RIVER FLIES

Environment Agency Findings and Approaches.

Graham Lightfoot and Shirley Medgett

ANGLING FLY ABUNDANCE ISSUES . ORIGINS .

- 1993 Wiltshire Fisheries Association coined term “Chalkstream Malaise”
- Marked reduction in “small upwing” fly abundance . “ Blue Winged Olives, Ordinary Olives and Pale Wateries”.
- Patchy *Ranunculus* growth, poor water clarity, and increased algal growth.
- Concern over *last 3 years.*
- “Mayfly” plentiful this year.

Ephemeroptera (Mayflies or up-winged flies)
x 2

Mayfly
Ephemera danica

Yellow May Dun
Heptagenia sulphurea

Turkey Brown
Paraleptophlebia submarginata

Blue Winged Olive
Serratella ignita

Iron Blue Dun
Baetis muticus

Angler's Curse
Caenis rivulerum

Medium Olive
Baetis vernus

Large Dark Olive
Baetis rhodani

Small Dark Olive
Baetis scambus

Small Spurwing
Centroptilum luteolum

Large Spurwing
Centroptilum pennulatum

Pale Watery
Baetis fuscatus

Pond Olive
Cloeon dipterum

Lake Olive
Cloeon simile

Pale Evening Dun
Procloeon bifidum

ISSUE PERSISTED THROUGH 1990s

- Trout fishermen continued to report flylife problems.

- Environment Agency and Wiltshire Fisheries set out to capture angler perception and records,in the “Millennium Chalk Streams Fly Trends Study”

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.

Prepared by:

Allan Frake, Environment Agency

Peter Hayes, FMRS, Wiltshire Fishery Association

with data available to all contributory associations and clubs.

