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Strategic ecosystem studies
of large slow flowing lowland
rivers.

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1.

ABSTRACT

This report covers the period April to September, 1989.

During this period sampling of invertebrates has concentrated on planktonic animals and those associated with one of the dominant macrophytes in the system, *Nuphar lutea*, the yellow water lily, since these are particularly important in the diets of larval and juvenile cyprinid fish.

Samples were taken at fortnightly intervals, from 3 main river sites (including 1 navigation channel), a side channel and, in the case of the plankton samples, from a marina, adjacent to one of the main river sites. A proportion of samples of both types has been analysed, but a large backlog of work remains to be done.

The fauna of the lily leaves is overwhelmingly dominated by 3 major taxa, Copepoda, Cladocera and Chironomidae. In general differences between sites were slight but this was an unusually dry year, with low water velocities, and in a more typical year differences may well be more pronounced.

Rotifera was by far the most abundant taxon in plankton samples. The genus *Polyarthra* was particularly abundant in the marina, but other genera were common at all sites with a peak in numbers in late May. A secondary peak was evident in the marina in early August.

Pesticide analyses were carried out on water and sediment samples from 3 main river sites and 3 large, associated drains, as in the previous Autumn, and results are presented.

This report covers the period April to September, 1989. The emphasis during this period has been on planktonic animals and those associated with plant surfaces, since these are of major importance in the diets of larval and juvenile cyprinids.

Samples of plankton and leaves of *Nuphar lutea*, the yellow water lily, were taken in the Godmanchester area, from the main river, upstream of Godmanchester Lock (TL234703), and in the navigation channel downstream of the lock (TL243706). Further samples were taken from Lees Brook (TL233702), a smaller side channel, fed from the main river via a spill-weir. Samples of plankton and *Nuphar lutea* were also taken from the main river at Needingworth (TL361711), about 25km downstream from Godmanchester, and plankton samples only were obtained from the adjacent "Pike and Eel" marina (TL359713). In all cases samples were obtained at fortnightly intervals or less. Plankton sampling commenced on 18 April and will continue, although with reduced frequency throughout the coming winter. Sampling of *Nuphar lutea* was started as soon as the plants were sufficiently developed, in May, and will continue until they die back in the Autumn.

A proportion of samples of both types has been partly analysed and some preliminary data are presented here. The backlog will be dealt with, as far as possible, during the coming winter, when sampling activity will be reduced.

Some measurements of water velocity were made in conjunction with the invertebrate sampling programme. However, in this unusually dry year velocities have been very low, for most of the time.

Concentrations of organochlorine and pyrethroid pesticides were determined from a series of water and organic sediment samples, taken in May. These samples were obtained from the same series of sites as in November, 1988 (see previous report for earlier results).

3. INVERTEBRATE SAMPLING METHODS

3.1 *Nuphar lutea*.

Submerged leaves were carefully enclosed in a conical plankton net (mesh, 50um) before being detached from their petioles. Leaves and washings from the net were then transferred to a polythene bag. Leaves were carefully washed in the laboratory and all of the resulting material was preserved in 70% Industrial methylated spirit (IMS). Ten leaves from each site were collected on each sampling occasion. Floating leaves were considerably less abundant than submerged leaves. Occasional samples of floating leaves were, however, taken for comparative purposes.

All of the sampled leaves were photocopied in order that their areas can be estimated using the IIS image analyser.

3.2 Plankton Samples

A battery operated, submersible bilge pump was used to pass 20l of river water through a 63um mesh sieve. Ten samples were taken from each site on each occasion. Material retained in the sieve was preserved in 70% IMS.

3.3 Subsampling

For initial analysis all of the samples from *Nuphar* and most of the plankton samples were subsampled. However, the complete samples have been retained for further, more detailed analysis, as necessary.

Material associated with leaves was made up to 100ml by addition of IMS and, after thorough mixing, a measured volume (at least 5%) was removed, using a wide-mouthed syringe. To date only the larger organisms, those retained by a 250um mesh sieve, have been examined.

