Orkney's Community Wind Farm Project - Hoy

Fish population assessment

Commissioned Report to Energised Environments Ltd., July 2020

Waterside Ecology
Druimindarroch
Arisaig
Inverness-shire
PH39 4NR
T: 01687 450298
M: 07788 717605
jon@watersideecology.co.uk

www.watersideecology.co.uk

Table of Contents **Page**

List of Tables **Page**

Orkney's Community Wind Farm Project - Hoy: fish population assessment

Commissioned Report to Energised Environments Ltd., July 2020

Contractor: Waterside Ecology

SUMMARY

Background

This survey was commissioned to provide data on fish populations and habitats in streams in and around the proposed Orkney's Community Wind Farm - Hoy. There is a single main watercourse within the site, the Burn of Ore. This watercourse was surveyed to determine fish species presence and abundance. The Proposed Development has potential to impact on fish through changes in water quality via run-off from the site or by direct disturbance to streambed habitats e.g. at stream crossings.

Methods

Sites were surveyed by electric fishing using standard Scottish Fisheries Co-ordination Centre semi- and fully-quantitative methods. Electric fishing was carried out at six sites on Burn of Ore. Surveys utilised a backpack electric fisher and a single anode. Dense riparian willow and gorse thickets prevented access to many parts of the watercourse. Therefore, no extensive habitat survey was possible. Habitats were assessed at the electric fishing sites and limited observations of other stream reaches suggested these were likely to be representative.

Main findings

- The surveyed reaches of the Burn of Ore have typical wet widths of between 1.5 and 3.0 m. Gradient is moderate or low. Depths and flow types are suited to all age classes of trout and include some deep pool habitat suited to adult brown or sea trout. Overhead bankside cover is abundant. No impassable barriers were recorded but survey was incomplete. Spawning substrates are present and probably widespread.
- Trout fry and parr were found at all sites in Burn of Ore. European eels were widespread. Flounder and three-spined sticklebacks were present in the lower reaches only.
- Single-run trout fry density on Burn of Ore ranged from 1.6 to 8.3 fry.100 m^{-2}. Mean density across the six sites was 4.5 fry.100 m^{-2} (σ=2.8), which is classified as poor based on the classification scheme for North region (Godfrey 2006). Single-run trout parr density ranged from 2.6 to 19.0 parr.100 m^{-2}. Mean density across the six sites was 8.5 parr.100m^{-2} (σ=6.8), which is classified as good.

The findings are discussed in relation to the Proposed Development and a number of recommendations are made for mitigation and monitoring.

1 Introduction

1.1 Background

This survey was commissioned to provide data on fish populations in streams on the site of the proposed Orkney's Community Wind farm - Hoy. The wind farm would be constructed on hilly ground in the south-eastern part of the island of Hoy. The wind farm comprised an array of six turbines, all located to the north of the Burn of Ore and within that catchment (See EIA Figure 1.2). A single watercourse crossing is proposed at ND 281 938, where the access track would cross the upper reaches of the Burn of Longigill.

1.2 Fish populations

1.2.1 Species presence

Very little fish work has been carried out in Orkney. However, the Burn of Ore was included in a three-year study of trout populations in Orkney carried out by Malcolm Thomson in 2007-2009 (Thomson 2015). Resident brown trout were recorded and Burn of Ore was identified as supporting an anadromous sea trout population. No data are provided on other species, but Thomson reports that European eel *Anguilla anguilla* and three-spined stickleback *Gasterosteus aculeatus* are found in Orkney burns, along with introduced minnow *Phoxinus phoxinus* and stone loach *Barbatula barbatula* in some areas. There are no records of Atlantic salmon *Salmo salar* spawning in any Orkney watercourses (Thomson 2015).

1.2.2 Conservation status

Due to recent declines, eels are of increasing conservation interest and are protected by European (EC No 1100/2007) and Scottish (Freshwater Fish Conservation (Prohibition on Fishing for Eels) (Scotland) Regulations 2008) legislation. The latter makes it illegal to take eels without a license from the Scottish Government. European eels are listed as critically endangered on the IUCN Red List.

Brown trout (including sea trout) and European eel are listed as priority species on the UK and Scottish Biodiversity Action Plan lists.

