Beauly
Fishery Board

2021 Beauly Catchment Electrofishing Report

		Date	Signed
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Approved by	**Jock Miller, Chairman of the Board**	**23/02/22**	Jock Miller

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1. Summary

30 NEPs sites (well spread) and 18 historic sites were completed in summer 2021 with the help of contractor Lynn Mckelvey, UHI student Karla Ilic, and a couple of volunteers.

The 48 sites gave a comprehensive coverage of the accessible reach, including the mainstem Glass for the first time. Of these, 17 were fully quantitative (3-run) sites (16 NEPS, 1 historic) enabling the potential for capture efficiencies to be calculated. The remainder were single run (semi-quantative).

The surveys highlighted:

- potential hydro-morphological problems on the R. Cannich and Affric.

-The Glass management unit as having the highest on average fry density (compared to the Farrar and Beauly management units).

-The Glass mainstem having higher average fry densities in comparison with the Farrar mainstem. Incorporating higher numbers of sites in the analysis next year should make comparison statistically possible.

-Fry and parr densities were found to be slightly higher on average compared to 2020, although a vast number of sites would need to be surveyed each year to make between-year comparisons statistically possible.

-The highest parr densities were found in the Belladrum sub-catchment.

The **minimum** densities presented in this report allows for comparison between sites in the catchment for 2021 and comparison with historic site data.

2. Introduction

Historic sites cover representative-good habitat for juvenile salmonids. These can be surveyed every few years to detect changes to juvenile densities at each site. Making catchment-wide conclusions is limited as the suite of sites are not truly representative of the habitat found in the entire catchment.

NEPS sites, being semi-randomly generated are more representative of the catchment as a whole and can be used to make catchment wide inferences. This year, a spread-out NEPS site distribution and low flows enabled the surveying for the first time of the R. Glass mainstem.

National Introgression Programme sampling (NIPS) occurred at each NEPS site to enable genetic introgression rates (of aquaculture DNA) in parr to be assessed. See Marine Scotland report [1].

The Farrar genetics project also commenced in 2021. This project is funded by Culligran estate with analysis being done by the River and Lochs Institute at UHI. It aims to assess how the number of spawners varies year on year. It should also highlight discrete salmon populations and their specific traits.

The summer of 2021 was incredibly dry and led to water scarcity situations on other rivers. On the Beauly, the hot, dry conditions led to an abundance of algae in tributaries and on the mainstem. Algae samples taken from various sites showed the algae to be *Oedogonium* spp, not associated with nutrient pressure.

3. Method

Historic sites The methods used are generally as outlined in the 2020 Electrofishing report [2] and abide by SFCC guidelines. Data is entered into the SFCC database. See report for more information on each historic site.

NEPS A set of Standard Operating Procedures are used for NEPs surveys. The electro-fishing method is similar to the SFCC protocol. Data is entered into Fish Obs software and Marine Scotland analyse the data and environmental variables to create benchmark (expected) fish densities for the catchment. In 2021, river order 5 (large rivers) were included in the NEPS sample frame and so the mainstem Glass was surveyed by Beauly Fishery Board (BFB) for the first time. The Lower Beauly is still too big to be included in the NEPs work to date.

Generally, the 2021 NEPS sites were suitable for electro-fishing and were broadly comparable in juvenile habitat quality to BFB's historic sites, therefore these have been presented together in this electro-fishing report. Unsuitable NEPS sites (those with naturally poor-quality juvenile salmonid habitat have been left out of more in-depth data analysis and these are specified in the text).

NIPS sampling involves snipping off a small part of the caudal fin of parr. Up to 30 parr were sampled at each NEPs site. Samples were sent to Marine Scotland for introgression analysis. Further details are not covered in this report.

Farrar genetics- this involved BFB and UHI visiting a total of 10 sites on the Farrar and taking genetic samples from the caudal fin of fry or preserving the whole fry. Genetic samples were taken from NEPS sites if site locations were suitable, otherwise additional sites were electro-fished to gain the number of fry required. Site details have been reported to UHI to enable consistency in future sampling. Further details are not covered in this report.

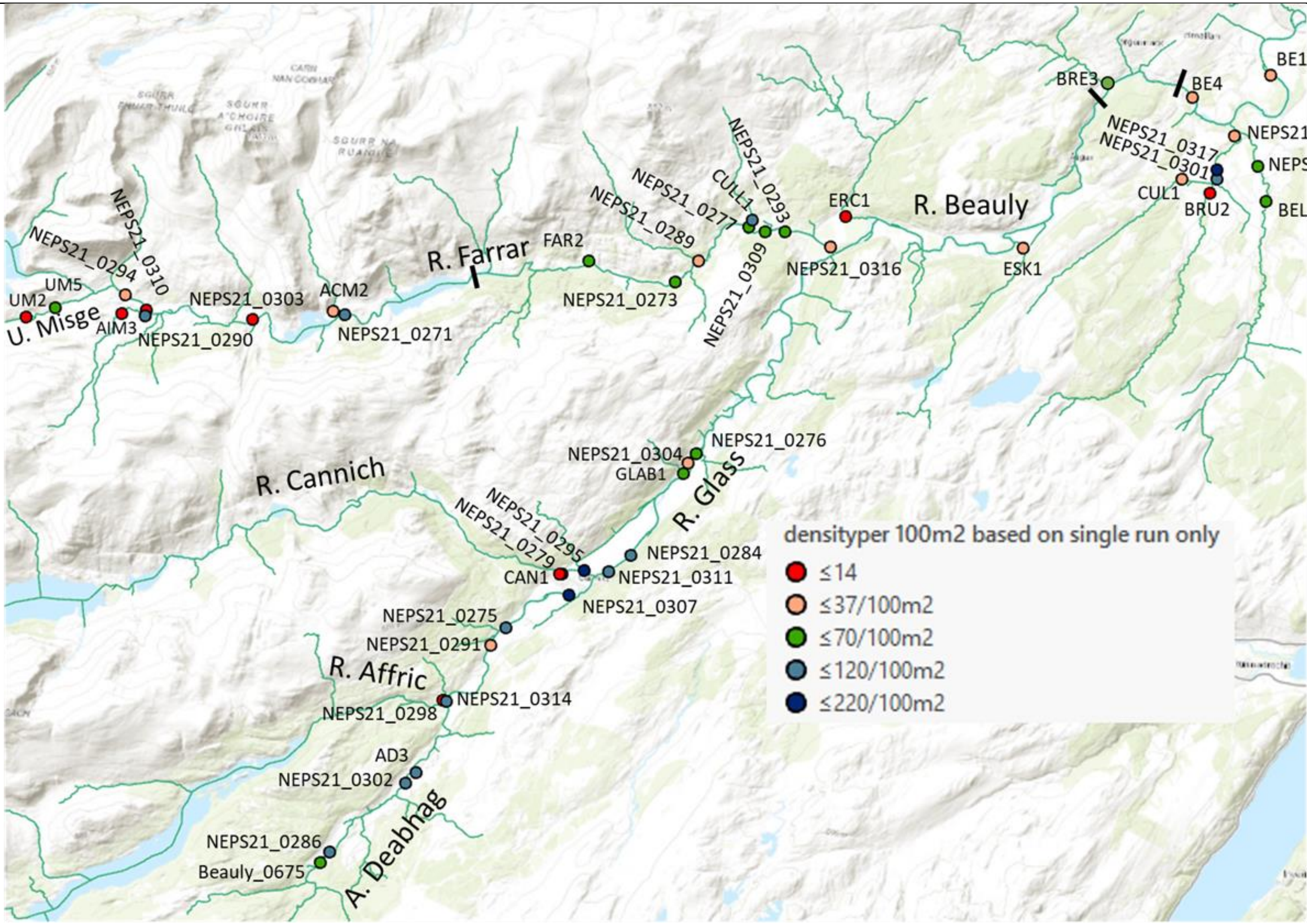
4. Results

The map below shows an overview of the electrofishing parr and fry densities for 2021. Classification (colouring of dots) gives an idea of how sites were relative to each-other based on a Jenks analysis, and do not relate to past data or benchmark figures. **All results are reported as minimum density estimates (i.e. results from the first run only).** This is because capture efficiencies from the 17 fully quantitative (3-run) sites had not been calculated at the time of writing. Work is underway to enter the NEPS data into the SFCC database to enable calculation of these capture efficiencies relevant to the current survey team ahead of the Marine Scotland update to the NEPS tool.

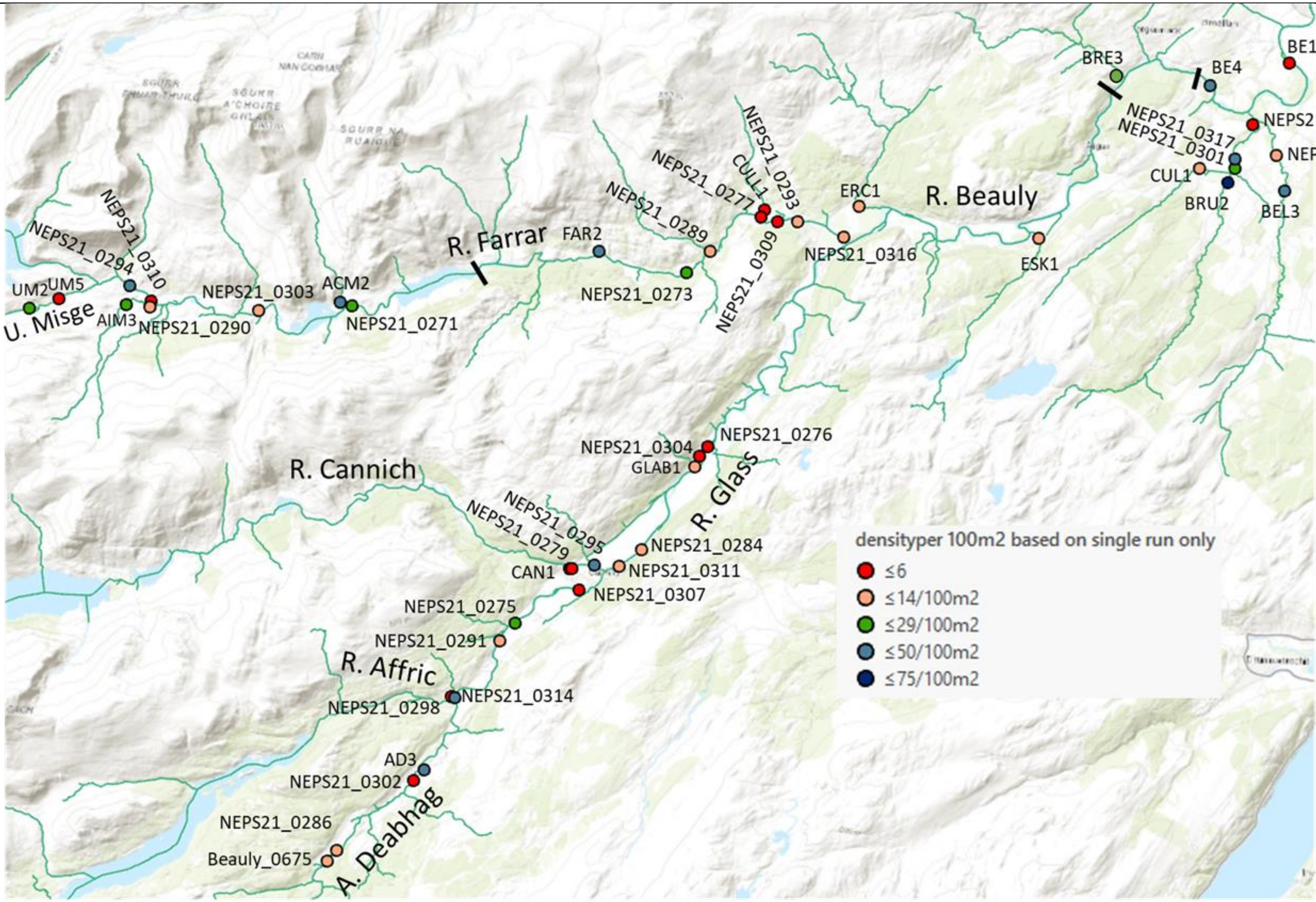
Capture efficiency is likely to have been between 50%-60% which appears similar to the previous Ness and Beauly survey team so, as a rough rule of thumb, for **total** densities double the figures presented here to compare with data presented in Electrofishing reports prior to 2020.

