SOUTH WEST WATER

ENVIRONMENTAL PROTECTION UNIT

BIOLOGICAL INVESTIGATION OF THE COMMON LAKE STREAM

FEBRUARY 1987

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INTRODUCTION

Following a request from the Pollution Inspector (Taw District), a biological survey of the Common Lake Stream was undertaken on 10 February 1987. The object of the survey was to determine the effect of effluent discharged from North Devon Meat Abbatoir on the aquatic macroinvertebrate fauna of the Common Lake Stream.

Surveys carried out in 1981 (1) and 1982 (2) indicated the effluent from North Devon Meat Limited was having a severe impact on the invertebrate fauna of this stream. North Devon Meat Limited has since made modifications to its effluent treatment and this now involves the following; air flotation, after which effluent passes to a large oxidation ditch, (a derivative of the Pasveer system with rotors to maximise aeration), this is followed by secondary settlement before passing to two lagoons. Finally the effluent is sprayed on to land.

A survey undertaken in 1985 (3) after these modifications were made, concluded that the invertebrate community of the Common Lake Stream had undergone an improvement in terms of diversity and abundance, however, the fauna observed still indicated the presence of organic pollution, although it was no longer of a severe nature.

For the present survey, biological sampling sites were selected to correlate with the 1985 survey. An additional site was examined on a tributary of the Common Lake Stream which receives run off from the spray irrigation of the North Devon Meat Limited effluent.

METHOD

Macroinvertebrate samples were obtained from riffle sections of the Common Lake Stream and a minor tributary of the stream (see figure 1 for site location) using the standard two minute kick method (4). Six sites were examined, four on the Common Lake Stream and two on a minor tributary.

An on site assessment was made of each invertebrate sample obtained, each invertebrate family present was recorded together with a qualitative estimate of abundance. Samples were then preserved in Industrial Methylated Spirits (IMS) and returned to the laboratory for further analysis. Physical details of each site i.e. substrate composition,flow rate, width of stream etc. was also noted. Biotic indices were calculated from the invertebrate data obtained. The biotic indices used for the purposes of this investigation were the Biological Monitoring Working Party (B.M.W.P.) score system. The average score per taxon (A.S.P.T.) value was also calculated. This value gives an indication of the proportion of pollution sensitive and pollution tolerant fauna present at a particular site and is less susceptible to fluctuations from seasonal effects, sampling inconsistency and the variability in the physical characteristics of a river (5).

RESULTS

Site details and biotic indices are shown in table 1. Previous data has been included where available. Table 2 provides a list of invertebrate families observed at sites 1 - 6 together with an indication of abundance. Biotic indices from the present survey are represented graphically in figure 2 together with data from past surveys.

DISCUSSION

Minor tributary of the Common Lake Stream receiving run off from spray irrigation of North Devon Meat effluent

Two sites were examined on a minor tributary of the Common Lake Stream. The first site was upstream of the North Devon Meat Limited Treatment Plant, it was not, however, upstream of the spray irrigation area (site 1 on figure 1). The stream at this point was only 0.65 metres wide with an unstable substrate, the surrounding land was marshy scrubland. Foam was observed in the stream suggesting the presence of proteinaeous material. The invertebrate sample obtained from this site contained four well represented stonefly families indicative of fair water quality for a stream of this nature, however, the presence of significant numbers of chironomidae and oligochaeta suggested the presence of an organic influence, this does not appear to have a severely restrictive effect on the invertebrate fauna.

The second site sampled on this tributary (see site 2, figure 1) was immediately upstream of the confluence with the Common Lake Stream. At this point the stream had widened to 1.30 metres and had a more stable substrate comprising 50% cobbles. Visual inspection of the stream did not reveal any obvious signs of organic enrichment. However, once the substrate had been disturbed the presence of proteinaeous type particles were apparent. The invertebrate community observed at this site contrasted with the previous site with a significant change in the composition of the invertebrate community. The dominant fauna observed at this site was the simulidae and chironomidae families. The simulidae feed by filtering particles from the water and the abundance of organic partic les in the stream has enabled this family to flourish. Large numbers of ascelidae and oligochaeta were also present. The overall invertebrate community was indicative of poor water quality resulting from strong organic enrichment.

