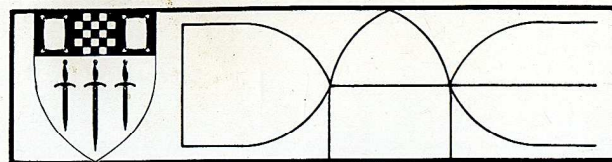


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**AN INVESTIGATION OF THE TILLING BOURNE**  
**Department of Adult Education**  
**University of Surrey**  
**1981**



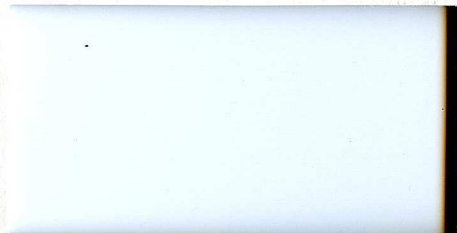
OCCASIONAL PAPER NO. 1

AN INVESTIGATION OF THE  
TILLING BOURNE

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PREFACE

This paper has been written as a result of an investigation of the Tilling Bourn  
Survey, by an Adult Education class of the University of Surrey. The investigation  
was carried out during the Spring Term, 1961, after a course which had involved  
the students in general ecology and local geology.

The pattern of the form evolved around the investigations at the site on  
the Tilling Bourn. Initial lectures and practicals were given by the course  
tutors (Dr J Hobrough and Miss M Taft) on stream ecology and geology and  
methods of investigation. The students then worked in independent groups,  
completing assignments, preparing their own reports and contributing to the  
whole project. The results of the investigations are described in this paper.  
The paper is intended to be a useful resource for their own work. It is  
for the reader, this paper can be seen as fulfilling a number of purposes.  
First, it indicates a new venture for the University of Surrey in publishing  
occasional papers on local history and geology.

OCCASIONAL PAPER NO. 1

NATURAL HISTORY SERIES

AN INVESTIGATION OF THE  
TILLING BOURNE

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- L A Wadham
- S K Wong

## PREFACE

This paper has been written as a result of an investigation of the Tilling Bourne, Surrey, by an Adult Education class of the University of Surrey. The investigation was carried out during the Spring Term, 1981, after a course which had involved the students in general ecology and local geology.

The pattern of the term evolved around the investigations at five sites on the Tilling Bourne. Initial lectures and practicals were given by the course tutors (Dr J Hobrough and Miss M Taft) on stream ecology and geology and methods of investigation. The students then worked in independent groups, sampling the stream, analysing the results and committing them to paper. The whole project resulted in an exhibition at "Green Surrey" in April 1981, and this paper.

For the reader, this paper can be seen as fulfilling a number of purposes. First, it initiates a new venture for the University of Surrey in publishing occasional papers which can provide motivation for students to write with their tutors papers of local or general interest. Secondly, it can be seen as an answer to some of the problems highlighted by Dr Feltwell (1980) in developing written work in Adult Education classes. Thirdly, the work carried out and the methods used for stream evaluation in this paper are provided as an appendix, thus teachers should find this and future papers a useful resource for their own work. Finally, the paper stands by itself. It provides information for local naturalists and can be seen as a piece of a jigsaw which fits into the understanding of Surrey Natural History.

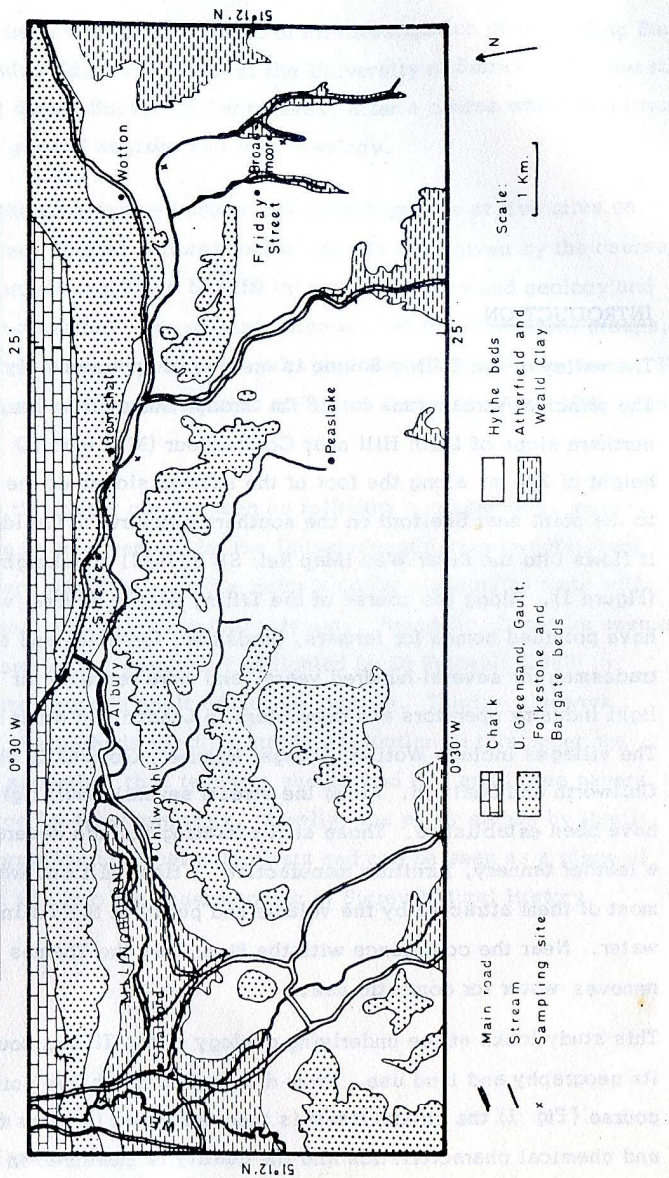
Dr J E Hobrough  
Professor D E James

## INTRODUCTION

The valley of the Tilling Bourne is an area of approximately 56 Km<sup>2</sup>. The principal stream runs for 20 Km through Surrey from its source on the northern slope of Leith Hill near Coldharbour (Man Ref: TQ 143437) at a height of 244 m, along the foot of the souther slopes of the North Downs to the point near Shalford on the southern outskirts of Guildford where it flows into the River Wey (Map Ref: SU 997481) at a height of 40 m (Figure 1). Along the course of the Tilling Bourne several villages have provided homes for farmers, herdsmen, foresters and other agrarian tradesmen for several hundred years, and more recently for shop-keepers, light industry operators and commuters to London and other nearby towns. The villages include Wotton, Abinger Hammer, Gomshall, Shere, Albury, Chilworth and Shalford. Along the stream several small light industries have been established. Those still operating include several fish farms, a leather tannery, furniture manufacture, a flour mill and watercress farms, most of them attracted by the volume and 'purity' of the Tilling Bourne's water. Near the confluence with the River Wey the Thames Water Authority removes water for domestic use.

This study looks at the underlying geology of the Tilling Bourne watershed, its geography and land use. From data collected at five points along its course (Fig 1) the stream itself is then described in terms of its physical and chemical characteristics and the quality is measured in terms of the Trent Biotic Index (Woodiwiss 1964) and Chandler's Score (1970). Both these indices are based on the number and species of macroinvertebrata found in a standard sample of water and bottom material at each of the collection points.

