

# Beaver-Salmonid Working Group

**BSWG**

**WORKSHOP PROCEEDINGS**  
**July 3<sup>rd</sup> 2013**  
**Marine Scotland Science Freshwater Laboratory**  
**Chairman: Roger Wheeler**

***Beaver-salmonid interactions in Scotland: Scoping the immediate action required towards production of the beaver-salmonid report to The Environment Minister.***



## **ACKNOWLEDGEMENTS**

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The Fishmongers' Company

**ABSTRACT**

Significant overlap is predicted between beaver and salmon habitat in Scotland. Given the economic and cultural value of the wild salmonid fishery, and current vulnerability of spring salmon stocks, concerns and unknowns regarding potential impacts from beaver activity should be considered seriously. Literature and experience from Europe and North America indicates that although beaver activity can have detrimental impacts on salmonids at local scale, when viewed at the watershed scale impacts on fish populations are considered positive. Cited benefits include increased fish abundance and productivity, with negatives centering on beaver dams as impediments to upstream and downstream migration, and related siltation and inundation of spawning habitat. Delegates concluded that the direct application of this knowledge to Scotland is confounded by fundamental differences in catchment and fishery related characteristics. Concerns highlighted knowledge gaps in the Scottish context including; comparative interspecific preference of pool habitats between salmonids, migration delays and associated predation risk, impact on riparian planting schemes, vulnerable genetic stocks and temperature barriers. Delegates advised caution when interpreting the findings of recent literature reviews, while requested primary research to inform the nature of beaver-salmonid interactions in Scotland.

Research project proposals were presented resulting in the identification of synergies whereby collaborative approaches can develop. Fisheries stakeholder involvement and European expert engagement is vital in ensuring that relevant concerns are raised and accounted for firstly in the Ministerial reporting process, and secondly in further primary research designs. It is suggested that management recommendations reflect strategic temporal (adult and smolt migrations) and spatial (sensitive catchments) scales, while ensuring compatibility with European legal requirements. A dynamic mode of beaver dam assessment will aid understanding of pass-ability for salmonids, and this local awareness coupled with national management provisions is required to minimise impacts on salmonids attributable to beaver activity. On-going research and monitoring in Scotland is essential to informing this adaptive management strategy.

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## 1. INTRODUCTION

Designed to invite input from experts and stakeholders, this workshop aimed to scope and assess the immediate action required by The BSWG and its contributors to produce the report to The Minister for Environment and Climate Change. Proceedings feature presentations followed by extensive discussions and questions on topics including the nature of beaver-salmonid interactions, related unknowns, the report structure, current project proposals, timescales and actions required.

Roger Wheeler welcomed and informed delegates that The BSWG was set up in 2010 as a result of a concern raised around the potential impact of a re-introduced beaver population on Scotland's migratory salmonid populations. This alarm was raised especially after the chosen Knapdale Scottish Beaver Trial site did not contain Atlantic salmon or migratory trout in significant numbers. The BSWG was formed in order to pull together the relevant information from a range of sources to provide an expert assessment of potential beaver-salmonid interactions in Scotland. Roger also highlighted developments in Tayside where the latest report estimates 38-39 beaver groups present ([SNH Commissioned Report 540](#)), which are to be tolerated until the formal Ministerial decision in May 2015. The group took the pragmatic view that this provided an opportunity to carry out research in a Scottish salmon and sea-trout river system.

The chairman encouraged support and feedback for work carried out to date and future projects that may inform decisions, while highlighting the importance of identifying knowledge gaps and concerns to inform the scope of additional research. From this would evolve an on-going and adaptive management plan, and would take account of developments in Scotland, and literature from abroad. Roger made special mention of the recent report, *Derogations for protected species in European Reintroductions* ([SNH Commissioned Report 524](#)), with cause for concern as a result of beaver population explosions having occurred in some European countries.

