

THE VITACRESS
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The Bourne Rivulet Initiative

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Our beginning

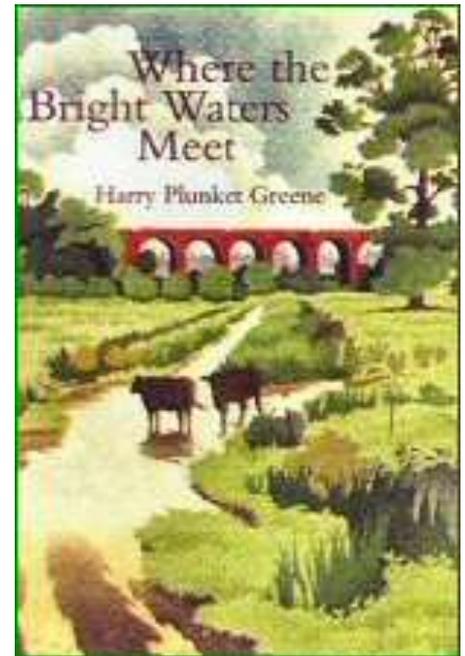
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- Chalk stream headwaters forum in June 2007
 - *a wide range of interest groups brought together*
 - *Agreed progress through focus on specific, defined areas*
 - *Only way forward was to work together*
- Decided to develop a specialist stakeholder group that was representative of all those involved in use, management, preservation of Bourne Rivulet
- Kicked off in November 2007.

The Bourne Rivulet -why is this headwater is important?

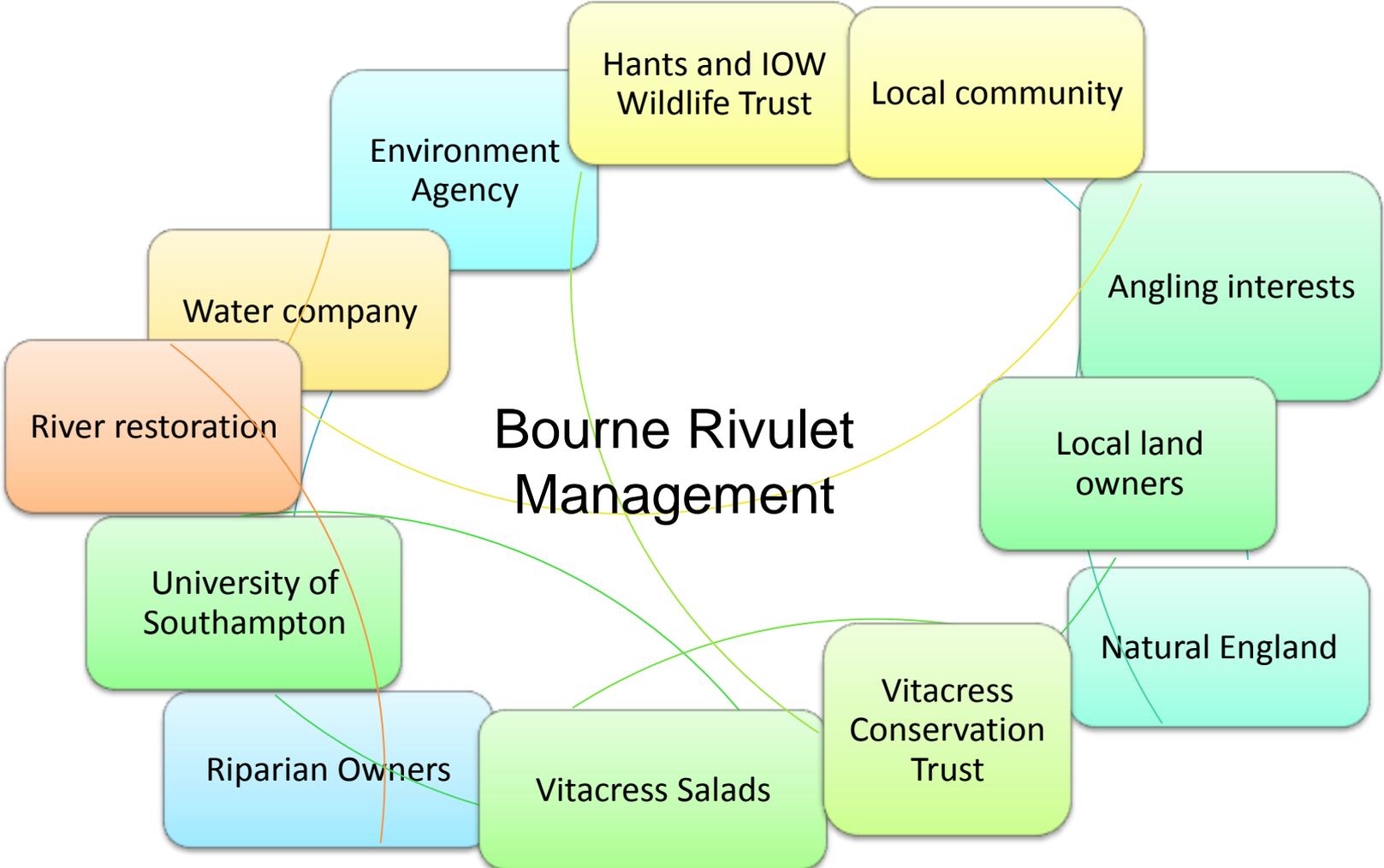
- Immortalised in Plunkett Greene's book published in 1924
- Major tributary of the Test, one of the world's leading chalk rivers
- The headwater has been impacted in recent years by intensification of several activities