General Geology along the Tillingbourne



In conclusion an attempt is made to relate the quality and relative eutrophication of the stream along its course to the uses made of the adjoining land which drains into the stream and to the geology and geography of the valley.

Geology

The source of the Tilling Bourne is on the Hythe Beds of the Lower Greensand and here, like its tributaries at Broadmoor and Friday Street, it has cut a steep-sided valley down to the older Artherfield Clay. A continuation of the northerly flow is blocked by the north-dipping scarp of the Chalk Downs, and the course changes to flow east-west, mainly over the Hythe Beds. The latter are structurally weak in this area due to the tension caused by the Albury anticline and the stream has followed the weakest path.

At Chilworth, the Hythe Beds have become more calcareous and hence less resistant and the stream has again cut down to the older Artherfield Clay. It is still flowing on the Clay at Shalford.

At Albury, the hills immediately to the south are synclinal but further south still is the Peaselake anticline, along which runs a small tributary of the Tilling Bourne.

Near the source the valley is narrow and steep-sided whereas further downstream it becomes gradually broader. To the north is the Chalk escarpment of the North Downs while to the south the Folkestone Beds with their ironstone bands result in fairly hilly country (Fig 1).

SITE 1    Broadmoor    Map Ref: 130450

Sampling was carried out at the above site which is a small tributary of the Tilling Bourne very near its source.

The valley is narrow, V-shaped and wooded. The source is on Artherfield Clay, with marshy areas nearby and forestry on the surrounding land both growing and being cut. There are also farms and stables nearby.

The stream itself is narrow, fairly fast, with a turbidity of less than 30 ppm. There are no ripple marks in the stream bed which is poorly sorted, containing mainly coarse to medium-fine sandstone particles with a little clay and a few pieces of chert. There were no outcrops seen in the surrounding area or in the bed itself. (Fig 2)

SITE 2    Wotton    Map Ref: 116469

Above this site the stream runs through woodland and many private properties. In the grounds of these houses the stream has been artificially widened to produce a series of fish ponds, separated by weirs. It flows onwards into more open, mainly pastoral, farmland.

At the site, the stream runs over Hythe Beds and the valley has broadened. Slight meanders appear, probably because of the many tree trunks which protrude from the bank. The trees, mainly Ash and Alder, which formerly covered the valley have been cut down. To the north there was a new plantation of Beech and at the crest (130 m) there were fields of stubble which might have been kale. Cattle were present so it can be assumed that any drainage from these fields would account for some enrichment of the stream. To the south the hills rose more steeply (180 m) and had been planted with larches. The flat somewhat marshy bottom to the valley suggested a flood plain.

Ripple marks were present on the north side of the stream bed which was locally well sorted but overall poorly sorted. There was also evidence of

FIGURE 2.

Broadmoor Sampling Site

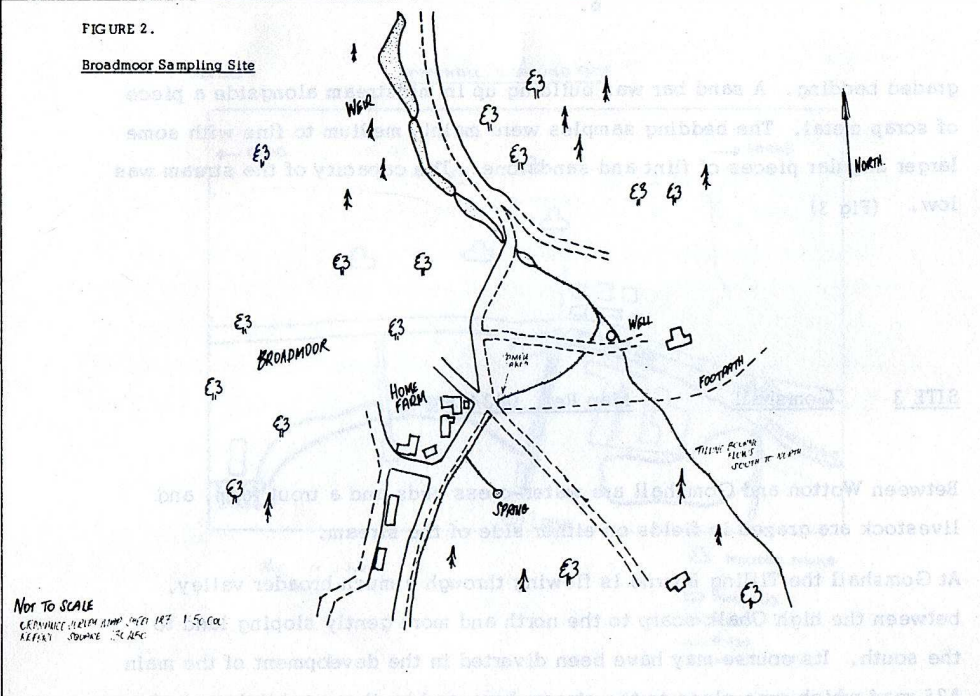
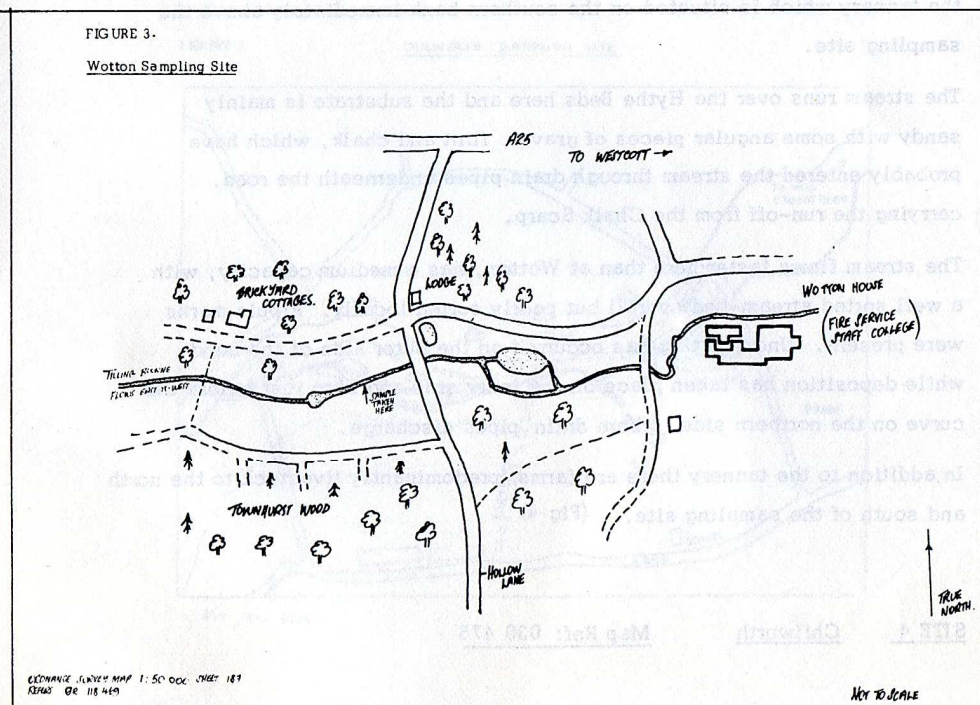


FIGURE 3.