## 2. BACKGROUND

### **2.1: Salmonid status and predicted overlap with beaver population: *Presentation by John Armstrong***

*Joining The Freshwater Laboratory in 1992 and publishing widely on salmonids, John is now the director of the Freshwater Fisheries Programme for Marine Scotland Science.*

Scotland has a relatively low diversity of fish fauna, comprising predominantly of Atlantic salmon and trout. Salmon are swift water specialists with juveniles being competitively inferior to trout in pool habitats. Contemporary salmonid management efforts currently focus on key strategies including; barrier removal, encouraging bankside tree cover, and reducing predation from avian and mammalian piscivores. As these concerns have been cited in the context of beaver-salmonid interactions, any impacts (positive or negative) must be addressed relative to Scotland's salmonid fauna.

Salmon and sea trout angling in Scotland has been shown to generate £110M annually, and 2786 jobs in the most recent study with data from 10 years ago (Radford et al, 2004). Rod catches have increased in recent years largely due to a reduction in net fisheries. Summer salmon runs are healthy, whereas spring runs are in a state of serious decline. These stocks utilise small, high order tributaries and, therefore, potential beaver activity in these areas requires further consideration.

John displayed the preliminary results of an on-going study indicating significant predicted overlap between salmon and beaver habitat for chosen catchments in Scotland. There is cause to take any potential impacts of beaver activity seriously for the following reasons:

1. Significant overlap exists between predicted beaver, and actual salmon populations.
2. Beaver activity may impact upon certain salmonid conservation efforts.
3. Spring salmon stocks are currently a cause for serious concern.
4. Salmonid fisheries generate significant economic revenue.

## **2.2: Update and background on beaver issues in Scotland: Presentation by Martin Gaywood**

*Martin joined SNH in 1994 to coordinate work on Habitats Directive species issues. Martin has been involved with beaver reintroduction issues since 2000, and has been manager of the Species Action Framework at SNH from its start in 2007.*

Please see link for full presentation and audio: Password to view: castorsalar  
[www.vimeo.com/bswg/beaverbackground](http://www.vimeo.com/bswg/beaverbackground)

SNH began work to assess the feasibility and desirability of reintroducing beaver in 1995. After receiving a licence from The Scottish Government in 2008, beavers were released at The Scottish Beaver Trial site. In 2012, the Government announced that it was to tolerate the wild beaver population in Tayside until its formal decision in May 2015.

A number of reports are being produced from the Scottish Beaver Trial, (along with that of the BSWG and The Tayside Beaver Study Group). These will be submitted to The National Species Reintroduction Forum and then The Minister in 2015. SNH is currently beginning a major beaver management review, which will include information relevant to fisheries interests. SNH will build in a means for the BSWG to contribute directly to informing this review process.

Beaver salmonid interactions can be considered on three levels:

1. Beaver presence and effect on salmonid populations
2. Beaver dam presence and effect on salmonid populations
3. Beaver dam presence and effect on salmonid movements

Delegates were reminded of the importance of spatial scales, with focus on fine scales more likely to detect any negative impacts of beaver activity on salmonids.

## **3. SESSION 1: BEAVER-SALMONID INTERACTIONS IN SCOTLAND**

### **3.1: Review of the effects of beaver on fish and fisheries: Presentation by Paul Kemp**

*Paul is the founding director of the International Centre for Ecohydraulics Research at the University of Southampton. His work includes fish pass design, assigning compensation flow regimes, and habitat restoration strategies.*

Please see link for full presentation and audio: Password to view: castorsalar  
[www.vimeo.com/bswg/review](http://www.vimeo.com/bswg/review)

The SNH review was commissioned as a result of concerns raised by salmon fisheries interests (in particular The Tweed Foundation) and its remit was to assess all fish species, including salmonids. Findings:

- Dams are usually built on low gradient streams.

