

Appendix 12.7

Fish Habitat Assessment

Contents

1	Introduction	1
1.1	General	1
2	Methods	1
2.1	Survey Extents	1
2.2	Habitat Requirements	2
2.3	Limitations	4
3	Results	5
3.1	Atlantic salmon (<i>Salmo salar</i>)	5
3.2	Sea lamprey (<i>Petromyzon marinus</i>)	5
	Appendix 1 - Watercourse Crossing Results	8

Tables

Table 2.1.1:	Watercourse Crossings Assessed	1
Table 2.2.1:	Overview of variables considered	2
Table 2.2.2:	Typical Habitats for Different Life Stages of Salmon	3
Table 3.2.1:	Summary of fish habitat assessment	6
Table 3.2.2:	Overview of spawning/ most sensitive periods for freshwater fish	7

1 Introduction

1.1 General

- 1.1.1 CH2M Fairhurst Joint Venture (CFJV) has completed a fish habitat assessment to inform the Design Manual for Roads and Bridges (DMRB) iterative design and assessment process of the Proposed Scheme.
- 1.1.2 Given the sensitivity of downstream receptors (e.g. Special Areas of Conservation), the fish habitat assessment was focussed on major watercourses crossed by the Proposed Scheme (e.g. as shown on 1:50,000 scale OS map), which are tributaries to the River Truim (River Spey SAC).
- 1.1.3 On this basis, the primary objective of the fish habitat assessment is to characterise habitats within the Proposed Scheme that could support Atlantic salmon *Salmo salar* or sea lamprey *Petromyzon marinus* at key stages in their life cycle; with a view to identifying the potential impacts of the Proposed Scheme.

2 Methods

2.1 Survey Extents

- 2.1.1 The surveys were carried out to a maximum of 150m upstream and downstream of major watercourse crossings, adapting the approach agreed through consultation with the Cairngorms National Park Authority and Scottish Natural Heritage (SNH) to the characteristics of watercourses within the upper River Spey catchment. The extent of survey was reduced where significant barriers to fish migration were known or encountered.
- 2.1.2 The minor watercourses crossed by the A9 within the proposed scheme are considered to be unsuitable for Atlantic salmon or sea lamprey spawning or nursery habitats because they are generally too small to maintain a regular water flow, and are primarily pipe culverts at present, meaning they are unlikely to meet the substrate requirements for spawning. As such, minor watercourses have been scoped out of this assessment.
- 2.1.3 Of the major watercourse crossings, Hydro IDs 89 (approx. ch. 23,400), 100 (approx. ch. 25,400), 107 (approx. ch. 26,600), 112 (approx. ch. 27,700), 114 (approx. ch. 28,000) and 129 (approx. ch. 30,500) are currently pipe culverts and are therefore unlikely to meet the substrate requirements for Atlantic salmon or sea lamprey spawning. Of the remaining major watercourse crossings within the Proposed Scheme, the SSE Aqueduct (approx. ch. 23,400), Allt Garbh (approx. ch. 29,200) and Allt na Ceardaich (approx. ch. 30,700), are considered unlikely to support spawning Atlantic salmon or sea lamprey, or to act as nursery habitat as they have highly engineered riverbeds. These too have therefore been scoped out of the assessment.
- 2.1.4 A list of the major watercourses that were surveyed is presented in **Table 2.1.1**.

Table 2.1.1: Watercourse Crossings Assessed

Hydro ID	Watercourse Name	Chainage
72	Allt Coire nan Cisteachan	ch. 20,750
77	Allt Coire Uilliem	ch. 21,450
82	Allt Coire Bhathaich	ch. 22,250
N/A (Dalwhinnie Junction)	River Truim	ch. 22,500
104	Allt Cuaich	ch. 26,000

2.2 Habitat Requirements

2.2.1 The fish habitat assessment focussed on identifying habitat features considered to be important to Atlantic salmon and sea lamprey, as detailed in current professional guidance (Hendry & Cragg-Hine 2003;¹ Maitland 2003²). An overview of habitat requirements are detailed in sub-section 2.2 with a summary detailed in **Table 2.2.1**.

