

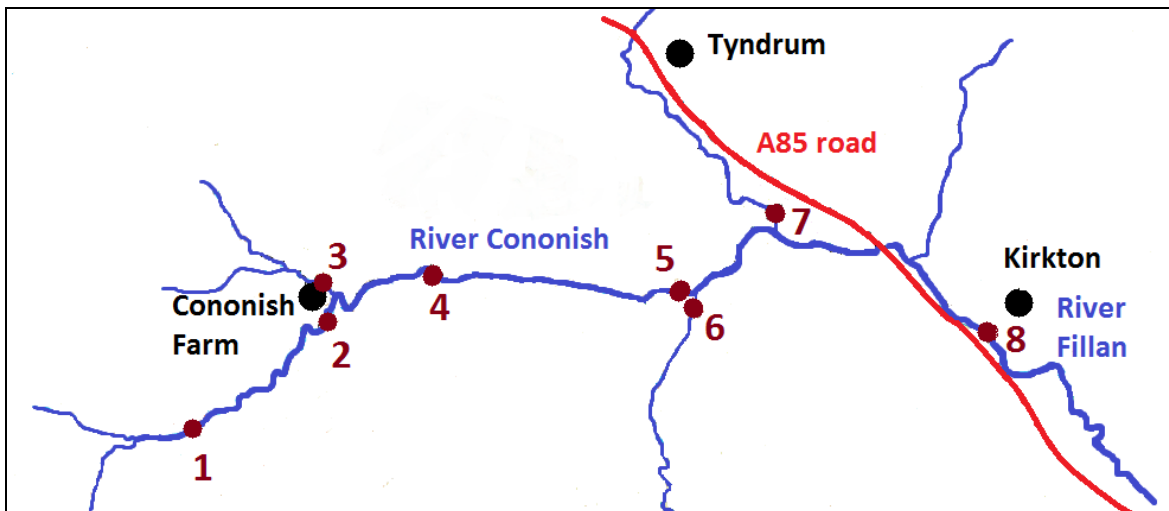
RIVER CONONISH INVERTEBRATE SURVEY 2006

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Background

The Cononish, the upper reaches of the River Dochart, should be very important for spring salmon but surveys by the Tay District Salmon Fisheries Board dating back to at least 1992 have shown that numbers of naturally spawned juvenile salmon and trout are very low compared to the nearby River Fillan, the name by which the lower reaches of the Cononish is known. Salmon fry of local origin that have been stocked into the area have not survived well. It has been suggested that this may in some way be related to water quality. Therefore a survey was undertaken in 2006 to look at the invertebrate (insect) community in the Cononish, its tributaries and the upper reaches of the River Fillan. Such surveys are most useful in the first instance because, in addition to being good indicators of overall water quality, freshwater invertebrates are of course also the most important food source for fish.

Invertebrates were collected from eight locations ranging from site 1 in the upper reaches of the Cononish to site 8 on the Fillan (see figure below). The invertebrate samples were collected in April, July and August 2006, using a standard sampling protocol. This involves three minutes vigorously kicking of the riverbed while holding a collecting net in a position where the animals, dislodged from the stones and sand, are carried by the current into the net. This was followed up by a one minute manual boulder search. Insects caught in the net were immediately transferred to plastic containers and later processed in the lab.



The insects were mainly collected in areas with medium to fast water flow, and the riverbed consisted of a mixture of smaller (pebble & cobble) and larger (boulder) substrate. All areas where insects were collected were considered to be suitable habitat for juvenile salmon.

A juvenile electric fishing survey was also conducted at four of the eight insect survey sites on 18 August 2006 in order to relate invertebrates to fish production. All of the sites fished are naturally accessible to salmon with spawning gravel present nearby but, at two of them,

unfed salmon fry had been stocked in the spring to augment the natural stock in order to saturate the available habitat. These fry were the progeny of adults obtained from the River Fillan which had been reconditioned by Fisheries Research Services

Insect surveys

Insect numbers and groups varied greatly between individual sites and sampling dates (Figure 1). For most sites the highest insect numbers were found in April when between 90 and 440 insects were recorded in the samples. At that time the highest numbers were found in the samples taken in the lower half of the study area. Mayfly species were particularly prominent in the April samples at those sites. The upper three sampling sites (situated upstream of Cononish Farm) contained relatively very few insects. While *Baetids* (free swimming “agile darter” type of larvae) dominated the mayflies in the lower sites in April, *Heptagenids* (flattened stone clinging larvae) were the dominant type of mayfly upstream.

