REPORT ON THE MILLENNIUM CHALK STREAMS FLY TRENDS STUDY

A survey carried out in 2000 among 365 chalk stream fly fishermen, fishery owners, club secretaries and river keepers

Subject: trends in aquatic fly abundance over recent decades and immediate past years, seen through the eyes of those constantly on the banks of, and caring for, the South country chalk rivers.

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with data available to all contributory associations and clubs.

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MANAGEMENT SUMMARY

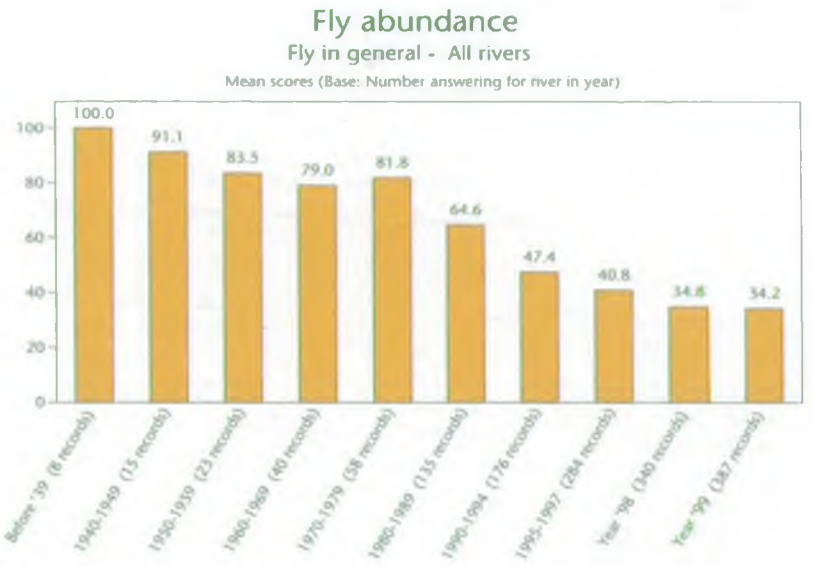
Falling fly numbers

Questionnaire results from 365 respondents were analysed to ascertain what observed changes had occurred in fly populations in southern chalk rivers over past decades. Detailed analysis and interpretation of the data centred on ascribing 'abundance scores' to the six reporting levels of fly hatches ranging from 'good hatches frequently' to 'absent'.

The results indicate that the overall abundance score in 1999 has fallen to 34 compared with the maximum score of 100 in the last decade before the War.

The main part of the reduction has occurred over the last 20 years. After 1980, the abundance score fell steeply (by about three-fifths) over the next two decades to the end of the Millennium.

The most precipitous fall was over the most recent period, the 10 years between 1989 and 1999, with the abundance score falling from 65 in the 1980s to 34 in 1999.



It is possible to benchmark the decline in aquatic fly abundance against the declines in populations of birds and butterflies that have recently been revealed by large-scale surveys.

Between 1972 and 1996, there was an average 40% population decline among the 20 species included in the Government's Farmland Bird Index.

Over this period, the tree sparrow declined 76%, the skylark 75%, the corn bunting 74%, and the turtle dove 85%. Numbers of swallows specifically are believed to have declined because of steep falls in the number of available insects.

Joint research by the Butterfly Conservation Charity and The Centre for Ecology and Hydrology based upon 1.6 million sightings by 10,000 volunteers shows that a third of butterfly species have suffered falls in numbers greater than 50%, and many other species have fallen by more than 20%. The high brown fritillary has declined by 77% since the 1970s, the wood white by 62%, the pearl-bordered fritillary by 60% and the marsh fritillary by 55%.

Further surveys have been published giving details of declines in other animal populations, such as bumble bees, water voles and dormice.

In reporting the changes in bird and butterfly abundance, the authors of these surveys and other commentators have drawn attention to the growing body of evidence linking the declines with recent agricultural intensification and changes in practice, as well as with urbanisation and loss of habitat, especially wetland habitat.

Footnote

In addition to the 'Fly Abundance Questionnaire' respondents were asked to give their views on which are the most important elements of the 'Chalk Stream Malaise', and what priority should be given to addressing the key issues at the present time, and in the future. The results of this questionnaire are published separately from this report.

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INTRODUCTION AND OBJECTIVES

The idea of conducting a broadly structured quantitative study of trends in aquatic fly abundance as observed by those frequently present on the river bank, arose in 1999 from the difficulties experienced by those whose responsibility it is to achieve optimal management of the chalk streams, in the wake of the adverse climatic and man-made conditions perceived to have characterised the 1990s.

Many factors were known to be bearing on the health of the chalk streams, and wide reference was made, and credence given, to the 'Chalk Stream Malaise'. Many of these factors were thought likely to be making a negative contribution to favourable status for invertebrate populations. However:

- data, based on the evaluative opinions of angling interests and management, aimed at guiding priorities for addressing these malaise factors were absent.
- it was not known how seriously to take issues of invertebrate health.
- water quality, at least within the relatively broad bands monitored by the Environment Agency, was not deteriorating.
- whilst considerable bodies of evidence in the form of written records of fly abundance were known to exist, a concerted attempt to retrieve and organise this data had so far seemed impracticable.

During this decade (and indeed before), widespread reports were received of declining fly hatches on the Hampshire and Wessex chalk streams.

No quantitative evidence was available to support or refute these reports, and as the source was fishermen (for the simple reason that anglers spend large amounts of time at the waterside looking for fly) the information was treated by the authorities as anecdotal and biased, on the grounds that it was unstructured and that fishermen will always complain about the lack of fly.

This is true, of course, but the hypothesis that anglers always complain inaccurately about declining fly numbers demanded examination.

Where scientific data had been collected on aquatic fly diversity (i.e. the presence in the river of nymphs of the various invertebrate species, as opposed to their numbers) in general all species appeared to be 'present and correct' and hence, using diversity as the standard measure of the health of the rivers, no cause for concern seemed to arise.

Scientific studies had concentrated on recording the nymphal form. The number of hatching fly, however, is of most interest to fishermen. Fly hatches have not been fully studied scientifically because they vary so much from day to day - nymph numbers are a better guide to a stream's potential, but even they have seldom been counted and reported by species numbers.

The huge and far-reaching study that was conducted early in the 1990s by Johnson and Bailey of King's College Division of Biosphere Sciences on behalf of the Salmon and Trout Association (ref 1) could find very little clear numerical evidence either to support or disprove the already commonly hypothesized decline in fly abundance.

It wasn't that the evidence was ambiguous - there just wasn't enough of it. The remit of that study did not extend to asking fishermen, club secretaries, river keepers and fishery owners, or to studying unpublished records kept by these people, although the report referred to the existence of these sources of data.

More recently, as a result of continued expressions of concern from fishermen, the Environment Agency had commissioned the Institute of Freshwater Ecology at East Stoke, Wareham to carry out a 'Scoping Study on the Ephemeroptera of the Southern Chalk Streams' (ref 2).