1.3 Habitat requirements

1.3.1 Trout

The physical habitat requirements of juvenile salmonids have been subject to a considerable amount of detailed study (for reviews see e.g. Crisp 1993; Hendry & Cragg-Hine 2003; Klemetsen *et al*. 2003; Summers *et al*. 1996). Trout spawn in late autumn and early winter, depositing their eggs in redds which they excavate in gravel and pebble substrates. Eggs are often deposited in areas of accelerating flow, such as the tails of pools and glides, upstream from riffles. However, in upland streams eggs may be deposited in any areas of gravel that can be physically moved. A good supply of oxygen is essential for eggs to develop and this is facilitated by a flow of water through the gravel. Clogging with fine sediment such as silt and fine sand reduces water flow resulting in egg mortality due to lack of oxygen. Egg survival is also affected by redd 'washouts' during winter spates – the direct, physical, scouring out of eggs from the gravel. Substrate stability, the dynamics of water flow and the weather all determine the extent of siltation and washouts.

After hatching the young fry remain in the gravel, absorbing nutrient from the remaining yolk sac. On emergence, usually between March and early May, the young fry disperse and set up territories which they defend aggressively. Trout fry prefer areas of relatively low velocity water near the streambed. Cover from stones, plants or debris is required and good cover is essential for maintaining high fry densities.

Trout parr generally favour areas of relatively low current speed where cover is available. Juvenile trout are often to be found in cover alongside the banks, in undercuts, among tree roots or in marginal

vegetation. Cover remains important for adult trout particularly in smaller streams. In larger rivers and lochs this may be less important, as deep water provides refuge.

1.3.2 European eel

Eel habitat requirements have received less attention than those of salmonid fish. Tesch (1977) suggests that so long as temperature and oxygen requirements are met, there are few stretches of water that are not suitable for eels. The main requirement for eels is cover, as they are averse to light and require suitable refuges during daylight hours. Eels of different size show different substrate preferences. Larger eels require large hollows, crevices or weed beds whereas small eels are sometimes abundant in cobble substrates, where they can burrow between the stones. Tree stumps, roots and other large structures provide ideal cover for eels. Eel diet is diverse, but the majority of the diet consists of benthic species (Moriarty 1978; Kottelat & Freyhof 2007).

2 Methods

2.1 Habitat survey

Dense riparian willow and gorse thickets combined with frequent underground sections made much of the watercourse inaccessible, and heavily peat-stained water obscured the substrate in accessible reaches. On this basis it was agreed that full, linear fish habitat surveys were impossible. Instead, it was agreed limited habitats surveys would be carried out at proposed stream crossing points on the track network once a draft layout was available. This would have provided data useful for micro-siting infrastructure if required e.g. to avoid sensitive habitats such as salmonid spawning areas. This survey was scheduled for late March 2020 but due travel restrictions resulting from the COVID19 pandemic, they could not go ahead. As such, the only fish habitat information available for this site at present is that collected from electric fishing sites along with general observation of the watercourse. Much of this information is qualitative due to the limitations on access and visibility noted above.

Habitat variables were assessed qualitatively at six electric fishing sites on the Burn of Ore (Table 1). Sites ORE-1 to ORE-3 are downstream of a dam ND 291 934, and sites ORE-4 to ORE-6 are upstream. Notes were made on water flow, depth, substrate, cover and availability of spawning substrate. Data from these six sites offer useful 'snapshots' from which some conclusions can be drawn as to the nature of fish habitat in Burn of Ore.

2.2 Electric fishing survey

2.2.1 Field survey

Fish populations were surveyed by electric fishing on 27th and 28th September 2019. The distribution and location of electric fishing sites (Table 1) was to some extent restricted by the difficulties in accessing the watercourse, and sites were located in the most suitable accessible reaches. Surveys were conducted using fully- or semi-quantitative methods as described by Scottish Fisheries Co-ordination Centre (SFCC 2014).

Table 1 Locations of electric fishing sites

Site code	Watercourse	NGR	Survey type
ORE-1	Burn of Ore	ND 29736 93353	Semi-quantitative
ORE-2	Burn of Ore	ND 29415 93205	Fully quantitative
ORE-3	Burn of Ore	ND 30349 93818	Semi-quantitative
ORE-4	Burn of Ore	ND 28842 93389	Semi-quantitative
ORE-5	Burn of Ore	ND 28339 93370	Semi-quantitative
ORE-6	Burn of Ore	ND 27473 93312	Semi-quantitative

A single electric fishing run was conducted at semi-quantitative survey sites. One fully quantitative site was surveyed in order to provide an index of survey efficiency. Where possible, survey sites covered the full stream width and incorporated a representative range of habitat types; however the dense riparian thickets in some reaches meant that only half the river was accessible for survey. Qualitative habitat descriptions were recorded at all survey sites. Further details of sites and electric fishing events are provided as Appendices 6.2 and 6.3.

