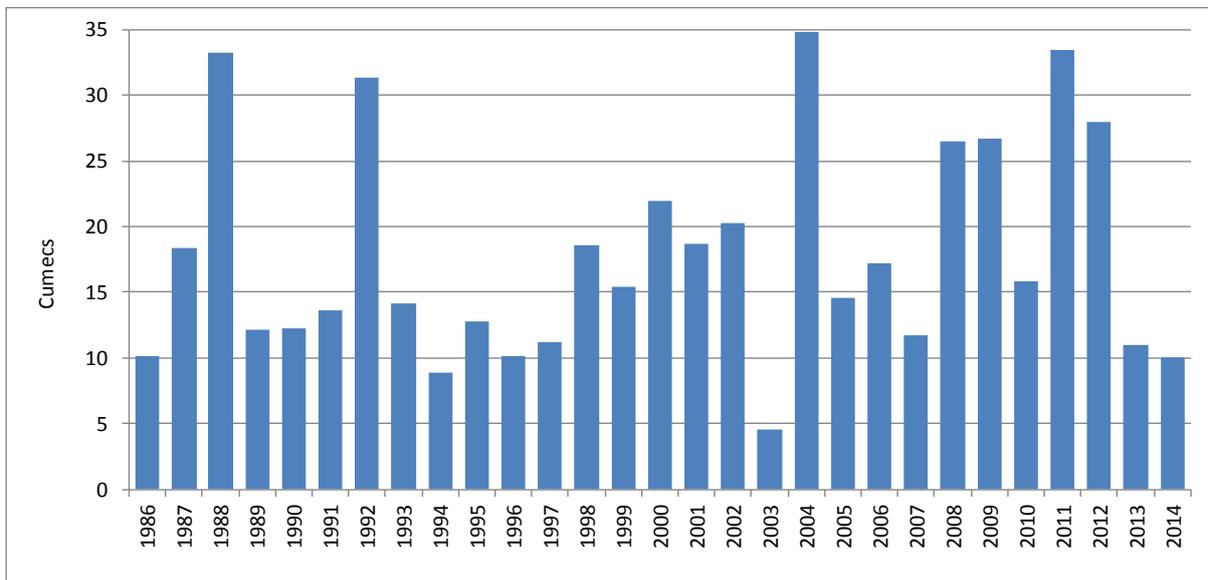
It is well recognised that angling catches are to a considerable extent dependent on weather conditions, particularly in smaller rivers. This is now demonstrated for the River Earn.

We have obtained reported salmon catch data for the River Earn from MSS back to 1986 although in recent years we have obtained our own returns. The total annual reported catches from 1986 to 2014 are shown in the figure below (it should be stressed that most of these fish are caught in the autumn). The fact that 2013 was one of the poorer catches reported and that 2014 was second worst presumably assisted the Earn being placed in category 3.



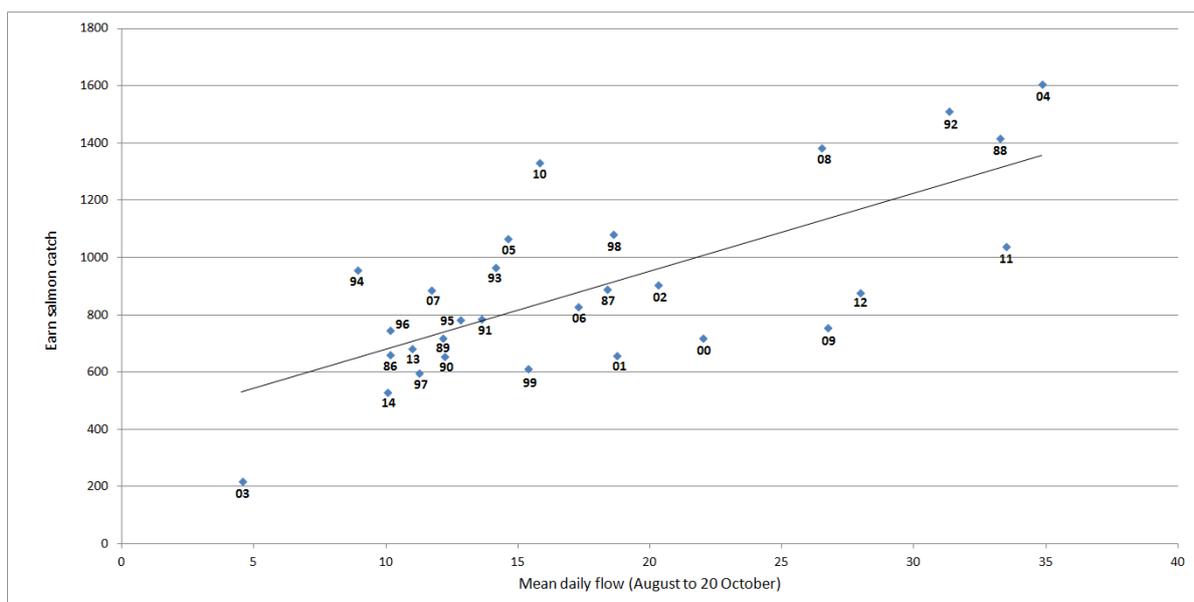
Annual reported rod catch of salmon, River Earn, 1986 to 2014.