This 1998 study reviewed the available scientific literature together with any macro invertebrate survey information from various sources to establish whether there was information on seasonal patterns of abundance and variations from year to year. The report also reviewed factors, both natural and resulting from man's activities, which may have deleterious effects on the distribution and abundance of upwinged flies. It concluded that there was scientific evidence to suggest that individual ephemeroptera species

and population densities in the aquatic pre-emergent larval stage could be considerably influenced by a number of factors - particularly flow and water quality. Similarly the terrestrial adult phase, crucial for successful reproduction and dispersal, could also be influenced by adverse weather conditions namely low temperatures, high winds and rain. It is however recognised that there is very little detailed scientific information on the factors which could cause disruption to both the aquatic larval and terrestrial adult phase of chalk river ephemeroptera.

Following the publication of the Scoping Study consideration was given to obtaining details of the emergence of upwinged flies through the seasons from empirical observations made by fishermen. In order to utilise this source of information it was proposed that a questionnaire should be developed to provide appropriate quantitative data. The questionnaire would cover information both from written records and from memory, with separate analysis and comparison between these two sources being provided for.

Although memories may be biased and selective, contemporaneous written recording of hatches has often been extremely detailed. In addition, the coverage both of rivers and reaches, and of days and seasons, afforded by gathering data from those who spend far more time on the river than scientists can, is many thousands of times greater.

METHODOLOGY

a) Sampling method, respondent qualifications and sample achieved

The methodology adopted was to approach as close as possible to a census, rather than a sample, of the target population.

The target population was defined as:

- Southern chalk stream fly fishermen, river keepers, club and syndicate secretaries, and riparian owners with the relevant knowledge and field experience.

The method of access was via the membership lists of clubs, syndicates and fishery associations. Since angling access to the Southern chalk streams is almost exclusively available through these organisations, coverage is maximised by this method.

In addition, the Wild Trout Trust membership list was utilised in order to extend coverage to include freelance anglers who might not be accessible through the fishing club route, and anglers fishing the chalk streams but resident further afield; and also with the objective of including as many anglers as possible with a scientific interest in the aquatic environment.

The sample is a purposive sample, and does not set out to achieve formal statistical parameters such as might for example be based upon a random sample drawn from a complete listing of the potential universe.

Membership of the sample is predicated simply upon qualification by membership of one of the above organisations, modified by the willingness to participate in such a survey. Willingness to participate will have been greater among those who felt able, by virtue of having some knowledge (however coarse-grained) of aquatic flies and either having kept records or taken mental note of abundance over the seasons. There are therefore characteristics present in the sample which could be described, alternatively, as either giving rise to bias, or giving rise to a more appropriate qualification to respond (on the basis of being better informed). At the end of the day, the survey sought to maximise coverage in terms of respondents' past presence on-stream, in terms of the rivers observed, and in terms of the suitability of the participants as respondents and where possible in terms of the availability of written records.

Almost 1500 questionnaires were sent out, duplication being eliminated as far as possible by inspection, and 365 were returned to form the basis of the survey - a response rate of 25%, which the authors consider to be extremely satisfactory given the relatively onerous nature of the completion task.

89 out of the 365 were keepers, owners, or club officials, who spend very many days on the river bank, most of these of course being anglers as well (see page 4 of the data set). Page 23 of the database shows 30% (109 respondents) working from written records.

Where the inclusion of a separate table in this report has not been possible for space reasons, reference is made to the relevant page in the electronic data set, which is available via email from Allan Frake as detailed in Appendix 3.

b) Observational coverage

Participants were asked how many times a season had they been on each river recently. The distribution of frequency is shown on page 13 of the database, and the mean (18.3 days per season across all rivers) on page 15. A separate matrix was requested for each river where respondents felt capable of reporting, and some respondents did take the opportunity to report on more than one river (365 people producing 387 river reports for 1999).

With 387 rivers reported on for the year of 1999 utilising observations from an average of 18.3 observer days per season on the river, the observational database on which the central core of the survey is founded for that year amounts to 7082 days.

Naturally, the observational database is smaller for earlier years, but since the survey deals in decades for the earlier periods this effect is counteracted and the observational databases on which the key conclusions about trends in fly abundance are based, is very substantial. For example, the 58 respondents reporting on fly in general for the 1970s produce a calculated coverage of 10 years x 18.3 days x 58 reporters = 10,614 days of potential observation.

c) Internal tests for bias, and robustness of data

Respondents were asked to state whether they were working mainly or partly from written records, or mainly from memory. The data from this question is shown on page 23 of the database and shows 30% (109 respondents) working from written records.

As a partial test for bias (i.e. a test for the 'rose tinted spectacles' of nostalgia) the fly abundance scores have been analysed across the historic period under study, by whether or not the respondents were working from written records (see page 409 of the database and page 13 this report) . This analysis does indeed show a degree of hypothesised bias in response, with those working only from memory producing slightly better reports of fly abundance in the earlier decades from the 1940s to the 1960s, and reporting slightly less good hatches in the more recent decades (see page 409 of the database). This indication of bias in the reportage needs to be, and has been, taken into account in evaluating and interpreting the data. However, the bias is not at anything like a high enough level to call in question the overall conclusions relating to the decline in fly numbers, particularly in the more recent decades and years. In fact, being able to measure the bias in this way adds considerably to our confidence in drawing conclusions from the results, and provides internal validation for the methodology used.

A degree of further internal validation is provided by inspection of the results for some individual species of fly and rivers, in that factors such as the indicated increase in mayfly *(Ephemera danica)* in recent years on the River Itchen, which parallels 'anecdotal' evidence and current experience. Similarly, the Frome is reported to have high abundance of Grannom, a factor which correctly reflects its heavy Grannom hatches, but also reflects the fact that its season opens on 1 April whereas the other rivers open their seasons later, after such Grannom as is present has ceased to hatch.

d) Questionnaire design

Questionnaire design for the fly abundance section focused on making it possible to respond as easily in either the fullest or the simplest terms: respondents could complete a valid questionnaire by producing a single code representing for example 'fly in general' for the year of 1999 for a single river of which they had experience. Or they could provide codes for individual recent years and previous decades simply in terms of 'fly in general'; or 'small upwings' or whatever they felt able to report upon. Colour coding was used to encourage reporting for the most recent years and the 'easiest' fly types. (The questionnaire can be seen in Appendix 1.)

Alternatively, if they had only recently started to take notice of fly numbers, or had only recently started fly fishing on the chalk rivers but had a broad knowledge of the different species, it was possible for them to respond only in terms of 1999, but to report on abundance across the total of 14 species and/or groupings of fly.

For those respondents whose records and/or memory went back over not just recent years but previous decades, either in terms of simply fly in general, or in terms of the individual species, the full spreadsheet or any relevant parts of it could be utilised to provide comprehensive data for import to the survey database.

There was no compulsion to complete cells where the respondent's information, memory, or confidence in fly identification was lacking; and whole years or decades (or whole categories of fly) could be simply missed out if the respondent had not fished, fished another river, been abroad, or had no relevant experience.