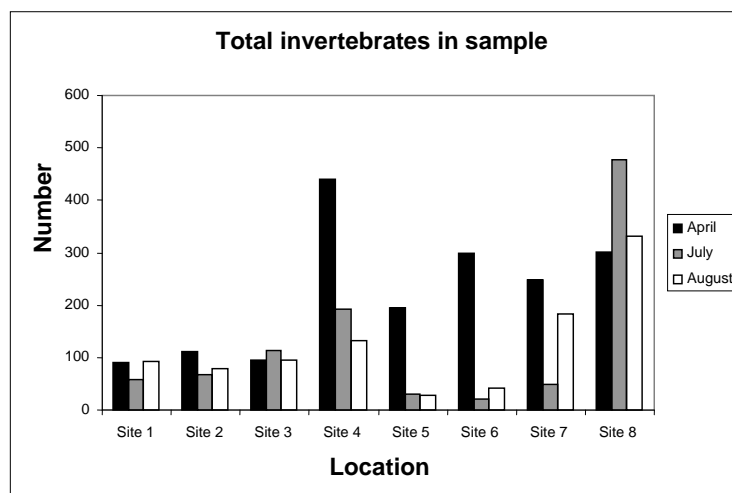


Fig 1: Total numbers of invertebrates caught at each site

On re-visiting the sites three months later the overall insect abundance had changed relatively little in the relatively poor sites upstream of Cononish Farm (sites 1 – 3) but it had decreased greatly in all lower sites except for site 8, i.e. the River Fillan (Figure 1). In fact more invertebrates were found in the one sample from the River Fillan than all other July samples combined, but most of these were chironomids (midges) which were relatively scarce elsewhere (Figure 5). The general drop in abundance was especially caused by a drop in mayflies (Figure 2), as expected for these as a high proportion would have been either at the adult or egg stage of their life-cycle.

As it was felt that the insect numbers in the upper sites were still extremely low, it was decided to revisit the sites again in August but there were only minor differences between the insects in the July and August samples, i.e. insect numbers remained very low except in the two lowermost sites (Sites 7 & 8).

Although overall insect numbers were very low at most of the sites, there was still a fairly high insect diversity (Figures 2 to 5). The main insect groups expected to be found in stony,

upland rivers like the Cononish were present, such as mayflies, stoneflies and caddis larvae, as well as midge larvae, beetles, and worms suggesting the sites could nearly all be considered to be good or very good in terms of water quality.