Fish were captured in hand-held dip nets then placed in bins of clean water where they were held until ready for processing. Fish were anaesthetised for handling and were identified to species. Salmonid fork length was measured to the nearest millimetre as was eel total length. All fish were allowed to recover fully in clean water before being released back into the survey reaches.

2.2.2 Analyses

All fish densities are expressed as fish per 100 square metres of wetted stream area (fish.100m^{-2}). Salmonid densities are presented separately for fry and parr.

The classification provided by Godfrey (2006) for North region is used to describe fish abundance in a regional context. The classifications are based on large data sets held by Scottish Fisheries Co-ordination Centre (SFCC). The quintile ranges of trout densities (Appendix 6.6) allow for comparison of fishery performance against regional and national reference points. The classification system is based on semi-quantitative fishing i.e. density based on number of fish captured during a single electric fishing run through an undisturbed site. Different classifications are provided for stream of various widths. Godfrey's data for North Region do not include Orkney, but given the geographical proximity of Orkney to Caithness and north Sutherland, and some geological similarities[1], it was judged to be the most relevant classification scheme.

3 Results

3.1 Habitat

The Burn of Ore flows from west to east, rising at about 100 m altitude on the eastern flank of Bakingstone Hill, and meeting the sea at the head of Ore Bay (ND 305 939). Three small, first order tributaries flow into the burn from the north: the Burn of Longigill and two further unnamed streams. The Burn of Ore is roughly 5 km in length, and of relatively shallow gradient. The concrete dam at ND 291 934 has created a small impoundment and has raised the level of the water for a short distance upstream. The dam is considered to be passable for trout[2].

Summary habitat data are provided in Table 2. Substrates are varied and with reaches of bedrock, 'hardpan', pebble and boulder. At most sites any mobile substrate appeared to be deposited as a shallow layer over the underlying bedrock or hardpan, making it rather unstable. However useful cover for trout fry was present amongst the substrate at most sites. Excellent bankside cover in the form of undercuts and draped vegetation was noted at all six sites, and the thicket vegetation which impedes access to much of the watercourse will provide good cover for trout parr in these reaches.

Suitable spawning habitat for trout was recorded at one site (ORE-2), and the presence of mobile gravel at several sites suggests that there is sufficient small grainsize substrate within the system to provide spawning opportunities. Deep pools and glides were noted which offer important cover for adult trout, including sea trout.

[1] http://mapapps.bgs.ac.uk/geologyofbritain/home.html
[2] "Obstacles to fish migration" layer at https://map.environment.gov.scot/sewebmap/

Table 2 Fish habitat at six locations on the Burn of Ore

Site	NGR	Habitat description
ORE-1	ND 30349 93818	Mainly pools and glide habitat, mostly over 40 cm deep, with some shallower runs and riffles. Substrate is a mixture of angular boulders and cobbles over soft subsoil. Draped vegetation provides some bankside cover.
ORE-2	ND 29736 93353	Mainly shallow run flow with a substrate of gravel and pebble over hardpan or bedrock. Some patches appear suitable for spawning. Plentiful cover from undercut banks and draped vegetation.
ORE-3	ND 29415 93205	Run flow, mainly 20-50 cm deep, over a substrate predominantly of boulder with some pebble and cobble. Plentiful bankside cover from undercuts and draped vegetation.
ORE-4	ND 28842 93389	Habitat is predominantly run flow with two broader areas where water is eddying (this is where fish were caught). Substrate is mainly bedrock with occasional boulders, a single small patch of gravel was noted underfoot. Abundant overhead cover from undercuts.
ORE-5	ND 28339 93370	Mainly run flow over a substrate predominantly of bedrock with some loose cobbles and gravel. Some slower flow at edges in undercuts, bankside cover from undercuts and draped willow.
ORE-6	ND 27473 93312	Mainly deep run flow with some pool/glide areas. Substrate is a mix of bedrock and compacted boulder/cobble, with some patchy loose gravel in pools. Plentiful bankside cover from undercuts and draped vegetation.