Table 2.2.1: Overview of variables considered

Variable	Rationale – Atlantic Salmon	Rationale – Sea lamprey
Watercourse gradient	Favourable conditions for Atlantic salmon spawning occur where the watercourse gradient is 3% (<2 degrees)	Spawning occurs over gentle gradient watercourses where gradient is approximately 1.9-5.8m km ⁻¹ which is equivalent to c.0.5% or c.0.3°.
Substrate	Salmon select areas comprised of gravel – cobble sized material variable depending on the size of fish creating the redd (boulders are typically absent) which can be moved into a 'redd', but which do not contain fine sediment which may smother eggs or alevin.	Spawning - stony gravels (15–115cm) with substrate small enough to move to create a nest. A proportion of sand and smaller substrate is required to consolidate the nest. Nursery areas – require slower flowing areas in slower sections of watercourses or at the slower edges of high velocity streams. Sandy silt substrates are required.
Channel width	Parameter given to characterise the nature of the watercourse.	Parameter given to characterise the nature of the watercourse.
Channel depth	Salmon typically spawn within water depth of 17-76cm. Fry and young are associated with water <20cm depth,	Spawning 40–60cm Nursery areas - 10cm–50cm or deeper
Bank structure/vegetation	Bankside vegetation/ structure can be important in providing cover for adult salmon during upstream migration, bankside vegetation and woody debris in the watercourse can provide shelter for juveniles.	Shading does not appear to influence spawning activity.
Presence of barriers	Waterfalls/ man-made structures can impede upstream migration of Atlantic salmon though they are capable of passing some obstacles (max height 3.7m).	Sea lamprey are more heavily affected by barriers to movement than Atlantic salmon by waterfalls, weirs and other structures.

Atlantic salmon

2.2.2 Atlantic Salmon habitat characteristics are set out below in accordance with Hendry and Cragg-Hine (2003).

2.2.3 Atlantic Salmon form a key feature of this assessment as it is a qualifying feature of the River Spey SAC, which lies in close proximity to the Proposed Scheme, where the River Truim forms part of the designated area.

¹ Hendry K & Cragg-Hine D (2003). Ecology of the Atlantic Salmon. Conserving Natura 2000 Rivers Ecology Series No. 7. English Nature, Peterborough.

² Maitland PS (2003). Ecology of the River, Brook and Sea Lamprey. Conserving Natura 2000 Rivers Ecology Series No.5. English Nature, Peterborough.

- 2.2.4 The Atlantic salmon is an anadromous species (i.e. adults migrate from the sea to breed in freshwater). It is well known for its abilities and persistence to overcome obstacles in its migration up rivers to reach spawning grounds.
- 2.2.5 There are a range of terms to describe the many life stages of the Atlantic salmon (**Table 2.2.2**). The basic life cycle initiates when an adult female lays eggs, which are then fertilised by the male. The eggs hatch into alevins and stay within the redd, or nest – a shallow excavation found within gravelly areas - for up to two months. Following this stage, they then grow into fry, parr and smolt, during which they first migrate to sea. Salmon remain at the parr stage for around four years, before they return to their natal river as ‘smolts’ to spawn.
- 2.2.6 Salmon rivers vary considerably in ecological and hydrological characteristics. Generally, salmon require clean, well-oxygenated water to breed, feed and survive. Beyond this, in-stream physical habitat variables that determine suitability are water depth, water velocity, streambed substrate and cover. Favourable locations for salmon spawning are likely to occur where the gradient of a river is 3% or less (equivalent to gradient of $>5^\circ$) with a water depth ranging between 0.17-0.76m. Salmon require an uncompact stream substrate of pebble and small cobble size³. The sites are generally transitional areas between pools and riffles where flow is accelerating, drawing oxygenated water across the eggs, and depth decreasing. At the fry and parr stage, habitat preferences are towards shallow, fast-flowing water with a moderately coarse substrate and cover. At the juvenile stage, suitable cover includes areas of deep water, surface turbulence, loose substrate and large rocks⁴.