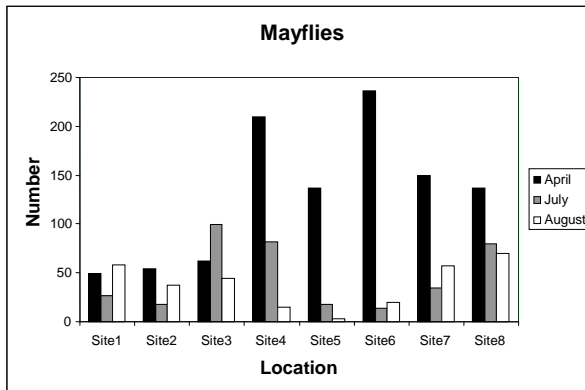


Fig 2: Mayfly larvae samples

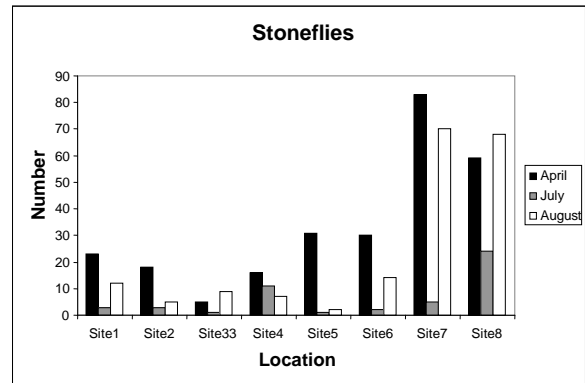


Fig 3: Stonefly larvae samples

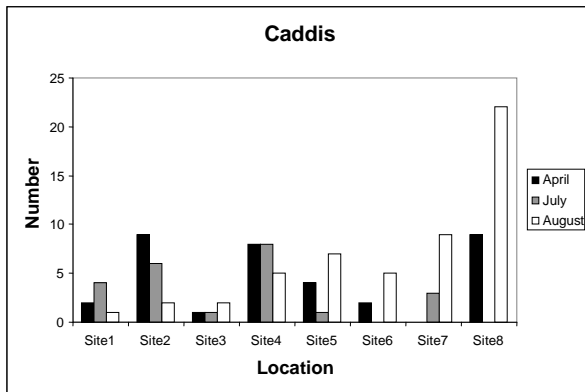


Fig 4: Caddis larvae samples

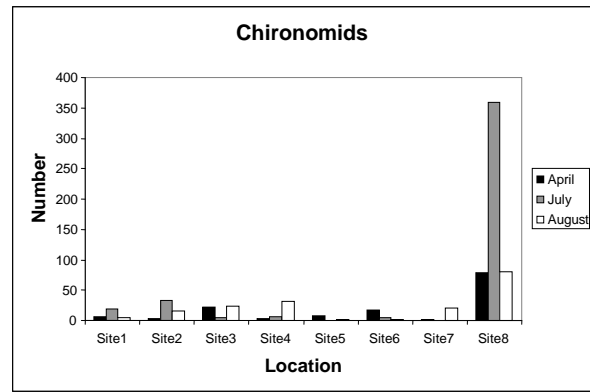


Fig 5: Chironomidae larvae samples

Fish surveys

On electrofishing on 18 August salmon fry were found at all four sites surveyed but no salmon parr were found at the topmost site (Table 1). Salmon fry were most abundant at the downstream sites. The best site (River Fillan, site 8) had not been stocked but sites on the Cononish were much poorer, even the one which had been stocked. However, fry growth rates were relatively high for upland Scotland. 45 – 50 mm would rather be the norm in the neighbouring River Lyon catchment for example.

Table 1: Results of electric fishing 18 August 2006

Site Code	Density* salmon fry (per 100 sq. m)	Density* salmon parr 1+ (per 100 sq.m)	Mean length salmon fry (mm)
Site 2 (Cononish, above farm)	18.8**	0	60.8
Site 4 (Cononish below farm)	13.4	2	64.2
Site 7 (tributary Crom Allt)	71.4**	2	50
Site 8 (Fillan at Kirkton)	93.8	1	60.7

* Minimum density based on one electric fishing pass

** Sites where salmon fry had been stocked to augment natural spawning

Discussion

Although insect abundance in the River Cononish and Cononish tributaries was generally low, the relatively high diversity of insect groups in the samples result in the Cononish being classified as a water body of good water quality. Since most of the main insect groups expected were present there appear to be no obvious indications of water quality problems.

The clear dip in insect abundance in July, and to some extent August, is not unusual as a high proportion of invertebrates normally present in the watercourse are at the adult stage of their life-cycle (flies).

The reason for the low abundance of invertebrates in the upper Cononish is unclear. One possibility is that this is just a result of very low nutrient levels in the Cononish. The almost complete lack of chironomids in the Cononish samples supports this as chironomids are fairly typical of (slightly) enriched water but not that common in nutrient poor water. Large numbers of chironomids were caught in the River Fillan which had a higher conductivity and will be partly enriched by effluent from the ever expanding Tyndrum village.

Another contributor to the low insect abundance in the upper Cononish may be linked to the relatively unstable riverbed substrate in this area. Being on the main Scottish watershed this area has amongst the highest rainfall in Scotland and is subject to damaging floods. The frequency of these is increasing as both total rainfall and its intensity has increased in recent years may have resulted in even more movement of river bed substrate, leading to smothering and wash out of aquatic invertebrates. The relative abundance of Heptagenid mayflies, which are particularly adapted to fast flows, in the upper river perhaps reflects this.

The broad differences in abundance of insects parallels the broad differences in numbers of salmon fry, despite spawning gravel being present at all locations electric fished. Low numbers of salmon in the upper Cononish, even despite stocking, coincided with low numbers of insects. However, the growth rates of salmon are actually high for this type of

environment. Given it has both high growth and high densities, the Fillan is clearly a very productive environment for salmon and this has been borne out by previous surveys. Given that fry emerge in late spring and have been growing through the summer it seems likely that chironomids are sustaining the fry in the Fillan, but in the Cononish there seems to be relatively little food after the fry emerge. The high growth rates of the few fry in the Cononish may be a result of low competition amongst the survivors.

