C:1 - Train personnel in each Association in fly identification and in sampling techniques.

Tweed Trout & Grayling Initiative

A mayfly nymph from the genus Rithrogena – March Browns and Olive Uprights – the most common invertebrate in two fly life samples taken around Peebles

Invertebrate Sampling

Federation of Border Angling Associations

Europe and Scotland Making it work together

SCOTTISH NATURAL HERITAGE

THE Tweed FOUNDATION

Summary

1) The results from two fly life samples carried out by members of the Peeblesshire Trout Fishing Association indicated that there are very healthy fly life populations in the River Tweed around Peebles.
2) As such the river around Peebles has a good supply of food for any resident fish populations.
3) The Peebles Sewage Treatment Works appears to be having little, if any, negative effects on the fly life populations.
4) Differences between the two fly life samples taken are probably due to minor differences in in-stream river habitat.
5) Declines in fly life populations perceived by anglers may be down to changes in the species present within Tweed fly life or changes in hatching time and not necessarily down to decreases in overall numbers.
6) Future changes in river fly life should be expected as climate continues to change.
7) Future sampling by the Peeblesshire Trout Fishing Association will allow changes in fly life populations to be observed.

Invertebrate Sampling – The Peeblesshire Trout Fishing Association

The invertebrate sampling site on the River Tweed at the top of Haylodge Park

As part of the TTGI volunteers from different Tweed Angling Associations were trained in invertebrate sampling and identification. The volunteers follow up the training by taking regular samples from their Association water. The samples are then identified and counted with the results being provided to the TTGI, which then uses the results to monitor Tweed invertebrate quality and abundance. Shown below are the invertebrate results, to date, from the Peeblesshire Trout Fishing Association (PTFA).

The invertebrate sampling was carried out in April 2006 by Mr K Annand and Mr M Linge during May 2006. The sampling method consisted of a three minute kick sample using a standard Scottish Environmental Protection Agency (SEPA) sized kick net followed by one minute of stone washing (explained in more detail in Appendix 1). The sampling sites were chosen by Mr K Galt (TTGI Biologist), Mr Annand and Mr Linge and consisted of a sampling site on the River Tweed either side of the town of Peebles. The upper sampling site was located at the top of Haylodge Park and the lower site was located below the Peebles Sewage Treatment Works (STW). Once taken the

The invertebrate sampling site on the River Tweed below the STW at Peebles

samples were preserved in a 1 litre sample bottles using 500ml of 100% Isopropyl Alcohol.
The invertebrates from the samples were identified and counted at the Tweed Foundation using low-powered microscopes. Identification was generally to Family level where possible although some invertebrates were identified to a lesser or greater degree (many similar species of river invertebrate are impossible to tell apart when small nymphs/larvae). Appendix 2 gives an explanation of the different groups that the invertebrates are divided into.

Table 1 – River invertebrate numbers recorded in the River Tweed around Peebles in April 2006 (see Appendix 2 for an explanation of the naming system).

Order	Family	Genus	Angler or Common Name	Haylodge Park	Below STW
MAYFLIES					
Ephemeroptera	Heptageniidae	*Rithrogena*	March Browns and Olive Uprights	**137**	**457**
Ephemeroptera	Heptageniidae	*Ecdyonurus*	Large Brook, Autumn Dun, etc	**101**	**2**
Ephemeroptera	Heptageniidae	*Heptagena*	Yellow Mays	**13**	**0**
Ephemeroptera	Baetidae	-	Most Olives	**21**	**24**
STONEFLIES					
Plecoptera	Leuctridae	*Leuctra*	Needle Flies/ Willow Flies	**2**	**0**
Plecoptera	Perlodidae	*Isoperla*	Yellow Sallys	**29**	**20**
Plecoptera	Chloroperlidae	*Chloroperla*	Small Yellow Sallys	**0**	**1**
Plecoptera	Perlidae	-	Large Stoneflies/Gadgers	**2**	**0**
CADDIS FLIES					
Trichoptera	Sericostomatidae	*Sericostomata*	Welshman's Button	**0**	**1**
Trichoptera	Brachycentridae	*Brachycentrus*	Grannom	**51**	**88**
Trichoptera	Other Cased Caddis	-	-	**3**	**0**
Trichoptera	Hydropsychidae	*Hydropsyche*	Grey Flag or Grey Hen	**20**	**2**
Trichoptera	Rhyacophilidae	*Rhyacophila*	Sandfly Sedge	**9**	**7**
Trichoptera	Other Case-less Caddis	-	-	**25**	**0**
OTHER					
Diptera	-	-	True Flies	**2**	**0**
Amphipoda	Gammaridae	*Gammarus*	Freshwater Shrimp	**17**	**55**
Amphipoda	Asellidae	*Asellus*	Water Slater	**2**	**1**
-	-	-	Freshwater Snails	**3**	**16**
-	-	-	Worms	**4**	**3**
			Water quality/abundance score	**A1**	**A1**