- In high density populations beavers can utilise steeper gradients.
- Beavers are less likely to build dams on large rivers.
- As beaver ponds age, the abundance and diversity of stream organisms increases.
- In cooler small-order streams, impoundments provide better habitat for large trout.
- If temperatures are above optimum, salmonids may be replaced by other species.
- As habitat is altered, interactions between co-habiting species may change.
- Refuge from high and low flows may be provided.
- Low oxygen and adverse temperatures may result from certain conditions.

Benefits of beaver activity for salmonids:

- Increased fish abundance.
- Increased productivity.

Impacts:

- Impediments to movement including upstream and downstream migrating salmonids.
- Siltation and inundation of spawning habitat.

Findings highlighted a significant bias towards studies in North America relative to Europe. There are positives and negatives over varied spatial and temporal scales. 184 citations from Europe and North America were considered to be positive, whereas 119 citations were negative. The report aimed to assess the weight of evidence relating to these findings. Of these positive effects, 51% were supported by evidence, whereas 29% of the negative effects were supported by evidence, with 71% considered to be speculative.

### **3.2: Discussions arising from morning presentations**

Delegates enquired as to the possibility of applying a hierarchy and weighting to the range of positives and negatives identified for results to be directly applicable to Scottish catchments and fish fauna. In reply, although the SNH remit was not to examine weightings, this suggested work could build on evidence in the review. This study uses data from all salmon species, and is biased to Pacific North West species such as Coho salmon. With a number of Pacific salmonid species being more dependent on pool habitat than Atlantic salmon, caution was advised in applying conclusions to Atlantic salmon. Besides the differences in species habitat preference within salmonid species, delegates drew attention to the differences in river system characteristics in Scotland.

Further comment suggested the balance of habitat complexity (beaver related benefits) versus connectivity (fish barriers) requires extensive study. Central to this theme is the need to understand, quantify and categorise the ability of Atlantic salmon and migratory trout to ascend and descend dams. Beaver dams can be barriers to Atlantic salmon migration (Mitchell and Cunjack, 2007). However, barriers are often temporary, and were found to be passable during high flows. Literature concludes that while certain dams hinder migration, the overall effect of beaver presence is often positive when considered on a catchment scale.

### **3.3. Further discussion session and questions:**

#### **3.3.1: Applying literature and experience from Europe and North America**

A member questioned how conclusions from the Kemp et al, (2010) review may have differed if the study scope fell only on Atlantic salmon, and whether further work could be undertaken using the literature sources identified. In reply, it is difficult to say how conclusions may vary, and that further research could be carried out to critically evaluate the sources specific to Atlantic salmon and migratory trout. A delegate suggested research should be taken further by relating differences in Scottish river system characteristics, such

as riparian tree cover. The group felt that enough reviews have been done, and there is a pressing need to engage European and North American expertise to comment on predicted beaver-salmonid interactions specifically relating to the characteristics of Scottish catchments. Fisheries interests' concluded that there are *health checks* required when applying the conclusions from the available literature reviews to the Scottish situation, and that these considerations should be clearly stated in the Ministerial Report.

### **3.3.2: Beaver Management**

Delegates enquired as to what extent concerns are related to regions with or without active beaver management. The chairman highlighted this concern while also stating that, although there has been a tendency to disregard beaver-salmonid literature from North America, any beaver management experience in these catchments should be taken into account.

Delegates drew attention to the fact that beaver management in general is markedly different in North America and parts of Norway and Sweden compared to other European countries – where beavers are protected. Members agreed that future beaver populations must be managed, with the following considerations:

1. To what extent is management required specifically in relation to salmonids?
2. How will permission requirements relate to European authority?

#### **Legal considerations**

Scottish Government representatives stated that permission is not required directly from Europe, and that we operate within the legal context of Scottish Law. It would be Scottish Law that would determine when and where one can manage beavers. However, ultimately Scottish Law must be compatible with European Directives, and if beaver management activities were deemed inappropriate, these actions could be challenged in a Scottish court. Beaver management requests would not be a matter of approaching The European Commission to seek permission, but a matter of Scottish Law running a system that is compatible with European requirements. For example, if there is a beaver dam that impedes migration of spring stocks, managers should be entitled to apply for a licence to control the dam and/or local beaver population. Members questioned the legislative process and specifically who should pay for continually removing dams. This question remains to be discussed, with an opportunity mentioned to learn from the licensing process for piscivorous birds.