Data for Glass site NEPS21_0272 (carried out on 20 July) has been left out as the survey turned out to be inefficient due to the small size of the fry (disappearing through net mesh) and Glass site NEPS21_0288 which was a silty backwater, unsuitable for salmonid fry. Both sites are left out of this report and are not included in subsequent analysis. Maps of juvenile trout densities are contained in Appendix 1. Full results tables are provided in Appendix 2.

Map 1A: Overview of minimum salmon fry densities per 100m2 found in 2021 (NEPS21_0272 and NEPS21_0288 not displayed).



Map 1B: **Overview of minimum salmon parr densities per 100m2 found in 2021** (NEPS21_0272 and NEPS21_0288 not displayed).



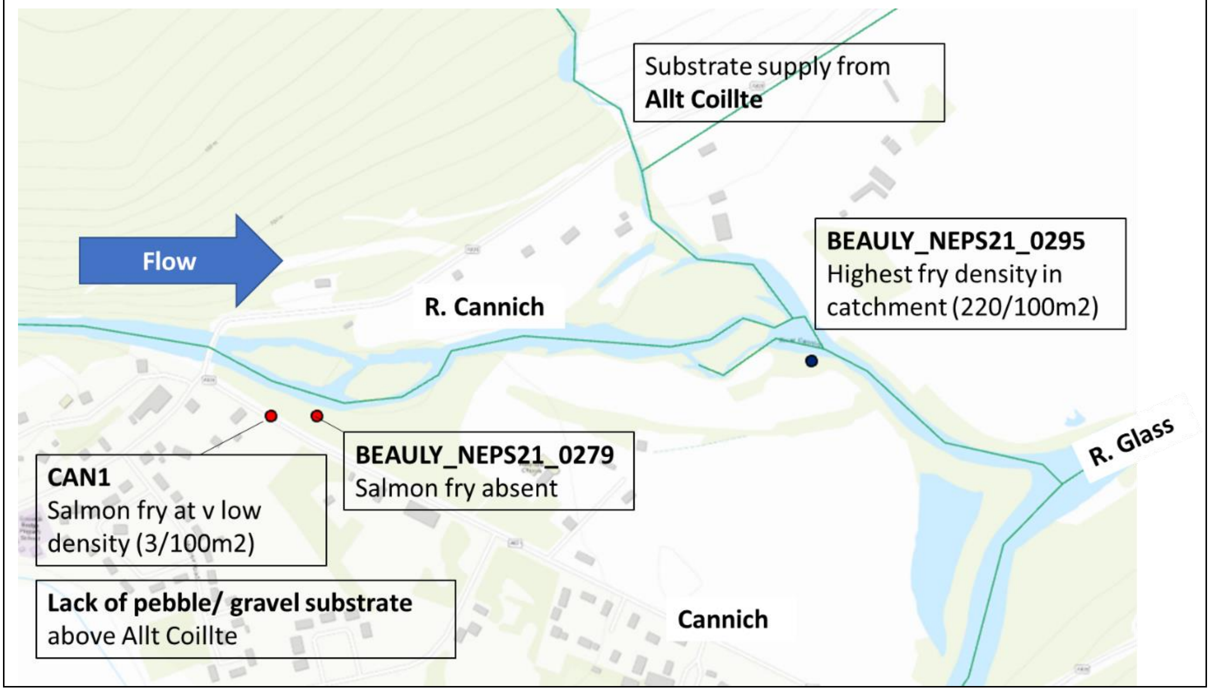
4.1 Site analysis: Fry

From Map 1A, it appears that the mainstem **Glass** has consistently good-excellent fry densities with a couple of exceptions. The R. Cannich and R. Affric both have sites on them that come out as poor (Cannich: CAN1, NEPS21_0279, Affric: NEPS21_0298). This was due to a lack of spawning peb/gravel substrate in the vicinity of these sites.

R. Cannich

Below is a close-up of the R. Cannich (Map 2). The salmon fry densities found on the river were of the highest and lowest found during electro-fishing surveys in 2021.

Map 2: Electro-fishing results for R. Cannich highlighting lack of substrate above Allt Coilte and exceptionally high minimum fry densities below where substrate comes in.



This appears to be due to a hydro-morphological pressure and further investigation is required to see where substrate stops further upstream of the Cannich road bridge, and to check if this is natural or not. A walkover of the R. Cannich would be ideal to further characterise the problem.

The **Farrar** appeared to have mostly good fry densities where habitat allowed. **Above the dam**, an exception to this was site UM2. Despite continued improvement, UM2 recorded poor numbers of fry (10/100m^2). Improvements in flow management (reduction in flows) are likely to have improved conditions, but riparian tree planting could further improve food availability to juvenile fish, potentially reduce the time it takes for juveniles to reach the pre-smolt stage and add to their fitness [3]. More fry would be expected here given the habitat present. The weir at the bottom of the U. Misge appears easily passable by adults making their way up. Improvements to the fish counters by SSE (including at Beannacharan dam) and the Farrar genetics project may help to see if spawner numbers are low on the U. Misge.

NEPS21_0303 (260m u/s footbridge) was a deep site with predominantly deep glide flows (sub-optimal for juvenile salmonids) and NEPS21_0271 and NEPS21_0294 (50m u/s bottom of island, Inchvuilt) were bouldery. At AIM3, despite there being good habitat present, salmon fry were found at just 3 fry/100m^2, a walkover of the Allt Innis a' Mhuilt to the confluence with the Farrar did not record any barriers to migration and pH was normal (7.1). It is possible that the poor numbers of salmon fry are due to the small size of the burn (c4m wide) and salmon are preferring to spawn in the mainstem, this may also be the case for ACM2 which is 5m wide and had moderate fry numbers of (27/100m^2). Both burns had good-excellent parr numbers indicating that parr are likely moving in from the mainstem to utilise the habitat. Active cobble bars on the Allt Innis a' Mhuilt suggest high energy spates occur on this burn.

NEPS21_0271 (180m downstream of Loch a' Mhuilidh) contained higher than expected numbers of both fry (102/100m^2) and parr (29/100m^2) given the habitat (and macrophytes) present and salmon may be choosing to spawn at and above this site as they are even more limited by the substrate and flows (which are slower) further downstream.

Below Beannacharan dam NEPS21_0289 was situated immediately below the alluvial fan of Neaty burn and as such, the substrate was very unstable. This is likely to have resulted in the moderate fry densities found here (22/100m^2). NEPS21_0316 (above sharp bend, 240m above confluence with R. Glass) was predominantly parr habitat which explains the moderate fry numbers found there (27/100m^2).

The **Beauly** mainstem sites showed moderate fry densities when compared with the rest of the catchment. This is likely due to the extremely stable nature of these sites below Kilmorack dam with compacted substrate and significant macrophyte growth. BE4 also had a lot of algae present which may have obscured fry from the view of the survey team.

The Belladrum sub-catchment generally held good- excellent fry densities except for the BRU2 site. The poor salmon fry density here (3 per 100m^2) is the lowest density ever found at this site (previous average 67/100m^2). The reason is unclear, however there was a strong smell of septic tank at the bottom of the site from an overflow. It is possible that a pollution incident had occurred prior to the visit on 17 July or (more likely) that a temporary woody debris barrier was in place further downstream during autumn 2020 preventing adult salmon accessing this site.

CUL1 (with a wetted width of 2.5m wide) is generally seen as a trout burn. The NEPS21_0285 site (Beaufort castle, 160m u/s confluence with Belladrum burn) was generally shallow (predominantly <30cm deep) with good-moderate habitat for fry (glide and run) but was overshaded (95% of the site was under beech tree canopy). Rhododendron was also present.

4.2 Site analysis: Parr

Parr density in the catchment is the closest information we have to calculating smolt output. See Map 1B.

The mainstem **Glass** appeared to have predominantly moderate parr numbers when compared to the catchment as a whole despite there being good parr habitat present at sites; NEPS21_0276, NEPS21_0284, NEPS21_0307, NEPS21_0286, and Beauly_0695. Previous NEPS surveys (in 2018 and 2019) have shown the A. Deabhag to be below carrying capacity. It will be useful to see how these 2021 densities compare with the benchmark figures due to be generated by Marine Scotland to see if this appears to be the case for the wider R. Glass.

At NEPS21_0291 (370m d/s Fasnakyle power station) parr were found in the shallow margins rather than in typical parr habitat in the main channel. It is not clear if this is due to flow regulation and repeat surveys in this stretch would be useful to see if this is a consistent occurrence.

At NEPS21_0311 (300m d/s R. Cannich) a two-stage channel had clearly developed, likely a result of regulated flow.

The poor parr densities found at NEPS21_0304 and NEPS21_0302 are likely due to the habitat being predominantly suitable for fry, and it is likely the moderate parr density at the GLAB1 site is due to parr dropping out of the burn and into the mainstem.

On the **Farrar above Beannacharan dam**, parr densities were patchy and this appears to reflect the habitat at the sites being surveyed. UM5 is predominantly fry habitat, NEPS21_0310 flows were predominantly deep glide and deep pool, NEPS21_0290 held predominantly pebble substrate (more suited for fry), at NEPS21_303 the flow was mostly deep glide. The excellent densities of parr at NEPS21_0294 site (50m u/s bottom of island, Inchvuilt) despite the substrate being predominantly (84%) boulder show that parr are moving into this site from elsewhere. Eels were expected to be present at this site, however none were found.