Wotton Sampling Site



graded bedding. A sand bar was building up in midstream alongside a piece of scrap metal. The bedding samples were mainly medium to fine with some larger angular pieces of flint and sandstone. The capacity of the stream was low. (Fig 3)

SITE 3      Gomshall      Map Ref: 083479

Between Wotton and Gomshall are water-cross beds and a trout farm, and livestock are grazed in fields on either side of the stream.

At Gomshall the Tilling Bourne is flowing through a much broader valley, between the high Chalk scarp to the north and more gently sloping land to the south. Its course may have been diverted in the development of the main A25 road which runs close to the stream here and by the establishment of the tannery which is situated on the southern bank immediately above the sampling site.

The stream runs over the Hythe Beds here and the substrate is mainly sandy with some angular pieces of gravel, flint and chalk, which have probably entered the stream through drain pipes underneath the road, carrying the run-off from the Chalk Scarp.

The stream flows faster here than at Wotton, has a medium capacity, with a well sorted stream-bed overall but poorly sorted locally. Ripple marks were present. Undercutting has occurred on the outer side of the bend while deposition has taken place on the inner side and also just before the curve on the northern side, where drain pipes discharge.

In addition to the tannery there are farms (predominantly livestock) to the north and south of the sampling site. (Fig 4)

SITE 4      Chilworth      Map Ref: 030 475

Between Gomshall and Chilworth the stream is fed by water from a spring at

FIGURE 4

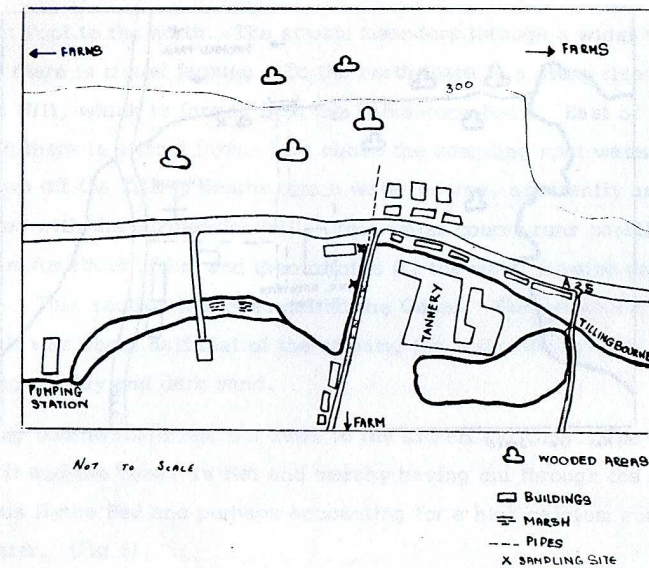
GOMSHALL SAMPLING SITE

FIGURE 5

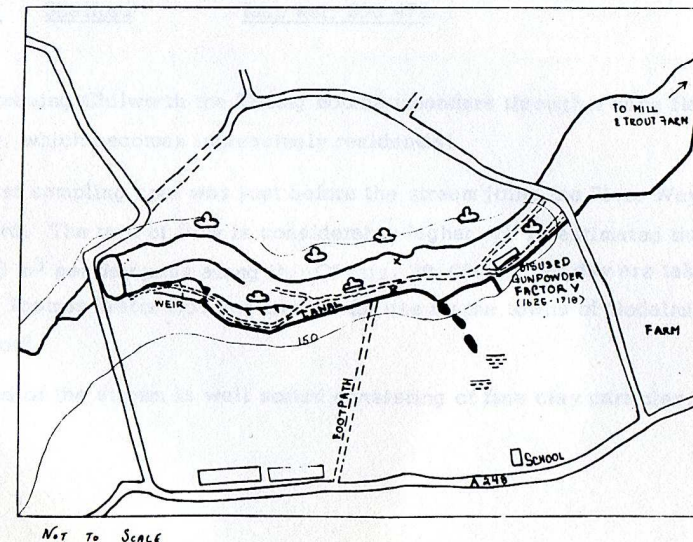
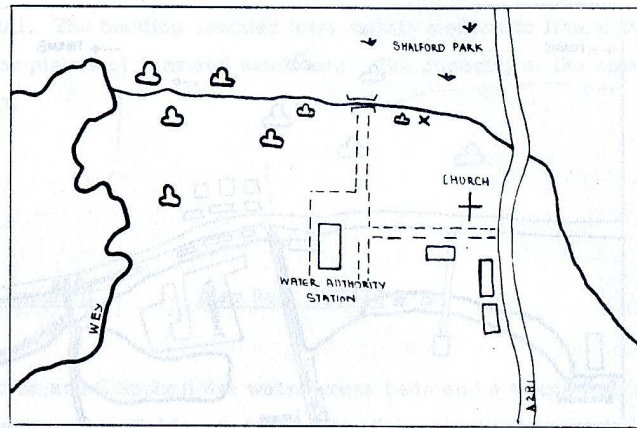
CHILWORTH SAMPLING SITE

FIGURE 6

## SHALFORD SAMPLING SITE



Not To Scale

the Silent Pool to the north. The stream meanders through a wider valley in which there is mixed farming. To the north there is a steep rise to St Martha's Hill, which is formed from the Folkestone Beds. East of Chilworth there is a trout farm. Just above the sampling spot water has been drawn off the Tilling Bourne into a water course, apparently artificial, associated with the Gunpowder Mill. This water course runs parallel with the stream for about 900m and then rejoins it, the water flowing down a steep waterfall. This section has been called the Canal. The velocity of the water in it was about half that of the stream, the bed was very fine, consisting of clay and dark sand.

The Tilling Bourne itself has cut down to the Artherfield Clay. The land between it and the 'canal' is flat and marshy having cut through the more calcareous Hythe Bed and perhaps accounting for a high calcium content in the water. (Fig 5)

SITE 5    Shalford

Map Ref: 998 479

After leaving Chilworth the Tilling Bourne meanders through a wide flat valley, which becomes increasingly residential.

The last sampling spot was just before the stream joins the River Wey at Shalford. The rate of flow is considerably higher. It is estimated that 72,000 m<sup>3</sup> per day pass along it. Of this, 18,000 m<sup>3</sup> per day are taken out by the Thames Water Co. and treated for use by the towns of Godalming and Guildford.

The bed of the stream is well sorted consisting of fine clay particles. ( Fig 6)

## METHODS

Physical measurements for flow, timed by floats over a 10 m length, width, depth and turbidity, by use of a calibrated tube, were taken.

Chemical measurements using standard colorometric techniques for pH, salinity, hardness and a permanganate test to compare each site for oxygen stability were also carried out.

Samples of the river bed were taken by scooping out from the bottom. Each specimen was dried and examined by sieving to give an indication of competence and degree of sorting.

The macroinvertebrata were collected by taking a kick sample into a standard fine mesh net (Frost *et al* 1970).