In the case of plankton samples, the material concentrated from 20l of river water was made up to 100ml from which 1ml subsamples were extracted for counting and identification, using a Lund Counting Chamber and a compound microscope. Thus each subsample represented 200ml of river water.

4. PRELIMINARY RESULTS

4.1 Invertebrate samples

4.1.1 Fauna of *Nuphar lutea* leaves.

At all sites the fauna is dominated by three major taxa, Copepoda, Cladocera and Chironomidae. Preliminary estimates

of mean numbers of these 3 taxa for each site are given in Table 1. For most of the period under review, differences between sites were slight. However, there are preliminary indications that Copepoda were particularly abundant at the downstream, Needingworth, site in early May while Cladocera showed a large peak below Godmanchester lock in mid June. Chironomid numbers, per leaf were generally below 500 but exceeded 4000 per leaf at the Lees Brook site in early July. There are also indications that the chironomid fauna of Nuphar in Lees Brook is more diverse than in the main river, where it is overwhelmingly dominated by a single genus, *Cricotopus*.

It must be emphasised, however, that only a small proportion of the total number of samples has yet been examined and these observations must, therefore, be regarded as tentative.

4.1.2 Zooplankton

Except in the "Pike and Eel" marina the numbers of Copepoda (mostly nauplii) were very low throughout the sampling period. In the Marina numbers were greater, with a peak density of around 900 l⁻¹ in late May and a second peak of around 600 l⁻¹ early in August.

Rotifers were, by far, the most abundant group of organisms in plankton samples, Table 2. The genus, *Polyarthra* was particularly abundant within the Marina in early May and during August but other genera were abundant at all sites, with a peak in numbers in late May, ranging from about 300 l⁻¹ below Godmanchester lock, to almost 900 l⁻¹ in the "Pike and Eel" marina. A secondary peak,

of about 550 l⁻¹ was evident in the marina in early August.

4.2 Pesticides

As in November, 1988 samples of water and of marginal sediment were obtained from 3 main river situations within the Ouse system and from 3 associated drains in June 1989. Samples were preserved immediately by the addition of sodium azide and were analyzed at the IFE River Laboratory. The results of these analyses are given in Tables 3 & 4,

Concentrations of organochlorines in water were low which corresponds with analyses carried out in the past by the Water Authority and now by NRA. Assignment of the pyrethroids, in sediment samples requires confirmation. The method, using the GLC has been improved and relative retention times are very reproducible. However, because of the longer retention times of pyrethroids, peaks within 0.005 (relative retention time) of the corresponding standards have been assigned. Isomer separation has been achieved for all the pyrethroids. If the assignments are correct, then the levels of pyrethroids in the sediments are very high and are a cause for concern. All of the pyrethroid peaks designated need to be examined in more detail by mass spectroscopy.

5.

FUTURE WORK

The coming winter, when sampling activity will be much reduced by comparison with the period under review, will allow the opportunity for much of the backlog of samples to be sorted the animals to be identified. This has been

an unusually dry, warm summer and water velocities have been very low for most of the time. Variation in water velocity associated with the operation of automatic sluices is likely to be an important perturbation to the system in most years. We therefore intend to continue next year with a similar sampling regime, and to investigate the relationship between water velocity patterns and the abundance and distribution of animals, in the expectation that next year will be more "typical". However, in order to be able to complete the analyses and submit the final report on time we will almost certainly have to reduce the number of sampling sites next year.

Further samples of sediment, for pesticide analysis, will be taken this autumn and next year. Having spread the samples over a fairly wide range of situations this year it is proposed, now to concentrate on only one or two main river sites and to sample their sediments more frequently.

Table 1.
Preliminary estimates of numbers of the 3 dominant taxa, Copepoda, Cladocera and Chironomidae on leaves of *Nuphar lutea*.