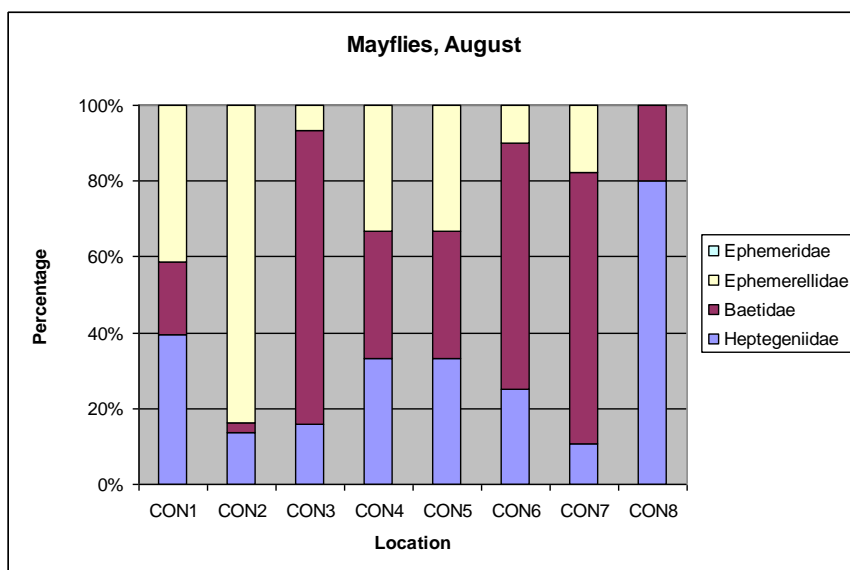
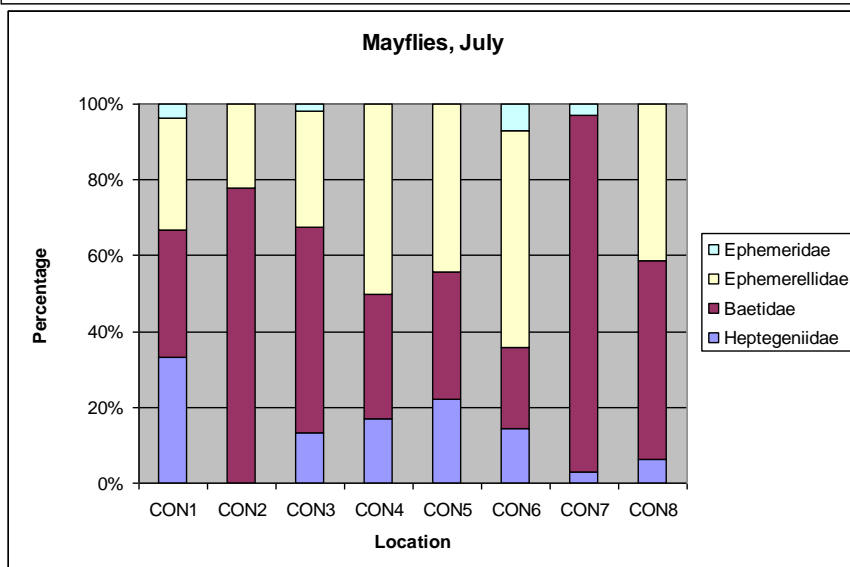
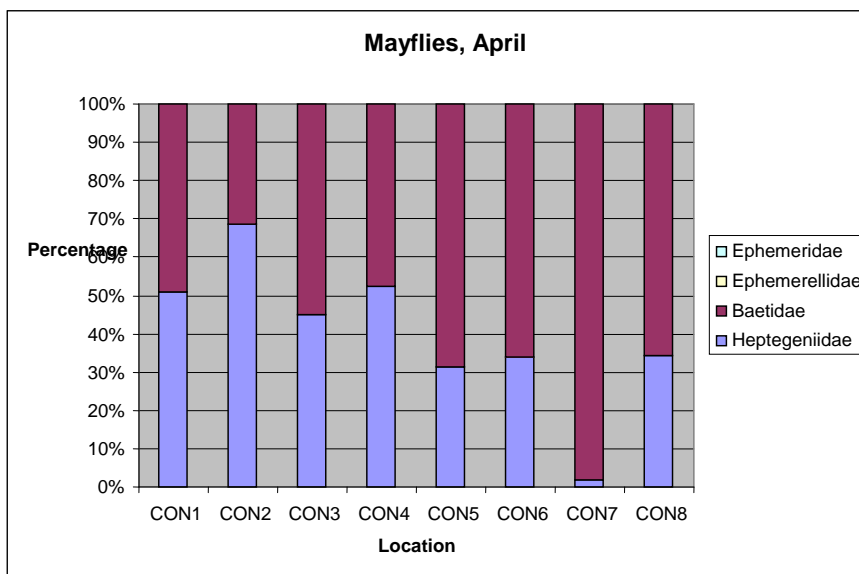
Low numbers of salmon are not new in the Cononish. In a previous survey in 1992 a density of only 5 fry per 100 sq. m was found at a site near Site 2 and none at all were found at Site 4.