WILTSHIRE FISHERY ASSOCIATION

ENVIRONMENT AGENCY

CHALK STREAM MALAISE

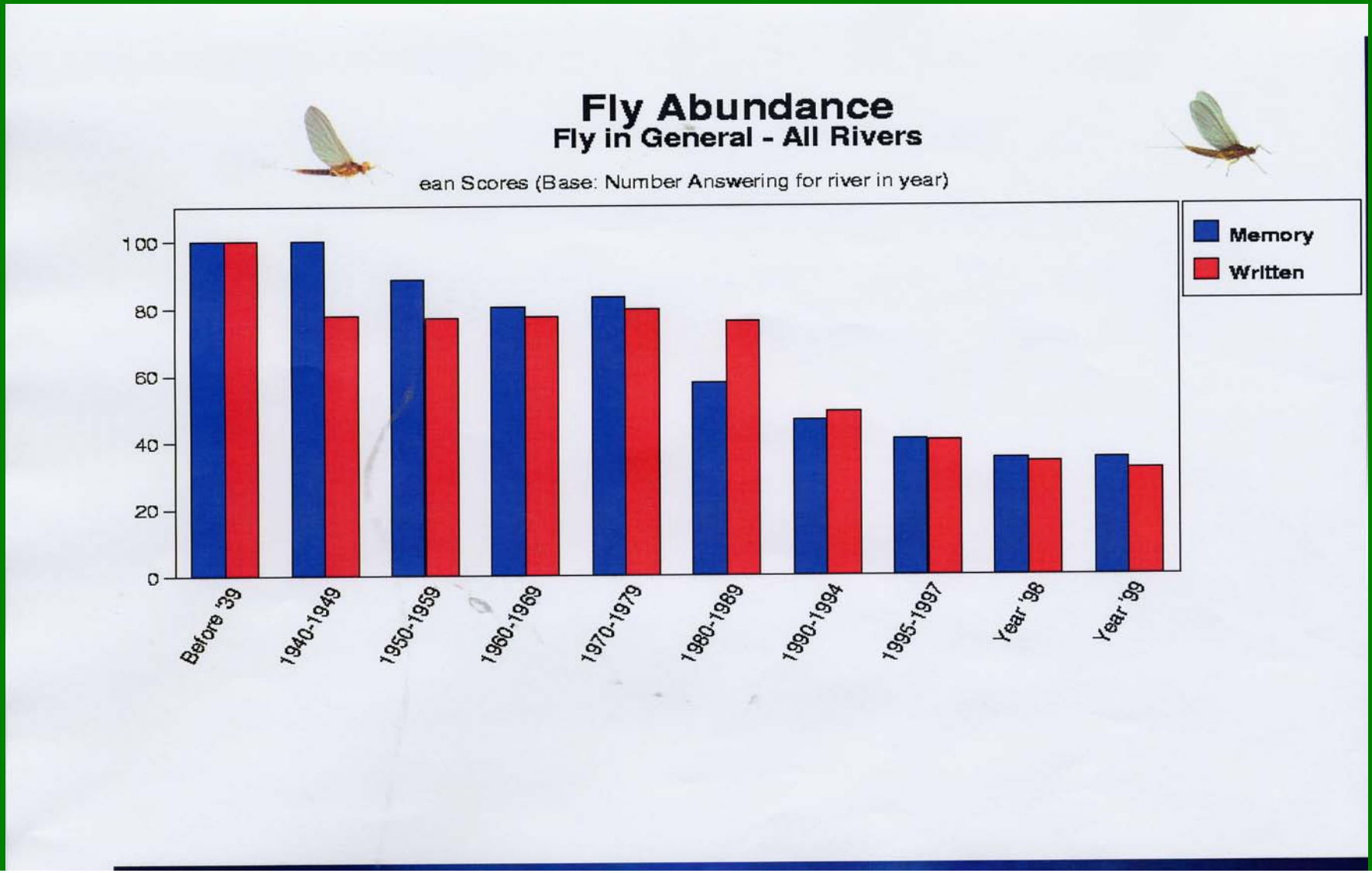
ANGLERS' VIEWS ON CONTRIBUTORY FACTORS

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

WILTSHIRE FISHERY ASSOCIATION

ENVIRONMENT AGENCY

MAIN SIGNAL


Fly Abundance
Fly in General - All Rivers
ean Scores (Base: Number Answering for river in year)
Memory
Written
100
80
60
40
20
0
Before '39
1940-1949
1950-1959
1960-1969
1970-1979
1980-1989
1990-1994
1995-1997
Year '98
Year '99

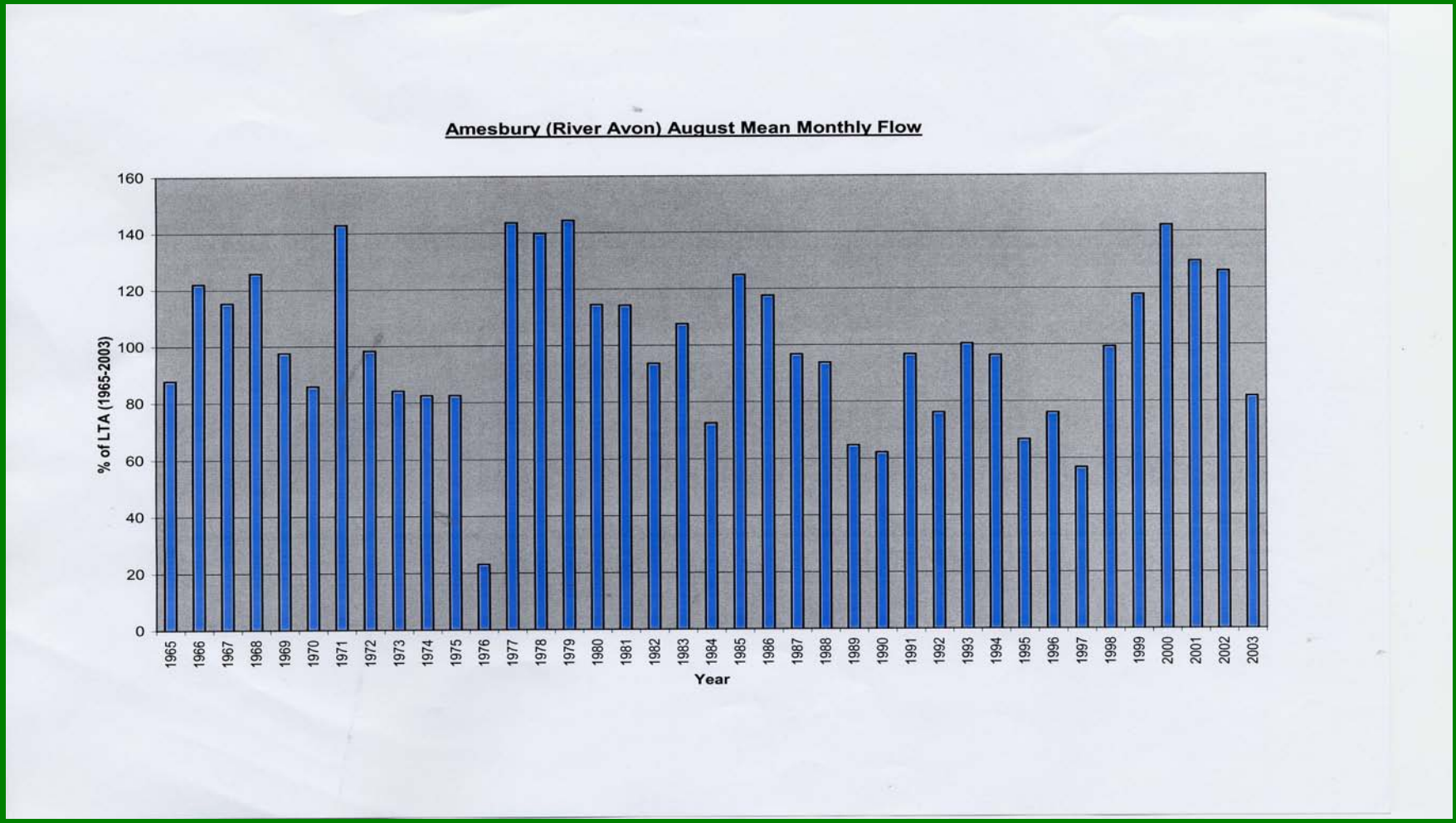
MILLENNIUM STUDY Cont..

