Managing Riparian Habitat for the benefit of Atlantic Salmon (Salmo salar)

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INTRODUCTION

The river Irfon is a 293km² sub-catchment draining the Cambrian Mountains in mid Wales before flowing into the river Wye at Builth Wells. The land use within the Irfon is predominately livestock farming (74%) with a significant part of the upper catchment in commercial coniferous forestry. The Irfon Special Area of Conservation (ISAC) project is a €1.6m initiative to bring salmon into favourable conservation status within the Irfon part of the Wye SAC. It is funded by LIFE+, Natural Resources Wales (NRW), the Wye and Usk Foundation (WUF), National Museum of Wales and the Rivers Trust. In addition to work to correct acid waters in the upper reaches, the project improved the riparian habitat of the SAC designated tributaries at a cost of £480K.

The section of the Irfon catchment that was targeted for habitat restoration supported a strong population of salmon prior to the project commencing, with a mean density of 0.48/m².

It has long been recognised that quantity and quality of habitat is a determining factor in the survival of juvenile salmon. Drawing conclusions from previous attempts to improve populations by managing habitat have been compromised due to inadequate monitoring (in both scope and duration), other limiting factors operating on the population (e.g. lack of spawning adults, poor water quality etc.) and the inability to discount any local rise in numbers at the expense of the whole population due to immigration into the improved section.

WUF has been improving stream corridors since 1998 and has now completed 272km throughout the Wye and Usk catchments. Periodic monitoring combined with observations of the evolvement of the stream corridor post cessation of stock grazing suggests that it takes 5-7 years for these upland channels to narrow and 'roughen up' and that the response of the fishery has been proportional to this roughening. Building on some experimental work in the Usk, this project tested whether the addition of channel roughening to the prescription would give more immediate benefits to the fishery.

MONITORING

A monitoring programme was established by the ISAC project in 2010 to quantify the distribution of SAC features (Salmon, Bullhead, Lamprey) within the system and assess the effects of the project.

From this programme, 7 quantitative and 26 semi quantitative sites were selected. The criteria for these sites was that they were outside the acidified section of the catchment and supported a density of juvenile salmon of 0.2/m² at some point during the project. 18 of these sites had recent historic data.

The sites were established independently of the work plan. By the end of the 3-year improvement programme, 13 sites fell within improved reaches and 19 sites remained as controls. One site was discounted from the analysis in 2013 due to a cattle drinking point being established in the middle of it by the project.