A planned outage at Culligran power station allowed the surveys on the lower Farrar to be conducted. Parr densities were found to be moderate- poor at the **bottom of the Farrar** (below Neaty burn) in comparison with the rest of the catchment. This is likely to be for a combination of reasons. Local knowledge highlighted that a cloud burst, associated spate and forestry track failure, around 2018 had deposited a large amount of sand (from Neaty and Culligran) into the mainstem and generally sites appeared to be slightly compacted. It is also possible that substrate coming in from tributaries below Beannacharan dam masks the unnaturally stable state of the river below the dam in general, and this is generally supported by hydro-morphology observations.

NEPS21_0289 was immediately below Neaty burn's alluvial fan and the substrate there was unstable. NEPS21_0277 (the tail of the pool immediately above Culligran burn) was a deep site and not optimal for juvenile salmonids. At historic site, CULL1 it's expected that parr move out of the burn into the deeper mainstem. At NEPS21_0309 (10m downstream of the SEPA gauging station) the poor parr numbers (2/100m^2) are explained by the predominantly sandy substrate (40% of the bed). There appeared to be a high proportion of sand making up the bed of the Farrar at Struy bridge.

Moderate parr densities were found at the lowest two sites on the Farrar and it is unclear why this was as habitat was generally good. NEPS21_0293 (top of island, Inchmore) held a minimum density of 11 parr/100m^2, partial compaction was recorded at the site. NEPS21_0316, (240m above the confluence with the R. Glass) had good habitat for parr (60% cobble) and held a minimum density of 10 parr/100m^2. The depths (c70cm) and flows at both of these sites were within the habitat requirements for parr [4].

Continued sediment management is required throughout the Farrar to ensure there is spawning and juvenile substrate available.

Alder regeneration was generally found along the banks of the Farrar, with less found further up the sub catchment. This is likely due to the existing deer management (and grazing pressure, including from wild goats) on each estate.

The **Beauly mainstem** riffle sites both had significant plant growth associated with them, suggesting overly-stable conditions. BE4 (the riffle downstream of Falls hut) had an excellent minimum parr density of 44/100m^2 (the highest recorded for this site) which may have been due to the low flows experienced on the day of survey making fish easier to catch, whereas BE1 (the riffle above Lovat bridge) had a poor minimum density of 5/100m^2 (half of that found last year). Although within the historical ranges, the density at this site appears to fluctuate widely.

The Belladrum sub catchment had good-excellent parr densities. Exceptions were due to the habitat present (NEPS21_0285, CUL1) although it is unclear why NEPS21_0313 (Belladrum burn, 45m d/s A833) held moderate densities considering that the habitat there was excellent. The site was surveyed on 17 Aug and water temperature was a cool 13.3°C due to the shaded nature of the burn so it is unlikely that high river temperatures seen throughout the catchment during the summer were a factor.

4.3 Management unit comparison

Below is a summary table of the 2021 electro-fishing results (Table 1).

Table 1: Salmon densities found across the management units, 2021. NEPS21_0272 and 0288 have been left out.

Management Unit	Total number of sites	Average minimum density/ 100m2 (standard deviation)
Beauly	12	Fry: 44 (45) Parr: 23 (21)
Glass	17	Fry: 79 (61) Parr: 13 (14)
Farrar	17	Fry: 46 (33) Parr:16 (13)

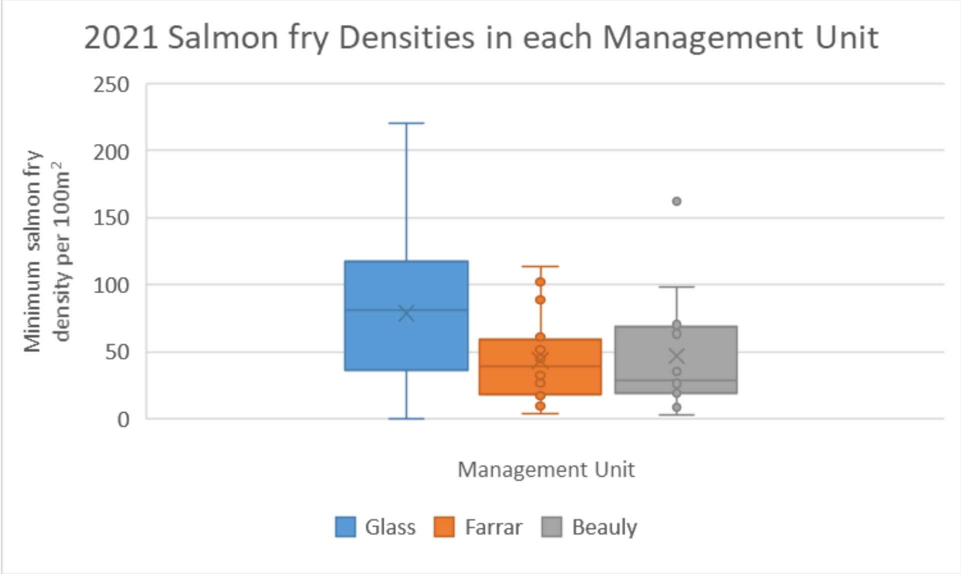
Average minimum fry densities were highest on the Glass and its tributaries (79 fry/ 100m^2), with a wide deviation from the mean. The average minimum fry densities found on the Beauly and Farrar were similar to each other (44 and 46/ 100m^2) respectively, again with wide deviation from the mean. Most of the Beauly sites were situated on the Belladrum catchment whereas most of the Farrar sites were mainstem, as such, comparison is limited with the Beauly management unit.

In terms of parr, the highest average minimum density was found on the Beauly (23/100m^2), followed by Farrar (16/100m^2) and Glass (13/ 100m^2).

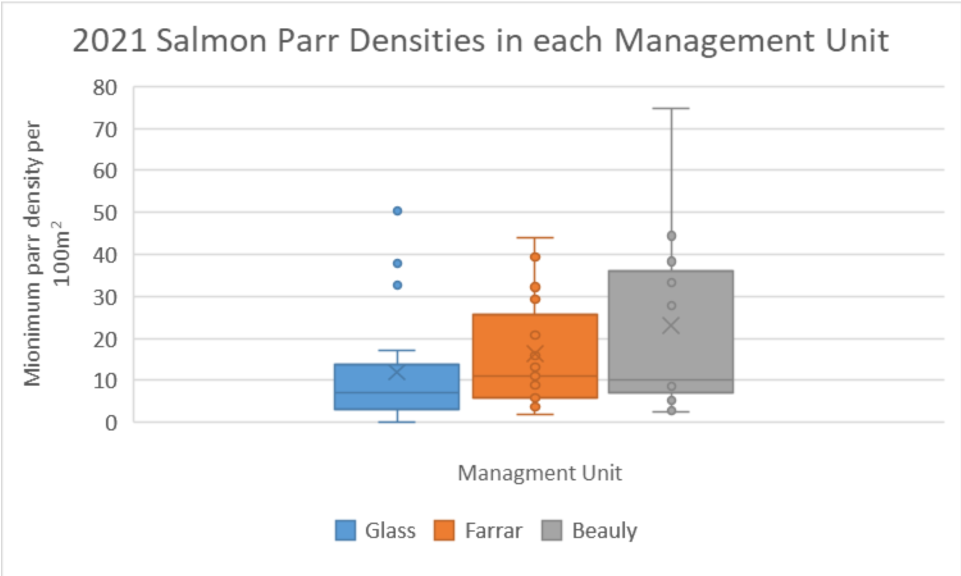
The standard deviation was high meaning that densities varied greatly in each management unit, this is likely due to the inclusion of both tributaries and main stem sites, and a few sites having known issues with associated low densities.

See Graphs 1A and 1B for summary box plots of salmon fry and parr densities for each management unit.

Graph 1A: Summary box plot of minimum salmon fry density per management unit, 2021



Graph 1B: Summary box plot of minimum salmon parr density per management unit, 2021



4.4 Mainstem only comparison

To see if in general there was a difference in productivity between the Glass and the Farrar main stems; representative sites were compared using a t- test. 12 Mainstem Glass and 14 mainstem Farrar sites were used. Sites left out of this analysis were: All Cannich sites (CAN1, 0279, 0295), all Affric sites (0298), backwater Glass site 0288, and Glass site 0272 (due to an inefficient survey).

The Beauly was left out of the statistical comparison as not enough main stem sites were surveyed (only 2 were surveyed this year).

Fry: The average minimum density of fry found on the Glass was higher than the Farrar (89/100m^2 [SD 43.4] compared to 45/100m^2 [SD 28.3]), but this was not found to be statistically significant.

Parr: The average minimum parr density on the Glass was lower than the Farrar (Glass: 12/100m^2 [SD 11.8], Farrar: 16/100m^2 [SD 13.2]) and were not statistically different.

Given that the carrying capacity of a river acts as a ceiling to parr numbers, parr densities are not expected to differ widely between the two rivers if habitat, geology or pressures are similar.

Based on these findings, a power analysis (Power and Precision 4 software) showed that for future years:

- a minimum number of 17 sites per river would have to be done to detect a difference of 20% between the mainstem Farrar and Glass fry densities.

-a minimum number of 26 sites per river would have to be done to detect a 5% difference between the mainstem Glass and Farrar fry densities.

-given the very large standard deviation found for parr densities and small difference in average density, it would be unworkable to detect even a 20% difference in parr densities (567 sites would have to be done!) using the same method as employed in 2021.

4.5 Historic site comparison

Site by site juvenile density graphs including salmon fry, parr and trout fry and parr are given in Appendix 3.

Table 2: Historic site minimum density averages (sites: ACM2, AD3, AIM3, BE1, BE4, Beauly_0675, BEL3, BRE3, BRU2, CAN1, CULL1, CUL1, ERC1, ESK1, FAR2, GLAB1, UM2, UM5).

	2020 minimum density per 100m2 (Standard Deviation)	**2021 minimum density per 100m2 (Standard Deviation)**
Average salmon fry minimum density/ 100m2	31 (25.6)	39 (35.6)
Average salmon parr minimum density/ 100m2	20.5 (14.0)	23 (19.3)

Given the repeat survey of 18 historic sites, density of both fry and parr were on average higher in 2021 when compared to 2020, although this was not found to be at a statistically significant level due to the relatively few number of sites surveyed. It is also worth noting that the electro-fishing team in 2021 was likely to have been more efficient than the variable team in 2020 (mostly volunteers were used).

Given the high variation in densities, to detect a 20% change in salmon fry densities between years a minimum of 167 sites per year would be required across the catchment. To detect a change of 5% a minimum of 276 sites would be required. The current style of semi-quantitative surveys does not allow for this number of sites to be visited annually. For parr, the equivalent site numbers would be 343 and 568.

5. Main findings and Recommendations

- The new data we now have for the R. Glass mainstem is very useful for gaining insight into the productivity of this main tributary of the Beauly and putting known fry densities from the rest of the catchment into context. This has allowed an initial comparison to be made between the Beauly's main tributaries the R. Glass and the R. Farrar. The average minimum fry densities were highest on the Glass and its tributaries (79 fry/ 100m^2). Beauly and Farrar were similar to each other (44 and 46/ 100m^2) respectively. In terms of parr, the highest average minimum density was found on the Beauly (23/100m^2), followed by Farrar (16/100m^2) and Glass (13/ 100m^2).