- “Small upwing”decline mirrors that of fly in general but more marked.
- Avon catchment worst declines of these .
- Caenidae(Angler’s Curse), Ephemeridae (Classic Mayfly)and Plecoptera (Stoneflies) show either no trend or less decline than “small upwings”

DEVELOPING AN EXPLANATION

- Since 2002 E.A staff from SWX and Hants IOW have worked with Wiltshire Fisheries Association and Test and Itchen Association to explain the findings . A number of hypotheses have been generated and tested against available evidence.
- The explanation currently standing up best to the evidence is presented below.

AVON LOW FLOWS



LOW FLOWS

- Flow is known to be a key factor relating to abundance of Baetidae (Olive) nymphs,which make up large proportion of the “small upwings”
- Corarino and Brunsven (1983)-- catastrophic drift of *Baetis* sp in reduced flows.
- Zelinka (1984) low velocities and siltation linked to loss of mayfly populations in experimental streams.
- Scallion and Edwards(1980) *E.ignita* (BWO) especially sensitive to silt.

LOW FLOWS

- Wright and Berrie (1987).Low flows on a chalk stream associated with poor *Ranunculus* growth ,often with siltation of bed. Baetidae an order of magnitude more abundant in high than low discharge years.(also Wright and Symes 1999)
- Wright et al (1994) Baetidae and Ephemerellidae have strong positive association with “submerged and floating” macrophytes.
- Wright et al (2003) Reduced instream macrophyte growth associated with reduced abundance of these two families.

LOW FLOWS

- There is a clear link of *Ranunculus* biomass to “small upwing” abundance.
- Poor *Ranunculus* growth caused concern on the Avon through the 1990s (see “Chalkstream Malaise”) ,with EN commissioning a survey in 1999. This contained a report that 1999 was the best year for growth for at least a decade.
- Cranston and Darby (2002) also reported that *Ranunculus* regained its dominance after high flows of 1999 and 2000.