Those who had written records available in great detail were asked to refer to them so as to enable them to form the basis for their completion of the questionnaire, condensing as appropriate information spanning a series of years. In following this procedure, considerable sacrifices had to be made in terms of data detail and heterogeneity in order to achieve comparability across the data set, and hence interpretative power.

Participants were asked to report 'how good was the fly' using the following codes: -

GHF = good hatches frequently
GHI = good hatches infrequently
SHF = sparse hatches frequently
SHI = sparse hatches infrequently
VLF = very little fly/ones & twos only (but present)
ABS = absent

These hatch definitions, which it was necessary to use in creating the essential mechanism to ensure comparable and analysable responses across the sample, will have required judgements from the respondents, in the making of which there will have been uncontrolled variance.

Feedback on the questionnaire was very positive and by inspection of questionnaires the data produced seems robust. Very few questionnaires had to be discarded on grounds of poor completion.

e) Fly abundance scores

The distributions of coded responses for the different species of fly and the different rivers over the decades and years are shown in detail in the database from page 25 to page 114, and mean scores calculated from these distributions are shown by fly type from page 115 to page 254, and by river within fly type from page 255 to page 380.

Mean scores were calculated by giving the following scores to the individual abundance codes used by respondents to report:

GHF scored at 100
GHI scored at 33
SHF scored at 25
SHI scored at 10
VLF scored at 5
ABS scored at 0

These scores were reached judgementally, and are intended to reflect as closely as possible the relative numbers of flies represented in reality by each code used by respondents in reporting. A change in the scoring procedure would have to be very dramatic indeed if it were to change the conclusions of the survey.

The advantage of this scoring method is that it summarises the data in a meaningful way for publication of the findings back to the 'man on the river bank'.

f) Peer reviews

This project has been submitted for peer review to Dr Anton Ibbotson, Dr Mike Ladle and Dr Cyril Bennett, and wherever possible their general and specific comments have been incorporated in the final report.

Dr Mike Ladle remains less than perfectly happy with the assumption that anglers can accurately report fly numbers, but said 'It is indisputable that the bar charts presented in the report suggest some sort of decline'.

Dr Cyril Bennett is in agreement with asking anglers, keepers, owners, etc. what they have observed and comments:
'Nearly all good ecological studies start with good observations, but unfortunately those people that spend a great deal of the time on the river so seldom record their observations, or if they do, they don't always pass them on to other interested parties. This survey is therefore extremely useful in bringing out a huge amount of these observations made over considerable period of time and shows a somewhat worrying decline in river fly abundance.'

In addition, he felt that the methodology used was 'unique and extremely good', and felt that the scoring system 'seems entirely OK - you've got to have one, and it certainly shows things up'.

TRENDS IN FLY ABUNDANCE

a) Overall summary

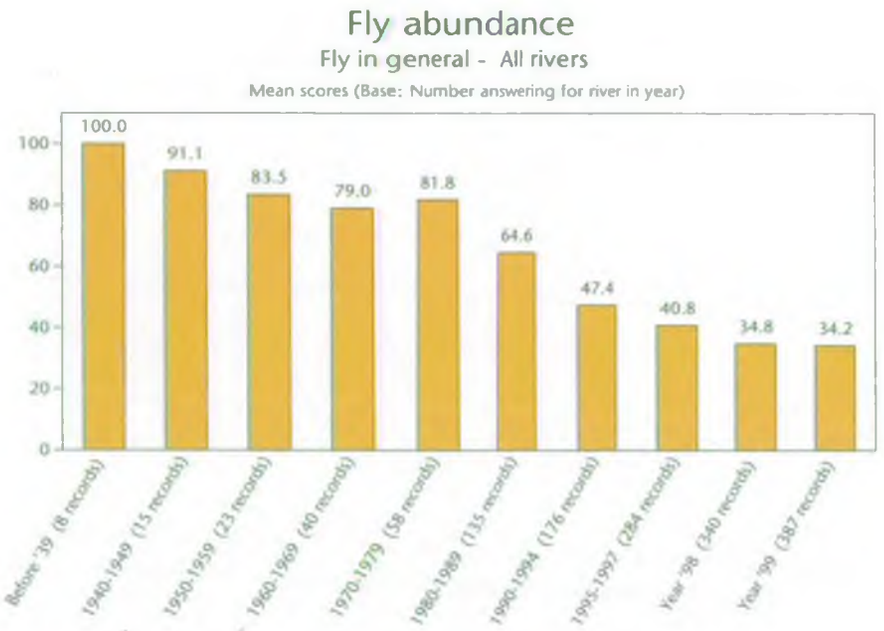
Looking at aquatic fly hatches in general across all the rivers covered by the survey, we see that the abundance score in 1999 has fallen to 34 compared with the maximum score of 100 in the last decade before the War.

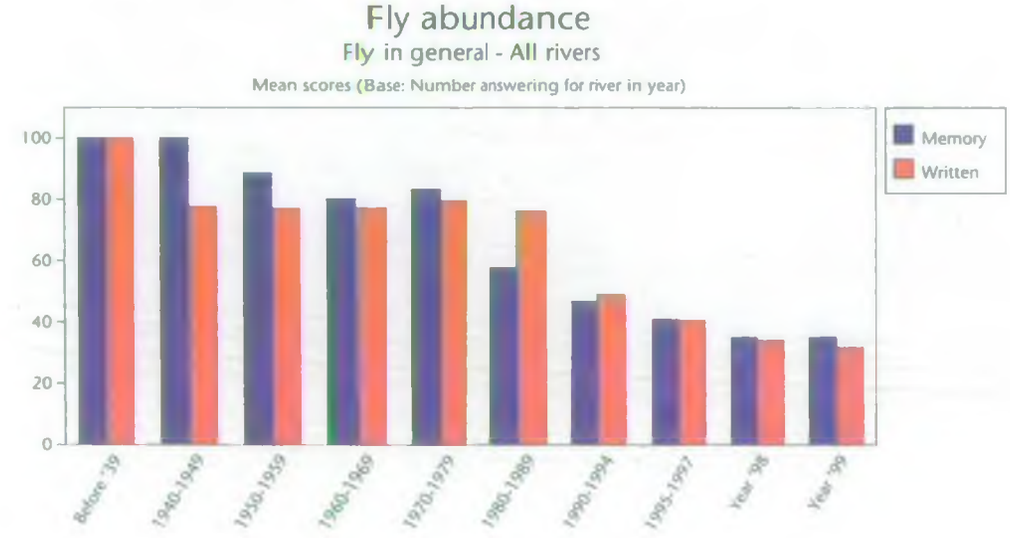
After some decline during and after the War, reported fly numbers held relatively steady for the 30 year period covering the 1950s, 1960s and 1970s although as we shall see there were some variations by fly type and by river.

The main part of the reduction has occurred over the last 20 years. After 1980, the abundance score fell steeply (by about three-fifths) over the next two decades to the end of the Millennium, and at 34 in 1999 stands at 42% of the level maintained over the three decades following the War.