-When the NEPS tool is updated with the 2021 capture efficiency data, then we will be able to put these results into better context in relation to 'benchmark' figures (fish densities expected to be found based on environmental predictors).

-The average minimum density of fry found on the **mainstem** Glass was higher than the mainstem Farrar (89/100m^2 [SD 43.4] compared to 45/100m^2 [SD 28.3]), although this was not found to be statistically significant given the number of sites surveyed. A greater number of mainstem sites (17-26 per river) needs to be surveyed and analysed to make a future comparison viable.

-Density of both fry and parr at **historic** sites were on average higher in 2021 when compared to 2020, although this was not found to be statistically significant due to the relatively few number of sites surveyed.

-Surveys generally highlighted that there may be hydro-morphological pressures in the catchment, but further work/ **walkover surveys are necessary to confirm whether the lack of suitable spawning (and juvenile) substrate is a natural or unnatural occurrence**. This is apparent on the R. Cannich, R. Affric, the R. Farrar and lower Beauly. Sediment management in relation to various structures and hydro dams is essential to keeping a supply of substrate available for fish habitat.

-The hot, dry summer led to low flows and the prevalence of the algae *Oedogonium* spp, across the catchment (mainstem Glass, Farrar, Culligran burn). This algae is not specifically associated with nutrient pressure. **Encouraging landowners to adopt native, riparian tree planting or regeneration in the upper catchment could help keep rivers cool and buffer the catchment against climate change.**

-Surveys of sub-optimal habitat are best to detect decline of adult spawner numbers, so it would be advantageous to adopt a few of the sub-optimal NEPS 2021 sites to pick changes up.

-Based on mapping the wadable (surveyable) and accessible areas for Atlantic salmon, 3 management units are to be adopted in the 2022 Fishery Management Plan (Beauly, Glass, Farrar). Areas in these 3 management units are broadly comparable (Approximate areas: Beauly 0.50 km^2, Glass 0.65 km^2, Farrar 0.55 km^2).

<u>Farrar</u>

-U. Misge: although some continued improvement in fry numbers at the top site (UM2) is likely due to improved flow management, more fry would be expected here given the habitat present. **Tree planting/ encouraging natural regeneration could improve the productivity of this site. Invertebrate monitoring at historic sites could help inform our knowledge of where to prioritise riparian tree planting for improved productivity.**

-Fish counter improvements planned by SSE, and Farrar genetics work should help us understand if the patchy distribution of fry and parr on the U. Misge is due to low spawner numbers.

-A walkover on Allt Innis a Mhuilt to the confluence with the Farrar did not highlight any barriers to salmon. The Allt Coire Mhuillidh continues to improve.

-**Continued sediment management (at the spout, other intakes and below Beannacharan dam) is necessary to ensure spawning and juvenile substrate is available further down the sub-catchment.**

-There were an absence of eels at Farrar site NEPS21_0294 despite bouldery habitat being present. This site is above 3 hydro dams. Exploring possible options for improved glass eel and elver passage could result in better utilisation of this habitat and wider benefits to the river ecosystem.

<u>Glass</u>

-Surveying the mainstem Glass for the first time highlighted how good the spawning habitat is there (uncompacted, prevalent) with good-excellent numbers of fry being found throughout. Parr numbers were patchier, with five sites having moderate-poor parr numbers despite there being good habitat available. Previous NEPS surveys (in 2018 and 2019) have shown the A. Deabhag to be below carrying capacity and it will be useful to see how these 2021 densities compare with the benchmark figures due to be generated by Marine Scotland to see if this appears to be the case for the wider R. Glass.

-The three sites done on the R. Cannich with extreme fry densities observed based on substrate availability suggests there is a hydro-morphology problem. **Further work is needed to identify exactly where the substrate stops further upstream of the road bridge and to identify a cause.**

-The single site done on the Affric also showed poor fry and parr numbers, reflective of a poor availability of substrate and **further work and electro-fishing is required here**.

-The Allt Loch Innis Gheamhraidh was dry when we surveyed NEPS21_0302, this may have been due to an abstraction rather than the ambient low flow levels.

-Sites NEPS21_0291 (downstream of Fasnakyle power station, parr in margins) and NEPS21 _0311 (downstream of R. Cannich, two-stage channel) show potential impacts of regulated flows on the river.

<u>Beauly</u>

-Of the two mainstem sites, fry numbers, despite being within the normal range (or better) for each site were found to be at moderate densities when compared to the rest of the catchment. Over stabilisation including compaction (with macrophyte growth) continues to be a negative factor at these sites.

-BRU2 had very low numbers of salmon fry (3/100m^2) relative to previous years (past average is 67/ 100m^2). It is possible that a large woody debris barrier may have prevented salmon access in autumn 2020 or that a pollution incident had occurred. **It is recommended that walkovers of all tributaries in the catchment are conducted in the summer-September of each year to identify and aid removal of any potential barriers ahead of the fish migration period.**

-NEPS21_0285 highlighted **overshading by beech trees and the potential for rhododendron control**.

-More mainstem sites should be included in future surveys (BE2 and 3) as mainstem lower Beauly are not currently included in the NEPS site selection.

-Whilst reccying NEPS sites, an impassable barrier to sea trout was found on Teawig burn. As it does not block more than 1.5km of habitat it would not qualify for WEF funding for remediation.

References

[1] J Gilbey, J Sampayo, E Cauwelier, I Malcolm, K Millidine, F Jackson & D J Morris (2021). A national assessment of the influence of farmed salmon escapes on the genetic integrity of wild Scottish Atlantic salmon populations. Scottish Marine and Freshwater Science Vol 12 No 12, 70pp. DOI: 10.7489/12386-1

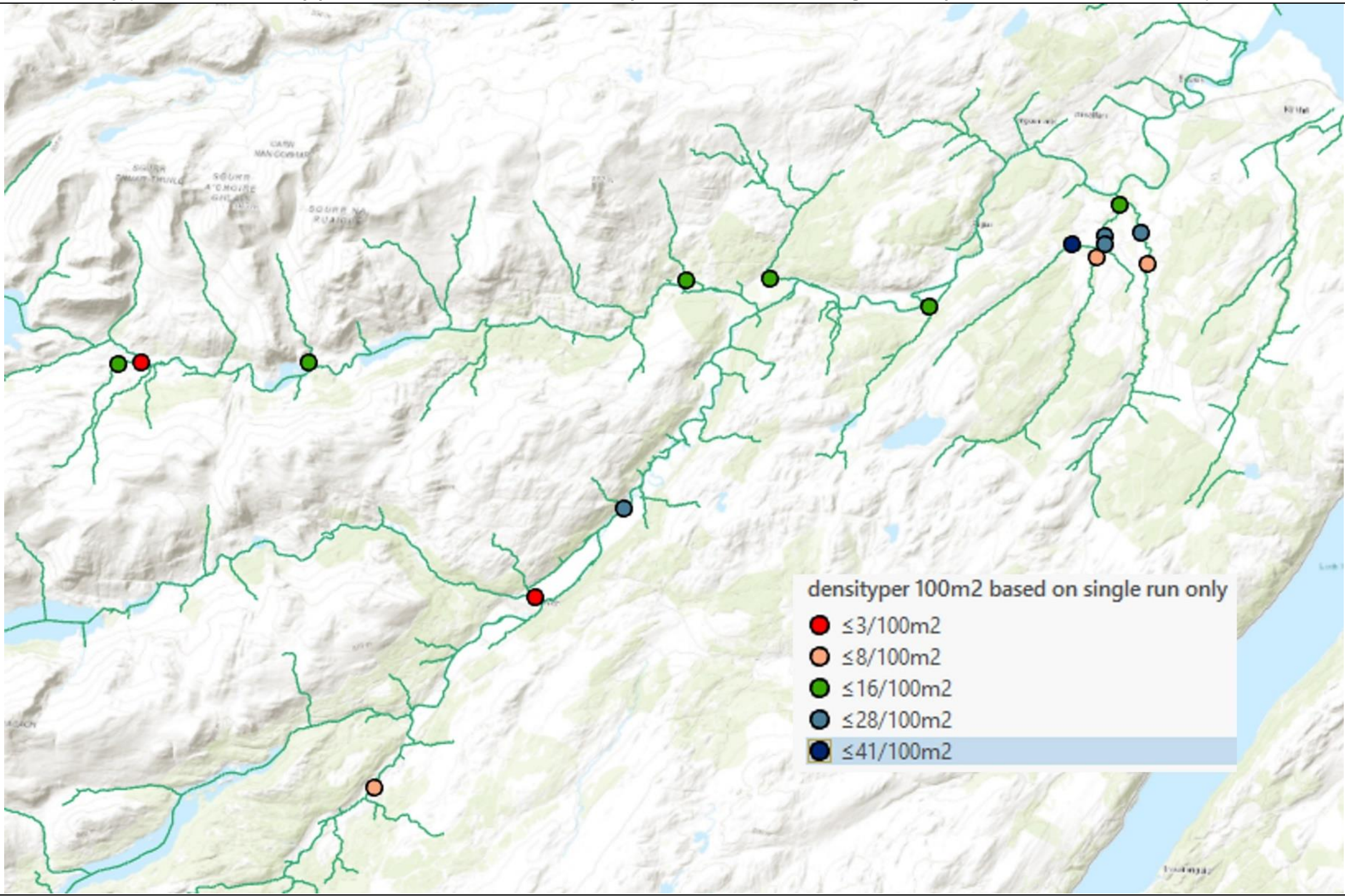
[2] Beauly Fishery Board 2020 Electrofishing report.

[3] McLennan et al (2021) Habitat restoration weakens negative environmental effects on telomere dynamics. Molecular Ecology 00: 1-14.