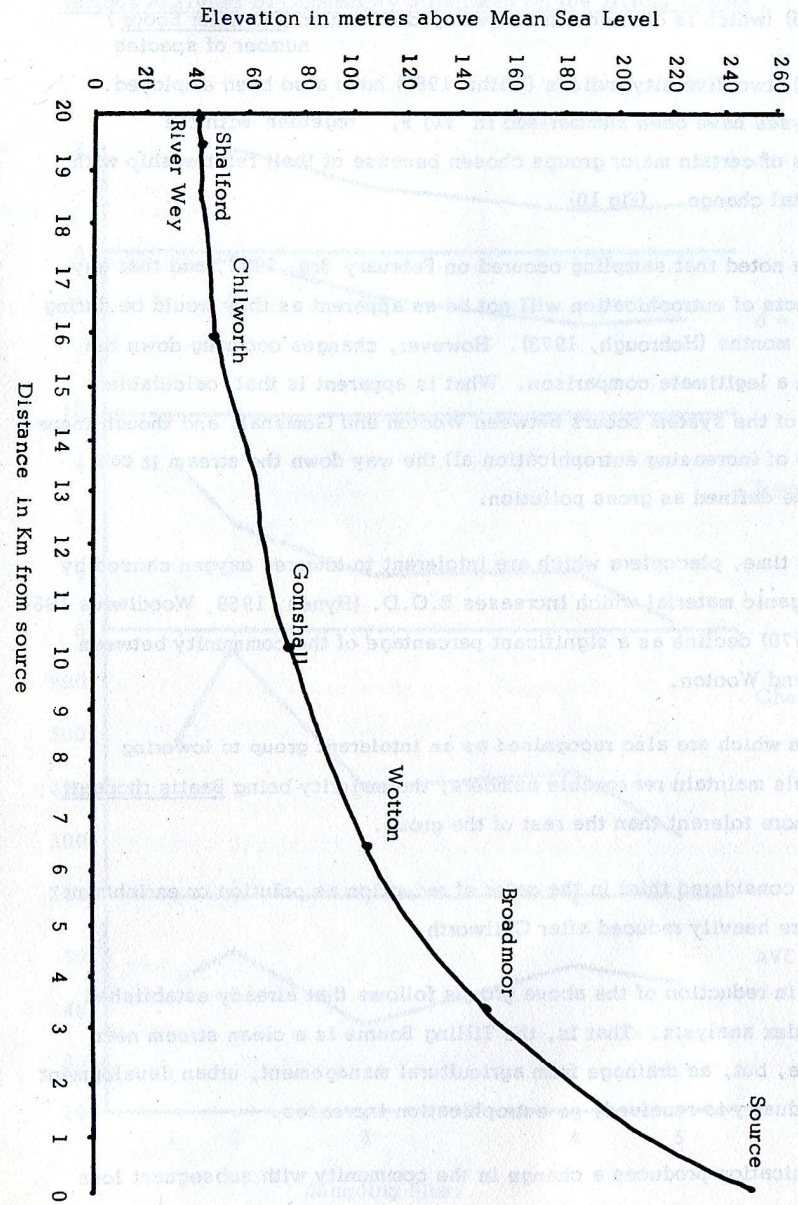
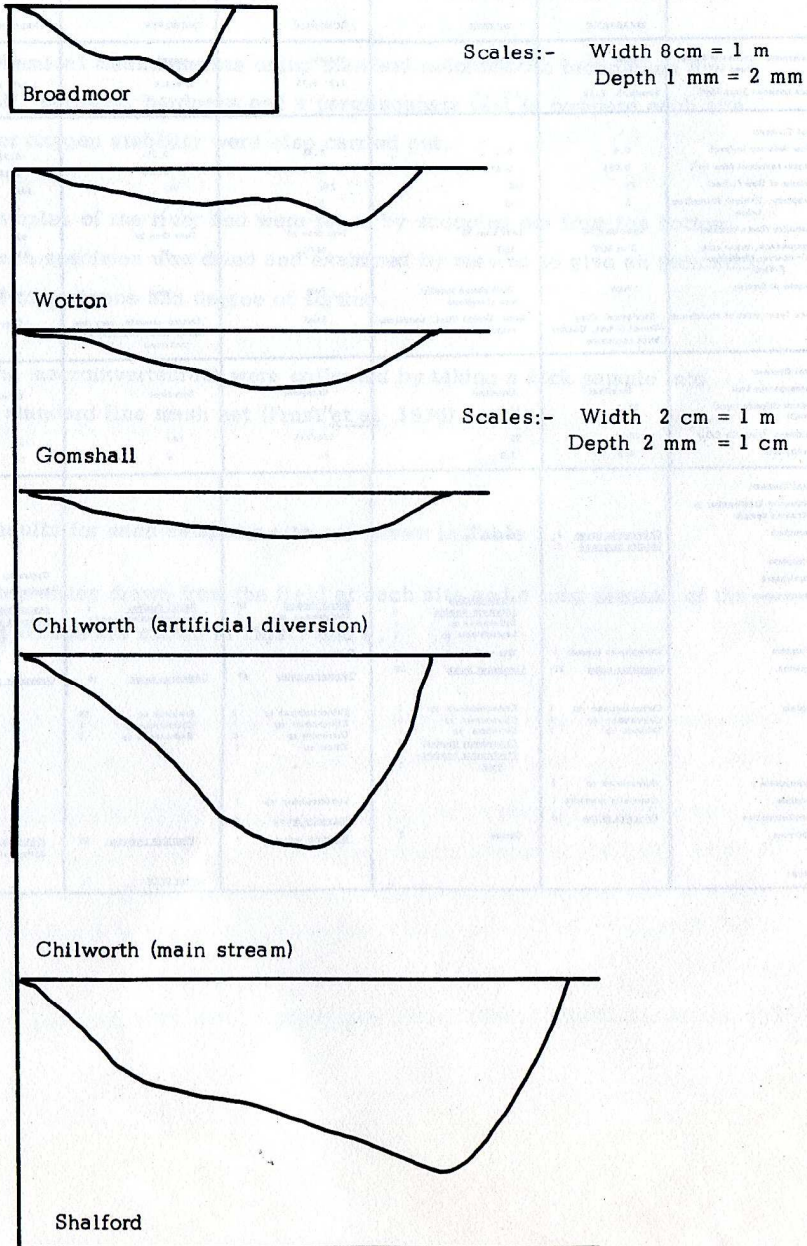
The results for each sampling site are shown in Table 1.

Stream profiles drawn from the field at each site and a long diagram of the Tilling Bourne are shown in Figs 7 and 8.