COMMON LAKE STREAM

A site examined upstream of the minor tributary confluence revealed a restricted invertebrate community (site 3, fig. 1). The average score per taxon of 4.6 calculated from the invertebrate data indicated a large proportion of the community comprised the more pollution tolerant taxa. One bank of the stream at this site is used as a tip site. A certain amount of debris from this tip was found in the stream. It is apparent from the invertebrate data obtained that the invertebrate fauna is experiencing the effects of organic enrichment. Comparison of results from this site with the 1985 survey shows a decline has occurred in both the diversity and abundance of the invertebrate fauna, however, the fauna observed in 1985 was also restricted (to a lesser extent) due to an organic influence.

The invertebrate fauna of the Common Lake Stream, 50 metres downstream of the minor tributary confluence (site 4, fig. 1) had undergone little change to that observed upstream. There appeared to be a mixing of community types from the tributary and the Common Lake Stream and this resulted in a very slight increase in diversity.

Approximately 600 metres downstream of this site a decline in the invertebrate fauna was apparent (site 5, fig. 1). This was due to a decrease in the abundance of the families present. The A.S.P.T. score of 4.47 also indicated the presence of more pollution tolerant taxa than that observed upstream of the minor tributary confluence.

Although a lowering of water quality is suggested by the invertebrate data, the fauna present is not representative of the gross organic pollution which has been observed in the past (see figure 2).

The final site examined on the Common Lake Stream was immediately upstream of Torrington Hunt Kennels before the stream enters the River Torridge (site 6, fig. 1). A considerable improvement in the invertebrate fauna was detected in comparison with results from the previous survey. Three families of stonefly (although in low numbers) and several caddis families were present. Simulium and chironomidae were no longer the dominant taxa indicating the effects of organic enrichment were less severe at this point. Whilst the overall invertebrate community showed signs of recovery from the organic influence evident further upstream, the presence of the asellidae (water hog louse) and erpobdellidae (leech) families suggests recovery is not complete.

CONCLUSIONS

1. Biological investigation of a small tributary of the Common Lake Stream receiving run-off from a spray irrigation area for North Devon Meat Limited effluent indicated the presence of fair water quality upstream of the effluent treatment plant.

   A significant change in water quality was detected at a site on the lower reaches of the tributary where a poor and restricted fauna was observed, representative of strong organic enrichment.

2. The invertebrate fauna observed in the Common Lake Stream, upstream of the tributary confluence was indicative of doubtful water quality. This may be a result of leeching from an unofficial tip present on one bank of the stream and/or another source(s).

3. The invertebrate community of the Common Lake Stream was not immediately influenced by the small tributary which receives run-off from the North Devon Meat Limited effluent spray irrigation area. Approximately 650 m downstream of the tributary confluence diminishing abundances of invertebrate families and the presence of slightly more pollution tolerant fauna suggested water quality had deteriorated. The cause of this decline could not be solely attributed to the tributary receiving spray irrigation run-off, as an organic influence was apparent upstream of the tributary confluence, therefore the deterioration of water quality may result from either; or a combination of, these influences.

4. Analysis of a biological sample obtained on the lower reaches of the Common Lake Stream immediately before confluencing with the River Torridge indicated the effects of organic enrichment evident further upstream were less severe at this point with a noticeable improvement in the invertebrate fauna of the stream.

RECOMMENDATIONS

1. Further investigation into the cause of the restricted invertebrate fauna observed upstream of the tributary confluence, Common Lake Stream should be made.

2. Biological surveys of the Common Lake Stream and the minor tributary receiving spray irrigation run-off should be continued on an annual basis to monitor any change in water quality and to assess the effect of any further changes in effluent management.

REFERENCES

1. P. Morley Williams - Biological investigation of the effect of waste from North Devon Meat Factory, Great Torrington, on the two receiving watercourses - 25 June 1981, S.W.W. BB/81/18.