The three sites downstream of the dam (ORE-1 to ORE-3) were judged to offer moderate quality habitat for trout fry and parr, with mixed substrates and adequate cover. Gradient in the reaches around these sites is low and the habitat appears to be relatively stable compared with that upstream of the dam, which is steeper with some long reaches that are bedrock-dominated. Despite the presence of bedrock areas, bankside cover is excellent in most reaches. This may be particularly important for trout parr which favour overhead cover, particularly in areas where cover on the streambed is lacking. Some of spawning calibre substrates noted in the upper reaches appeared to be unstable and potentially vulnerable to wash-out during spates.

The Burn of Longigill was not formally assessed. It is a very small watercourse even at the point where it joins the Burn of Ore. The proposed track crossing point is a short distance from the source of the stream, and it is highly unlikely that the burn would be of sufficient size at this point to provide a significant amount of useful trout habitat.

3.2 Fish populations

Electric fishing surveys were carried out at six sites on the Burn of Ore (Table 1). Five sites were surveyed semi-quantitatively and one was surveyed fully quantitatively to provide a measure of team survey efficiency. Trout were recorded at all sites, and eels were found at the four most downstream sites but not at the upper two. Flounder and three-spined stickleback were recorded only at ORE-1. Trout fry densities were highest at the most downstream sites, while the opposite was true of parr with densities increasing progressively the further upstream the site.

Assessed against Godfrey's (2006) classification for trout densities in the North region, trout fry densities were moderate at ORE-1 and ORE-2, poor at ORE-3, and very poor at ORE-4, ORE-5 and ORE-6. Mean trout fry density across the six sites was 4.5 fry.100m^{-2} (σ=2.8), which is classified as poor.

Trout parr densities were classified as poor at ORE-1, ORE-2 and ORE-3, moderate at ORE-4, and excellent at ORE-5 and ORE-6. Mean trout parr density across the six sites was 8.5 parr.100m^{-2} (σ=6.8), which is classified as good.

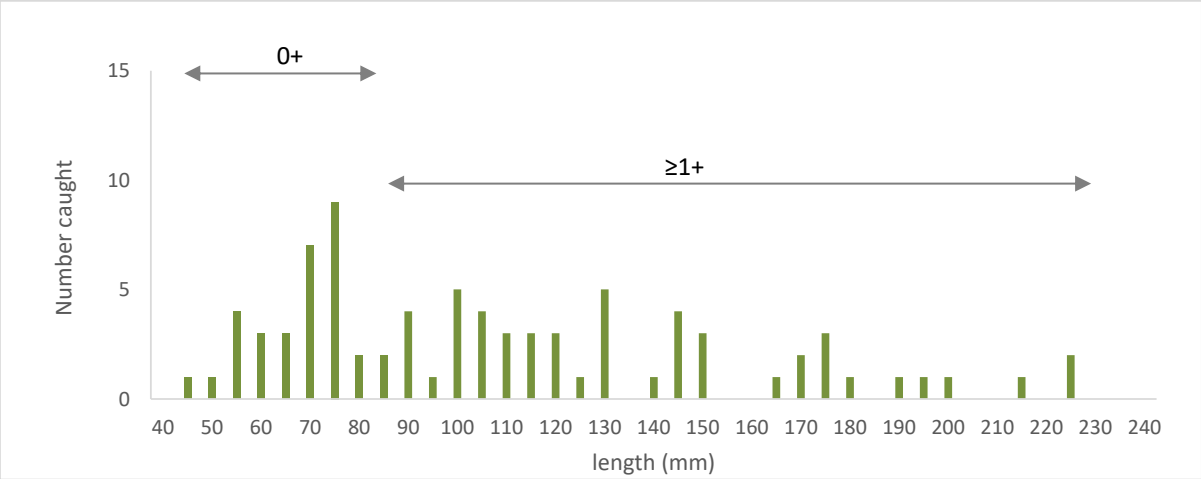
Table 3 Electric fishing results, Burn of Ore (densities based on single run sampling)

Site	**Trout density** (fish.100 m^{-2})		Eels (n)	Other fish species
	Fry	Parr		
ORE-1	7.0	2.6	Present	Flounder, 3-sitned stickleback
ORE-2*	8.3 (9.5)	3.6 (4.8)	8	None
ORE-3	4.7	4.1	2	None
ORE-4	1.8	7.1	1	None
ORE-5	1.6	14.5	None	None
ORE-6	3.5	19.0	None	None

*Zippin densities in parentheses. See Appendix 6.4 for depletion data.