#### **Rules and assessment**

Delegates discussed the importance of establishing a set of rules for beaver-salmonid interactions, which will be used to govern implementation of any management actions. Given the range of uncertainties, the group agreed that monitoring is required to inform an on-going adaptive management strategy. There is a need for a dynamic mode of assessment to identify issues in particular seasons and salmon runs. Delegates suggested local awareness at small reach scales, coupled with application of national 'rules'. SEPA and SNH could manage the licensing issue through development of a general license or time limited license for managing problem beaver dams with minimum bureaucracy.

With migratory salmonids often having a short window in which to migrate, a licensing system must reflect these time imperatives. Options currently used in other European countries (in particular Scandinavia) should be explored, with particular consideration of welfare issues for beavers caused by dam removal during natal periods, or when the entrance to the beaver lodge is concealed by the dam.

#### **Beaver range in Scotland**

A national scale approach was mooted towards future beaver reintroductions whereby certain sensitive salmonid catchments would not be considered suitable for future reintroductions. However, it is generally accepted that beavers will eventually inhabit most



areas of suitable habitat in Scotland. Beaver range expansion into new catchments can occur by travelling over the watershed in upland areas, or by swimming through salt water between estuaries. Beavers will still be considered a 'former native', and any further human introductions would require a license, with natural re-colonisation into new ranges deemed acceptable. The extreme of recommending no beavers on particular rivers would be difficult to enforce. Instead, delegates recommended management of any beaver dams deemed to be problematic at key strategic points in the season.

#### **The precautionary principle:**

Until definitive knowledge is available, delegates stressed that precaution should be applied on particularly sensitive salmonid spawning tributaries, and during the spawning and smolt migration periods. Firstly, given the current conservation importance of spring salmon stocks (section 2.1) any future impact from beaver activity is of utmost concern. With SAC legislation requiring protection of populations and genetic diversity, on-going monitoring was recommended in these designated catchments.

#### **3.3.3: Beaver dams**

Discussions continually cited passage of dams as the largest uncertainty. It is understood that a high density of beavers will result in more dams relative to a low density population. However, given that beaver dams are often not permanent structures and are regularly washed away and re-built, it was suggested that management approaches reflect these highly dynamic structures.



**Figure 1: Beaver Dam on the Lunan Burn in Tayside, June 2013.**

Research is required to determine the characteristics of dams and their pass-ability. Members were surprised that although data exists at landscape scale, knowledge is limited at individual dam scale, with only one study mentioned to have graded the porosity of beaver dams on a scale of 1-4 (Woo and Waddington, 1990), along with recent work of a similar nature for debris dams in The New Forest. With future debates certain to arise in Scotland around individual dams, delegates suggested the categorisation of dam structures in relation to their pass-ability using parameters including the following:



1. Species (including lamprey and eel)
2. Life stage (juvenile, smolt, adult)
3. Upstream and downstream passage
4. Flow considerations
5. Natal or non-natal dam (for legal aspect should mitigation action be required)

Downstream migration concerns specific to smolts centre on the following:

1. Potential blockage
2. Associated delays
3. Related predation risk from trout and other piscivores
4. Uncertainty around temperature barriers to migration

### **3.3.4: Summary of concerns and unknowns raised in morning discussion**

- Dams as barriers to adult and smolt movement upstream and downstream
- Associated delays and related predation concerns
- Reductions in spawning habitat upstream of dams by inundation and siltation
- Temperature barriers
- Cumulative impacts of dams over multiple years and fish age classes
- Concerns for lamprey and eel migrations
- Spring salmon and SAC's
- Slow recovery of already weak catchments after any impacts
- Impacts on fishery orientated riparian planting schemes

### **3.3.5: Can the case be made for management of beavers in relation to Scotland's salmonid fishery?**

The chairman summarised that the case has been made clear, before reiterating the importance of monitoring to inform an on-going adaptive management strategy.