2. M.R.N. Newton - Biological investigation of the Common Lake Stream - 1 October 1982, S.W.W. SS/ES/82/3.

3. M.R.N. Newton - Biological investigation of the Common Lake Stream in relation to the effect of the uprating of effluent treatment by Peninsula Proteins - October 1985, SSE/ENV/85/29.

4. Standing Committe of Analysts (1978) Handnet sampling of aquatic macroinvertebrates, H.M.S.O., London.

5. P.D. Armitage, D. Moss, J.F. Wright and M.T. Furze - The performance of a new water quality score system based on macroinvertebrates over a wide range of running water sites (1983) Water Res. Vol. 17 No. 3 pp 333 - 347.

TABLE 1 - SITE DETAILS AND BIOTIC INDICES 1981 - 1987

SITE	N.G.R.	B.M.W.P. SCORE				NUMBER OF FAMILIES				AVERAGE SCORE PER TAXON			
		1987	1985	1982	1981	1987	1985	1982	1981	1987	1985	1982	1981
1. Tributary receiving effluent upstream of Peninsula Proteins.	SS 4970 2015	85	-	-	-	-	-	-	-	5.67	-	-	-
2. Tributary receiving effluent immediately upstream of confluence with Common Lake Stream	SS 4930 1985	57	71	-	-	13	15	-	-	4.39	4.73	-	-
3. Common Lake Stream 50m upstream from confluence with tributary.	SS 4940 1980	69	91	96	31	15	18	20	8	4.6	5.06	4.8	3.875
4. Common Lake Stream 50m downstream of tributary confluence	SS 4855 1970	82	88	-	46	17	18	-	12	4.82	4.89	-	3.83
5. Common Lake Stream, Common Bridge, Torrington	SS 4850 1970	67	70	14	-	15	16	4	-	4.47	4.38	3.5	-
6. Common Lake Stream, upstream Kennels	SS 4790 1980	95	54	19	37	18	12	6	9	5.28	4.5	3.17	4.11

TABLE 2

INVERTEBRATE FAMILIES OBSERVED AT SITES 1 - 6
BIOLOGICAL INVESTIGATION OF THE COMMON LAKE STREAM - FEBRUARY 1987

INVERTEBRATE FAMILY	TRIB. RECEIVING EFFLUENT		COMMON LAKE STREAM			
	SITE 1	SITE 2	SITE 3	SITE 4	SITE 5	SITE 6
Plecoptera						
Leuctridae	C/A	-	-	-	-	-
Taeniopterygidae	O	-	-	-	-	R
Perlodidae	O	-	-	-	-	R
Nemouridae	C	O	O	R	R	O
Ephemeroptera						
Baetidae	C	-	C	C	C	C
Trichoptera						
Sericostomatidae	-	-	R	R	O	R
Rhyacophilidae	-	-	R/O	O	O	R
Polycentropidae	C	O	-	-	-	-
Limnephilidae	C	R	-	O	R	-
Hydropsychidae	-	-	O	R	O/C	O
Coleoptera						
Dytiscidae	R	R	-	-	-	R
Hydrophilidae	-	-	-	R	-	-
Diptera						
Tipulidae	C	R	R	R	-	R
Simulidae	VA	VA	C/A	C/A	C/A	C
Chironomidae	C	A	C	C	O/C	O
Crustacea						
Gammaridae	O	R/O	-	O	O	O
Asellidae	-	C	O	C	O/C	O/C
Mollusca						
Ancylidae	-	-	C	O	C/A	C
Sphaeridae	C	-	-	-	-	R/O
Hydrobiidae	O/C	O	O	C	C	C
Planorbidae	-	R	-	-	-	-
Tricladida						
Planaridae	-	-	R	O/C	R	-
Hirud inea						
Glossiphoniidae	-	R	R	R	O	-
Erpobdellidae	-	-	C	C	C	O
Oligochaeta						
Oligochaeta	C	C	C	C	C	O/C

Key to abundance

R - Rare, 1 - 2 individuals, O - Occasional, 3 - 10 individuals
C - Common, 11 - 49 individuals, A - Abundant, 50 - 100 individuals
VA - Very abundant, 100+ individuals