Readings of scales taken from the trout in the Burn of Ore indicate that fry range in length from 42 mm to at least 84 mm (shown in red on Figure 1). Mean fry length across all sites was 66.5 mm (σ=9.8). At least two age classes of parr were present, 1+ from around 90 mm to 130 mm, and 2+ from around 140 mm upwards. Two mature female brown trout of 200 and 247 mm in length were recorded at ORE-3.

Figure 1. Trout size distribution, Burn of Ore.



4 Discussion

4.1 Survey limitations

As discussed above, it was not possible to conduct linear surveys of fish habitats within the Proposed Development area due to restricted access to the stream banks, long sections of underground flow, and heavily peat-stained water obscuring the substrate. As such, the fish habitat data for the Hoy Wind Farm site are largely from electric fishing sites, where it was gathered through a combination of investigating with feet and hands, and probing with wading staffs. As a result, most of the information presented here is qualitative. Nevertheless, as the extent of proposed infrastructure is now much more limited than was originally proposed, the lack of extensive habitat data is unlikely to greatly impact on the quality of ecological impact assessments based on the results. Furthermore, the surveyors walked much of Burn of Ore during the survey and while some of the stream was partly obscured by vegetation it was apparent that the survey sections were likely to be representative of much of the stream. The main limitation of the habitat data was the inability of surveyors to assess habitats at the proposed crossing on Burn of Longigill, as this had not been defined at the time of survey. This issue is considered further in section 4.3 below.

Water and light conditions for the survey were fairly good, with dry relatively bright weather and moderate water levels. Temperatures were within the suitable range for salmonid survey. The fully quantitative survey at site ORE-2 gave a good depletion, demonstrating effective fishing (Appendix 6.4).

4.2 Habitat and fish populations

Burn of Ore appears to offer moderate to good quality trout habitat, with excellent bankside cover for parr and some deeper areas for adult trout. As the dam on Burn of Ore is passable for trout, the entire reach between the sea and the top electric fishing site (ORE-6) is believed to be accessible to sea trout. Map data suggest sea trout may have access for a considerable distance upstream of ORE-6, but this was not confirmed by survey. Spawning habitats suited to trout are available.

Parr densities were considerably greater than fry densities, suggesting that perhaps 2019 was a relatively poor fry year in this area. Data from Thomson (2015) showed the proportion of fry in trout samples from the Burn of Ore over the three years of 2007–2009 ranged from 45.4% to 57.5%. Trout fry made up 39.5% of the total number of trout caught in the current survey of Burn of Ore. Results would be consistent with poor recruitment in 2019.

Thomson found that trout growth rates in Hoy burns are rather low compared to the rest of Orkney, and that trout also appear to smolt at an older age than those from Mainland Orkney. Parr aged 1+, 2+ and 3+ were found annually in the Burn of Ore over the three years of Thomson's survey, and 4+ and 5+ parr were found in one of the years, whereas in Mainland Orkney where growth rates were higher only 1+ and 2+ parr were recorded annually, and 3+ only in some burns and not every year. The slow growth and long residence time could account for the high proportion of parr and, perhaps, the relatively high proportion of parr found during the current survey.

4.3 Potential impacts

Diffuse and point source impacts from construction works around watercourses clearly have potential to affect stream habitats and fish populations. Typical sensitivities around wind farm developments and salmonid fish relate mainly to the exposure of large quantities of soil and the potential for siltation. Inputs of silt and other fine material including peat can cause damage to fish habitats and direct mortality to fish and ova. Spawning habitats can be particularly at risk in the event of siltation since clogging of interstitial space with fine material prevents oxygen reaching eggs and alevins. Similar or greater impacts may result in the event of major erosion resulting from large scale developments. Runoff of silt or peat may be a potential concern during construction at the Hoy Wind Farm site, however the proposed layout is now restricted to a relatively small area within the original red line boundary, and any works would be at some distance from the Burn of Ore with the nearest turbines (T3 and T4) each approximately 300 m from the watercourse. As a result, risks to fish and fisheries at this site may be relatively low.