Table 2.2.2: Typical Habitats for Different Life Stages of Salmon

Life Stage	Habitat
Eggs/ alevins	Pebble to small cobble sized substrate
Fry (<1-year-old)	Pebble to small cobble sized substrate, fast flowing, shallow broken water
Parr (>1-year-old)	Small cobble to boulder sized substrate, fast flowing broken water, often slightly deeper water than fry
Adults	Deep pools

Sea lamprey

- 2.2.7 Sea Lamprey habitat characteristics are set out below in accordance with Maitland (2003).
- 2.2.8 Sea lamprey form a key feature of this assessment as it is a qualifying feature of the River Spey SAC which lies in close proximity to the Proposed Scheme where the River Truim forms part of the designated area.
- 2.2.9 Sea lamprey is an anadromous species. Sea lampreys need clean gravel for spawning and the scale of gravel beds required is described as ranging from a few square meters to hundreds of square meters in large rivers. Sea lamprey lay eggs in crude nests within the gravel beds. These

³ Scottish Fisheries Co-ordination Centre (2007). Habitat Surveys Training Course Manual. [pdf] Available at: <http://www.sfcc.co.uk/assets/files/SFCC%20Habitat%20Training%20Manual.pdf>

are comprised of shallow depressions previously created by lifting away small stones with their suckers. Eggs are laid and then sometimes covered with larger stones or vegetation. Once hatched, juvenile lamprey drift downstream and areas of sand or silt (typically comprising 90% sand) are utilised by burrowing juvenile ammocoetes, where they spend several years until transformation into adulthood occurs where they migrate downstream to the sea⁵.

- 2.2.10 Sea lamprey migration upstream is limited by physical barriers in watercourses, and the species is usually unable to migrate upstream of obstacles such as high waterfalls, weirs, dams and severe pollution that other species, such as Atlantic salmon, may be able to pass.

2.3 Limitations

- 2.3.1 No significant constraints to the survey were identified. However, the assessment considered the limitations of the survey due to seasonality whereby any seasonal aquatic macrophyte growth may not have been detected during survey visits in December. Given the characteristics and vegetation communities of surrounding habitats, this is not considered to affect the validity of the survey results.
- 2.3.2 Similarly, recording watercourse characteristics during the winter/ early spring is likely to produce higher estimates of water depth/ channel width than a survey undertaken during the summer months. The assessment had regard to normal conditions within the upper River Spey catchment, as specified by the closest SEPA water-level gauging station.

⁵ SNH (2005). Assessment of sea lamprey distribution and abundance in the River Spey: Phase III