However, the next Figure below shows a graph of the average daily flow over the period 1 August to 20 October each year at SEPA's gauging station at Forteviot Bridge on the lower Earn. This reveals that 2013 and 2014 were very dry autumns.



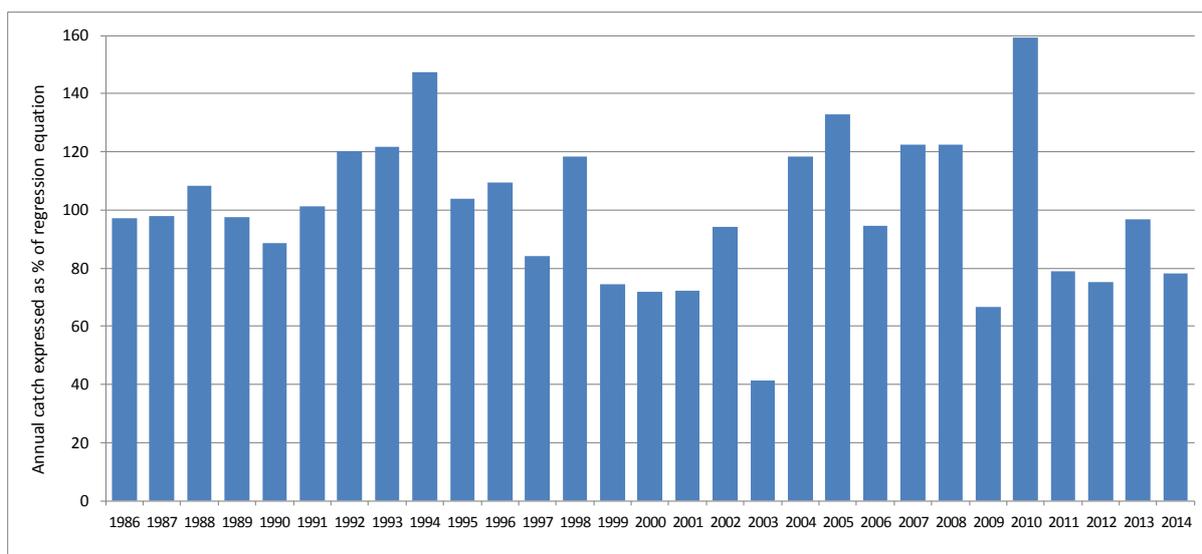
Average daily flow, River Earn at Forteviot Bridge, over the period 1 August to 20 October, 1986 to 2014. Data courtesy of SEPA.

A strong correlation exists between the average daily flow over the period 1 August – 20 October and the reported annual Earn salmon catch. This is shown graphically below with individual years identified. 2013 and 2014 were clearly affected by the lack of flow.



Plot of autumn flows in the River Earn versus reported salmon catch. Numbers correspond to individual years, 1986 to 2014. Linear regression line also shown.

In order to try to remove some of the effect of flow, the figure below expresses each year's catch as a percentage of regression equation. Now having a series that has been partially corrected for flow, the last few years catches are perhaps more reflective of a more general trend in grilse abundance. The graph doesn't therefore indicate any catastrophic juvenile population decline. Indeed, the relative stability over time might be interpreted as an indicator of relatively healthy juvenile production.