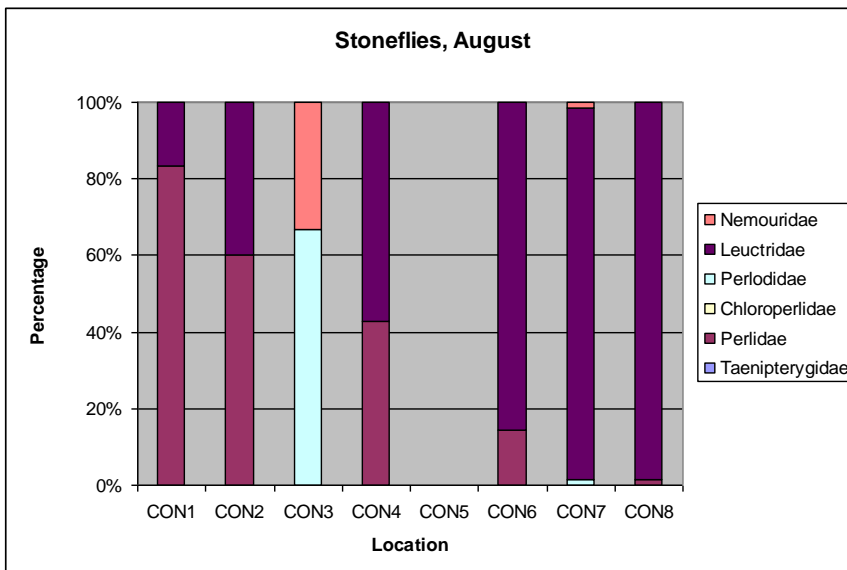
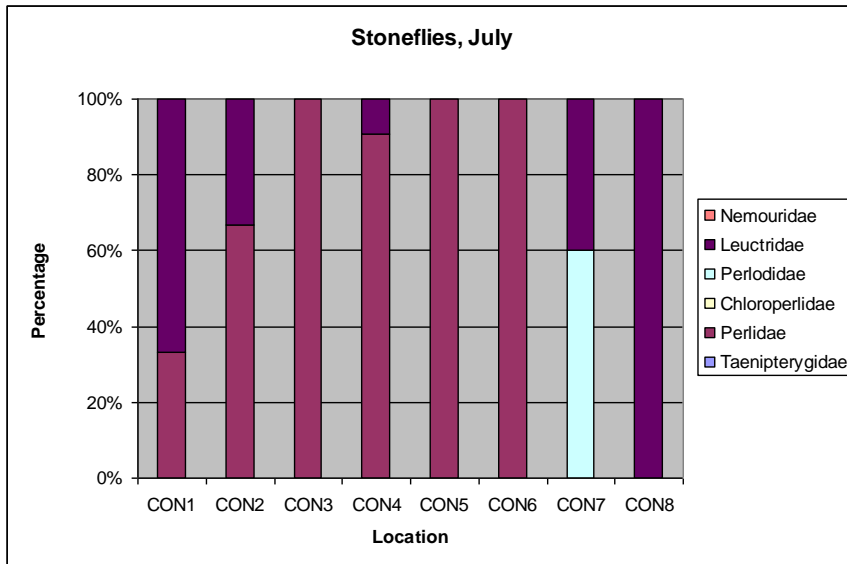
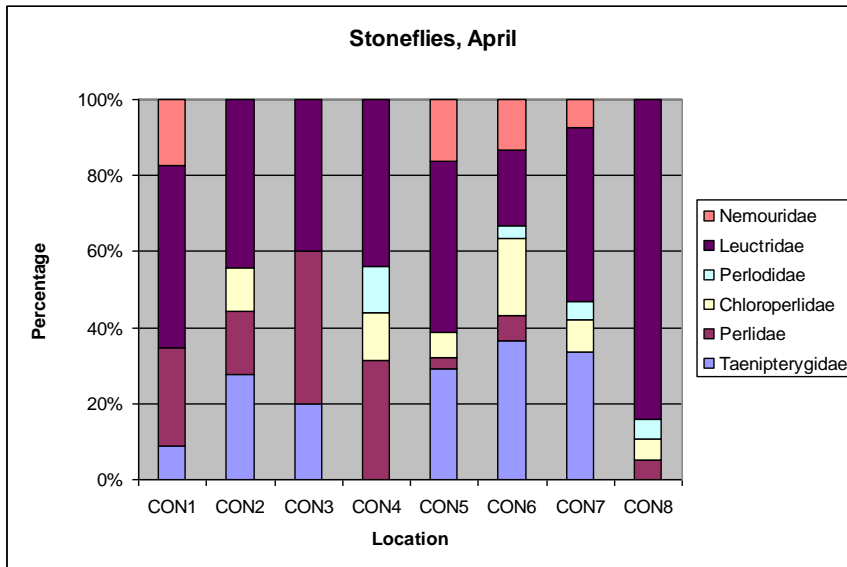
Conclusion