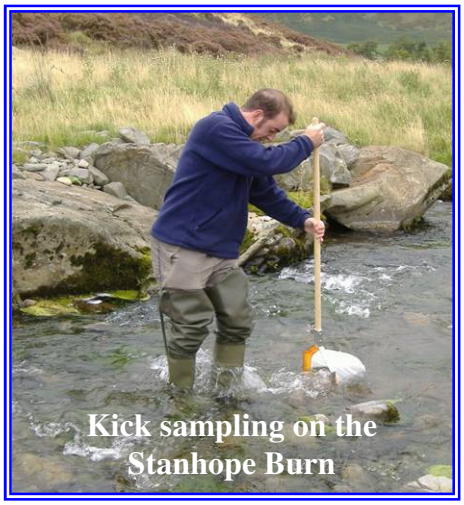
The Water Quality/Abundance score given to each invertebrate sample is based on two scores. The first score is based on water quality (ranked A-D, with A being the highest quality and D being the lowest water quality). This is decided by the presence of pollution-intolerant invertebrates. The second score is based on abundance (ranked 1-6, with 1 being the highest abundance and 6 being the lowest). Therefore the highest score would be A1 and the lowest D6. A full description of the scoring system is given in Appendix 3.
Both Peebles fly life samples, when put into the scoring system, scored in the highest categories for both water quality and fly life abundance, indicating that the invertebrate populations are thriving in the rivers around Peebles. This indicates that there is a very good supply of food for any fish living in the rivers. Interestingly, the STW seems to be having no obvious effect on the fly life immediately below it, suggesting that any solids or liquids being released are being adequately treated. Although both samples scored well there were differences in numbers of the different categories between the two, which are probably due to minor differences in river substrate types and average flows and not due to the STW. In fact the numbers of pollution intolerant flies are as good below the STW as they are above. These two invertebrate samples clearly show that the fly life numbers in the River Tweed around Peebles are thriving, which goes

against the opinion of many anglers who believe that fly life has declined. The explanation for this could well be that the fly life has changed, without necessarily declining, so that the flies they saw in the past have been replaced by other species or that hatch times have changed so that they don't see flies hatching when they're fishing on the water. Insects being cold-blooded animals are generally affected by water temperature. For instance some species that have two generations or "hatches" per year in the South of England only have one generation or "hatch" per year in Scotland. For the same reason the time of year when emergence to adult, or "hatches" take place is affected by temperature. With milder winters and warmer summers hatches may become earlier in the season, take place at different times of day or may become more spread out and, as such, may be "missed" by anglers. More importantly, species that prefer colder conditions will be replaced by those more tolerant or preferring warmer conditions, and may become restricted to headwaters.. Repeat sampling should be carried out in future years which will build up an information base that will allow trends/changes in fly life populations to be identified.
One thing of note from the samples is the absence of the mayfly nymph known as the Blue-winged Olive (*Serratella ignita*), which is very common in the Tweed and its tributaries. This mayfly spends much of the year dormant in the egg stage of its life cycle and would be expected to be absent from invertebrate samples taken in May.

Additional

As part of the TTGI, the Initiative Biologist has been repeating a fly life survey carried out by Dr Derek Mills and Barbara Smith in 1974 to see what changes have occurred within the fly life of the River Tweed between this time and the present day. This repeat survey, which started in March 2006, was due to be completed in July 2007 however the high water levels during that month prevented any sampling from taking place. Unfortunately the sampling could not be carried out when the water levels fell as the repeat survey required sampling specifically during the first week of July. It has therefore been rescheduled for July 2008 when it is hoped that this large scale repeat survey can be finished. Although it was unable to be finished much of the sampling and identification required for the repeat survey has already been carried out and although in depth analysis of the results has not been able to take place yet it does appear that there have been considerable changes within the fly life of the areas sampled, but without any obvious decline. What changes have taken place appear to have been as a result of both the river becoming cleaner and changes in climate with some species increasing in number and range and others decreasing as a result.