## **4. MINISTERIAL REPORT**

### **4.1: Proposed structure**

An extensive discussion developed resulting in significant amendments to the proposed report structure detailed in appendix A.

### **4.2: Discussions arising from report structure**

#### **4.2.1: Stakeholder involvement**

Delegates agreed that fisheries interests should be involved in the reporting process through consultation, to get early buy-in and give confidence that concerns have been addressed.

#### **4.2.2: Report content**

The report should be a succinct summary and update of relevant information. All statements must be qualified with evidence, including confidence levels relating to positives, negatives and perceived impacts/interactions relative to Scotland's Atlantic salmon and brown trout. The Minister should know immediately:

1. Core concerns including impacts and worst case scenarios
2. How these concerns apply specifically to Scottish catchments
3. Legal implications of any recommendations proposed by The BSWG.

#### **4.2.3: The Scottish context**

Members questioned the relevance of literature about the use of pools behind beaver dams in North American salmonids. The group accepted that although a significant amount is known about salmonids in Scotland, little is known about beaver-salmonid interactions. European and North American experience must be considered, and to this end, it was suggested that a meta-analysis is carried out on the literature identified in the Kemp et al, (2010) review. Ultimately, trout populations could increase as a result of beavers (section 3.1), with potential detrimental effects on salmon. A delegate also suggested that the 'statement of the unknowns' chapter (Appendix A, section 4 k) could be considered to be *the Scottish context*.

#### 4.2.4: Spring salmon

A delegate enquired as to whether spring salmon use forested areas (where beaver may populate), or predominantly upland moorland catchments. In reply, it was stated that these upland streams, which are sensitive to climate warming, are currently subject to major re-planting schemes, with fisheries interests questioning how beaver activity may impact on these efforts.

#### 4.2.5: Dam locations

Predicting beaver dam 'pinch points' using river width data is possible, but recent research from a Swedish study has proved depth to be a parameter of greater importance than width. The group agreed that attempting to predict 'pinch points' with insufficient data is not feasible, and that collecting depth data is not to be pursued. It was mentioned that it is possible to rule out areas such as a river main-stems (e.g. deeper than 1.5m, and greater than 6m in width) where beavers cannot dam. The chairman summarised that one cannot accurately predict where and when dams will be built in Scottish river systems, and whether these dams will have consequences for salmonids.

## 5: CURRENT PROJECT PROPOSALS



Figure 2: Impoundment upstream of a beaver dam in Tayside.

### 5.1: Tayside beaver-salmonid study

Options for research on Tayside were mentioned with reference to current locations and abundance of beaver dams. There is currently a minimum of 10 dams in the Tay catchment of various characters. These do not appear to be constructed in areas where one would routinely expect migratory salmonid populations. New dams continue to be reported and should be monitored by the BSWG. Opportunities for research into other beaver-salmonid interactions such as that of riparian tree cover should be seriously considered in Tayside.

### 5.2: Norwegian beaver-salmonid study

Dr Duncan Halley of The Norwegian Institute for Nature Research (NINA) has been in regular contact with the BSWG. He has suggested carrying out primary research on the Namsen catchment in Norway, where significant populations of beavers and salmon have been studied. Duncan has been invited to submit a research proposal to the group for consideration. He has also notified the group of an excellent recent PhD on beaver-salmonid interactions in Alaska, currently being completed by Rachel Malison (papers in prep.)

### 5.3: Tweed catchment economic study

The Tweed Foundation has a comprehensive dataset spanning 25 years, in addition to a barrier removal programme and recent economic study. It was suggested that the BSWG use existing data from The Tweed on benefits gained after removal of barriers. Applying the worst case scenario assumption that beaver dams are barriers, it is suggested that the study *work in reverse* to show the impacts if barriers remained in place for certain catchments. Delegates highlighted the importance of assessing both the biological (e.g. smolt production) and economic (fisheries revenue) outputs of such a risk assessment. The Tweed Foundation is to be contacted directly to further discuss this proposal.