The most precipitous fall was over the most recent period, the 10 years between 1989 and 1999, with the abundance score falling from 65 in the 1980s to 34 in 1999.

Footnote: Fly abundance scores (from 100=maximum,down to 0=none) were calculated from the codes used in the questionnaire by respondents, reflecting the goodness/sparseness and the frequency/infrequency of hatches seen on the river. The method of calculation is given in section 5 c).





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One way of evaluating the reliability of the abundance scores provided by respondents is to compare the mean scores calculated from the responses of those working from written records (one in three) and compare them with the responses of those working only from memory. This comparison is shown in the lower chart on the previous page. (The upper chart presented and commented upon on the previous page represents the average of all respondents.)

In general, there is a very high level of agreement between those whose memories are supported by written records and those without that advantage. There is no generalised bias obvious from the figures plotted here, and both groups start at the same point and end at the same point, with a remarkable degree of agreement for the 30 year period following the War and for the 1990s.

There is some evidence of memory-only respondents viewing the distant past (the 1940s and 1950s) 'through rose tinted spectacles'; and seeing a decline in the 1980s that those with records would not support.

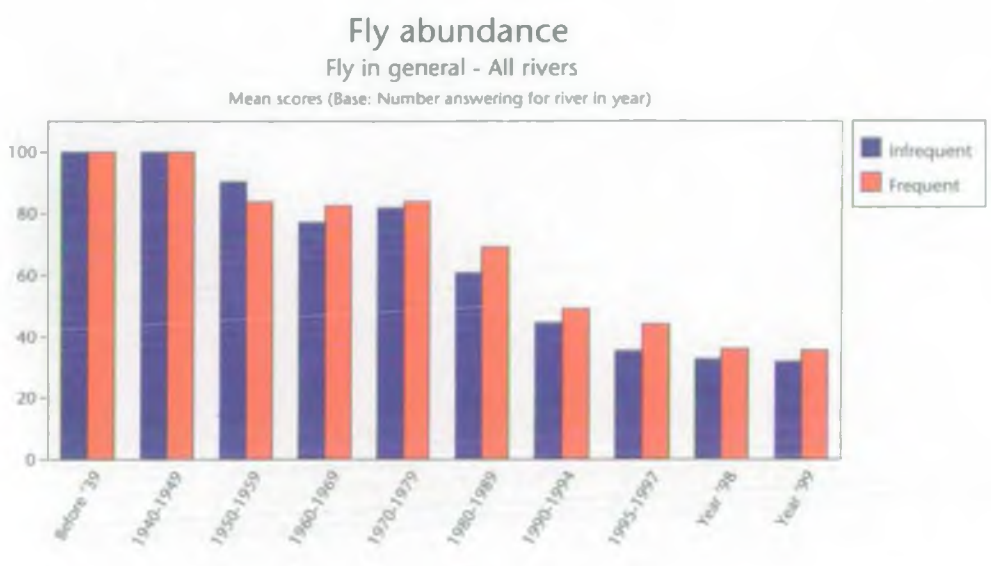
As a result, if we give more credence to those working from written records, we would conclude that levels of fly abundance stayed much the same at just under 80 all the way through from the War years until the end of the 1980s.

This conclusion would throw the deterioration in fly numbers that has occurred in the last decade into even sharper relief.

Another good internal test of the reliability of the abundance scores is to look at the comparison between those who have been on the river most frequently and those who have been present on the bank rather less.

This analysis shows very good consistency between the two groups, with the most frequently present respondents (16 days per year and over) reporting consistently, but only slightly higher abundance. This is as expected, since in periods of increasingly infrequent and sparse hatches, the more days a person is on the bank, the greater the chance they have to coincide with such good hatches as there are.

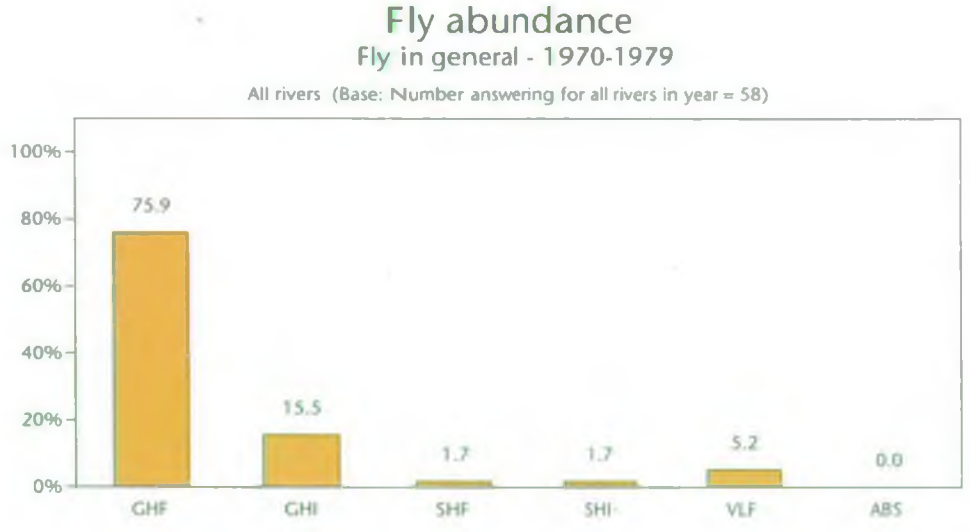
The chart showing this data follows (over 40% of respondents fished for more than 15 days per year and more than 20% for over 30 days):

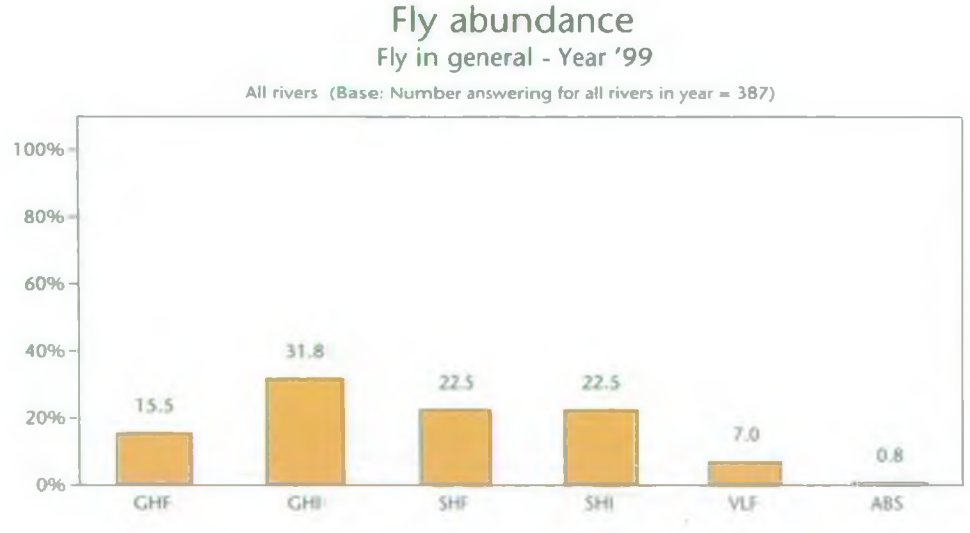


Footnote: - Respondents fished, or were present on the river bank, for an average of 18.3 days across all the people who fully completed the questionnaire, and as a result the data is based upon some 7100 days of observation for 1999 and 6250 for 1998. The number of respondents reporting on each decade drops as we deal with earlier decades, but we are still able to base our conclusions on extrapolated estimates of e.g. 25000 days for the 10 years of the 1980s, 7500 days for the 1960s, and 1500 days for the 1930s.