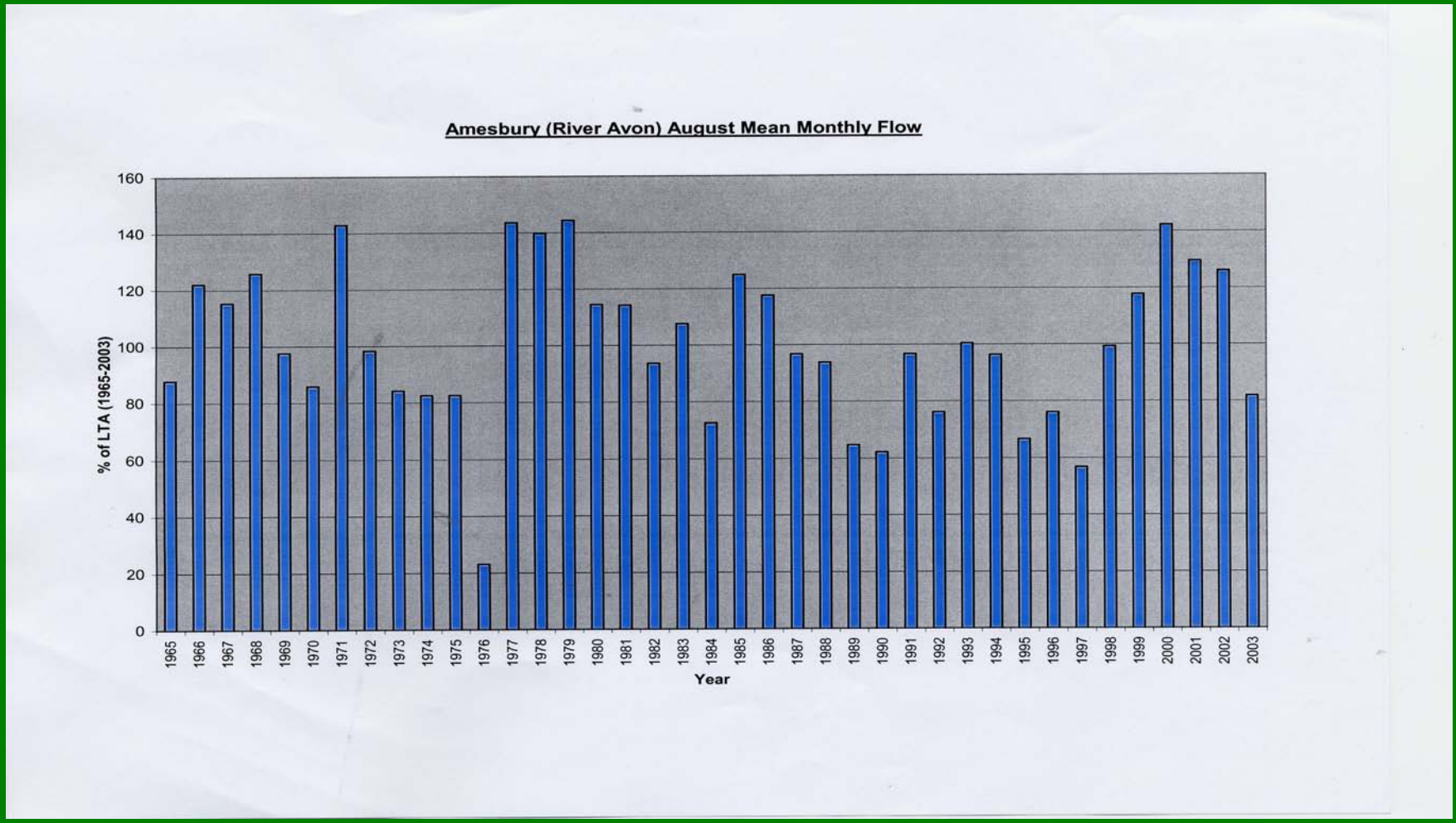
LOW FLOW SUMMARY

- Low flows act on 2 key families nymph abundance directly (eg drift) and via silt deposition and reduced *Ranunculus* growth ("Malaise" symptoms.)
- Any other factor(s) reducing *Ranunculus* biomass will *add to the nymph abundance impact due to low flow.*
- Flow usually not the most critical factor for *E.danica* abundance (Wright 1992 and Wright and Symes 1999)