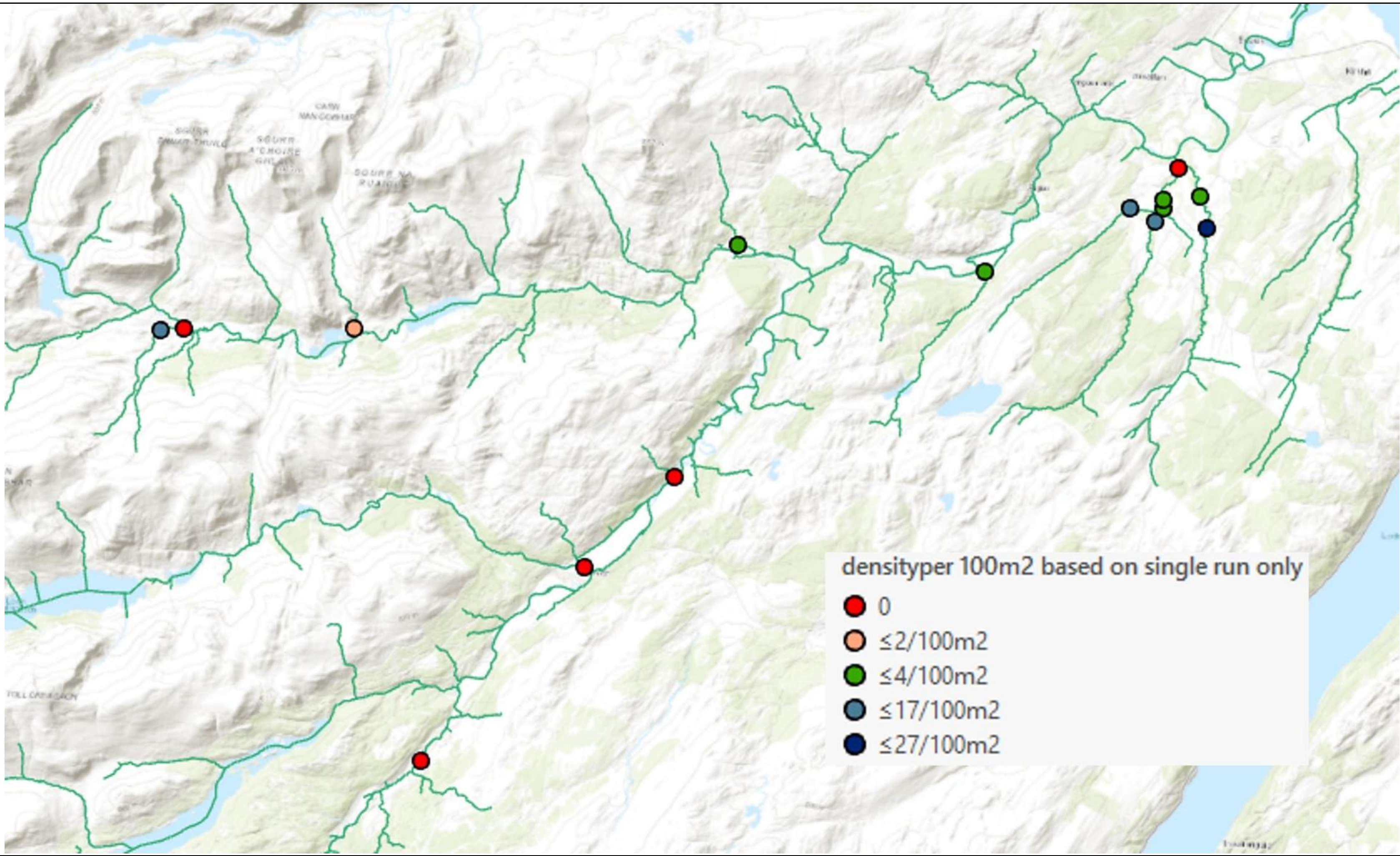
[4] Armstrong J.D. et al (2003) Habitat requirements of Atlantic salmon and brown trout in rivers and streams. Fisheries Research 62: 143-170.

Appendix 1- Maps showing Minimum Juvenile trout density per 100m^2

Map 1C: **Overview of Trout fry (minimum density per 100m2) found in 2021. Only sites where trout might be expected are included here (rivers <10m wide).**



Map1D: **Overview of Trout Parr (minimum density per 100m2) found in 2021. Only sites where trout might be expected are included here (rivers <10m wide).**



Appendix 2- Full results table, 2021 Electro-fishing data

2021 Electro-fishing data

Management Unit	Site Name	Date	Area (m2)	Minimum density Salmon parr per 100m2	Minimum density Salmon fry per 100m2	Minimum density Trout parr per 100m2	Minimum density Trout fry per 100m2	Salmon parr habitat	Comments
Farrar	Beauly_NEPS21_0271	26/08/21	126	29.4	102.4	1.6	5.6	poor	D/s Loch a Mhuillidh. Bouldery, compacted
Glass	Beauly_NEPS21_0272*	20/07/21	192	0	7.3	0.0	0.0	moderate	Glass, Carnoch. No depletion, fish too small/ inefficent survey
Farrar	Beauly_NEPS21_0273*	14/09/21	100	16	45	0.0	0.0	good	u/s bottom of island. Cob/bol armoured, gravel underneath, over-stable. Rare caterpillar.
Glass	Beauly_NEPS21_0275	26/07/21	129	17.1	81.4	0.0	1.6	good	Glass, Kerrow.
Glass	Beauly_NEPS21_0276*	26/07/21	149.31	0.7	42.4	0.0	0.0	good	u/s Locket's pool.
Farrar	Beauly_NEPS21_0277*	07/09/21	101.25	5.9	52.3	0.0	0.0	moderate	u/s Culligran burn, deep. Lots of minnows.
Glass	Beauly_NEPS21_0279	04/08/21	101	3	0	0.0	0.0	poor	R. Cannich d/s roadbridge. No flow, predominantly boulder
Glass	Beauly_NEPS21_0284	22/07/21	212.9	7	117.4	0.0	0.0	good	Glass, Kerrow burn lodge
Beauly	Beauly_NEPS21_0285	13/08/21	138	2.9	31.9	0.0	12.3	excellent	Bruaich, Beaufort castle
Glass	Beauly_NEPS21_0286*	30/07/21	124	8.9	89.5	1.6	12.1	good	A. Deabhag d/s Plodda lodge
Glass	Beauly_NEPS21_0288	27/07/21	194	0	0	0.0	0.0	poor	still backwater, far side of island, level with Lockets pool. Minnows, stickleback,eel.
Farrar	Beauly_NEPS21_0289	15/09/21	130	13.1	22.3	0.0	0.0	excellent	unstable, d/s Neaty burn.
Farrar	Beauly_NEPS21_0290*	18/08/21	100	10	89	0.0	0.0	good	Braulen cottage
Glass	Beauly_NEPS21_0291	27/07/21	123	8.9	37.4	0.0	0.0	good	d/s Fasnakyle PS. Parr found in shallow areas (RB), partly compacted
Farrar	Beauly_NEPS21_0293*	08/09/21	110	10.9	51.8	0.0	0.9	excellent	Inchmore, deep and strong flow, consistently missed fry
Farrar	Beauly_NEPS21_0294	18/08/21	100	44.0	34	0.0	0.0	poor	Inchvuilt
Glass	Beauly_NEPS21_0295*	03/08/21	111.44	50.3	219.8	0.0	2.7	excellent	R. Cannich, d/s Allt Coilte. Substrate supply= lots and lots of fish!!
Glass	Beauly_NEPS21_0298	27/07/21	129.95	3.8	4.6	0.8	0.0	poor	R. Affric, u/s Bothy cottage. lack of varied substrate
Beauly	Beauly_NEPS21_0301*	11/08/21	122.8	27.7	98.5	2.4	27.7	excellent	Bruiach burn, d/s Culburnie burn.
Glass	Beauly_NEPS21_0302	05/08/21	109.04	3.7	89.0	0.0	8.3	good	A. Deabhag above knockfin, shallow, fry
Farrar	Beauly_NEPS21_0303	25/08/21	136.42	8.8	9.5	0.0	0.0	moderate	U/s footbridge, compacted
Glass	Beauly_NEPS21_0304*	21/07/21	132	1.5	34.8	0.0	0.0	moderate	d/s Glass burn, partly compacted, woody debris!
Glass	Beauly_NEPS21_0307*	05/08/21	148.09	5.4	187.0	0.0	0.0	excellent	u/s Cannich

2021 Electro-fishing data continued

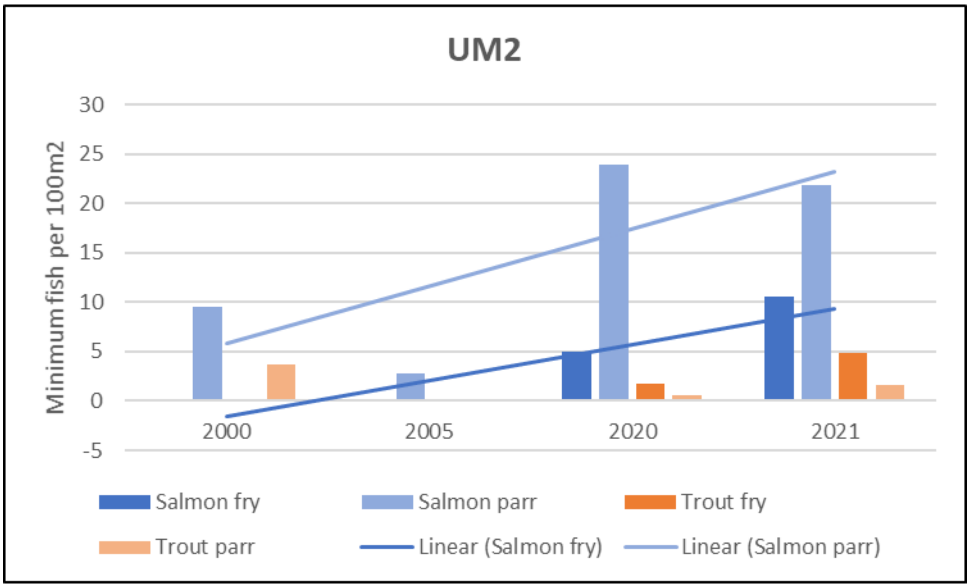
Management Unit	Site Name	Date	Area (m2)	Minimum density Salmon parr per 100m2	Minimum density Salmon fry per 100m2	Minimum density Trout parr per 100m2	Minimum density Trout fry per 100m2	Salmon parr habitat	Comments
Farrar	Beauly_NEPS21_0309*	06/09/21	109	1.8	61.5	0.0	0.9	moderate	d/s SEPA gauge. Compacted, sandy due to past landslide?
Farrar	Beauly_NEPS21_0310*	19/08/21	131.52	3.8	14.4	0.0	0.0	good	d/s ford, Braulen cottage. Silt dusting, site 78% deep pool and glide. Minnows.
Glass	Beauly_NEPS21_0311	24/08/21	122	9.8	86.9	0.0	2.5	excellent	d/s R. Cannich. 2 stage channel, water level rising fast!
Beauly	Beauly_NEPS21_0313*	17/08/21	115.09	8.7	63.4	4.3	23.5	excellent	Belladrum burn d/s road bridge.
Glass	Beauly_NEPS21_0314	20/08/21	100.55	37.8	116.4	1.0	1.0	good	A. Deabhag above R. Affric, good spawning substrate amongst boulders
Farrar	Beauly_NEPS21_0316*	08/09/21	137.19	10.2	27.0	0.0	0.0	excellent	Above sharp bend. Triangular site to avoid deep, fast pool. Culligran power station outage allowed survey.
Beauly	Beauly_NEPS21_0317*	16/09/21	111.2	33.3	161.9	2.7	21.6	excellent	Bruaich burn, d/s STW. Occassional globs of sewage fungus on rocks (<0.1% cover). White butterbur on both banks.
Farrar	UM2	26/08/21	124	21.8	10.5	1.6	4.8		Uisge Misgeach above remnant bridge
Farrar	UM5	25/08/21	161.6	5.6	48.3	3.7	2.5		Uisge Misgeach, above track bridge
Beauly	BE1	19/09/21	95.27	5.2	26.2	0.0	0.0		Beauly, u/s Lovat bridge
Glass	CAN1	29/09/21	208.56	2.9	3.4	0.0	1.9		R. Cannich, d/s roadbridge
Beauly	BE4	19/09/21	90.09	44.4	35.5	0.0	1.1		Beauly, d/s Kilmorack
Farrar	ACM2	26/08/21	124.28	32.2	26.6	1.6	12.9		Allt Coire Mhuillidh
Farrar	AIM3	25/08/21	115.46	20.8	3.5	16.5	15.6		Allt Innis a Mhuilt
Farrar	FAR2	07/10/21	109.2	39.4	66.8	0.0	0.9		Mainstem Farrar
Farrar	CULL1	07/09/21	72.88	5.5	113.9	2.7	13.7		Culligran burn
Beauly	CUL1	22/09/21	78.72	10.2	20.3	10.2	40.7		Culburnie
Beauly	BRU2	17/07/21	116.2	74.9	3.4	9.5	6.0		Bruaich burn, d/s bridge. V low fry numbers.
Beauly	BRE3	26/08/21	98.28	33.6	70.2	1.0	1.0		Teanassie
Beauly	BEL3	14/07/21	120.12	38.3	19.1	26.6	5.8		Belladrum
Glass	AD3	24/09/21	100.8	32.7	120.0	0.0	4.0		A. Deabhag above Knockfin bridge.
Beauly	ESK1*	30/09/21	103.51	8.7	20.3	2.9	13.5		Eskadale
Glass	GLAB1	22/09/21	102.37	6.8	43.0	0.0	28.3		Glass burn
Beauly	ERC1	29/09/21	127.5	10.2	8.6	2.4	11.8		Erchless burn
Glass	BEAULY_0675	24/09/21	179.93	13.9	61.7	1.7	5.6		Tomich