Appendix 1: Kick Sampling and Stone Washing



Kick sampling on the Stanhope Burn

To kick sample correctly you simply place the kick net against the bottom of the riverbed whilst using your foot to disturb the stones directly upstream of the net. This dislodges the invertebrates in the "kick" area and the water current carries them into the net. During a three minute kick sample the kick net has to be moved four or five times as most of the invertebrates from the initial area being "kicked" will have been dislodged after around 30 seconds. The area covered during the kick sample depends upon the length of the kick sampler's leg and the number of times he moves the net during the sampling (the sampler moved the net somewhere between four and six times covering an area

roughly between half a square metre and a square metre). Stone washing is the process of using the hands to "wash" river invertebrates off of stone found on the riverbed. Stones are washed in the frame of a kick net and the process is carried out in the river so that the water current can be used to carry dislodged invertebrates into the net. Stone washing allows the collection of invertebrates that aren't always collected during kick sampling (e.g. freshwater limpets adhere strongly to rocks and need to be dislodged by hand).

Appendix 2: Note on Scientific Naming

1. The smallest unit is the individual **Species** e.g. *trutta*, the Trout
2. Related species are grouped together in a **Genus** (plural genera) e.g. *Salmo*, Trout and Atlantic Salmon
3. Related genera are grouped together in a **Family** e.g. the Salmonidae which includes the genera: *Salmo* (Trout and Atlantic Salmon) and *Salvelinus* (the Charrs)
4. Related families are grouped together into an **Order** e.g. Salmoniformes, which includes the families Salmonidae (Trout and Atlantic Salmon) and Thymallidae (Grayling)

This gathering together of larger and larger collections of related groups continues all the way up to **Kingdoms** such as Animalia (Animals) and Plantae (Plants).

Appendix 3: Water quality/abundance score

Table A

Invertebrate Groups	**Pollution Intolerance Score**
Baetidae	5.3
Heptageniidae	9.8
Stoneflies	10.8
Case-less Caddis	8.2
Cased Caddis	8.7
Shrimps	4.5
Hog Louse	2.1
Leeches	3.6
Snails	2.9

Table B

Abundance Per Invertebrate Group	**Multiply Pollution Intolerance Score By**
1 – 2	x1
3 – 9	x2
10 – 49	x3
50 – 99	x4
100+	x5

Table C

Overall Score For Invertebrate Groups	**Water Quality Score**
Less than 70	D
Less than 105	C
Less than 140	B
140 and over	A

Table D

Overall Abundance	**Abundance Score**
Less than 50	6
50 – 99	5
100 – 199	4
200 – 299	3
300 – 399	2
400+	1

Shown above is the scoring system used for working out the Water Quality/Abundance score given to each invertebrate sample. Only the invertebrate groups listed in Table A are used when working out the Water Quality/Abundance score. Invertebrate samples receive a score for water quality (ranked A (highest quality) to D (lowest quality)) and abundance (ranked 1 (high

abundance) to 6 (low abundance)). The abundance score is worked out as follows:- If we use Baetidae as an example and imagine that we have an invertebrate sample with approximately 37 Baetidae present we see from Table A that the Baetidae receive a pollution intolerance score of 5.3 (pollution intolerance scores are specific to each group of invertebrates listed). The pollution intolerance score is then multiplied by a number dependent on the abundance of Baetidae. The number we multiply the pollution intolerance score for the Baetidae by is shown in Table B. In this case we multiply by three (Table B shows that if the abundance is between 10 and 49 the pollution intolerance score for the invertebrate group in question is multiplied by three). This will give the Baetidae a score of 15.9, as is shown in the table below.

Invertebrate Group	Pollution Intolerance Score	Abundance	Multiply Pollution Intolerance Score By	Score
Baetidae	5.3	37	3	15.9

This process is repeated for each of the invertebrate groups listed in Table A and once completed the scores for each invertebrate group are added together to give an overall score. A water quality score is then given based on this overall score as shown in Table C (e.g. if the overall score for the invertebrate groups was 152 the water quality score would be A as the table shows that all overall score for the invertebrate groups above 140 gets a water quality score of A).
The abundance score ranges from 1 (high abundance) to 6 (low abundance) and is based on the overall abundance of all the invertebrate groups listed in Table A and Table D shows how the abundance score is calculated.

This scoring system was developed and provided by the Ayrshire Rivers Trust and Craig Macadam (National Ephemeroptera Recording Scheme, Riverfly Workshops).