These analyses, by the use of written records, and by how frequently people are on the river bank, are in addition to being informative, extremely reassuring about the robustness of the data collected in this survey.

A useful way of seeing the picture that lies behind the mean scores which we have been viewing in the charts presented above is provided by looking at the number of respondents reporting each level of hatches for different time periods. Above is the 1970s with Good Hatches Frequently (GHF) at 76% and effectively no sparse hatches reported. Below is 1999 with 'GHF' reduced to 15% and sparse hatches taking the place of good ones. The mean score for the chart above is 81.8, and that for the chart below, 34.2.





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b) Trends by type of fly

When we look at the different types of fly, we find several distinct differences in trends.

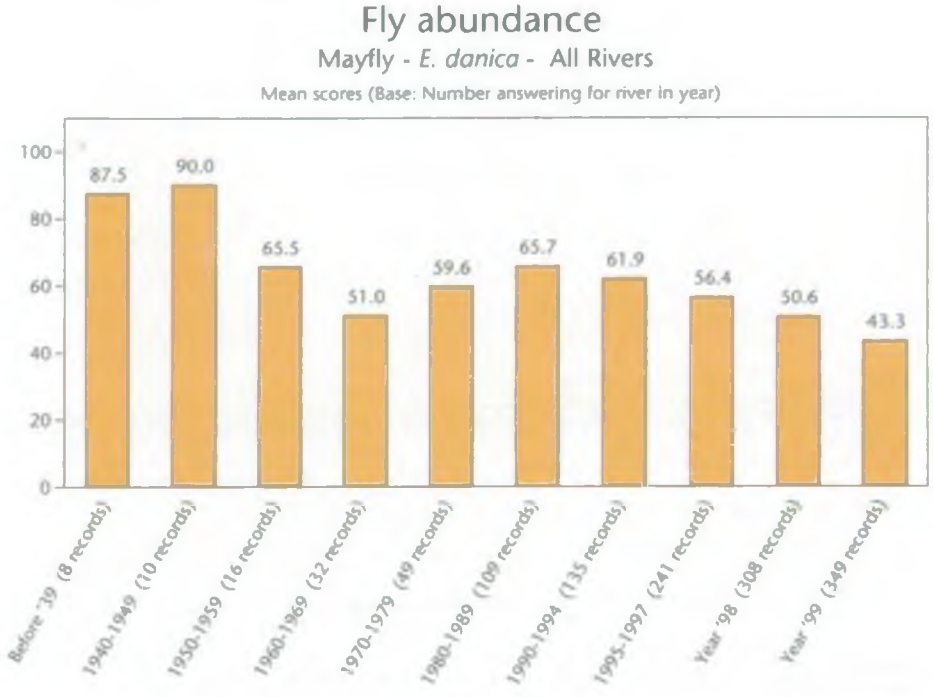
Although many species follow the same trend at the same levels over the years – for example small upwings generally; medium olive; and spurwing/pale watery - others follow the same trend but at lower levels, and some exhibit a quite different picture.

To avoid cluttering the text with graphs, we comment below on the trends that it may be worth the reader referring to in the electronic data base, with the database page numbers to refer to. We have illustrated two species in the text as examples; one of these (the mayfly -*Ephemera danica*) involving greater resistance to decline, and the other (the iron blue - *Baetis niger*) greater susceptibility.

It is noteworthy that the mayfly larva spends all its development period in silt on the river bottom, and hence tends to thrive in the conditions produced by increased siltation resulting from agricultural run-off, together with lower flows and higher deposition resulting from abstraction. It is therefore not surprising to find it exhibiting an increase in abundance over the period of agricultural (and particularly arable) intensification from the 1960s to the end of the 1980s, with a relatively shallow decline following in the 1990s. That said, the mayfly's abundance score has fallen by half from 90 to 43 and whilst its range has probably increased (especially on the Itchen, see database p. 383), hatches have become much more sparse in recent years.

The situation is very different with the iron blue. Abundance of the iron blue declined much more sharply than the generality of small upwings, from 100 before the War to 58 in the 1970s, and then dipped sharply again by a quarter in one decade to 42 for the 1980s, thence even more drastically to 32 in the early 1990s, 24 in the mid-1990s, and it now stands at 20. Its only stronghold is in the Test and Itchen (see database pp.352 and 391).

Mayfly
(Ephemera danica)

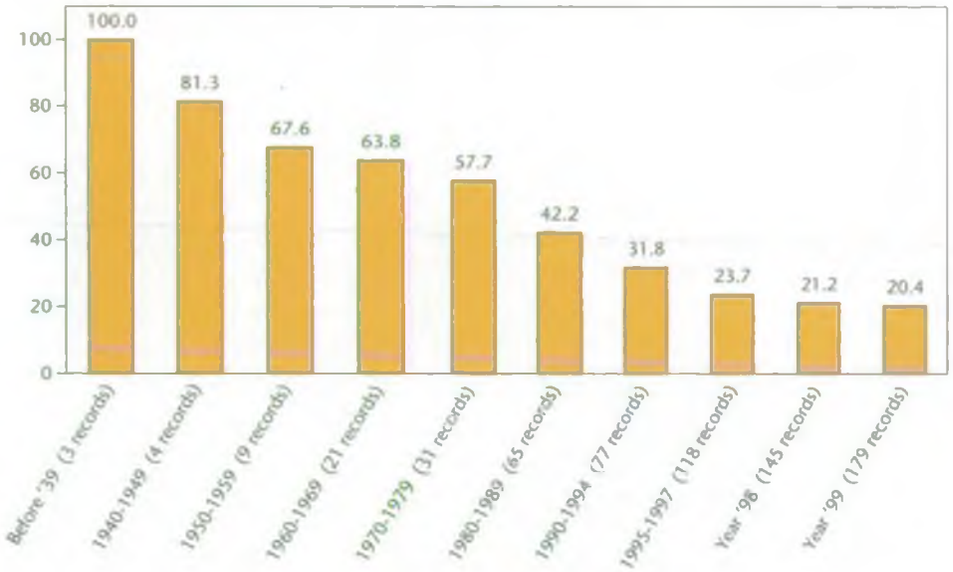


Iron blue dun
(Baetis niger)

Fly abundance

Iron blue - All rivers

Mean scores (Base: Number answering for river in year)



As referred to above, with the **small upwings** generally, the pattern of decline (see database p. 271) has mirrored that of fly in general - but it has ended up in 1999 at the lower level of 31% compared with 34%. The average for all fly has been buoyed up by higher scores for mayfly, smuts, midges, and gnats.