*=3 run (fully quantative)

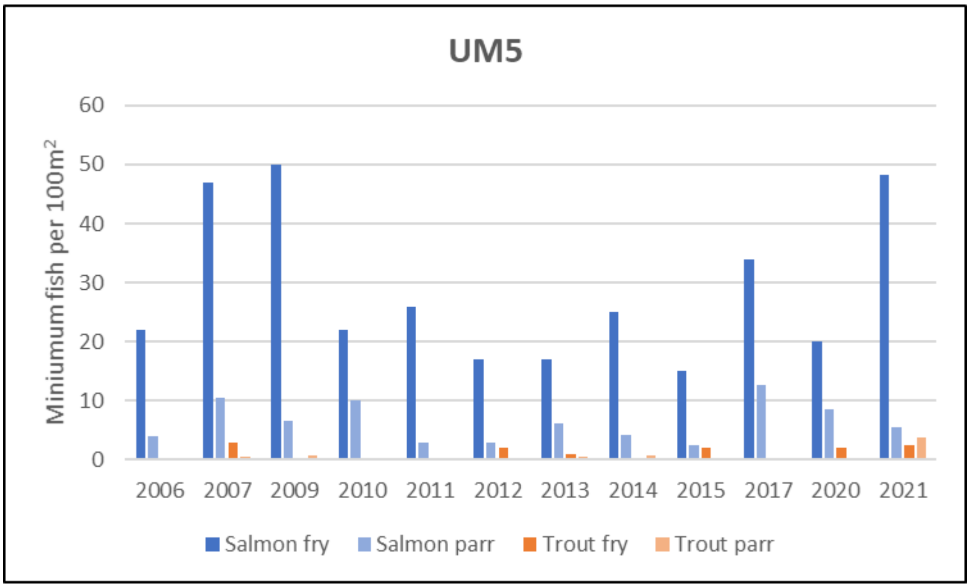
Appendix 3-Historic site Graphs showing minimum fish density per 100m2 over time.