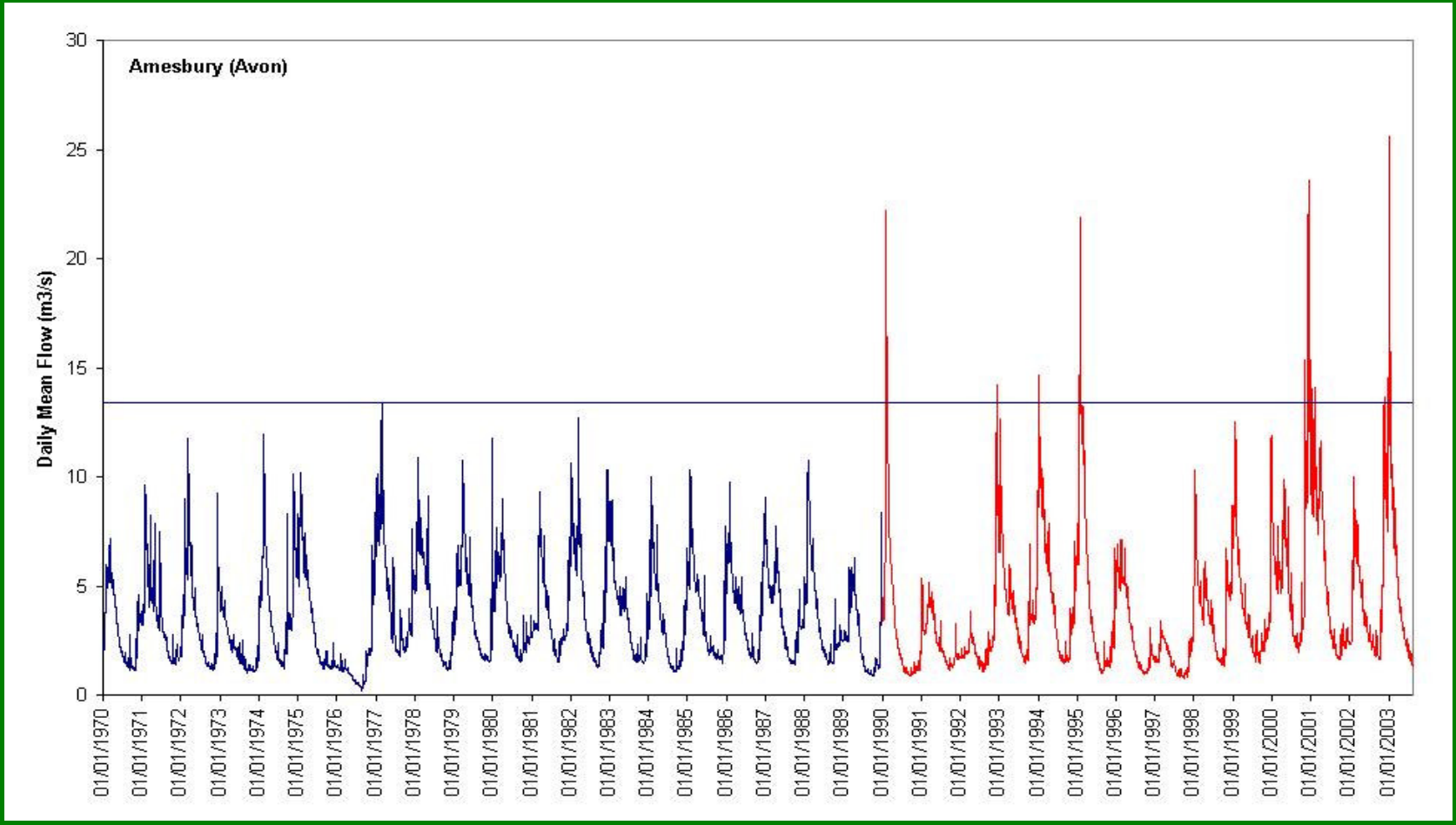
LOW FLOWS EXACERBATING FACTORS

- Groundwater abstraction affecting some parts of Avon system .
- Elevated silt inputs from agricultural intensification via runoff.
- High P levels enhance low flow effects on *Ranunculus*