The access track would cross the upper reaches of Burn of Longigill at ND 281 938. This stream has not been surveyed. However, map data show the proposed crossing to be within 200 m of the stream's source. It is highly improbable that this small, first order stream could have collected sufficient bedload at this location to provide any significant amount of mobile substrate, as a result of which there is little likelihood that either spawning or productive juvenile trout habitat is present at the crossing location. It is probable, therefore, that the primary risk in relation to the proposed crossing would be downstream propagation of fine sediments into the lower reaches of Burn of Longigill, or into or Burn of Ore itself, during construction. It might, nevertheless, be prudent to check habitats at the crossing location if opportunities are available to micro-site post-consent.

Downstream impacts on water quality including siltation, large scale pollution events or significant shifts in stream hydrochemistry may be a risk factor to fish at any proposed crossings, and from wider construction of e.g. roads and turbine bases. Construction impacts may be minimised by following

standard good practice procedures and pollution prevention guidance (e.g. SEPA/Environment Agency 2007; Scottish Government 2012). Guidance in relation to river crossings and fish is provided by SEPA 2010b

In some circumstances exposure of mineral soils due to removal of blanket peat has the potential to increase leaching of potentially toxic metals such as aluminium, zinc or iron. Aluminium leaching may be a lower risk in streams draining peatland, since where levels of dissolved organic carbon are high it tends to form organic chelates, rendering it less toxic (Rosseland & Kroglund 2011). Iron can also be toxic to freshwater species including fish in some circumstances, as can zinc (Vuori 1995). Iron toxicity is influenced by a range of other parameters including levels of pH, dissolved organic carbon (DOC) and other toxic metals including aluminium (Vuorinen *et al*. 1999). Some consideration of these possible impacts should be considered within any water quality monitoring plan that may be required for the site.

4.4 Recommendations

- Stream crossing design, construction and micro-siting will incorporate suitable mitigation measures to avoid impacts on habitats and fish movements.
- Regular monitoring of turbidity and suspended solids will be required during construction. Any such monitoring should include a responsive element, with an on-site ECoW checking areas where active works are taking place and areas where sediment run-off may be a concern during periods of high rainfall.
- If stream hydrochemistry is to be monitored during construction, determinants should include those identified as being potential risk factors to fish or their habitats.
- If fish are to be monitored during construction, fully quantitative surveys should be carried out in the pre-construction year. Monitoring sites should include some of those fished in the current survey, as this will give an indication of annual variation in the absence of construction impacts. Additional control sites upstream of the Burn of Longigill confluence should be established.

5 References

Crisp, D.T. 1993. The environmental requirements of salmon and trout in fresh water. Freshwater Forum, 3(3): 176-201.

Hendry, K. & Cragg-Hine, D. 1997. Restoration of Riverine salmon habitats. Fisheries Technical Manual 4, Environment Agency, Bristol.

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

Klemetsen, A., Amundsen, P-A, Dempson, J.B., Jonsson, B., Jonsson, N., O'Connell, M.F. & Mortensen, E. 2003. Atlantic salmon *Salmo salar* L., brown trout *Salmo trutta* L. and Arctic charr *Salvelinus alpinus* (L.): a review of aspects of their life histories. Ecology of Freshwater Fish, 12, 1-19.

Kottelat, M. & Freyhof, J. 2007. Handbook of European Freshwater Fishes. Cornol, Switzerland.

Moriarty, C.M. 1978. Eels: A Natural and Unnatural History. David & Charles, Newton Abbot. 192pp.

Rosseland, B.O. & Kroglund, F. 2011. Lessons from acidification and pesticides, pp 387-407 in: Aas, Ø., Einum, S., Klemetsen, A & Skurdal, J. 2011. Atlantic Salmon Ecology. Wiley-Blackwell.

SEPA. 2010a. Guidance for applicants on supporting information requirements for hydropower applications. Scottish Environment Protection Agency.

SEPA. 2010b. Engineering and the Water Environment: Good Practice Guidance, River Crossings. Second Edition. Scottish Environment Protection Agency, November 2010.

Summers, D., Giles, N. & Willis, D.J. 1996. Restoration of Riverine Trout Habitats: A Guidance Manual. Fisheries Technical Manual 1, R&D Technical Report W118, Environment Agency, Bristol.

Tesch, F. W. 1977. The Eel, Biology and Management of Anguillid Eels. John Wiley and Sons, New York.