TABLE 1 : RESULTS OF SAMPLING FIVE SITES ON THE TILLING BOURNE

	BROADMCCR	WCTON	GCMSHALL	CHILWORTH	SHALFORD
Map Reference	Ordnance Survey Sheet 187	116469	084479	030475	998479
Distance between Sites (Km)	Source/1: 2.25	1/2: 3.0	2/3: 3.75	3/4: 5.8	4/5: 3.6
Physical Context:					
Flow Velocity (m/sec)	0.4	0.3	0.48	0.25	0.37
Cross-sectional Area (m <sup>2</sup> )	0.085	0.475	0.52	0.428	2.18
Volume of flow (l/sec)	34	142	250	107	806
Capacity: H=high; M=medium; L=low	L	M	L	L	H
Turbidity (parts/million)	Less than 30	Less than 30	Less than 30	Less than 30	92
Competence, grain size C=course; M=medium; F=fine	C to M/F	M/F	M/C	M	M
Degree of Sorting	Poor	Well sorted locally, poor elsewhere	Poor	Well	Well
Rock Type: order of abundance	Sandstone, Clay, Gravel (Chert, Quartz) Brick roadstone	Sand, Gravel (flint, sandstone) (angular)	Sand	Sorting variable, very fine angular sand, fine clay and sandstone	Clay
Chemical Context:					
Permanganate test	Excellent	Excellent	Excellent	Excellent	Excellent
Sodium chloride (ppm) NaCl	33.3	17.0	33.3	50.0	33.3
Hardness (ppm: Ca CO <sub>3</sub> )	20	30	120/140	180	220
Acidity (pH)	6.5	7.0	8	8	8
Biological Context:					
Community List/number in standard sample					
Plecoptera	<i>Chloroperla terran</i> 1 <i>Leuctra hippopus</i> 3	<i>Leuctra</i> sp 1			
Coleoptera					<i>Corticea</i> sp 1 <i>Sialis</i> sp 1
Megaloptera					
Ephemeroptera	<i>Beetis rhodani</i> 1	<i>Beetis rhodani</i> 4 <i>Ephemerella damica</i> 5 <i>Ecdyonurus</i> sp 1 <i>Leptophlebia</i> sp 1	<i>Beetis rhodani</i> 10 <i>Ecdyonurus</i> sp 7	<i>Beetis rhodani</i> 1 <i>Palaepotophlebia</i> sp 11	<i>Beetis rhodani</i> 12 <i>Ephemerella vulgata</i> 20
Trichoptera	<i>Stenophylax</i> (caseid) 1	<i>Silo</i> sp (caseid) 1	<i>Hydropsyche</i> sp 4	<i>Hydropsyche</i> sp 1	
Crustacea	<i>Gammarus pulex</i> 21	<i>Gammarus pulex</i> 20	<i>Gammarus pulex</i> 47	<i>Gammarus pulex</i> 10	<i>Gammarus pulex</i> 1
Diptera	<i>Orthocladinae</i> sp 1 <i>Chironomus</i> sp 1 <i>Tabanus</i> sp 1	<i>Orthocladinae</i> sp 3 <i>Chironomus</i> sp 3 <i>Dicranota</i> sp 1 <i>Chironomus thummi</i> 8 <i>Ptychoptera contami-</i> <i>nata</i> 1	<i>Orthocladinae</i> sp 2 <i>Chironomus</i> sp 1 <i>Dicranota</i> sp 4 <i>Tipula</i> sp 1	<i>Simulium</i> sp 50 <i>Chironomus</i> sp 1 <i>Hydracarina</i> sp 1	
Hydracarina	<i>Hydracarina</i> sp 1				
Annelida	<i>Eiseniella tetraedra</i> 1		<i>Lumbriculidae</i> sp 1		
Platyhelminthes	<i>Polycelis felina</i> 10		<i>Polycelis felina</i> 2		
Mollusca		<i>Corixa</i> 2	<i>Hydrobia jenkinsi</i> 1	<i>Hydrobia jenkinsi</i> 50	<i>Hydrobia jenkinsi</i> 15 <i>Sphaerium</i> sp 1
Pisces				<i>Cottus acipenser</i> 1	

Cross-sections of stream



PROFILE OF THE TILLING BOURNE

## DISCUSSION

From the results, a number of analyses have been carried out. In addition to the Trent River Board Biotic Index (Appendix I) and the Chandler Score (Appendix II) (which is also shown as averaged Chandler (Chandler Score) number of species Cooke 1976) two diversity indices (Wilhm 1967) have also been employed. These analyses have been summarised in Fig 9, together with the percentages of certain major groups chosen because of their relationship with environmental change. (Fig 10)

It should be noted that sampling occurred on February 3rd, 1981, and that any drastic effects of eutrophication will not be as apparent as they would be during the summer months (Hobrough, 1973). However, changes occurring down the stream form a legitimate comparison. What is apparent is that calculable enrichment of the system occurs between Wooton and Gomshall and though there is evidence of increasing eutrophication all the way down the stream it can at no time be defined as gross pollution.

At the same time, plecoptera which are intolerant to lowered oxygen caused by decay of organic material which increases B.O.D. (Hynes, 1959, Woodiwiss 1964 Chandler 1970) decline as a significant percentage of the community between Broadmoor and Wooton.

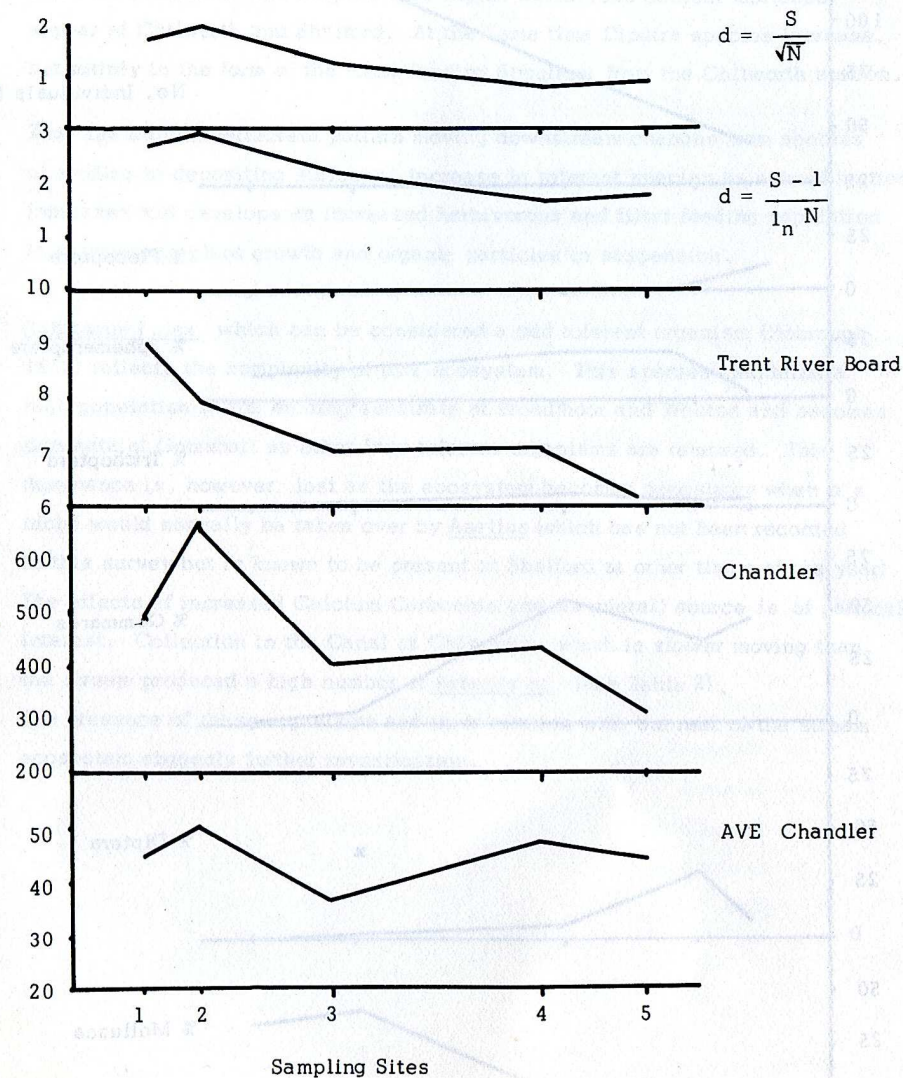
Ephemeroptera which are also recognised as an intolerant group to lowering oxygen levels maintain reasonable numbers, the majority being Baetis rhodanii which are more tolerant than the rest of the group.