Farrar

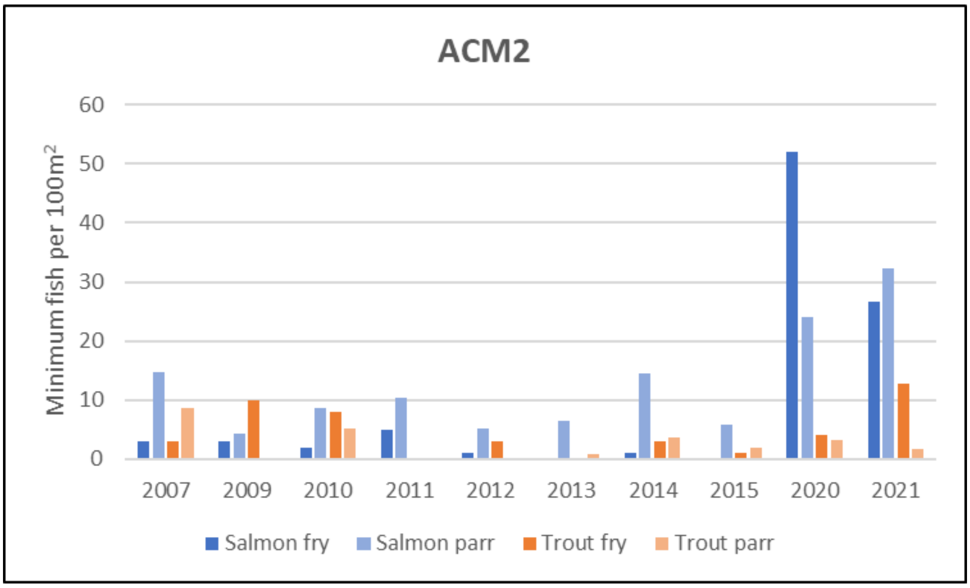
Uisge Misge- top site



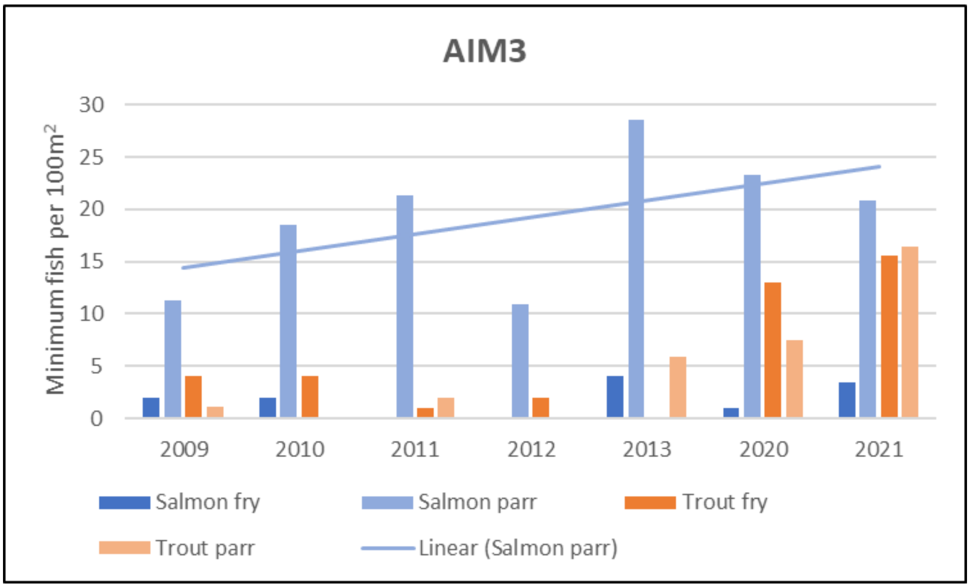
-above track bridge



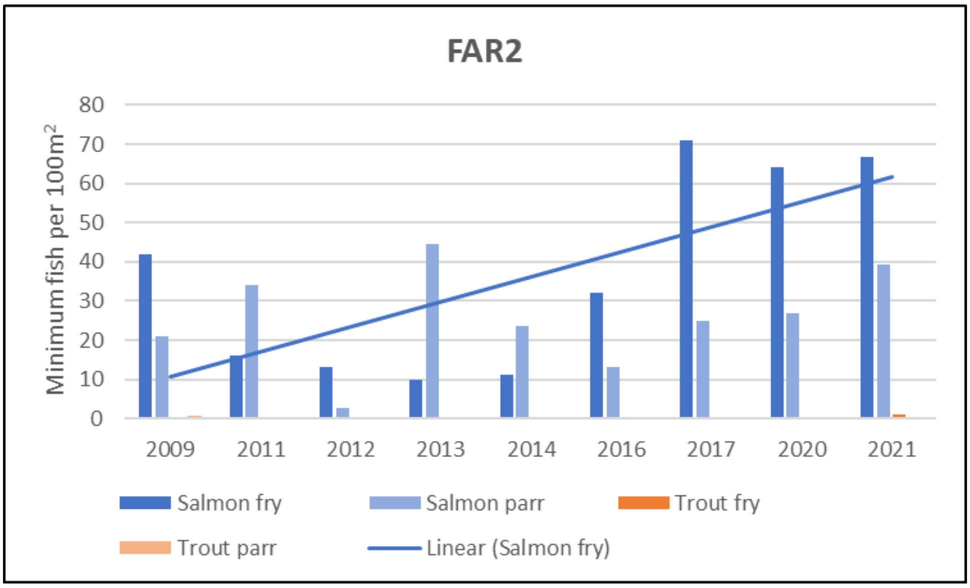
Allt Coire Mhuillidh



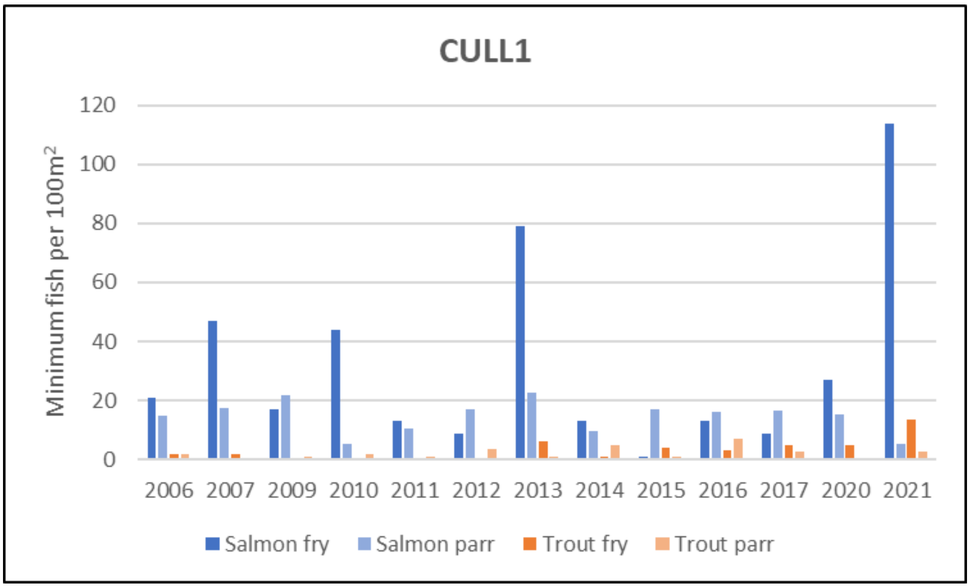
Allt Innis a’ Mhuilt



Mainstem Farrar

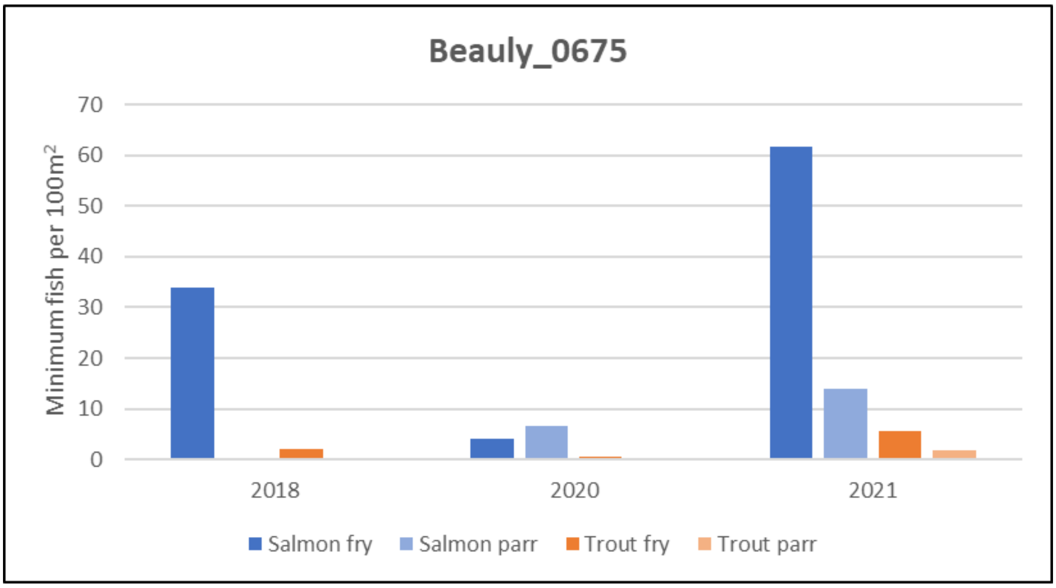


Culligran burn

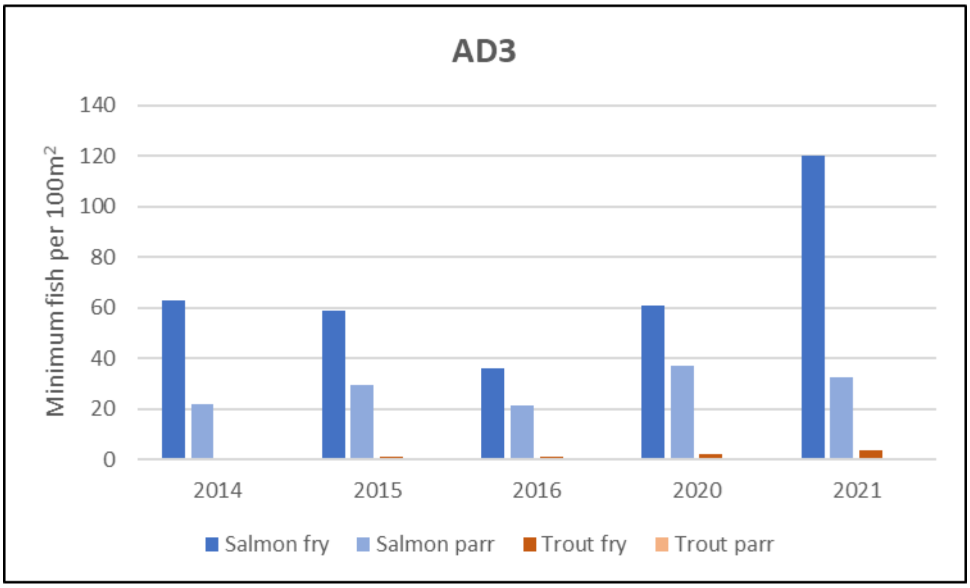


Glass (including Cannich):