In past decades, the strength of the small upwings has been signally evident on the Test and to a lesser degree on the Itchen (see database p. 382). In recent years, however, there has been an 'evening down' to a low level of abundance across all rivers following disproportionately steep decreases on these two rivers.

Sand fly
(Rhyacophila dorsalis)

Grey flag
(Hydropsyche instabilis)

Cinnamon sedge
(Limnephilus lunatus)

Mayfly
(Ephemera danica)

Mayfly has continued very strong on the Test; has even increased in recent years on the Itchen; and has maintained significant hatches on the Avon. On the Wylye, Frome and Nadder it has declined to a marked degree since the 1980s (see database p. 383).

The presence of **sedge** (the caddis flies or *Trichoptera*) was fairly consistent at about two-thirds of total potential during the three decades of the 1960s, 1970s, and 1980s. Then a steep decline set in, producing a graph very similar for following years to that of fly in general (see database p. 289). Again, its stronghold is on the Test, but its worst declines have been on the Avon from the 1960s onwards; and on the Nadder from the 1980s to the end of the millennium (database p. 384).

Grannom (the caddis fly - *Brachycentrus subnubilis*) has been scoring in the 20s since the 1960s, although it is clear that in earlier years it was much more common - and references in literature confirm this. It used to be common on

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Grannom
(Brachycentrus subnubilus)

Large dark olive
(Baetis rhodani)

the Test and Itchen, but is now almost absent there: meanwhile, its stronghold remains the Frome and it is increasing at present from low levels on the Wylye, and variable at low levels elsewhere (see database p. 385).

Smut - (*Simulidae*), **midges and gnats** - (*Chironomidae*) (database p. 307) are still present nowadays at a relatively high level of abundance, having suffered only relatively slight declines from scores in the 60s in the post-war years to scores in the 50s - 49 in 1999. It is known that many of these species of black fly are more resistant to deteriorating water quality than other aquatic flies. Plentiful and increasing on the Itchen and the Test in the 1990s particularly, and steady on the Wylye, these flies have generally decreased elsewhere recently (see database p. 386).

Stonefly yellow sally
(Isoperla grammatica)

For all practical purposes, **stonefly** have been at very low levels in this chalk stream area during the period under review (database p. 316). **Willow fly** (*Leuctra geniculata*) and **needle fly** (*Leuctridae*), both small, are the only stonefly species with any significant distribution on the chalk streams. Populations are clearly variable, however, and are enjoying an upswing on the Test and the Nadder at the moment; and on these two rivers in particular the graph shows evidence of cyclical swings in the population (database p. 387) .

The **large dark olive** - (*Baetis rhodani*) reached the peak of its abundance in the 1960s at 84, returned to previous levels at 72 in the 1970s, and then suffered a catastrophic decline to 44 in the 1980s followed by further reductions to 32 in the early 1990s and to 25 by the end of the last decade (database p. 325) . The Itchen is where its numbers have held up best, but on other rivers it is now at a very low level indeed (database p. 388). It is interesting to speculate that the warmer winters of the recent decade may have had a negative impact on favourable status for this important fly of the cool weather of very early spring.

Medium olive
(Baetis vernus)

Since the 1960s when **medium olive** - (*Baetis vernus*) populations were at their best, the pattern of decline has been very similar indeed to that of fly in general, although the residual abundance score in 1999 is rather lower than average at 29 - worryingly so for this staple fly that has been one of the sheet anchors both in terms of trout food and in terms of angler imitation (database p. 334). Populations are reported very high on the Nadder in the 1980s and early 1990s with a drastic reduction following in the latter half of the last decade. The stronghold for the medium olive is the Itchen, with steady declines evident in recent years on the Wylye and the Avon in addition to the Nadder, pointing to a problematic environment for this fly in the Avon catchment (database p. 389).

The trend in the numbers of **blue winged olive** (*Ephemerella ignita*) almost precisely mirrors that of fly in general, but ends up at a lower figure of 28 in 1999, giving rise to concern for the future of this important item of trout nutrition (database p. 343). In fact, as with the medium olive, the decline has been disproportionately catastrophic on the rivers of the Avon catchment - the Avon itself, the Wylye, and the Nadder. On these rivers, the abundance score is at or below 20, a level to which it has declined sharply since the early 1990s when it was over 60 on the Nadder, over 50 on

Blue winged olive
(Ephemerella ignita)

the Avon, and over 40 on the Wylye (database p. 390). Were it not for the Avon catchment, the blue winged olive would be doing well, relatively among the small upwings. It is extremely well placed on the Itchen where its decline has been less marked; and although declining it is much in evidence on the Test: whilst on the Frome it is at a higher level than it was in the 1980s and much higher than in the 1970s. We know that blue winged olive populations are variable (Skues complained bitterly of its failure at Abbots Barton in several years, earlier in the last century) but its recent sharp loss of numbers in the Avon catchment, taken together with that of the medium olive, is a matter for great concern.

Iron blue
(Baetis niger)

The **iron blue**, as noted above, has exhibited an earlier and steeper decline than other small fly species (see database p. 352). The iron blue is known to be particularly palatable to trout, to the extent that they will feed preferentially on the hatching dun whilst other species are hatching more profusely around it on the river. It is interesting to speculate whether, because of this high palatability, in the situation where small fly in general is suffering significant decreases in abundance as a trout food supply, a fly species like this that is particularly sought out by trout may have had its numbers reduced disproportionately quickly by trout predation. But it is also, like the large dark olive, a creature of the cool weather in early spring, and the recent series of warmer winters may well have not suited it.

Large spurwing
(Centroptilum pennulatum)

Small spurwing
(Centroptilum luteolum)

Pale watery
(Baetis fuscatus)

The picture for **spurwings** - (*Centroptilum*) and **pale wateries** - (*Baetis, Centroptilum* and *Procloeon spp*) is to all intents and purposes the same across all rivers as that for fly in general (see database pp. 361 & 392). A number of different species fall into this angler categorisation, making species-specific conclusions dangerous. However, the pale watery flies as a group are well recognised by anglers, and the trends reported by our respondents across the different rivers are clear. The Itchen remains the stronghold for this group of flies at a score above 50 compared with that of 30 and below for the other rivers, and is single-handedly holding up the average abundance score. There has been a very serious decline on the Avon since the 1980s; and to a lesser extent on the Wylye and the Nadder (pointing again to an Avon catchment problem) and on the Test. There has been an increase on the Frome from disastrously low levels in the 1980s and early 1990s.

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Small dark olive
(Baetis scambus)

The **small dark olive** - (*Baetis scambus*) is recorded at relatively low levels of abundance throughout the period, and since it is an extremely small fly which is difficult to see on the water and hatches most commonly in July when relatively few anglers are on the river bank, one suspects a degree of under-reporting.