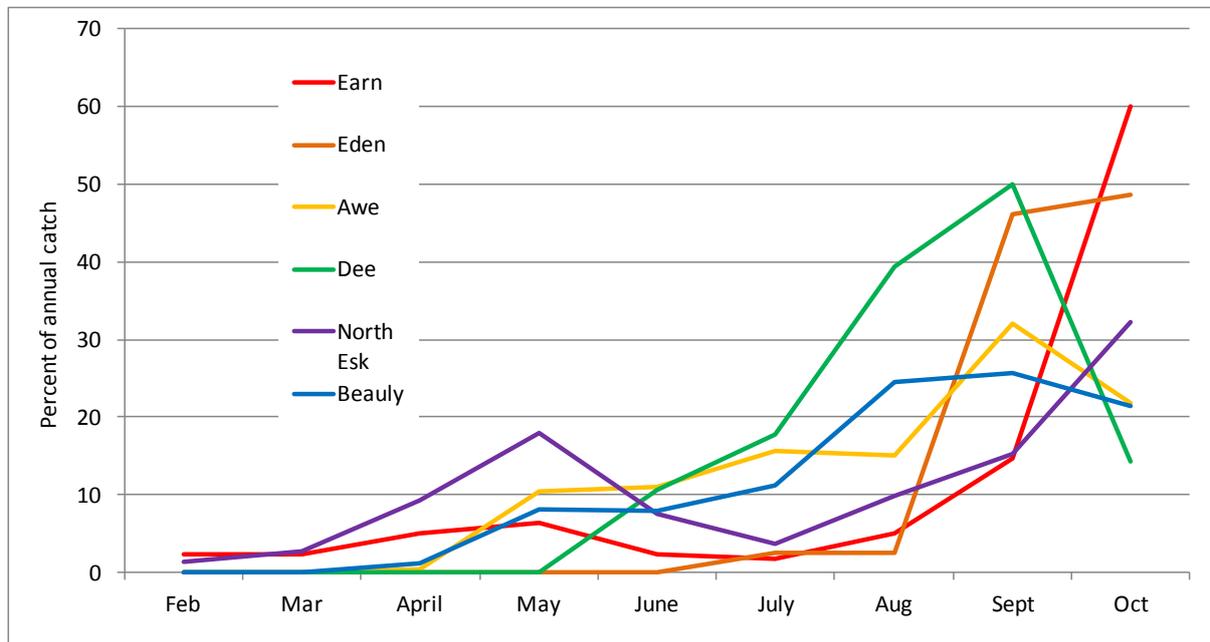
Clearly, a system of compliance that wholly depends on reported catch without attempting to correct for conditions on such a river cannot be relied on to accurately reflect population trends in salmon.

7.2 Applicability of fish counter derived exploitation rates

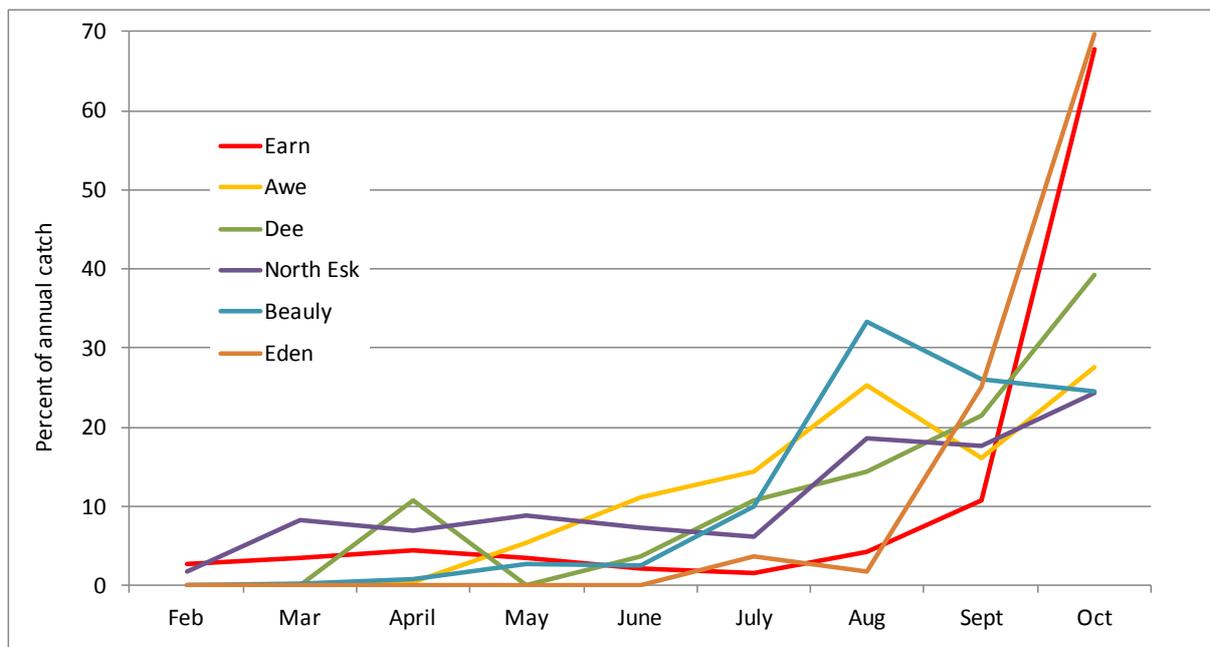
We note that, in theory, the effect of river conditions on catches might to some extent be corrected for by the fact that counter data are considered on an annual basis. Indeed, the exploitation rate used in the model for 2014 was relatively low because, on average, the four counters considered showed reduced exploitation in that year.