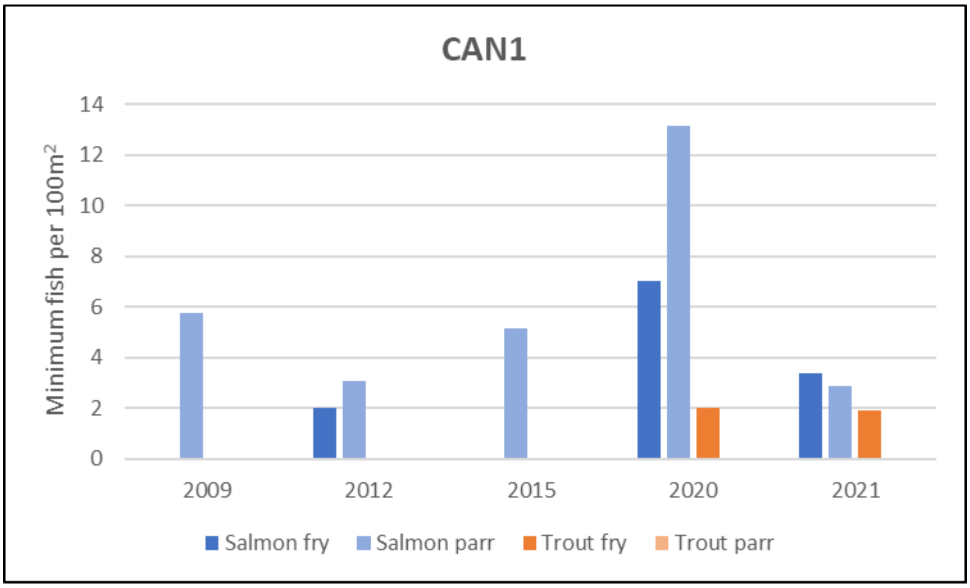
Abhainn Deabhag- above Plodda cottage



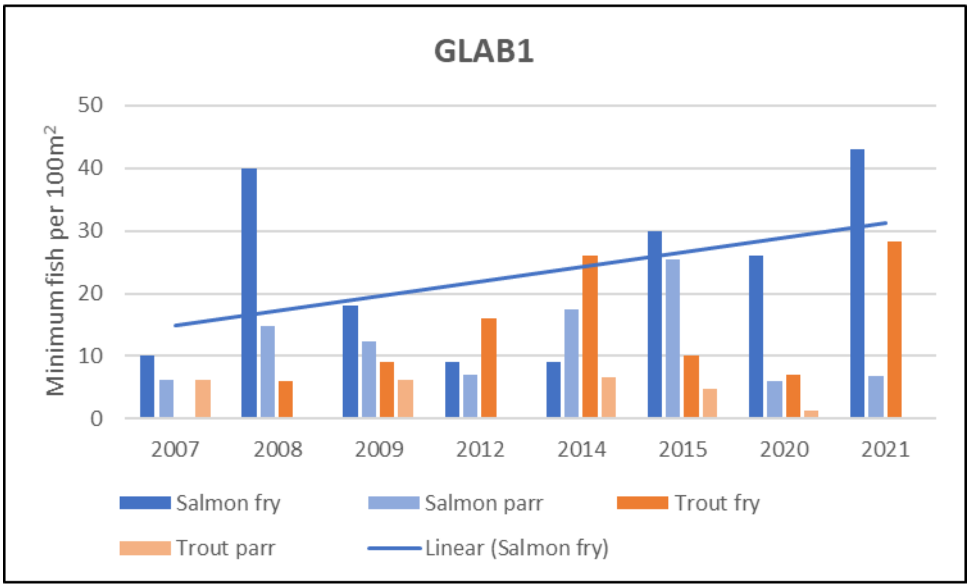
-above Knockfin bridge, Tomich



R. Cannich- below road bridge

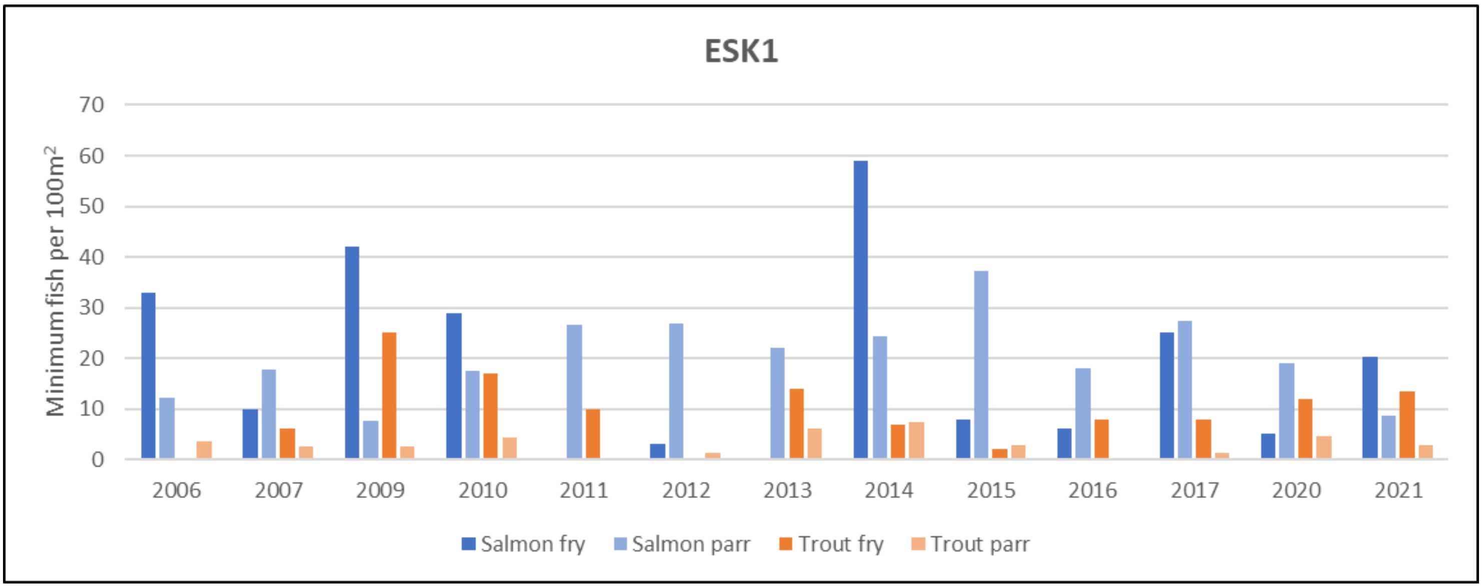


Glass burn

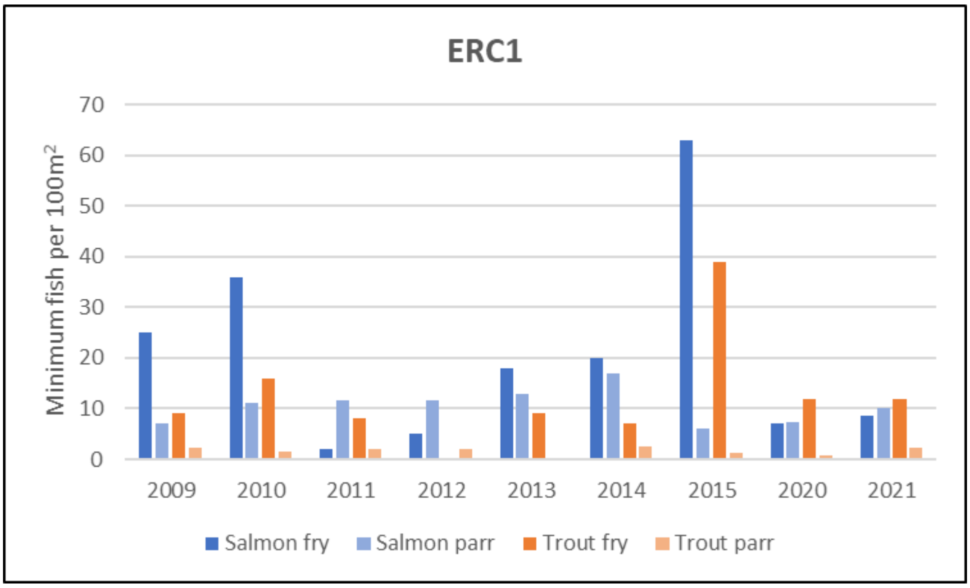


Beauly:

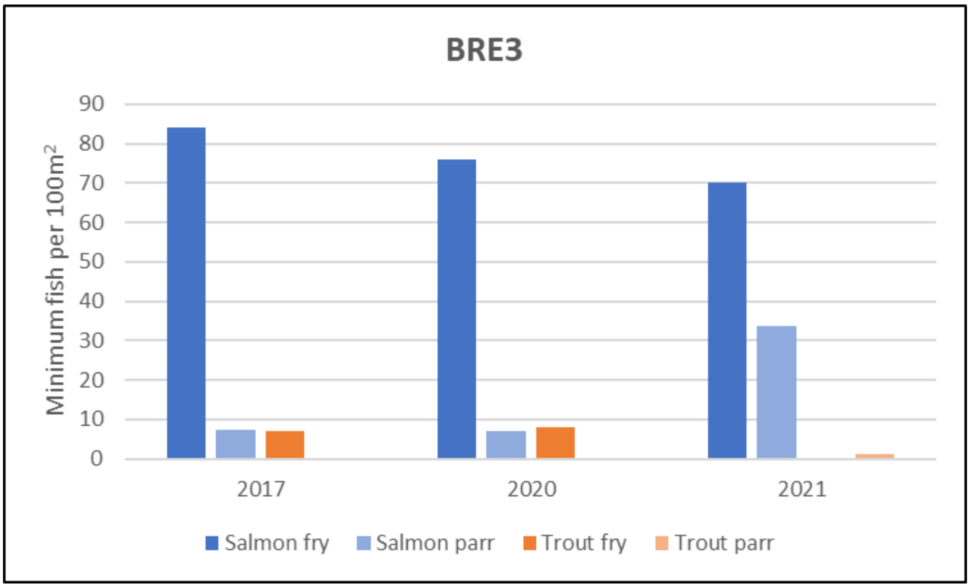
Eskadale



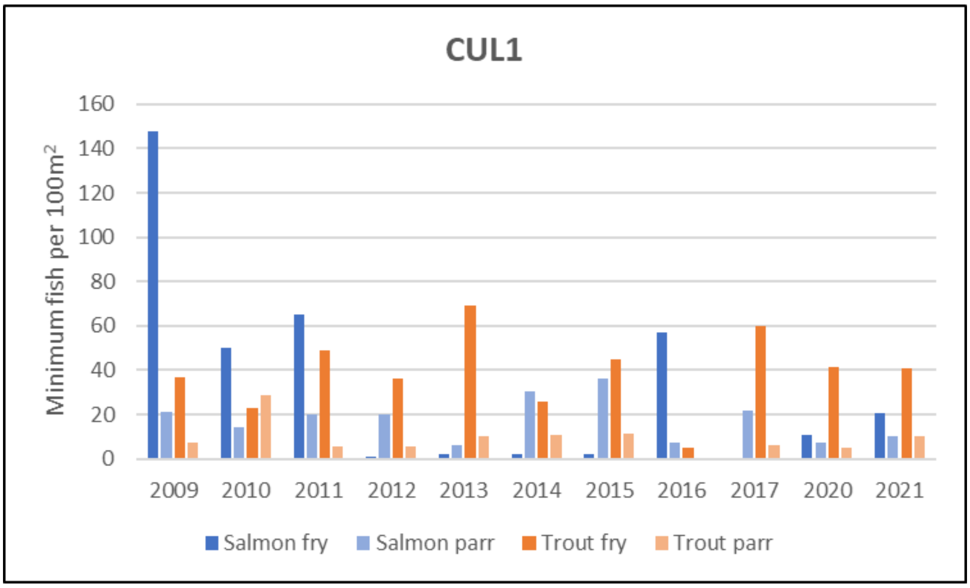
Erchless burn



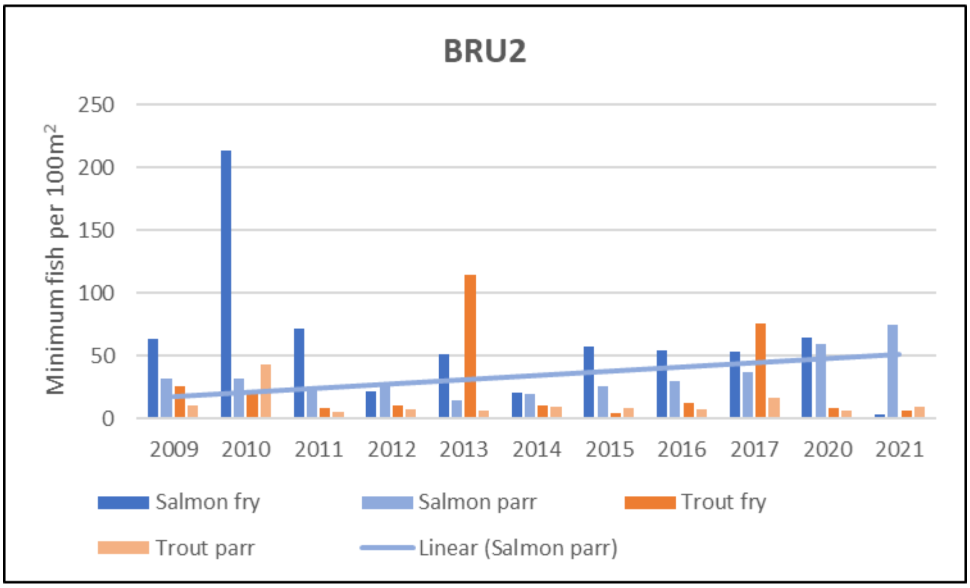
Teanassie burn



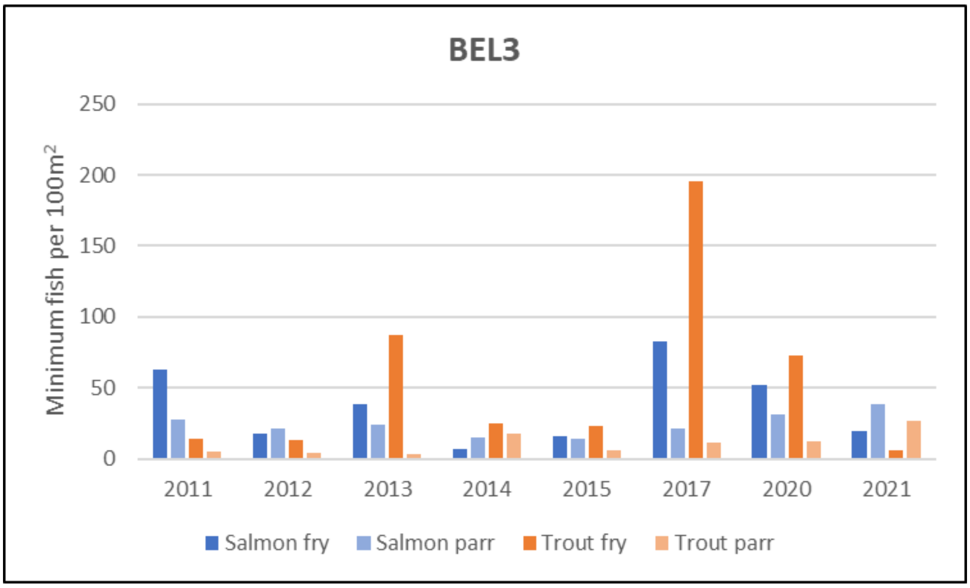
Culburnie burn



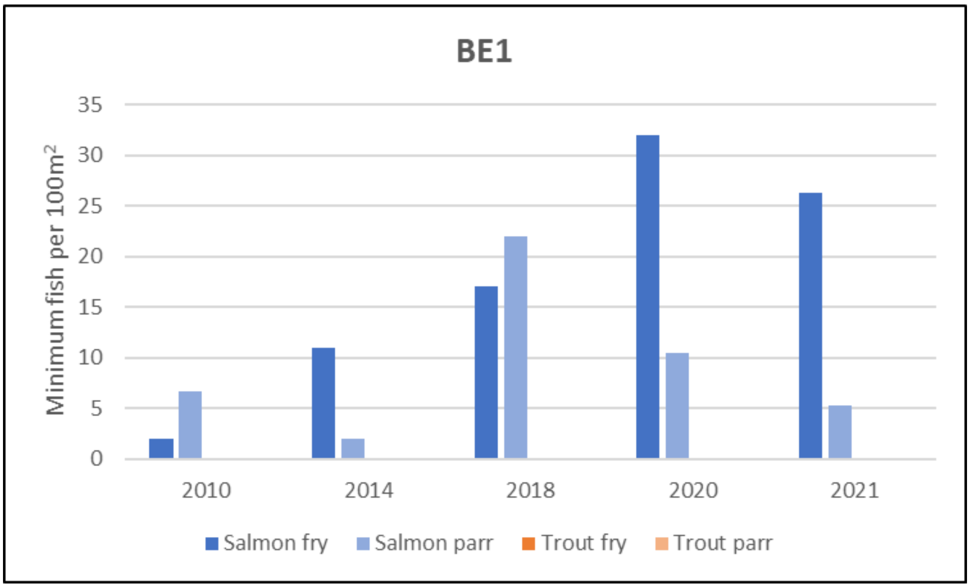
Bruaich burn



Belladrum burn



Beauly mainstem- riffle above Lovat bridge



-riffle downstream of Falls hut, Kilmorack