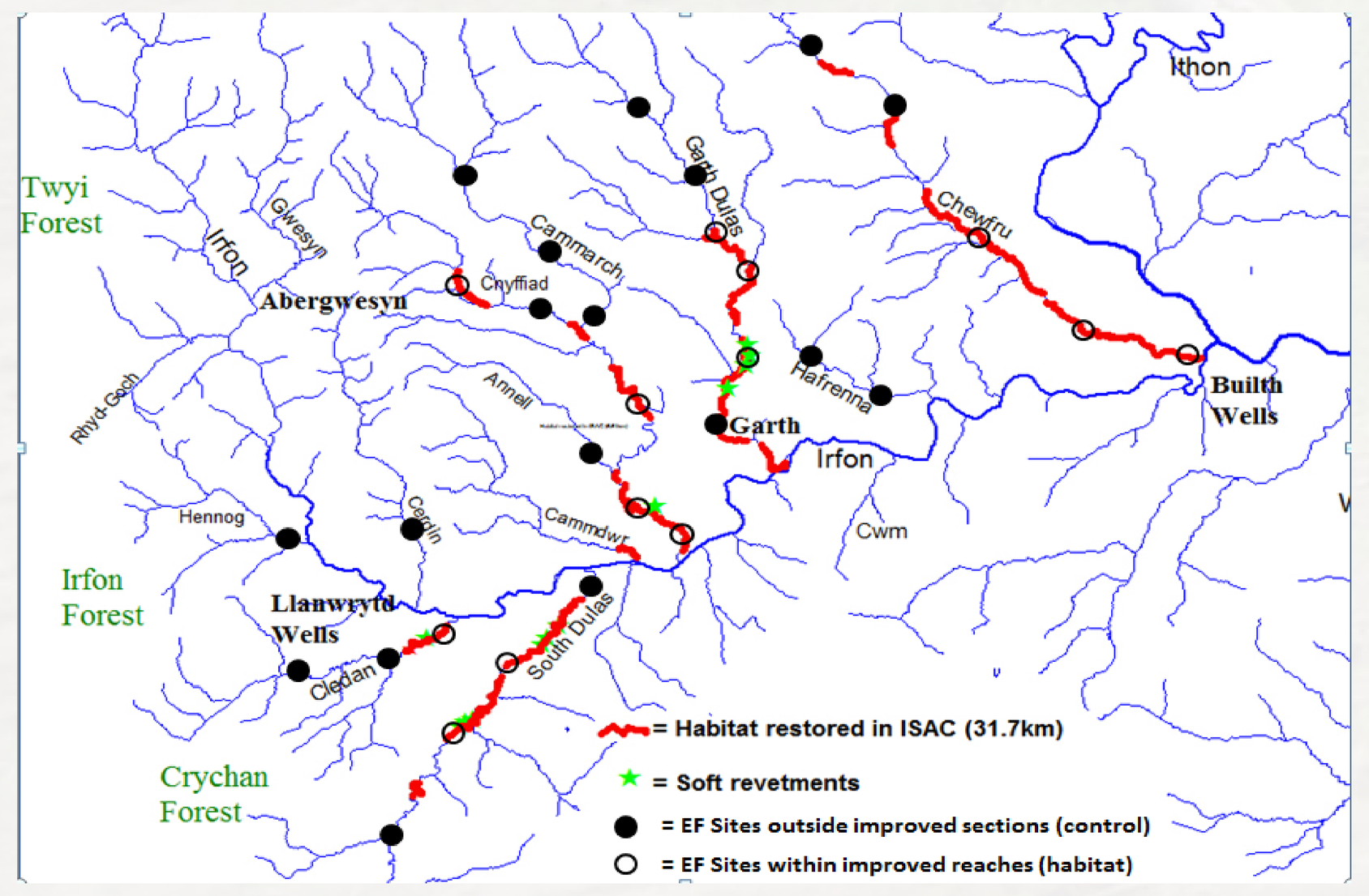

Figure 1. Distribution of habitat works and monitoring sites within the Irfon catchment.

METHODOLOGY

A walk-over survey in 2010 and analysis of recent electro-fishing results allowed reaches of degraded habitat to be identified. After gaining consent from landowners, a prescription was applied. This, depending on local need, included adding lateral riparian cover (pleaching and pinning alder, hawthorn, hazel and willow into the river's edge), stock exclusion and targeted coppicing of over-shaded sections as advocated by O'Grady et al. (1993). The aim was to increase habitat diversity, the amount of instream cover and the diversity of channel structure. By improving long reaches on each of the streams (mean 6.1km) and comparing both control and restored sites annually to a baseline established in 2010, it was possible remove the natural, annual variation and discount local immigration from the analysis.

Figure 2. A section of the Chwefru, shortly after completion of the prescription.

RESULTS

31.7km of tributary was improved in the project.

At a local scale juvenile salmon numbers increase significantly (fig. 5) at the sites where heavy intervention had occurred eg. fig. 2 and 4.

Within an improved reach the degree of intervention varied from intensive (e.g. fig. 2 and fig. 4) to zero: where the reach encompassed short sections of natural un-impacted habitat with no scope for local improvement.

By comparing each year's results for a site with the 2010 baseline and assessing whether densities have increased or decreased the effect at a reach scale has been assessed. The populations of sites in reaches improved performed in a significantly (P>0.99) different way to the normal behaviour of the control sites, as shown in fig. 6.

Both the sites that had material pleached or pinned into them and those that were within improved sections but had little local intervention improved (fig. 7.). The overall population of juvenile salmon increased by a mean of 0.52 fish/m² (123%) in the improved reaches compared to an increase of 0.08 fish/m² (16%) in the control reaches over the duration of the project (fig. 8).

The mean width of the improved reaches was 6.4 metres so this equates to an additional 1.5 million wild juvenile salmon over the expected life span of the improvements.