3 Results

3.1 Atlantic salmon (*Salmo salar*)

- 3.1.1 Through consultation with SNH, SEPA and Spey Fishery Board (SFB), Atlantic salmon are known to occur throughout the River Truim which forms part of the River Spey SAC, designated in part for its important populations of Atlantic salmon and sea lamprey. In-channel features on the main-stem of the River Truim incorporate fish passage; therefore, Atlantic salmon have been observed spawning upstream of the Proposed Scheme towards Balsporran. Given the records of Atlantic salmon along the main body of the River Truim, the entirety of this watercourse is considered suitable for supporting Atlantic salmon.
- 3.1.2 The Allt Cuaich (ch. 26,000) and Allt Coire Bhathaich (ch. 22, 250) are both tributaries to the River Truim. Both watercourses are heavily abstracted as part of the SSE Tummel Hydro-scheme and, as a result, water levels are typically low under normal conditions. Whilst Atlantic salmon has been recorded upstream of the Allt Cuaich, neither watercourse is generally accessible or suitable for spawning Atlantic salmon under current conditions.
- 3.1.3 Substrates within the Allt Coire nan Cisteachan comprise gravels, pebbles and boulders with some deposition at the left side of the current crossing. Water flow is typically fast with riffles, with a typical depth of up to 0.5m. Potential salmonid spawning habitat is present immediately upstream and downstream of the crossing; however, a perched culvert (1.5m vertical drop) is noted where a cycle track crosses the watercourse downstream, which will limit fish access.
- 3.1.4 Substrates within the Allt Coire Uilleim comprise gravels, pebbles and boulders with some deposition at the south side of the current crossing. Water flow is typically moderate with a typical depth of up to 0.3m. No obvious in-channel barriers to fish passage are present; therefore, potential salmonid spawning habitat is present immediately upstream and downstream of the crossing.
- 3.1.5 Substrates within proximity to the River Truim comprise sands, gravels, pebbles and boulders; as well as some visible bedrock. Water flow is typically fast with riffles and a typical depth of approximately 1m, with a pool-riffle system is visible upstream. No obvious in-channel barriers to fish passage are present; therefore, salmonid spawning habitat is present immediately upstream and downstream of the crossing.
- 3.1.6 Given that Atlantic salmon are present within the River Truim, they are likely to be present in suitable spawning habitat at the crossing of the River Truim, Allt Coire nan Cisteachan and Allt Coire Uilleim. Discrete areas of spawning habitat are also likely to occur around the confluence between the River Truim and associated tributaries.

3.2 Sea lamprey (*Petromyzon marinus*)

- 3.2.1 Through consultation with SNH, SEPA and Spey Fishery Board (SFB), there are no records of sea lamprey for the River Truim, with the nearest confirmed record noted downstream on the River Spey towards Newtonmore (APEM 2004). Site condition monitoring (SCM) data for the River Spey SAC highlights that supporting habitat for sea lamprey is generally sub-optimal upstream of Newtonmore.
- 3.2.2 Potential sea lamprey spawning habitat was found in similar areas to those highlighted for Atlantic salmon; however, there was generally a lack of fine sediments (e.g. silt) needed for sea lamprey larval-development (Maitland *et al.* 2003).

3.2.3 Whilst no records of sea lamprey have been identified within the Proposed Scheme, there is potential for this species to be present in spawning habitat. No juveniles are expected to be encountered with optimal nursery habitats located downstream of the River Truim.

Table 3.2.1: Summary of fish habitat assessment

Hydro ID	Watercourse Name	Chainage	Suitability Upstream		Suitability Downstream		Limiting factors
			Salmon	Lamprey	Salmon	Lamprey	
72	Allt Coire nan Cisteachan	ch. 20,750	Potentially suitable spawning habitat	Potentially suitable spawning habitat	Potentially suitable spawning habitat	Potentially suitable spawning habitat	Perched culvert (1.5m vertical drop) where cycle track crosses the watercourse downstream
77	Allt Coire Uilliem	ch. 21,450	Suitable spawning habitat	Potentially suitable spawning habitat	Suitable spawning habitat	Potentially suitable spawning habitat	
82	Allt Coire Bhathaich	ch. 22,250	None	None	None	None	Abstraction upstream leading to very low flow
N/A (Dalwhinnie Junction)	River Truim	ch. 22,500	Suitable spawning habitat	Potentially suitable spawning habitat	Suitable spawning habitat	Potentially suitable spawning habitat	
104	Allt Cuaich	ch. 26,000	Potentially suitable spawning habitat	Potentially suitable spawning habitat	Potentially suitable spawning habitat	Potentially suitable spawning habitat	Abstraction upstream leading to very low flow Trash screen upstream which may prevent fish passage



3.2.4 The presence of habitat suitable for notable fish species will have implications for timings of construction activities, particularly watercourse crossings and in-channel works. This is due to the vulnerability of fish at egg or alevin (for Atlantic salmon) stage where the species are more susceptible to impacts due to river works at times when they are immobile within river sediments. The relevant sensitive timings for Atlantic salmon and lamprey species are summarised below in **Table 3.2.2**, in line with guidance presented by SNH⁶. Those months presented in green are those where restrictions on in-channel works are lifted with respect to the species concerned.