Trichoptera: considered third in the order of reduction as pollution or enrichment increases are heavily reduced after Chilworth.

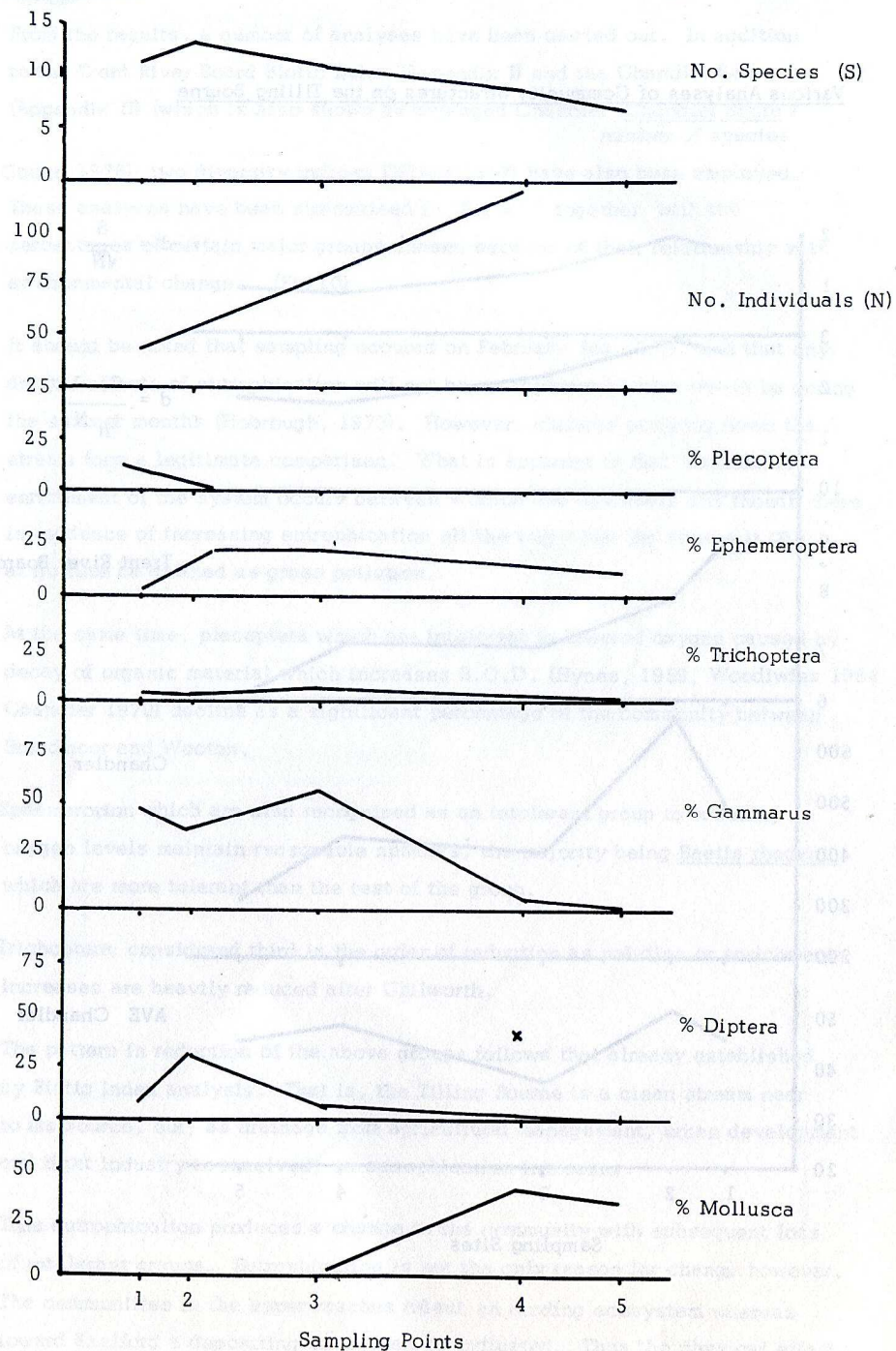
The pattern in reduction of the above groups follows that already established by Biotic index analysis. That is, the Tilling Bourne is a clean stream near to its source, but, as drainage from agricultural management, urban development and light industry is received, so eutrophication increases.

Thus eutrophication produces a change in the community with subsequent loss of intolerant groups. Eutrophication is not the only reason for change, however. The communities in the upper reaches reflect an eroding ecosystem whereas toward Shalford a depositing ecosystem is indicated. Thus the physical effects of flow with the resultant substrate development is a factor in establishing the

Various Analyses of Community Structures on the Tilling Bourne



Results of Sampling



community.

Increasing nutrients collected from the drainage basin coupled with increasing pH, and increasing Calcium Carbonate and salt levels will also effect the community down stream. More plant material will develop in enriched conditions and coupled with higher calcareous content molluscs appear at Chilworth and Shalford. At the same time Dipetra species increase, but mainly in the form of the filter feeding Simulium from the Chilworth station.

Thus the macroinvertebrata pattern moving downstream changes from species of eroding to depositing surfaces, increase in tolerant species as eutrophication increases and develops an increased herbivorous and filter feeding population in response to plant growth and organic particles in suspension.

Gammarus Pulex which can be considered a mid tolerant organism (Hobrough 1978) reflects the complexity of this ecosystem. This species maintains a high population in the eroding substrate at Broadmoor and Wooton and becomes dominant at Gomshall as other less tolerant organisms are removed. This dominance is, however, lost as the ecosystem becomes depository when it's niche would normally be taken over by Asellus (which has not been recorded in this survey but is known to be present at Shalford at other times of the year). The effects of increased Calcium Carbonate and its overall source is of particular interest. Collection in the Canal at Chilworth, which is slower moving than the stream produced a high number of Astacus sp (see Table 2). The presence of these organisms and their relation with the rest of the stream ecosystem suggests further investigation.

TABLE 2.

Community of macroinvertebrata sampled within the man made Canal at Chilworth which was built for use with a gun powder factory.