Figure 3. Garth Dulas at Dolderwen in 2010 before work

Figure 4. Garth Dulas at Dolderwen in 2013, 3 years after Hawthorn revetment and stock exclusion.

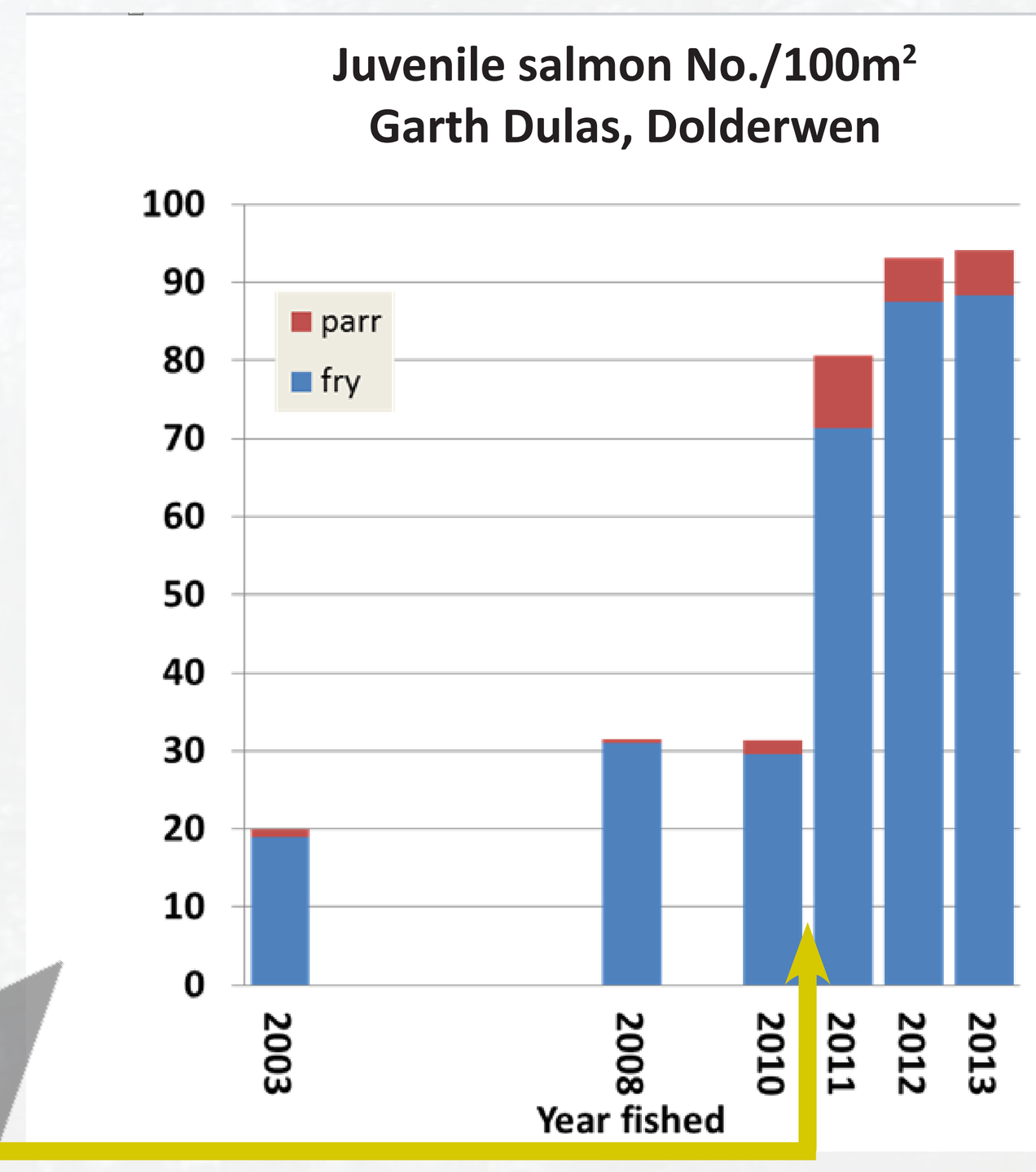

Figure 5. Effect of Dolderwen work on density of juvenile salmon.

Work was carried out in autumn 2010.