However, the figures below show the monthly distribution of the 2013 and 2014 catch in the rivers Earn and Eden and in the rivers Awe, Beaully, Dee (Kirkcudbright) and North Esk, the rivers on which the fish counters are located. It can be seen that the Earn and Eden catches were skewed later than was generally the case in the other rivers, the Earn most so. It may be, therefore, that these counters are not wholly suitable for representing the exploitation rates in the Eden and Earn. For example, a river which has strong runs throughout the year, e.g. the North Esk, cannot be used to represent a river which largely

depends on an autumn run, unless of course the autumn component of the North Esk could be separated out.



Monthly distribution of the reported rod catch in the rivers Eden, Earn, Awe, Beaully, Dee (Kirk) and North Esk, 2013.



Monthly distribution of the reported rod catch in the rivers Eden, Earn, Awe, Beaully, Dee (Kirk) and North Esk, 2014.

7.3 Under reporting

We have no evidence that under reporting of salmon catches occurs in the Tay district although claims and counter claims of under reporting have been put to us during this process. However, irrespective of the truth of the matter, it must be appreciated that if underreporting exists it will have the effect of affecting compliance. The possibility that underreporting may occur should always be borne in mind and we suggest is a potential reason why Scottish Ministers should not rely on catch data alone.

7.4 Deterring anglers may affect future compliance

It has been put to us that some beats and angling clubs on the rivers Earn and Eden might lose anglers if mandatory catch and release is brought in. There are concerns that if effort falls because of angling restrictions, this may in turn impact negatively on catches which will make it even more difficult to achieve compliance.

8. Conclusions

All of the issues discussed affect estimated conservation limits or compliance. A number of significant issues may make it harder particularly for rivers like the Earn and Eden to reach compliance, especially after several dry years. We consider therefore that there could be a strong possibility of these rivers being wrongly classified and that a thorough review of the methodology is needed in the short term, taking into account the points raised here. In the meantime the implementation of measures should be delayed until this is done.

We also conclude that although the existing methodology could be refined somewhat, catch data clearly cannot be the only means of stock assessment on which the existence of fisheries is based. Other methods of stock assessment must be brought into the mix alongside catch data. We consider it essential that Marine Scotland continues to promote more fish counters on the lower reaches of a representative spread of rivers. We also consider it essential electrofishing data should be used, particularly in rivers where it is suspected that catch data are really unreliable for whatever reason.

References

Crozier, WW, ECE Potter, E Prevost, PûJ Schon, and N O'Maoileidigh. 2003. "A Coordinated Approach Towards the Development of a Scientific Basis for Management of Wild Atlantic Salmon in the North-East Atlantic (SALMODEL)." *Queens University of Belfast, Belfast*

MacLean J. C. (2007) The development of Conservation Limits (CLs) for Scottish salmon stocks: III – Estimation and transport of CLs. *Scottish Fisheries Research Report*, 66. The Scottish Executive Environment and Rural Affairs Department.