Fig 1. BIOLOGICAL SAMPLING SITES EXAMINED ON THE COMMON LAKE STREAM AND A MINOR TRIBUTARY - FEBRUARY 1987

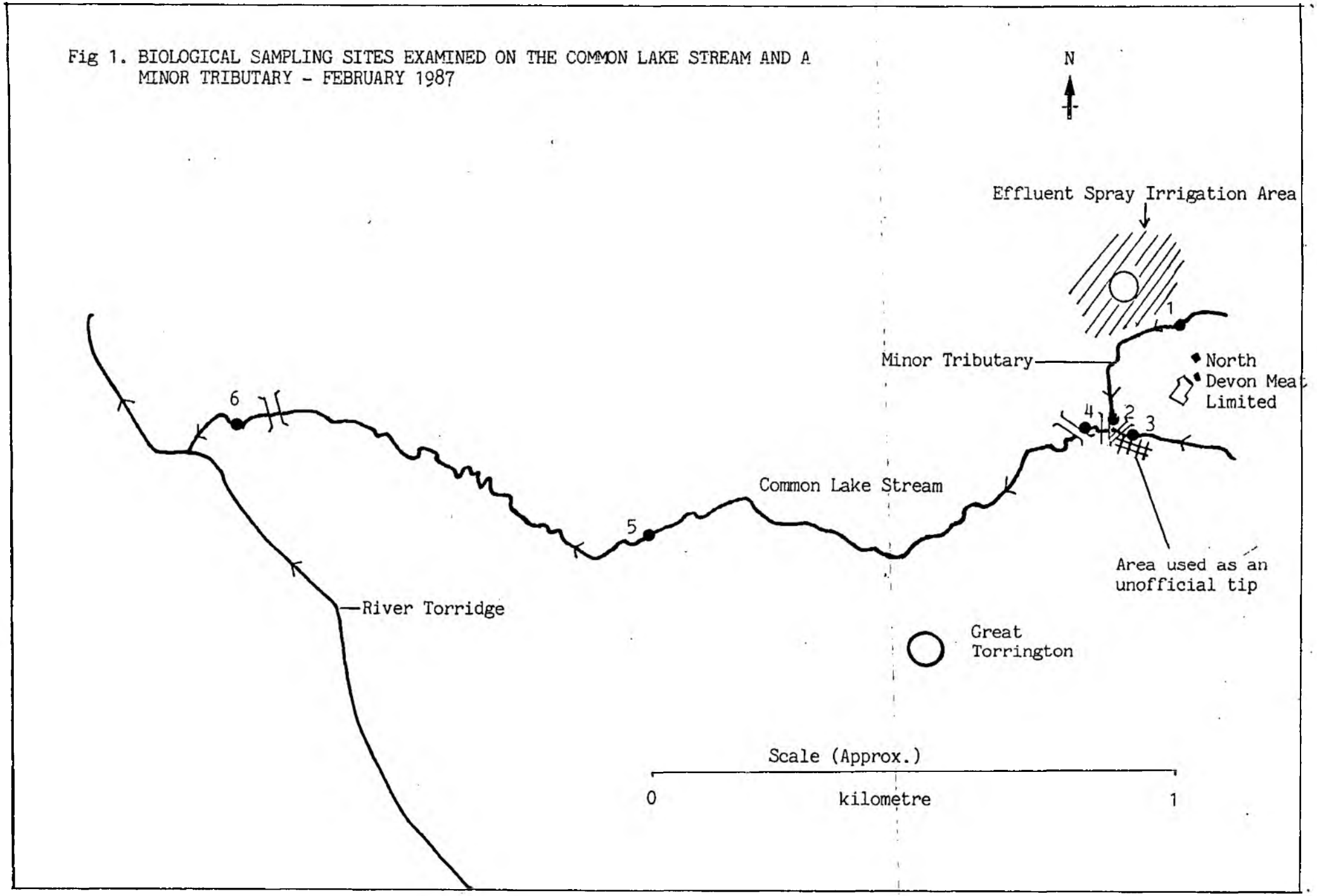

Fig. 2 BIOTIC INDICES OBTAINED FROM SITES 1 - 6, BIOLOGICAL SURVEY 1987, TOGETHER WITH PAST SURVEY DATA