In conclusion it appears that the Cononish may just be a very impoverished and hostile environment, which perhaps may be deteriorating as a consequence of climatic change. However, the contrasting abundance of salmon in the Fillan, perhaps demonstrates the strong effect which stream fertility has on controlling salmon numbers.

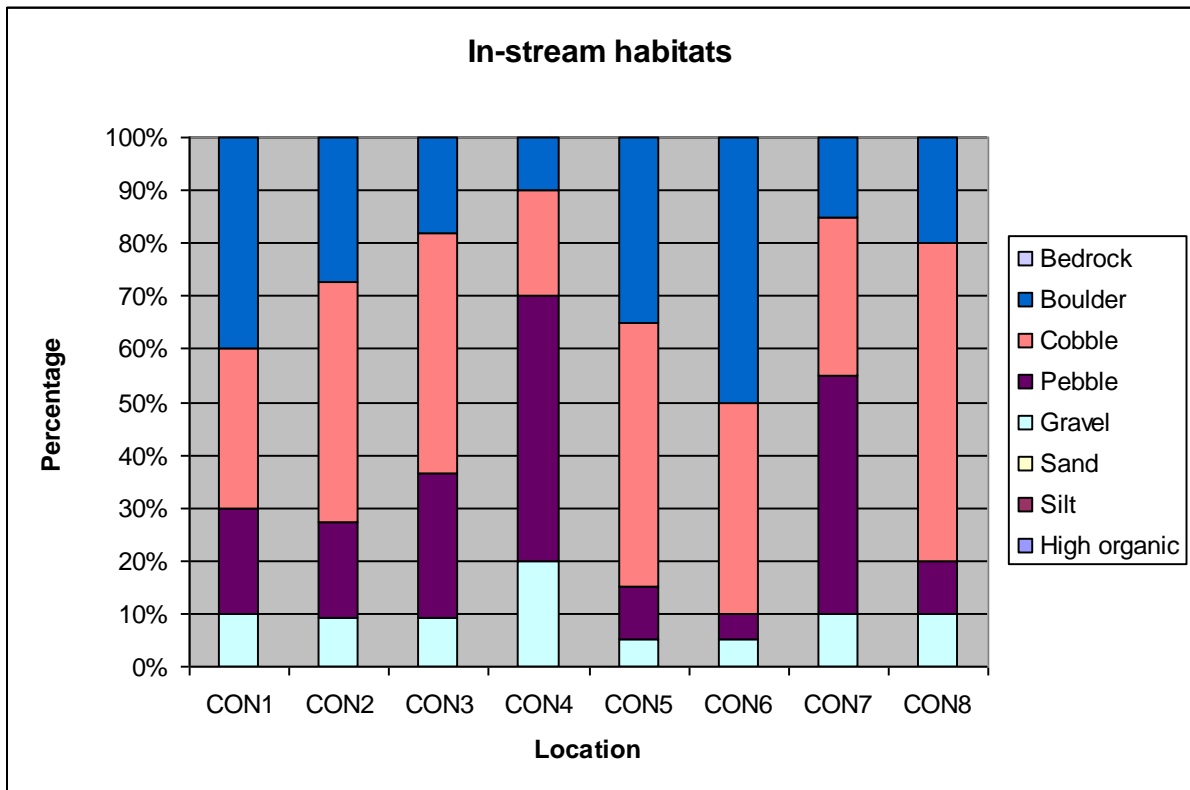
Of course, care should be exercised over any conclusions based on data from only a one year survey. Results elsewhere have shown that invertebrate abundance can vary greatly between years, sometimes without any obvious reason for this variation. But the fact that salmon have been doing poorly for at least 15 years suggests there is a long term problem.