AVON LOW FLOWS



AMESBURY HYDROGRAPH



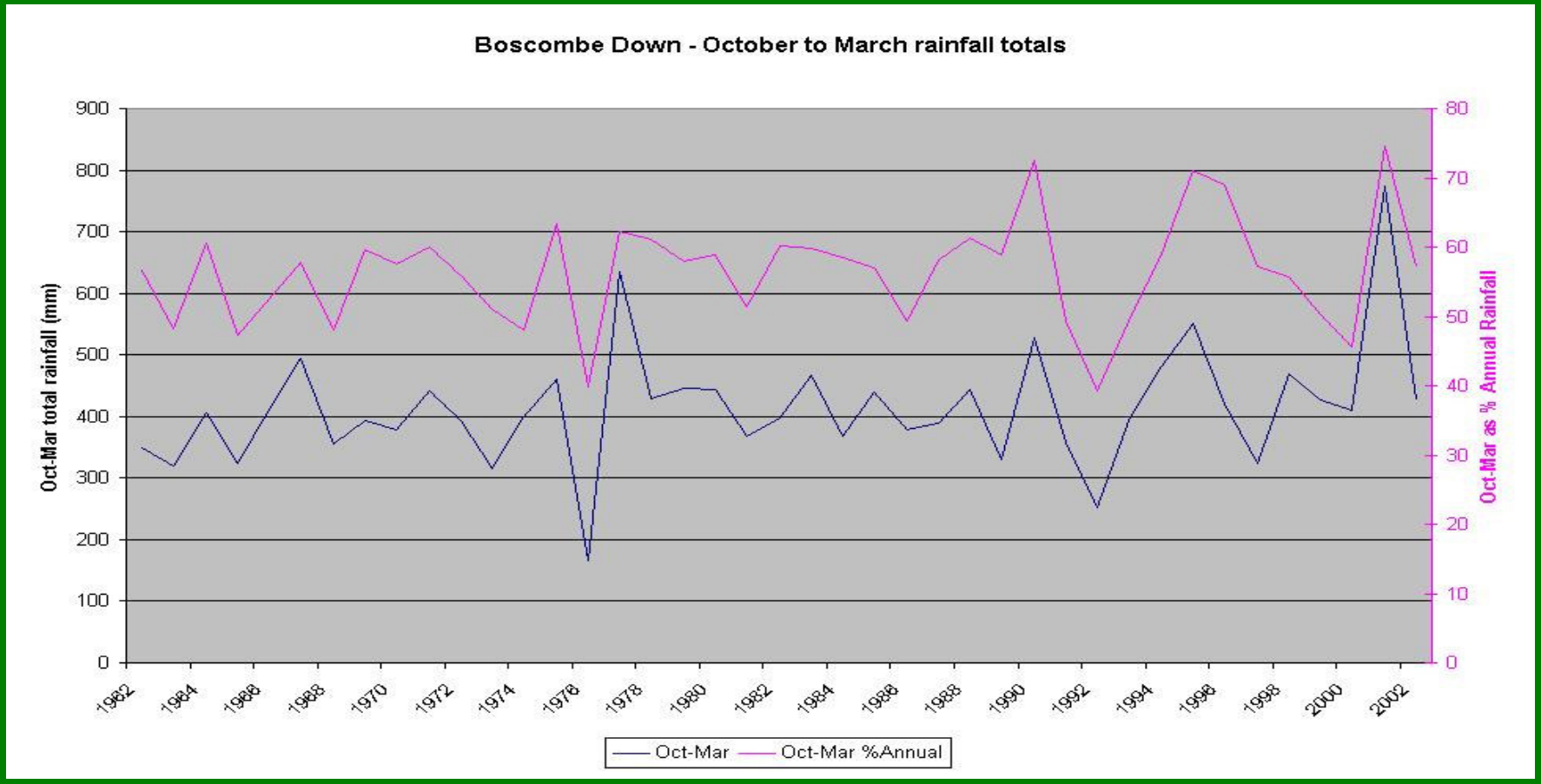
HIGH PEAK FLOWS

- 1990 event washed out large % age of *Ranunculus* on Avon (and other SWX streams) (File evidence)
- Key event for "decline"
- Note also low winter flows, known to be associated with poor *Ranunculus* growth.
- Other impacts possible (as *Ranunculus* lost, velocity can increase -- "stone polishing")
- Increasing climate variation in UK, trend towards more extreme summer low flows and winter high flows (Marsh and Sanderson 1997)

HIGH PEAK FLOWS EXACERBATING FACTORS

- Preceding low flows weaken plant structure.
- Elevated P levels reduce root development.
- Siltation can weaken roothold.
- Land management can enhance run off rates.