### 5.4: River Conon large woody debris proposal

The Forestry Commission (Kenny Kortland) in partnership with The Cromarty Firth Fishery Board (Simon McKelvey) are currently beginning an innovative project to input large woody debris into watercourses. European Environment Agency Reports state that the UK has fallen behind many European countries in the volume of deadwood provision in its forests. The Forestry Standard also encourages the input of deadwood into rivers: the aim of this collaborative project.

It is proposed that a spin-off from this project could study the issue of large woody debris dams and fish passage, by creating structures that mimic beaver dams in a spawning tributary. Fish passage will be tested during the spawning run, and again during the smolt run. Delegates questioned the feasibility of accurately reconstructing beaver dams, and this is a matter for further debate. It was agreed that the Conon proposal should be considered, with possible links with the University of Southampton proposal (5.5).

### 5.5: University of Southampton PhD proposal

Workshop discussions identified the key unknown as being the ability of salmonids to ascend beaver dams. To that end, Dr Paul Kemp proposed setting up a PhD studentship with the following objectives:

1. Define the structure and composition of beaver dams and map associated hydraulics. How do these structures differ from debris dams?
2. Reconstruct dams under lab conditions using unique large scale flume facilities, map hydraulics, and conduct fish passage trials.
3. Conduct a field study using telemetry to assess the pass-ability of beaver dams in Scotland (and possibly Norway) to validate the results of objective 2.

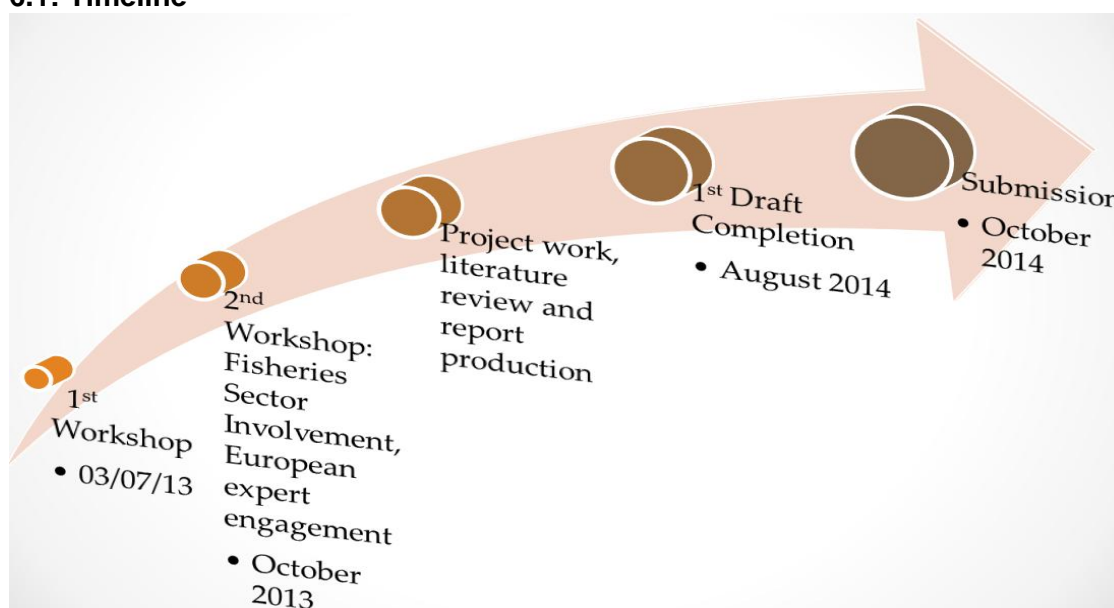
Delegates agreed that the project was appropriate and desirable, and given current resource limitations, the PhD approach would provide much added value. SNH and SEPA representatives mentioned current PhD studentship programmes that are in place, and delegates acknowledged the opportunity to link this project with work proposed in The Conon catchment (5.4), Norway (5.2), and Tayside (5.1).