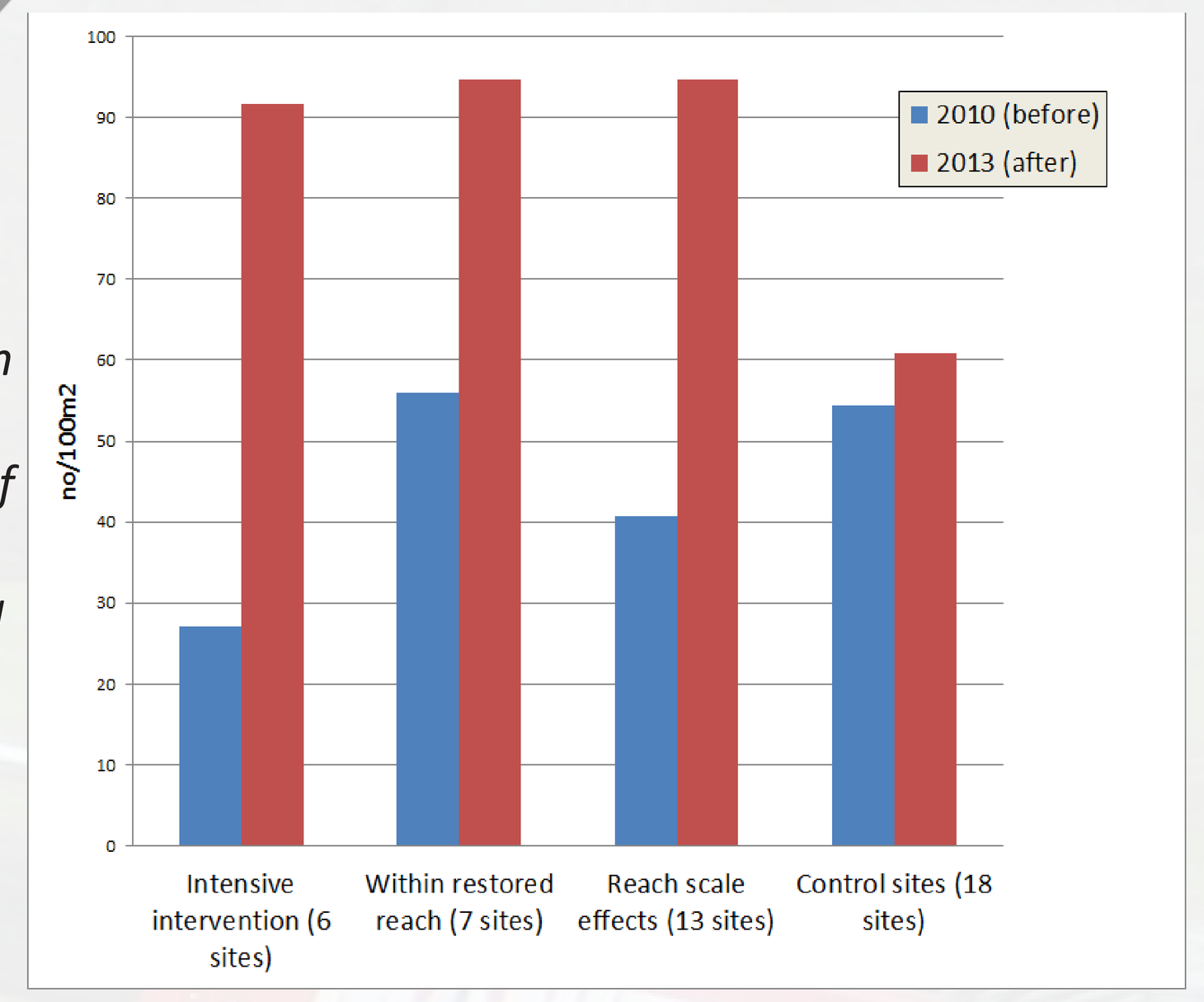

Figure 7. Breakdown of mean densities of salmon in study area

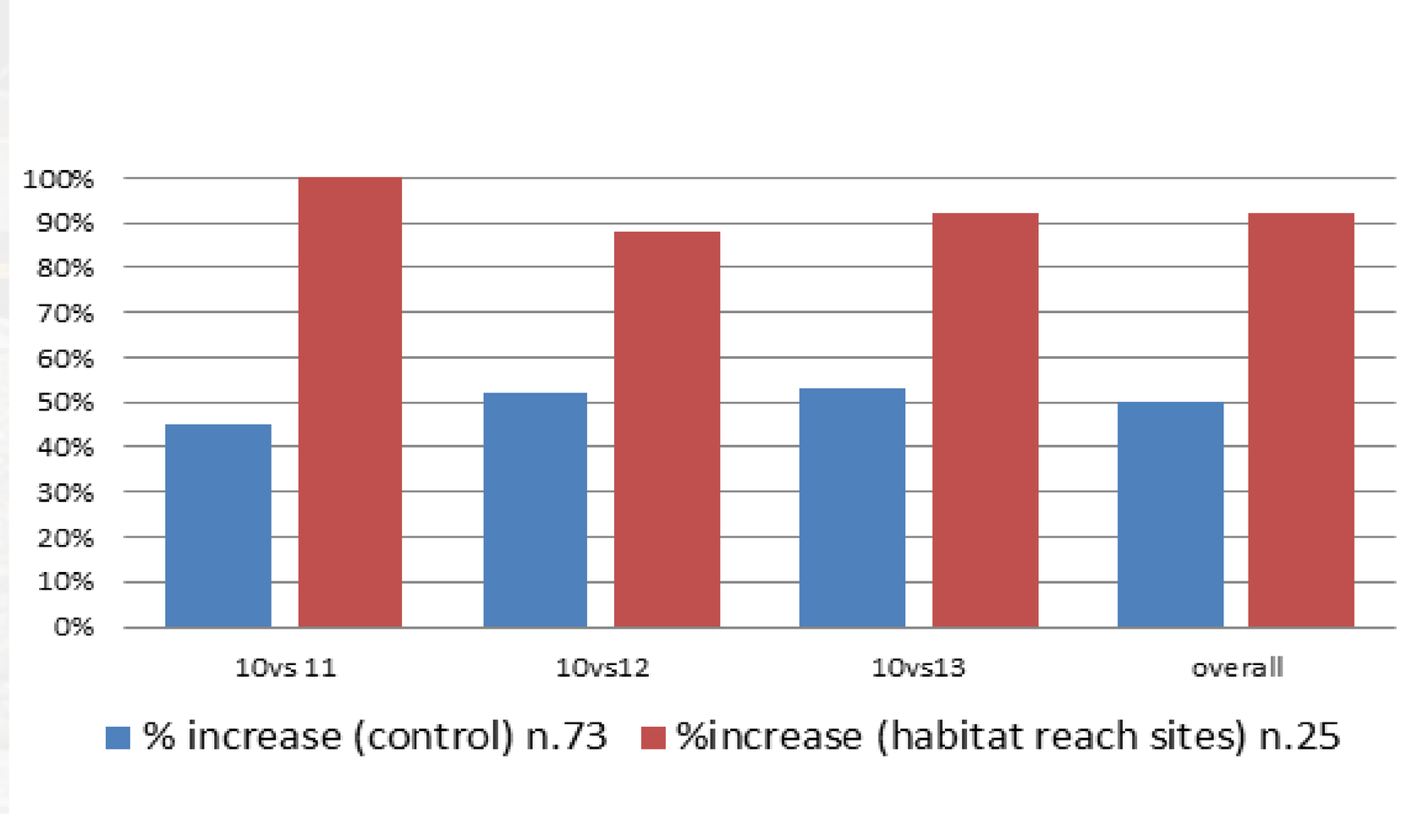

Figure 6. Behaviour of all sites compared to 2010 baseline

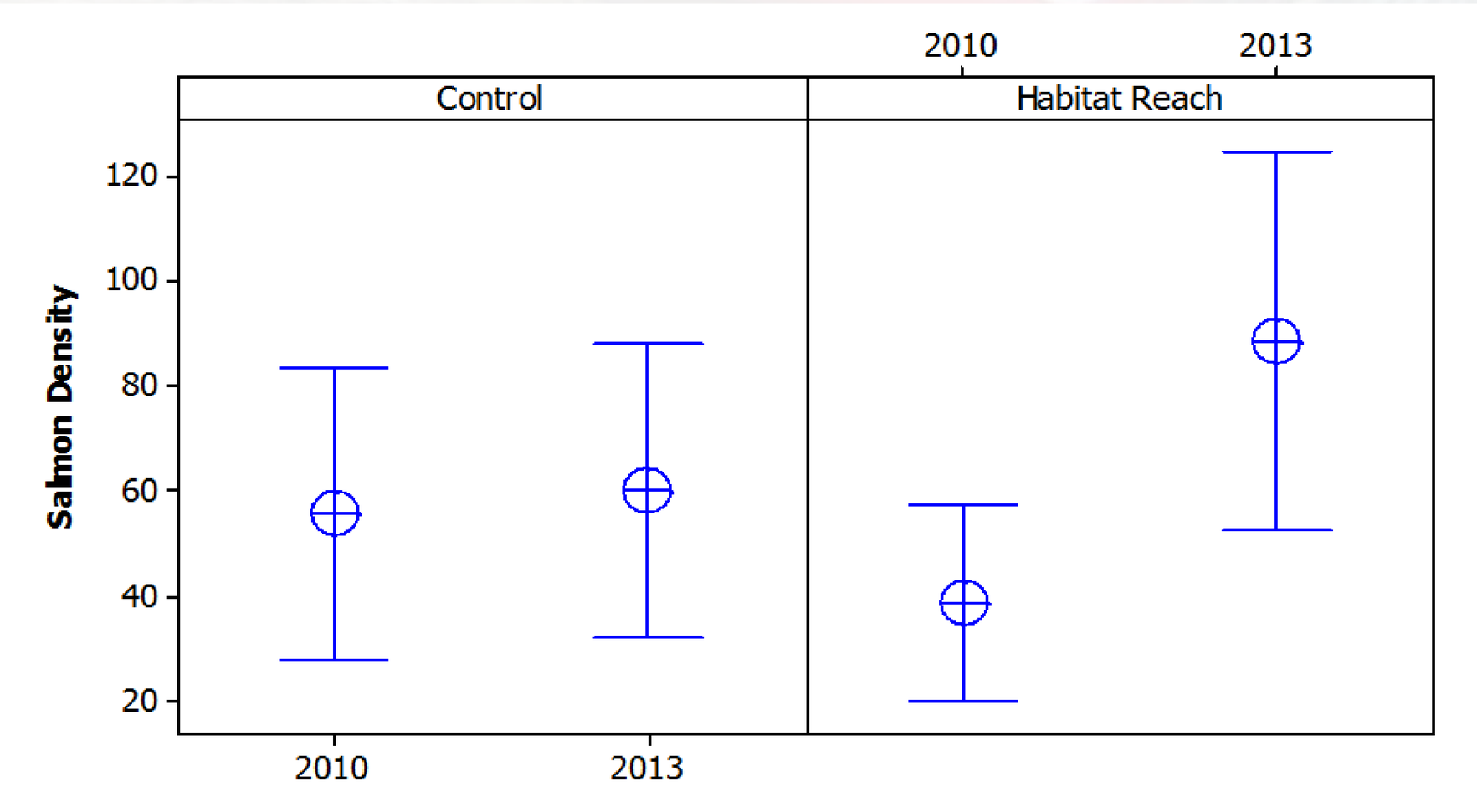

Figure 8. Mean density in control and habitat improved reaches (95% CI for the mean).

CONCLUSIONS

- Habitat restoration for salmon fisheries has often been done where habitat is not the limiting factor and/or at a scale that does not take into account all juvenile life stages. By targeting a catchment where habitat was the limiting factor and addressing the issue there has been a strong response in the salmon population.
- High energy upland streams respond more slowly than lowland streams to the cessation of grazing the riparian vegetation.
- The addition of lateral cover had a direct effect of fish populations. At a local scale sites operating at density dependence responded to the habitat prescription by an average of 0.64 juvenile salmon per m².
- At a reach scale, significant enhancement of salmon populations by improving habitat at all the sites within that reach that require work, appears to be possible.
- The causative relationship has yet to be determined. The work has improved habitat structure, reduced rates of sediment loss from the riparian zone to the river channel and reduced opportunities for avian predators.

FURTHER INFORMATION

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