However, it has clearly declined with other small fly, and the decline has been most marked, again, on the Nadder, Wylye and Avon - together with the Test, and in near history the Itchen, where it had enjoyed an increase in the early and mid-1990s (see database pp 370 and 393).

Anglers curse
(Caenis rivulerum)

Caenis - (*Anglers curse*) is very variable in terms of abundance and reporting of it is somewhat patchy prior to the 1980s, making it somewhat risky to draw conclusions about trends over the longer term. It currently enjoys big populations on the Frome and Nadder. In the past it had very high levels of abundance on the Wylye. On the Avon it rose to a peak in the early 1990s and has fallen back since then (see database pp 379 and 394).

c) Trends by river and catchment

In terms of hatches of fly in general, by 1999 all rivers were at a low ebb.

Worst were the Wylye and Frome, with scores of 28.7 and 29.5 respectively against the average of 34.2 - and although this does not seem such a big shortfall, the Wylye is shown to be 16% worse off for fly than the average, and given the very high numbers of observations upon which it is based, this is likely to be highly statistically significant.

Only the Itchen is clearly better off than the average, at a score of 40.1 (17% better than average). The other rivers are very close to the average in terms of numbers of fly.

The Test had a better year in 98, and both the Itchen and the Test enjoyed very significantly better fly abundance in the mid-1990s than did the other rivers with scores of 55.8 and 52.5 against an average for all rivers of 40.8 (see database sequences starting p. 115 and p. 381). In the early 1990s the Avon was doing well for fly at 58.3, just behind the Itchen and the Test where the scores were in the 60s - but it declined quickly over the middle '90s.

Levels of fly abundance on the Wylye and the Frome were already at a relatively low level in the 1980s; and it looks as if the Nadder experienced a sharp decline in the early 1990s.

Where fly numbers have suffered, it is clear from the findings that it is the small upwings that have declined most dramatically in recent years (p. 382), whilst mayfly numbers have held up (p. 383).

More detailed comments about variations between rivers in terms of the strengths and weaknesses of different fly species have been included in the previous section.

REFERENCES

Ref 1: The Deterioration of Fly-life Associated with Chalk Streams in Southern England, Johnson & Bailey, Kings College Division of Biosphere Sciences, October 1990. Commissioned by the Salmon and Trout Association, supported by the Country Landowners Association.

Ref 2: Scoping Study on the Ephemeroptera of Southern Chalk Streams, Wright, J.F, Blackburn, J.H, Gunn, R.G.M, Symes,K.L, & Bowker, J. Institute of Freshwater Ecology. Published by Environment Agency 1998.

Acknowledgements

The authors gratefully acknowledge the enthusiastic assistance of Andrew Manston for the questionnaire data processing and Dr. Mike Ladle, Dr. Anton Ibbotson, Dr. Cyril Bennet and Jenny Reay for their constructive comments on the report. Dr. Cyril Bennett also kindly gave his permission to reproduce the mayfly images contained in the report.

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Millennium Fly Abundance Study: Please fill in what you can of this sheet for the chalk stream/s you know or knew in the past,and further sheets as required.

Please write your Name: Angler/Keeper/Owner/Club Official (please delete as appropriate)

River/Stretch: Could we have your Telephone no in case we need to confer with you at all?:

And your house name/no./road&postcode? (write in below)

Address:

The WFA/EA will publish the results widely if the survey is successful

HOW GOOD WAS THE FLY?Tell us first for 1999 (easiest to recall), and then for '98, & then for '95-6-7 taken together,& then for any earlier 5/10-yr periods you can recall! please use these codes to tell us what you can remember:

GHF = good hatches frequently; **GHI** = good hatches infrequently; **SHF** = sparse hatches frequently; **SHI** = sparse hatches infrequently; **VLF** = very little fly/ones & twos only (but present); **ABS** = absent: **Just write one of these codes in a box for each period/fly you feel capable of reporting on. If you only fill in '99,& only for "Fly in General",it will still be vital data for the future. Go for the coloured boxes first - the simplest data is valuable.**

Period/year reported	Fly in General	Small Upwings Generally	Mayfly ie Danica	Sedge but not Grannom	Grannom	Smuts, Midges, Gnats	Stonellies	Different species of small upwings in particular (by the angler's name).						
								Lge Dark Olive	Medium Olive	Blue Winged Olive	Iron Blue	Spurwing/ P.Watery	Small Dk Olive	Caenis
Year '99														
Year '98														
1995 to '97														
1990 - 1994														
1980 - 1989														
1970 - 1979														
1960 - 1969														
1950 - 1959														
1940 - 1949														
before'39														

And how many times a season have you been on the above river recently? please tick: 1-5 ☐ 6-10 ☐ 11-15 ☐ 16-20 ☐ 21-25 ☐ 26-30 ☐ 30+ ☐

Continued overleaf

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Continued

And is there another river you can tell us about? If so,please use the same codes in the matrix below to record what you can,even if it's only partial.

Name of River/Stretch:-

Period/year reported	Fly in General	Small Upwings Generally	Mayfly ie Danica	Sedge but not Grannom	Grannom	Smuts, Midges, Gnats	Stoneflies	Different species of small upwings in particular (by the angler's name).						
								Lge Dark Olive	Medium Olive	Blue Winged Olive	Iron Blue	Spurwing/ P.Watery	Small Dk Olive	Caenis
Year '99														
Year '98														
1995 to '97														
1990 - 1994														
1980 - 1989														
1970 - 1979														
1960 - 1969														
1950 - 1959														
1940 - 1949														
before'39														

And how many times a season have you been on the above river recently? please tick: 1-5 6-10 11-15 16-20 21-25 26-30 30+

Finally,are you working:mainly from memory? partly from written records? mainly from written records?

Please write any further comments on the following sheet

We thank you very much indeed for your time and trouble in providing this information (in confidence) to the EA/WFA millennium fly study team.

Please return with your Chalkstream Malaise Questionnaire to:
Allan Frake, Environment Agency, Rivers House,
Sunrise Business Park, Blandford,Dorset DT11 8ST

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APPENDIX 2: GUIDE TO DATA SET AND ACCESS DETAILS

Introduction

The data set from the questionnaires is organised in coloured bar charts.

There are 422 bar charts in the data set.

Consistent use has been made of colours to identify data concerning the different rivers and groups of rivers.

The rivers Avon, Wylye and Nadder have been combined to produce the data for Avon Catchment Rivers.

All rivers reported on for which the sample size of respondents was too small for individual representation in the data have been combined in Other Rivers.

Caution needs to be exercised in drawing too detailed conclusions from the figures for the earliest periods for individual rivers, as the respondent sample sizes are small for these. The further back we go in time, the more it makes sense to look only at the figures for All Rivers.

To facilitate across-river comparisons over time, a series of multi-bar charts starts at p. 381.

Guide

Reference is to page numbers in the data set.
The reader is encouraged to refer to Appendix 1 (The Fly Abundance questionnaire) to clarify the data contained in pages 4-422; and to Appendix 2 (the Chalk Stream Malaise questionnaire) to clarify the data contained in pages 1-3.
QNA indicates question not answered.