SITE	TAXDN	May17	May31	June14	June27	July11	July25	Aug08	Aug22
Godmanchester Main River	Cladocera	50	150	490	125	12	129	65	239
	Copepoda	140	110	430	145	24	72	114	33
	Chironomidae	360	370	450	1105	202	207	62	120
Godmanchester Below Lock	Cladocera	17	430	3940	80	48	495	238	287
	Copepoda	127	90	40	122	87	275	54	150
	Chironomidae	69	290	320	382	249	525	64	333
Godmanchester Lees Brook	Cladocera	20	720	840	225	10	360	208	400
	Copepoda	230	350	170	180	110	290	145	90
	Chironomidae	240	140	440	1485	2010	1030	545	375
Needingworth Main River	Cladocera	520	1410	950	220	100	178	145	300
	Copepoda	1160	410	220	230	110	276	150	113
	Chironomidae	1220	330	570	340	365	186	95	93

TABLE 2

Preliminary estimates of numbers of Rotifera l⁻¹ (excluding the genus *Polyarthra*).

SITE	Apr18	Apr26	May03	May10	May23	Jun07	Jun20	Jul03	Jul25	Aug02	Aug15	Aug29
Godmanchester Main River	*	40	45	235	3550	20	125	30	755	160	65	65
Godmanchester Below Lock	*	*	*	465	1995	60	175	60	550	150	110	80
Godmanchester Lees Brook	*	*	45	340	1430	75	115	55	150	100	30	40
Needingworth Main River	*	*	140	1990	2740	185	25	0	195	25	25	15
Needingworth Marina	115	135	1030	4375	3230	90	40	2	35	730	440	2770

* = no data yet available

TABLE 3

Preliminary estimates of numbers l⁻¹ of *Polyarthra*.

SITE	Apr18	Apr26	May03	May10	May23	Jun07	Jun20	Jul03	Jul29	Aug02	Aug15	Aug29
Godmanchester Main River	*	3	10	28	8	0	8	20	28	285	515	325
Godmanchester Below Lock	*	*	*	28	38	0	5	0	735	165	210	45
Godmanchester Lees Brook	*	*	125	95	55	3	15	0	28	165	45	13
Needingworth Main River	*	*	20	1295	55	8	5	8	1180	140	25	65
Needingworth Marina	130	100	545	2145	615	80	10	50	30	4410	4880	2065

* = no data yet available

TABLE 4
 Concentrations of some organochlorine and pyrethroid pesticides in water and sediment in parts of the Great Ouse and associated drains.

PESTICIDE	Main River Sites			Drains		
	A	B	C	D	E	F
	(A) Water samples $\mu\text{g l}^{-1}$					
HCH	0.012	0.012	0.014	0.021	0.005	0.002
BHC	nd	<0.001	0.001	0.001	0.002	<0.001
TDE	nd	nd	nd	0.106	nd	nd
DDT	0.002	nd	nd	nd	nd	nd
Aldrin	nd	nd	nd	nd	nd	nd
DDE	0.002	0.002	0.003	0.001	<0.001	<0.001
Dieldrin	0.002	0.002	0.001	0.005	0.001	<0.001
Endrin	0.001	nd	<0.001	0.06	nd	nd
Heptachlor	nd	nd	nd	nd	nd	nd
c-Permethrin	0.08	0.08	0.05	nd	0.09	0.04
t-Permethrin	0.02	0.003	0.02	0.06	0.05	0.02
Cypermethrin	0.01	0.020	0.04	0.088	0.07	0.04
Fenvalerate	nd	<0.001?	0.002	0.001	0.002	<0.001
	(B) Sediment samples $\mu\text{g kg}^{-1}$ dry sediment					
HCH	0.5	nd	nd	3	0.4	0.6
Aldrin	nd	nd	nd	nd	nd	nd
Dieldrin	11	13	2	3	0.2?	<0.1
Endrin	0.8	11	0.1	2	3	nd
TDE	8	16	3	1	4	nd
c-Permethrin	82	25	24	7	17	27
t-Permethrin	36	7	7	nd	42	30
Cypermethrin 1	<1	1	<1	<1	6	9
Cypermethrin 2	1	nd	<1	<1	3	2
Cypermethrin 3	1	4	12	1	11	3
Cypermethrin 4	nd	nd	nd	nd	nd	nd
Fenvalerate 1	3	<1	nd	1	3	2
Fenvalerate 2	<1	nd	<1	nd	24	2

(4 isomers Cypermethrin, 2 isomers Fenvalerate)

? = assignment very uncertain

nd = not detected