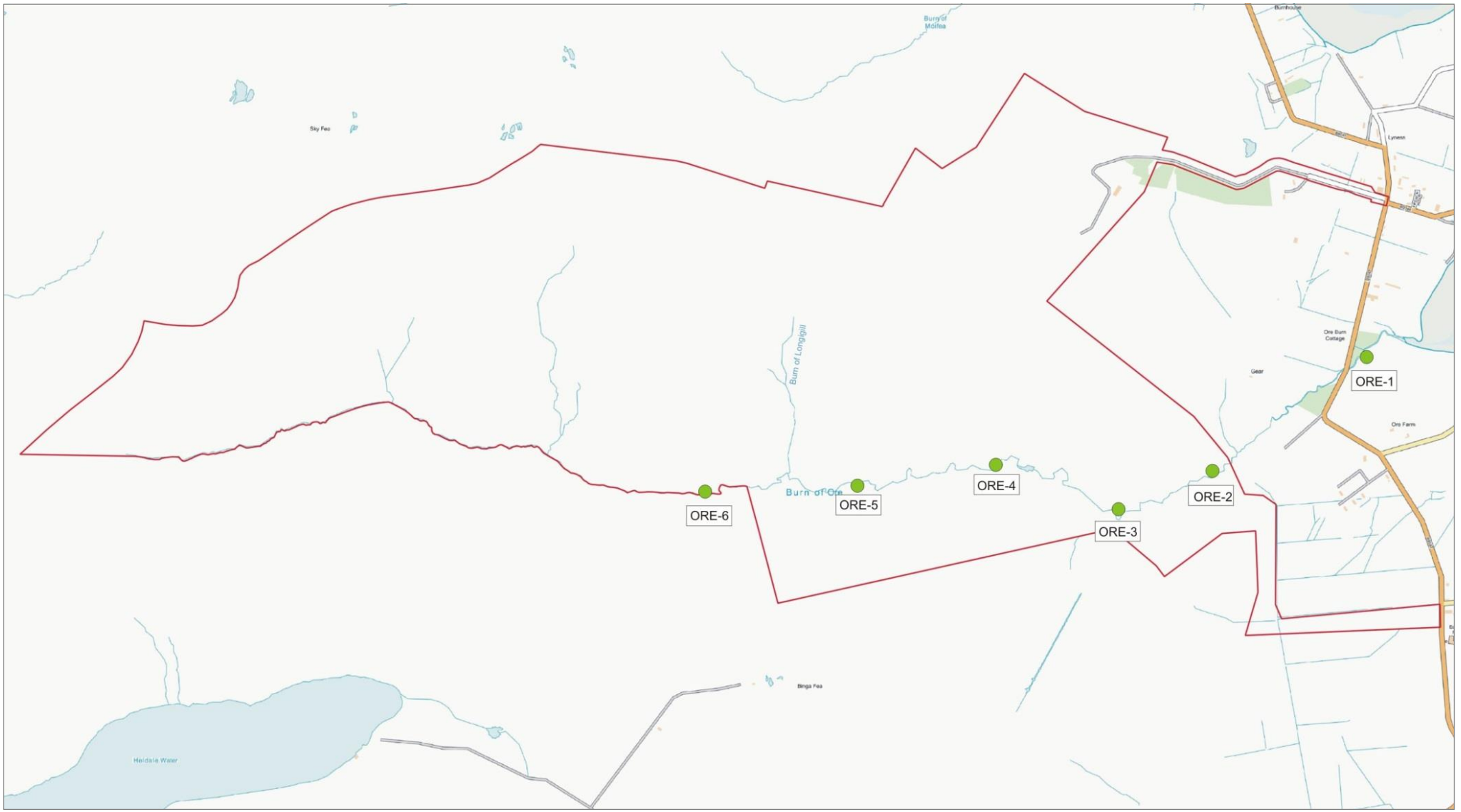
Thomson, M. 2015. Life history characteristics in the sea trout (*Salmo trutta* L.): insights from small catchments in Orkney. Thesis submitted for a Doctor of Philosophy, School of Life Sciences, Heriot Watt University.

Vuori, K-M. 1995. Direct and indirect effects of iron on river ecosystems. Annales Zoologici Fennici, 32, 317-329.