RAINFALL PATTERN



RAINFALL Cont...

- Rainfall patterns were more variable from the late 80s.
- Periods of very intense winter rainfall giving high runoff.
- Main determinant of flow patterns in Avon .

WHAT DO EA BIOLOGY SAMPLES SHOW ?

Table 1. Baetidae Log abundance records for the Upper Avon (Avon Bridge, Manningford Bruce, Amesbury and Durrington).
Table includes 1978 historic Avon data. * indicates data not available for preceding years.

	1978	1978	1990	1990	1991	1991	1992	1992	1995 *	1995	1996	1996	1997	1997	2000 *	2000	2002 *	2002	2003	2003
	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn
			1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
Log D																				
Log C	■	■				■											■ ■	■ ■	■	■
Log B	■ ■	■ ■	■ ■ ■	■ ■	■ ■ ■ ■	■ ■	■ ■ ■	■ ■ ■	■ ■	■ ■ ■ ■	■ ■ ■	■ ■	■ ■ ■ ■	■ ■	■ ■ ■ ■	■ ■ ■				
Log A			■	■ ■					■ ■									■		
Zero counts																				

Log Abundances:	Sites:
zero = 0	1 = Avon Bridge
A=1-9	2 = Manningford Bruce
B=10-99	3 = Amesbury
C=100-999	4 = Durrington
D= 1000-9999	

AVON SUMMARY

- Change in rainfall patterns the main driver causing more extreme and variable flow and increased runoff .
- Low flow effects on invertebrates and macrophytes, exacerbated by high P,extra silt and abstraction in places.
- High flow effects via macrophytes-exacerbated by preceding low flows,highP,high silt levels,and enhanced runoff.(Other high flow effects possible.)
- *Reasonable explanation for timing and magnitude of"Malaise"symptoms also particular fly families and plantlife affected.*

AVON SUMMARY cont...

- Stronger *Ranunculus* growth and higher base flows from 1999 created improved habitat for 2 key families of “small upwings”.

- Good hatches of “small upwings” reported on Avon and Upper Wylye in 2004.(With strong growth of *Ranunculus*).

R ITCHEN EVIDENCE

- Classic chalkstream .(95% groundwater)
- Summer flows better supported by groundwater than Avon.
- Little change in flood peaks through 90s.
- P levels lower than Avon.
- Millennium Study shows better for fly in mid 90s than others.
- Pale Wateries and BWOs better than Avon.

R ITCHEN EVIDENCE

- Very detailed work for Itchen Sustainability Study.
- Evidence based on over 200 invertebrate community samples collected since 1989.
- Six month antecedent flow best predictor of invertebrate community composition and the abundance of mayfly groups.

R ITCHEN EVIDENCE

- High baseflow community

  composed of a diverse assemblage of typical chalk stream invertebrates such as mayfly, stonefly, caddisfly and shrimp

- Low baseflow community

  reduced abundance of above groups and an increase in the abundance of snails leeches and water hoglouse.

R ITCHEN EVIDENCE

- Significant association between *Ranunculus* abundance and the abundance of BWOs and Olives.

- Changes in the abundance of *Ranunculus* were therefore mirrored by change in invertebrate community and the abundance of BWOs and Olives .

R ITCHEN EVIDENCE

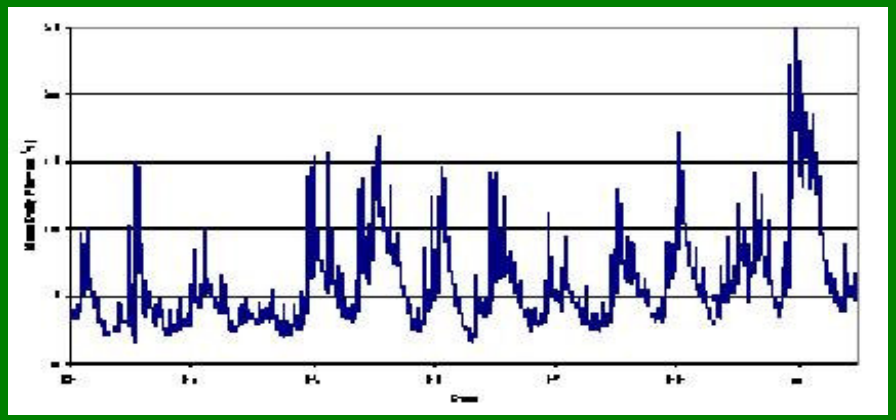
- A relationship between invertebrate abundances and flow was shown at all 13 River Itchen sites.
- Flow was the primary driver of trends in invertebrate abundance over the past decade.
- Abundances of BWOs and Olives are about 50% lower as a result of a low flow year compared to a normal flow year.
- Similarly abundances of BWOs and Olives are about 50% lower as a result of a normal flow year compared to a high flow year.