<u>Baetis rhodanii</u>	C
<u>Ephemera vulgata</u>	F
Hydropsychae sp.	O
<u>Gammarus pulex</u>	A
<u>Astacus pallipes</u>	F
Simulium sp.	R
Chironomus sp.	R
<u>Hydrobia jenkinsii</u>	R
Sphaerium sp.	C
Helmis sp.	R
Siailis sp.	R

A = Abundant  
 C = Common  
 F = Frequent  
 O = Occasional  
 R = Rare

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APPENDICES

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Hobroy, J.E. 1979. The effects of pollution on Gammarus pulex (L.) in the lower reaches of the Trent River. Hydrobiologia 66: 1-10.

Forst, S. and A. 1970. A biological approach to water quality management. Water Pollut. Contr. Lab. J. 10: 1-10.

Grand, J.R. 1970. A biological approach to water quality management. Water Pollut. Contr. Lab. J. 10: 1-10.

APPENDICES

Appendix I Trent River Board Biotic Index

Appendix II Biotic Index for Chandler Score

Woodwards, F.S. 1964. The biological system of stream classification used by the Trent River Board. Cherry Lab. J. 11: 433-447.

Coat, J.H. 1973-1974. Comparison of some diversity indices applied to populations of benthic macroinvertebrates in a stream receiving organic wastes. I. Water Pollut. Contr. Lab. J. 23: 1873-1874.

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Appendix I: Biotic Index - Trent River Board

Classification of Biological Samples

Clean		Total No. of groups present				
		0-1	2-5	6-10	11-15	16+
		Biotic Index				
Plecoptera	More than one species	-	7	8	9	10
nymph present	One species only	-	6	7	8	9
Ephemeroptera	More than one species*	-	6	7	8	9
nymph present	One species only*	-	5	6	7	8
Trichoptera	More than one species†	-	5	6	7	8
larvae present	One species only†	4	4	5	6	7
<u>Gammarus</u> present	All above species absent	3	4	5	6	7
<u>Asellus</u> present	All above species absent	2	3	4	5	6
Tubificid worms &/or Red Chironomid						
larvae present	All above species absent	1	2	3	4	-
All above types absent	Some organisms such as <u>Eristalis tenax</u> not requiring dissolved oxygen may be present	0	1	2	-	-

Polluted

Appendix I (cont)

Groups

The term "group" here denotes the limit of identification which can be reached without resorting to lengthy techniques. Thus the groups are as follows:

- Each known species of Platyhelminthes (flatworms).
- Annelida (worms) excluding genus Nais.
- Each known species of Hirudinae (leeches).
- Each known species of Mollusca (snails).
- Each known species of Crustacea (Asellus, shrimps).
- Each known species of Plecoptera (stone-fly).
- Each known genus of Ephemeroptera (may-fly) excluding Baetis rhodani.
- Baetis rhodani (may-fly).
- Each family of Trichoptera (caddis-fly).
- Each species of Neuroptera (alder-fly).
- Family Chironomidae (midge larvae) except Chironomus Ch. thummi.
- Chironomous Ch. thummi (blood worms).
- Family Simuliidae (black-fly larvae).
- Each known species of other fly larvae.
- Each known species of Coleoptera (beetles and beetle larvae).
- Each known species of Hydracarina (water-mites).

In order to classify a biological sample the main indicator organisms from the first column are looked for. If, for example, Gammarus is present, but Trichoptera, Ephemeroptera and Plecoptera are absent, then Gammarus line is used. The number of groups (chosen from the lists of groups below the table) in the sample are counted. The Biotic Index is then found where the Group column and the Gammarus line meet.

\*Baetis rhodani excluded.

†Baetis rhodani (Ephem) is counted in this section for the purposes of classification.

(After Woodiwiss, 1964)

Appendix II: Biotic Index for Chandler's Score

Groups present in sample	Increasing abundance				
	Present	Few	Common	Abundant	Very abundant
Each species of <u>Grenobia alpina</u>	90	54	98	99	100
<u>Taeniopterygidae</u>					
<u>Perlidae</u> , <u>Perlodidae</u>					
<u>Chloroperlidae</u>					
Each species of <u>Leuctridae</u> , <u>Gamniidae</u>	84	89	94	97	98
<u>Nemouridae</u> (excl. <u>Amphinemura</u> )					
Each species of <u>Ephemeroptera</u> (excl. <u>Baetis</u> )	79	84	90	94	97
Each species of <u>Cased caddis</u> , <u>Megaloptera</u>	75	80	86	91	94
Each species of <u>Ancylus</u>	70	75	82	87	91
Each species of <u>Rhyacophila</u> ( <u>Trichoptera</u> )	65	70	77	83	88
Genera of <u>Dicranota</u> , <u>Limnophora</u>	60	65	72	78	84
<u>Simulium</u>	56	61	67	73	75
<u>Coleoptera</u> , <u>Nematoda</u>	51	55	61	66	72
<u>Amphinemura</u> ( <u>Plecoptera</u> )	47	50	54	58	63
<u>Baetis</u> ( <u>Ephemeroptera</u> )	44	45	48	50	52
<u>Gammarus</u>	40	40	40	40	40
Each species of <u>Uncased caddis</u> (excl. <u>Rhyacophila</u> )	38	36	35	33	31
Each species of <u>Trichladda</u> (excl. <u>C. alpina</u> )	35	33	31	29	25
Genera of <u>Hydracarina</u>	32	30	28	25	21
Each species of <u>Mollusca</u> (excl. <u>Ancylus</u> )	30	28	25	22	18
Each species of <u>Chironomids</u> (excl. <u>C. riparius</u> )	28	25	21	18	15

/continued

Appendix II (continued)

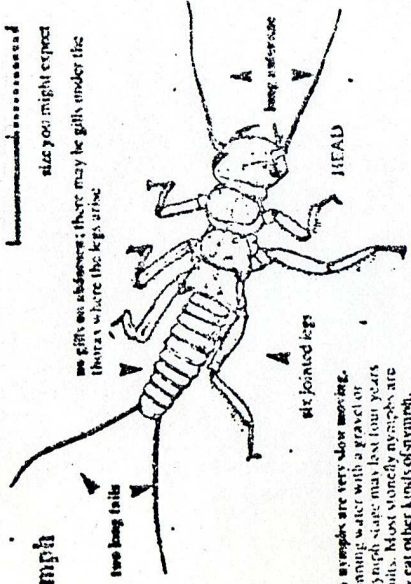
Each species of <u>Glossiphonia</u>	26	23	20	16	13
Each species of <u>Asellus</u>	25	22	18	14	10
Each species of <u>Leech</u> , excl. <u>Glossiphonia</u> , <u>Haemopis</u>	24	20	16	12	8
Each species of <u>Haemopis</u>	23	19	15	10	7
Each species of <u>Tubifex</u> sp.	22	18	13	12	9
Each species of <u>Chironomus riparius</u>	21	17	12	7	4
Each species of <u>Nais</u>	20	16	10	6	2
Each species of <u>Air breathing species</u>	19	15	9	5	1

No animal life

0

### stonely nymph

brownish colour

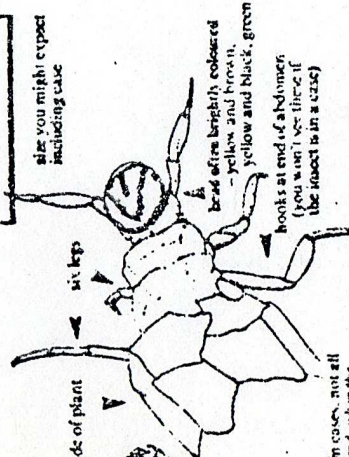
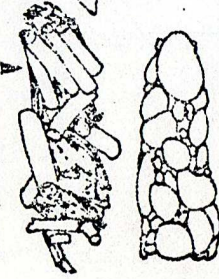


A creature, stonely nymphs are very slow moving. Found in clear running water with a gravel or stoney bed. The nymph stage may last four years with frequent moult. Most stonely nymphs are plant eaters; a few eat other kinds of nymphs.