## 6. CONCLUDING SESSION

### The Ministerial report - *'An honest appraisal stating the unknowns'*

Delegates advised that the report should pull together the various threads in an expert assessment of the likely beaver-salmonid interactions in Scotland. The chair emphasised that primary research should not be constrained by the limited timeframe, and indeed it should draw attention to the on-going and proposed research extending beyond 2015. In order to achieve a more robust understanding of beaver-salmonid interactions in the Scottish context, members suggested a detailed primary research scoping exercise is required in the first instance.

#### 6.1: Timeline



**Figure 3: Proposed timeline discussed in the concluding session.**

Delegates advised that the second workshop (October 2013), focus on management options, rather than primary research scoping, as was initially suggested. An update on current research efforts would nevertheless be necessary. European involvement was deemed desirable, but the chairman questioned inviting experts from Europe, while requesting clarity on exactly which knowledge gaps we wish to plug through engaging European expertise. Given the resource limitations of the group, it was suggested that delegates are invited to join by video-conference from abroad. Of importance, European engagement was also emphasized to be a necessary aspect of the reviewing process for the Ministerial Report. Wider input is required from the wild fisheries sector including securing early buy-in specifically regarding any future primary research. The relevance of directly involving The SWT and RZSS was questioned, and remains to be discussed.

## 7. DISCUSSION

The chairman concluded by reiterating the importance of on-going and proposed research to improve knowledge of the likely impacts of beaver on salmonids in Scotland. Literature and experience suggests that interactions are highly variable and complex, with a strong bias towards North American studies, and a paucity of information for Atlantic salmon. Predicted overlap between beaver and salmon habitat is significant for the six major Scottish catchments studied. Uncertainty related specifically to the application of findings from abroad

to Scotland, with the ability to generalise being confounded by differences in catchment characteristics, feared to result in larger impacts of beaver activity in Scotland than found abroad. With Scotland's limited fish fauna, and the knowledge that trout are competitively superior to salmon in lentic habitats, it is predicted that trout populations will benefit from beaver activity. Furthermore, spring salmon are currently of conservation concern, and the group recommended beaver activity be closely monitored in these catchments. Primary research is driven firstly by the ministerial reporting deadline of October 2014 and secondly on timescales extending beyond 2015. Delegates welcomed research proposals for several projects, while acknowledging that little time remains for new research to inform the Minister. Members encouraged the use of the Tayside beaver population to carry out new research.

The impact of beaver damming activity centred on concerns for upstream and downstream migration, associated delays and predation risk, siltation and inundation of spawning redds and additional concerns for lamprey and eel migrations. Riparian tree cover provision is a major contemporary fisheries management tool, with delegates voicing concern around the impact of beaver felling on these aims. The Ministerial report must pull together the various threads in an expert assessment of the likely interaction of beavers and salmonids in Scotland. Fisheries stakeholder involvement is important during this process, as is the engagement of expertise in Europe and North America, with these parties being invited to review the report prior to submission.

If beavers are to remain in Scotland in the absence of most natural predators, active management of the population is necessary. Further knowledge is required in order to inform appropriate management approaches specifically in relation to salmonids, with practical actions required to be compatible with European legal requirements. SEPA and Scottish Government representatives discussed further the development of a set of rules to advise when and where management action may be appropriate in relation to salmonids. It is suggested that the coming SNH beaver management review can build in these provisions, through discussion with the BSWG. A future beaver-salmonid management plan should provide a means to prevent the local impacts associated with beaver dams and riparian felling, while taking account of the wider scale benefits that beaver activity may bring to the river ecosystem. Through on-going research to inform a pro-active management approach with minimum bureaucracy, detrimental impacts on salmonids can be minimised.