Annex 1: Mayfly and stonefly families in samples

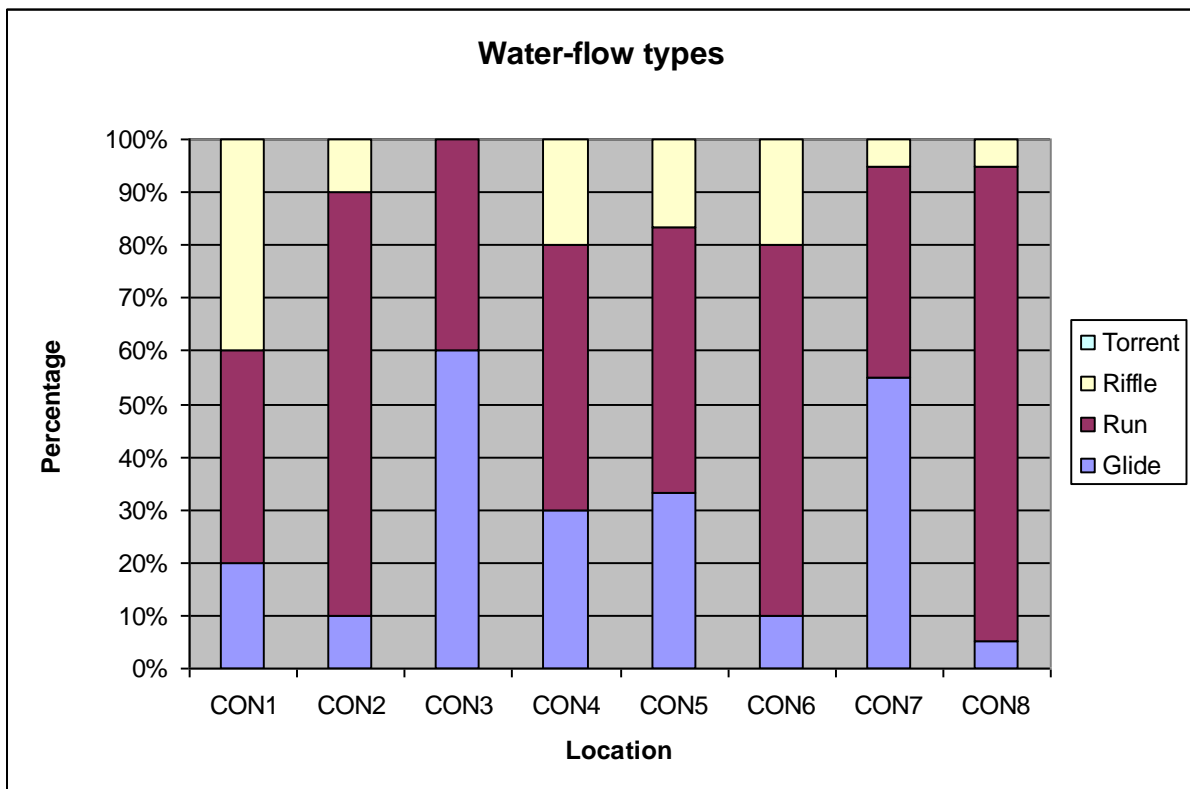




Annex 2. Habitat and flow data at sampling points



In stream habitat types where invertebrate samples were taken



Water flow types where invertebrate samples were taken