Vuorinen, P.J., Keinänen, M., Peuranen, S. & Tigerstedt, C. 1999. Effects of iron, aluminium, dissolved humic material and acidity on grayling (*Thymallus thymallus*) in laboratory exposures, and a comparison of sensitivity with brown trout (*Salmo trutta*). Boreal Environmental Research, 3, 405-419.

6 Appendices

6.1 Redline boundary/developable area and electric fishing sites



6.2 Electric fishing survey site locations and survey event details.

Site	Watercourse	NGR	Length (m)	Width (m)	Area (m^2)	Voltage	Conductivity ($\mu S.cm^{-1}$)	Temp. (°C)	Level	Colour
ORE-1	Burn of Ore	ND 30349 93818	54	2.9	156.6	200.0	132	12	medium	coloured
ORE-2	Burn of Ore	ND 29736 93353	48	1.8	84.0	180.0	122	11	medium	coloured
ORE-3	Burn of Ore	ND 29415 93205	93	1.6	147.8	180.0	124	12	medium	coloured
ORE-4	Burn of Ore	ND 28842 93389	28	2	56.0	220.0	105	11	medium	coloured
ORE-5	Burn of Ore	ND 28339 93370	31.5	2.0	62.0	220.0	105	11	medium	coloured
ORE-6	Burn of Ore	ND 27473 93312	67	1.7	115.6	220.0	109	11	medium	coloured

6.3 Depletions attained at fully quantitative electric fishing sites

Site	Equipment type	Number trout fry caught			Number trout parr caught			Total trout		
		run 1	run 2	run 3	run 1	run 2	run 3	run 1	run 2	run 3
ORE-2	Backpack	*7*	*1*	*0*	*3*	*1*	*0*	10	2	0

6.4 Zippin estimates of total fish numbers with lower and upper 95% confidence limits

Site	Trout fry			Trout parr caught			Total trout		
	N	Lower 95%	Upper 95%	N	Lower 95%	Upper 95%	N	Lower 95%	Upper 95%
ORE-2	8.01	8.00	8.20	4.04	4.00	4.50	12.04	12.00	12.47

6.5 Eel lengths at electric fishing sites

Site	Watercourse	Individual lengths (mm)	Number seen but not captured
ORE-1	Burn of Ore	present	Not recorded
ORE-2	Burn of Ore	80, 85, 105, 110, 125, 225, 240	2
ORE-3	Burn of Ore	105, 120	None
ORE-4	Burn of Ore	120	None
ORE-5	Burn of Ore	-	None
ORE-6	Burn of Ore	-	None

6.6 Relative regional classification for the North fishery statistical region (based on 50 sites)

	Width Class	
	<6 m	>6 m
Salmon 0+		
0th percentile	1.0	0.5
20th percentile	7.1	4.5
40th percentile	9.3	13.1
60th percentile	12.7	28.4
80th percentile	20.1	32.7
100th percentile	48.9	67.4
% zero density	34.5	9.5
Salmon 1++		
0th percentile	1.2	1.1
20th percentile	1.7	4.4
40th percentile	4.6	7.0
60th percentile	8.5	13.3
80th percentile	13.0	19.1
100th percentile	21.3	27.7
% zero density	24.1	9.5
Trout 0+		
0th percentile	1.0	0.5
20th percentile	4.4	0.8
40th percentile	5.2	1.9
60th percentile	8.5	2.9
80th percentile	12.6	4.2
100th percentile	98.5	5.5
% zero density	6.9	19.0
Trout 1++		
0th percentile	1.2	0.6
20th percentile	3.0	0.6
40th percentile	4.4	0.9
60th percentile	7.1	1.1
80th percentile	8.6	1.6
100th percentile	14.7	3.6
% zero density	20.7	38.1

Descriptive categories used in text

Density in regional classification	Description used in text
Min to 20th percentile	Very poor
20th to 40th percentile	Poor
40th to 60th percentile	Moderate
60th to 80th percentile	Good
80th to 100th percentile	Excellent

6.7 Electric fishing site photographs

	ORE-1 ND 30349 93818 Downstream end
	ORE-1 Pool in middle of survey reach
	ORE-2 ND 29736 93353 Site from downstream

	ORE-3 ND 29415 93205 From downstream
	ORE-3 From upstream
	ORE-4 ND 28842 93389 From downstream

	ORE-5 ND 28339 93370 Downstream
	ORE-6 ND 27473 93312 Downstream
	ORE-6 Upstream end looking downstream