⁶ Scottish Natural Heritage, (2006). Guidance for Competent Authorities when dealing with freshwater SAC sites. Scottish Natural Heritage, Battleby.



Table 3.2.2: Overview of spawning/ most sensitive periods for freshwater fish



Species	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec
Atlantic salmon	Red	Red	Red	Red	Green	Green	Green	Green	Green	Red	Red	Red
Sea lamprey	Green	Green	Green	Green	Green	Red	Red	Green	Green	Green	Green	Green
River lamprey	Green	Green	Red	Red	Red	Red	Green	Green	Green	Green	Green	Green
Brook lamprey	Green	Green	Green	Red	Red	Red	Green	Green	Green	Green	Green	Green



Appendix 1 - Watercourse Crossing Results

Watercourse: Allt Coire nan Cisteachan		Hydro ID: 72	Chainage: 20,750		
Upstream		Comments	Downstream		Comments
Channel width	2.5m		Channel width	2m	
Channel depth:	0.2-0.3m		Channel depth:	0.2-0.3m	
Substrate:	gravel, pebbles, boulders		Substrate:	gravel, pebbles and boulders	
Gradient:			Gradient:		
Bank structure/vegetation:	Left bank: steep, gabions present, bank vegetation consists of heather and conifer saplings Right bank: less steep with similar vegetation to the left bank		Bank structure/vegetation:	Left bank and right bank: vegetation consists of heather and purple moor grass, banks have a slight undercut	
Barriers Y/ N	N		Barriers Y/ N	Y	
Photograph Upstream:			Photograph Downstream:		
					
<p>Overview of suitability for fish: Substrates within the Allt Coire nan Cisteachan comprise gravels, pebbles and boulders with some deposition at the left side of the current crossing. Water flow is typically fast with riffles, with a typical depth of up to 0.5m. Potential salmonid spawning habitat is present immediately upstream and downstream of the crossing; however, a perched culvert (1.5m vertical drop) is noted where a cycle track crosses the watercourse downstream, which will limit fish access.</p>					

Watercourse: River Truim		Hydro ID: N/A	Chainage: 22,450	
Upstream		Comments	Downstream	Comments
Channel width	5-6m		Channel width	5-6m
Channel depth:	1m		Channel depth:	1m
Substrate:	sand, gravel, cobbles, pebbles, boulders and some bedrock		Substrate:	sand, gravel, cobbles, pebbles, boulders and some bedrock
Gradient:	Left bank: 20-40% incline Right bank: 30% incline		Gradient:	Left bank: 20-40% incline Right bank: 30% incline
Bank structure/vegetation:	Left bank: bank 2m high, some undercutting of the bank, grassland/ dry heath habitat on bank with three scattered birch trees. A few exposed boulders and bedrock. Right bank: some deposition of boulders and cobbles, heath habitats on bank with a few scattered Scot’s pine and willow.		Bank structure/vegetation:	Left bank: grassland habitat Right bank: grassland/heath habitat
Barriers Y/ N	N		Barriers Y/ N	N
Photograph Upstream:			Photograph Downstream:	
				
<p>Overview of suitability for fish: Substrates within proximity to the River Truim comprise sands, gravels, pebbles and boulders; as well as some visible bedrock. Water flow is typically fast with riffles and a typical depth of approximately 1m, with a pool-riffle system is visible upstream. No obvious in-channel barriers to fish passage are present; therefore, salmonid spawning habitat is present immediately upstream and downstream of the crossing.</p>				