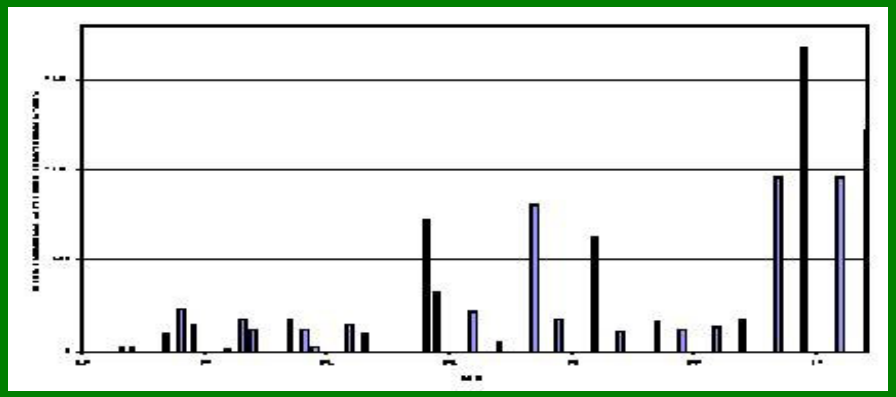
R ITCHEN EVIDENCE

- Flow linked abundance changes of an order of magnitude and timing needed to explain Millennium Study declines.

R ITCHEN EVIDENCE

- Flow and Baetidae abundance over the period 1989 to 2002.





PRESENT SITUATION

- Working gp feel that “rainfall patterns/flows acting on impacted catchment” hypothesis for these rivers is supported by evidence,and probably explains a large part of “decline”, but would like to see more checks that no significant effect of agricultural chemicals involved.

NATIONAL OVERVIEW

- In upland sheep rearing areas EA biologists have demonstrated significant invertebrate impacts from sheep dip, particularly after the mid 1990s with the very powerful synthetic pyrethroids .
- EA Eden Study(2003). Long term quantitative data showing no general trend of decline but less extreme (or less recent/traceable) sheep dip effects mid to late1990s at 2 sites.
- 200km of Cumbrian rivers seriously affected in mid to late 90s.

NATIONAL OVERVIEW cont..

- Teifi (EA 2003), major decline in 30km of river was shown to be due to poor practice in sheep dipping. 10 other streams in SW Wales affected (EA SW Wales 2004).
- 1999 Report “Up to 1200 km of river might be affected in Wales.”
- R.Teise (EA 1999) catchment (Kent orchard area) effects of OP and SP pesticides on stream invertebrates demonstrated.

NATIONAL OVERVIEW cont..

- Area views on main factors in local fly declines .
- Sheep dip 6, low flow 6, high flow (inc macrophyte loss) 4, siltation 3, overgrazing 1,turbidity1, signal crayfish 1.
- The first two were most evidence based , the first tending to come from upland areas and the second predominantly relating to groundwater fed systems.

INITIATIVES

- Schemes for countering Avon exacerbating factors.
- Ranunculus habitat requirements R+D.
- “Key flies” R+D for monitoring review.
- Diagnostic techniques for anglers
- R+D re pesticide impacts, endocrine disruption in invertebrates, and veterinary medicine investigation.
- Nationally coordinated program of action and R+D proposals .

SUMMARY

- Multiple pressures acting over the last 15 years associated with “declines”.
- Geographical and temporal extents vary, and when causative pressures reduced, upturns occur.
- Fluctuations in fly abundance noticed and reported by fly fishermen when excessive.
- Concerns recognised and issue being addressed by Environment Agency.

RIVER FLIES

Environment Agency Findings and Approaches.

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