The photograph is of *Pterobius*

### caddis fly larva

usually lives in a case - the case made of plant matter, sand, or stones.



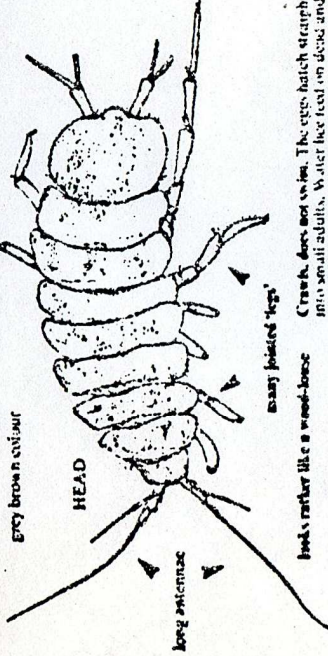
Although most caddis larvae live in cases, not all do. The case is usually covered around, when the insect crawls. One type does wrap itself, and sometimes the case is fixed to a plant or stone. Beets eat this larva and the adult there is another stage in the life cycle - the pupa - chrysalis of a butterfly. Then the case is attached to a plant or

stone, and the ends of the case closed off. The larvae are usually plant eaters.

Photograph of *Phryganea* sp.

### water house

grey brown colour

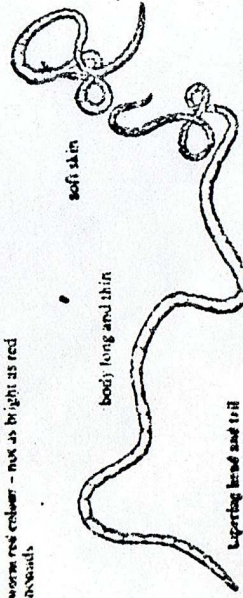


Looks rather like a wood-bore  
Crawls, does not swim. The eggs hatch straight into small adults. Water lice feed on dead and decaying matter, especially plant material.

The photograph is a view from above of *Ambrysus* sp.

### stage worm

like a small earthworm - which is a chiseled worm  
earthworm red colour - not as bright as red chironomids



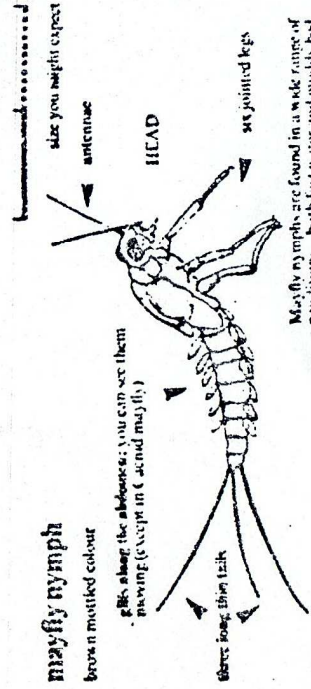
Usually lives in mud; and crawls over the mud surface like an earthworm.

It eats no food, rather like a slow spring - quite distinctive.

It often builds thin mud tubes. It feeds on organic waste - dead animals and plants. The eggs hatch to small adults.

### mayfly nymph

brown mottled colour



Mostly nymphs are found in a wide range of conditions - both fast water and muddy pool. The nymph stage may last for three years. The nymphs frequently moult. The old skins are quite common. The adult, which moult only a few hours, doesn't feed. The nymph is plant eating. Note: some mayflies (the Caddisids) have gill covers protecting the gills. This makes the gills hard to see.

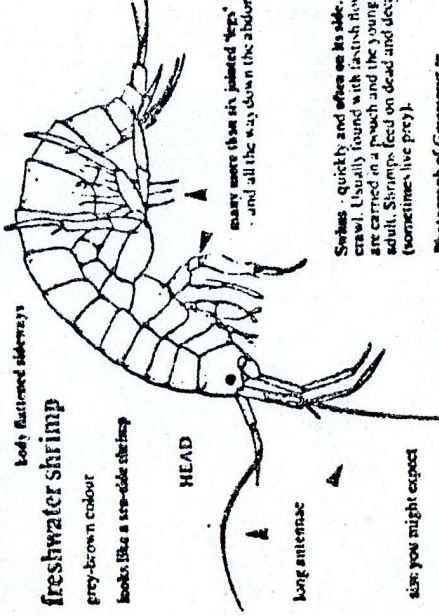
A swimmer. Usually moves quickly by beating its abdomen up and down. The nymphs, which nymphs look similar all in a class, swim with a silk-tooth movement, rather like a fish. The nymphs have gills along the abdomen.

Photograph of *Baetis* sp.

### freshwater shrimp

grey-brown colour

looks like a sea-shrimp



Swims - quickly and often on its side. It can also crawl. Usually found with fish in the water. The eggs are carried in a pouch and the young look like the adult. Shrimps feed on dead and decaying matter (sometimes live prey).

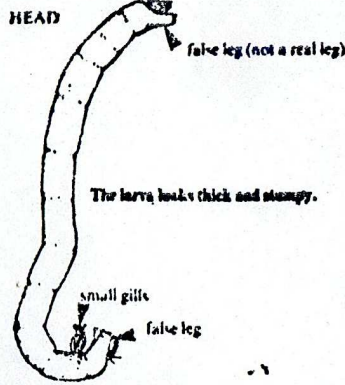
Photograph of *Gammarus* sp.

### 'blood worm'

larva of Chironomid midge

red colour - bright red. Ignore any green or grey types for the Survey

size you might expect



This larva looks rather like a worm, because it is difficult to make out a distinct 'head' and 'body'

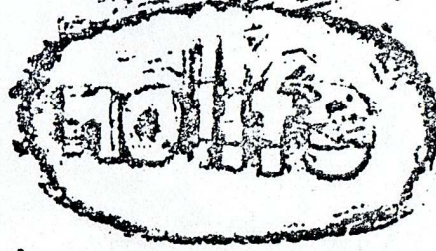
It swims quickly, looping and unlooping - these movements keeping it up in the water. Sometimes though you might find it in a thin mud tube. The adults emerge from the pupa stage (which is somewhat like the larva stage) in Summer, sometimes in enormous numbers.

Photograph of *Chironomus* sp.

### rat-tailed maggot

size you might expect

This maggot is the larva of a fly. It is grey in colour, with false legs, like those of the house fly maggot. It has a long tube, several times the length of the body, which it extends to the nearest oxygen supply. Usually found in mud, or on the bed of a stream devoid of oxygen.



size you might expect