## **8. SUMMARY OF ACTIONS**

- Hold a second beaver-salmonid meeting on 25th October 2013, inviting input from the wider fisheries sector, and consider Scandinavian expert input.- SD
- Distribute beaver-salmonid habitat overlap mapping report.-JA
- Liaise with SNH in production of their beaver management review. –BSWG
- Apply weightings and confidence levels to relevant beaver-salmonid literature- BSWG
- Do not pursue predicting beaver dam 'pinch points' with insufficient depth data- BSWG
- Monitor beaver dam building activity in Tayside in liaison with The Tayside Beaver Study Group with the view to selecting study sites- SD & HDi
- Develop a protocol for assessing new beaver dams in Tayside- SD & HDi
- Invite Duncan Halley to submit a beaver-salmonid research proposal for the Namsen Catchment in Norway- SD



- Contact The Tweed Foundation regarding the proposed study- SD
  - Consider further the River Conon by assessing the feasibility of dam construction - BSWG
  - Consider seriously the University of Southampton PhD proposal- PK & BSWG
  - Engage European expertise in reviewing report drafts- BSWG
- 

## **9. APPENDICES**

### **A: AMENDED REPORT STRUCTURE**

#### **1. EXECUTIVE SUMMARY**

#### **2. TERMS OF REFERENCE**

#### **3. INTRODUCTION & CONTEXT OF THE SCOTTISH SALMONID FISHERY**

#### **4. BEAVER – SALMONID INTERACTIONS - A REVIEW OF KNOWLEDGE FROM EURASIA AND NORTH AMERICA**

- a) Fish movement
- b) Sediment
- c) Habitat availability and complexity
- d) Invertebrates
- e) Predators
- f) Temperature
- g) Flow
- h) Oxygen
- i) Water quality
- j) Fish productivity
- k) Unknowns identified from the literature

#### **5. BEAVER-SALMONID INTERACTIONS IN SCOTLAND**

- a) Considerations when relating European and North American knowledge to Scotland
- b) Likely interactions with Atlantic salmon and brown trout in Scotland
- c) Potential impacts and worst case scenarios
- d) Additional unknowns

- e) Primary research required

## 6. PREDICTIONS OF SCOTTISH BEAVER-SALMONID HABITAT OVERLAP

- a) Methods & datasets  
 b) National perspective  
 c) Catchment detail (Tweed, Esk, Conon, Argyll, Ayrshire)  
 d) Tayside - relating to current distribution of wild beaver population

## 7. BEAVER - SALMONID MANAGEMENT OPTIONS AND RECOMMENDATIONS

- a) Review of management situation in Europe and North America  
 b) The case for management of beavers in relation to Scotland's salmonid fishery  
 c) Management recommendations  
 d) Legal implications  
 e) Suggested monitoring and consultation to inform an on-going adaptive management strategy

## 8. CONCLUSION

## 9. ACKNOWLEDGEMENTS

## 10. REFERENCES

## 11. APPENDIX: LIAISON WITH STAKEHOLDERS INTERESTED IN BEAVER-SALMONID INTERACTIONS

## B: ATTENDEES AND APOLOGIES

\* Denotes members of the BSWG

<b>Attendees</b>	<b>Apologies</b>
<i>Roger Wheeler*</i>	Andrew Wallace*
<i>Martin Gaywood*</i>	David Summers*
<i>Alan Wells*</i>	Peter Collen
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<i>Andrew Kitchener*</i>	Iain Sime
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<i>Colin Bean*</i>	Duncan Halley
<i>John Armstrong*</i>	James Scott
<i>Hugh Dignon*</i>	David Bale
<i>Sean Dugan*</i>	
<i>Scot Mathieson*</i>	
<i>Helen Dickinson</i>	
<i>Dave Gilvear</i>	

<i>Simon McKelvey</i>	
<i>Kenny Kortland</i>	
<i>Alan Law</i>	

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