Pages 1-3 = data from the Chalk Stream Malaise questionnaire.

In page 2, we have confined analysis to each respondent's top three priorities, although 10 were requested.

Page 4 = respondent type (angler/keeper/owner/club official)

Page 5 = total number responding for each river.

Pages 6-14 = distributions of number of fishing days per respondent, for each river.

Page 15 = average number of fishing days per respondent for each river.

Pages 16-24 = number working from written records vs memory only.

Pages 25-114 = distributions of 'goodness of hatch' codes for each river, year/decade and for each fly type.

Pages 115-254 = mean abundance scores calculated from hatch codes, for each river, year/decade and fly type. Across-river comparisons.

Pages 255-380 = mean abundance scores calculated from hatch codes, for each river, year/decade and fly type. Across-time comparisons.

Pages 381-394 = the above two categories combined in multi-bar charts (they said it couldn't be done!) To facilitate across-river comparisons across time.

Pages 395-408 = comparison of the basic abundance scores across time between frequent and infrequent river bank visitors, for each fly type.

Pages 409-422 = comparison of the basic abundance scores across time between respondents using written records and those relying only on memory, for each fly type.

Access to data set

In addition to the hard copy written report, the data set will be made freely available via email to all contributory organisations, clubs, syndicates, major fisheries and associations.

Adobe Acrobat Reader, which is available from the Internet as a free download, will be necessary in order to access the data.

It is unlikely that the older/slower PC, or the older/slower modem will be able to accommodate and read the data set, having regard to its considerable size and complexity.

To gain access to the data set via email, please contact Allan Frake by email at the following address:
allan.frake@environment-agency.gov.uk

Peter Hayes may be contacted for technical queries on the data by email at:
peterhayes@silverback.co.uk

THE WILTSHIRE FISHERY ASSOCIATION

The Wiltshire Fishery Association (WFA) represents the interests of riparian owners, fishing clubs and lessees (and through these of individual fishermen) in the Salisbury Avon catchment. This includes the rivers Avon, Wylye, Nadder, Bourne, Ebble and Till.

The Association was founded in 1950, and there has been a high degree of continuity in the management of the WFA over the last half-century.

The main objectives of the WFA are to:

- *safeguard and promote the interests of the fishery owners, lessees, and rod fishermen of the WFA area, co-ordinating members' interests as necessary.*
- *collect and disseminate information affecting those interests.*
- *promote and facilitate due consultation with the Department for Environment, Food and Rural Affairs, the Environment Agency, English Nature and any other statutory authority constituted to exercise functions relating to the administration, regulation, and protection of fisheries in the WFA area.*
- *Keep the Fishery Representatives on the Agency advisory committees informed of the views of the local fishermen and to advise and support them in their efforts to preserve and improve the fisheries.*
- *co-operate with other associations, societies or like bodies having similar objects, including national angling groups.*
- *make donations to any national or regional organisations, having similar objects to those of the Association or being concerned to protect fisheries against pollution, degradation or damage.*
- *to nominate to the Agency persons suitable for appointment to the advisory committees.*
- *take any steps which may be considered, in the opinion of the Association to be for the benefit of the fisheries in the WFA area.*

The WFA is not directly involved in the control or management of any fisheries. The Association represents about 3000 members of local fishing syndicates. Several syndicates have block membership, but the subscription for individual members is £6 per annum.

In recent years the Association has addressed many issues on behalf of its members:

- *water abstraction from the chalk aquifers (chiefly affecting the Rivers Wylye and Bourne).*
- *the chalk stream malaise (particularly the effects upon water crowfoot and aquatic fly life by low flows and agricultural run-off).*
- *scientific research to evaluate the effects of fishery management practices and habitat enhancement work including pointing the way towards obtaining financial help for such work.*
- *weed cutting: in which the Association co-ordinate dates and has established a code of practice.*
- *liaison with water management and conservation interests, particularly the Environment Agency, English Nature and the Wiltshire Wildlife Trust. In particular the management of the Site of Special Scientific Interest and the Special Area of Conservation which now cover most of the Wiltshire Fishery Association Area, and negotiation over the OLDS (Operations Likely to Damage the Site) have been much to the fore.*

While supporting the establishment of these special sites and areas and welcoming the protection that they will hopefully bring in the fullness of time against the threats that are faced by the chalk streams, the WFA is working to avoid and preclude the creation of unnecessary bureaucratic hurdles for fishery management in the sustainable development and improvement of their fisheries. The Association adheres firmly to the view that the wishes of the riparian owner or his fishery tenants must prevail unless what they want to do can be demonstrably shown, in accordance with proven scientific evidence, to be damaging to the environment or to other angling interests.

The Wiltshire Fishery Association is widely involved in both local and National consultation processes, (for example the Agency's proposed new Trout and Grayling Strategy, the Salmon and Freshwater Fisheries Review, and the countryside access legislation), both directly and through the Regional Fisheries, Ecology and Recreation Advisory Committee (RFERAC). It has strong links with the Salmon and Trout Association, The Wild Trout Trust, the Game Conservancy Trust, the Wiltshire Wildlife Trust and other neighbouring fishery associations.

Membership forms are available from Mr P. Douglas-Pennant FCA. Tel: 01722 337661.

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THE ENVIRONMENT AGENCY

The Environment Agency is the leading public agency for protecting and enhancing the environment in England and Wales.

Our vision is for a healthy, rich and diverse environment for present and future generations.

Taking our lead from the Government's strategy for sustainable development, we have drawn up a long-term vision of a better future to work towards. This vision involves:

- A better quality of life – people will enjoy a healthier environment, richer in wildlife and natural diversity
- An enhanced environment for wildlife – wildlife will thrive in urban and rural areas and habitats will improve for the benefit of all species
- Cleaner air for everyone – the emission of chemical pollutants into the atmosphere will decline greatly and remain below harmful levels
- Improved and protected inland and coastal waters – our rivers, lakes and coastal waters will be far cleaner, and sustain diverse and healthy ecosystems, water sports and recreation
- Restored, protected land with healthier soils – our land and soils will be exposed to pollutants far less; they will support a wide range of uses, including production of healthy, nutritious food and other crops, without damaging wildlife or human health; contaminated and damaged land will be restored and protected
- A 'greener' business world – industry and businesses will value a rich and diverse natural environment, and in doing so reap the benefits of sustainable business practices, improve competitiveness and value to shareholders and secure trust in the wider community
- Wiser, sustainable use of natural resources – all organisations and individuals will minimise the waste they produce, reuse and recycle materials much more and be more efficient in their use of energy and materials
- Limiting and adapting to climate change – drastic cuts will be made in the emission of 'greenhouse gases' such as carbon dioxide; society will be prepared for probable changes to our climate
- Reducing flood risk – flood warnings and defences will continue to prevent deaths and minimise damage from flooding; wetlands and better drainage systems will be used to reduce flood risks.

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