Watercourse: Allt Coire Uilleim		Hydro ID: 77	Chainage: 21,400		
Upstream		Comments	Downstream		Comments
Channel width	2m	Channel flows down left side; deposition on right side at crossing	Channel width	2.5m	Channel flows down left side; deposition on right side at crossing
Channel depth:	0.3m		Channel depth:	0.3m	
Substrate:	gravel, pebbles, cobbles, boulders		Substrate:	pebbles, cobbles and boulders	
Gradient:	Left bank: 10-20% incline Right bank: 20% incline		Gradient:	30%	
Bank structure/vegetation:	Left bank: 0.5m height, slightly undercut, marshy grassland habitat on bank Right bank: relatively flat with a risen area of approx. 1m, undercut in some areas, vegetation consists of scattered regenerating lodgepole pine		Bank structure/vegetation:	Left bank: marshy grassland habitat on flat area with dry heath and scattered willow on 30% slope Right bank: deposition and undercut, 1-1.5m height (almost vertical), heath and grassland habitat on bank with Scot's pine roots deeply undercut.	
Barriers Y/ N	N		Barriers Y/ N		
Photograph Upstream:			Photograph Downstream:		
					
<p>Overview of suitability for fish: Substrates within the Allt Coire Uilleim comprise gravels, pebbles and boulders with some deposition at the south side of the current crossing. Water flow is typically moderate with a typical depth of up to 0.3m. No obvious in-channel barriers to fish passage are present; therefore, potential salmonid spawning habitat is present immediately upstream and downstream of the crossing.</p>					

Watercourse: Allt Coire Bhathaich		Hydro ID: 82	Chainage: 22,250		
Upstream		Comments	Downstream		Comments
Channel width	3m	Very low flow	Channel width	4m	Very low flow
Channel depth:	0.1m		Channel depth:	0.1m	
Substrate:	bedrock washed down and deposited near bridge crossing		Substrate:	gravel to large boulder	
Gradient:	Left bank: 50% incline Right bank: 80% incline		Gradient:	Left bank: 70% incline Right bank: 80-90% incline	
Bank structure/ vegetation:	Left bank: bank level with channel, significant deposition (large boulder, cobbles and pebbles) before crossing, heath/grassland habitat on bank Right bank: slight undercut, landslip closer to bridge, very large boulders to gravel, heath/ grassland on bank		Bank structure/ vegetation:	Left bank: grassland/heath habitat on bank, natural berm immediately downstream that undercuts, bank 2m height Right bank: grassland/ heath habitat on bank, 3-4m height	
Barriers Y/ N	N		Barriers Y/ N	N	
Photograph Upstream:			Photograph Downstream:		
					
<p>Overview of suitability for fish: The substrate at the crossing location is primarily composed of pebbles, cobbles and boulders, with lots of deposition under the current crossing, particularly on the right bank. There is a wire fence located downstream of the current crossing. At the time of survey, the flow was slow, and the water depth was approximately 0.1m.</p>					

Watercourse: Allt Cuaich		Hydro ID: 104	Chainage: 26,000		
Upstream		Comments Trash screen present within channel – mesh size approx. 0.1m x 0.15m. Clogged with debris making it a potential barrier to fish and otter. Small pool present approx. 5m upstream	Downstream		Comments Trash screen present upstream
Channel width	8m (4m active)		Channel width	8m (4m active)	
Channel depth:	0.2-0.3m		Channel depth:	0.2m	
Substrate:	cobble, pebble, boulder		Substrate:	cobble, pebble, boulder	
Gradient:	Left bank: gabion baskets present Right bank: 15% incline		Gradient:	Left bank: variable Right bank: 15% incline	
Bank structure/vegetation:	Left bank: gabion baskets Right bank: grassland		Bank structure/vegetation:	Left bank: gabion baskets Right bank: grassland	
Barriers Y/ N	Y	Barriers Y/ N	Y		
Photograph Upstream:			Photograph Downstream:		
					
<p>Overview of suitability for fish: The substrate at the crossing location is primarily composed of pebbles, cobbles and boulders, with lots of deposition under the current crossing. There is a wire fence/ trash screen located at the upstream end of the current crossing which is clogged with debris, acting as a potential barrier to fish passage. At the time of survey, the flow was moderate, and the water depth was approximately 0.1.</p>					