Aims

- Provide a focus for meeting of all agencies, stakeholders and representative groups interested in the Bourne Rivulet
- Agree ideal state; identify deficiencies; agree actions to rectify; implement and review
- Develop an action plan for the multi-purpose long-term management of the Bourne Rivulet
- Undertake applied research and take expert advice as necessary
- Develop approach on the Bourne Rivulet as an exemplar for other headwaters such as on The Itchen

Our membership – a partnership



Current Achievements

- PhD completed of Melanie Dixon ✓
- New PhD research being commissioned ✓
- Good status of Bourne established ✓
- Two year electro-fishing study initiated ✓

PhD -The sustainable use of water to mitigate the impacts of watercress farms on chalk streams in southern England

UNIVERSITY OF SOUTHAMPTON
ABSTRACT
FACULTY OF ENGINEERING, SCIENCE & MATHEMATICS
SCHOOL OF CIVIL ENGINEERING & THE ENVIRONMENT
Doctor of Philosophy

THE SUSTAINABLE USE OF WATER TO MITIGATE THE IMPACT OF
WATERCRESS FARMS ON CHALK STREAMS IN SOUTHERN ENGLAND

By Melanie Joanne Dixon

Cruciferous plants release isothiocyanates when their tissues are wounded. Release of phenethyl isothiocyanate (PEITC), from watercress (*Nasturtium officinale* (R.Br)) is thought to affect invertebrates in chalk receiving waters downstream of watercress farms and is potentially exacerbated by discharge from crop washing on site. There is currently no standard method for measuring PEITC in aqueous samples and little is known about its behaviour in the aquatic environment.

Water in which frozen watercress leaf/stem tissue had been washed was analysed using solid phase extraction and gas chromatography-mass spectrometry techniques. PEITC could be consistently identified from samples prepared with as little as 1g watercress and was measured at concentrations of 397 – 696 $\mu\text{g/g}$ watercress washed. Ecotoxicological testing showed disruption of *Gammarus pulex* (L.) reproductive behaviour in watercress wash water and PEITC solution. Two-hour exposure to wash water prepared at 1g watercress per litre water resulted in a mean precopular separation ET_{50} of 89 ± 6 minutes (four tests). This may account for the unsustainable population in the Bourne Rivulet (downstream of Lower Link Farm, Hampshire) where repeated exposure to an elevated level of PEITC occurs. *In situ* acute 7-day caged *G. pulex* tests at the watercress farm showed that untreated factory wash water resulted in significantly higher mortality ($18 \pm 5\%$ of test organisms) compared to control levels ($3 \pm 1\%$) and that after treatment by recirculation of wash water through watercress beds mortality analogous to control levels was found ($5 \pm 1\%$).

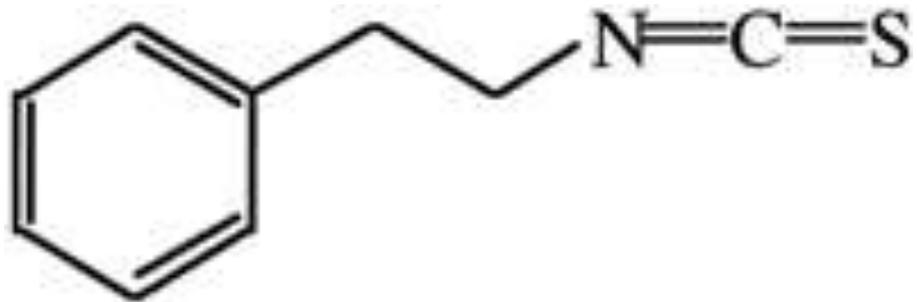
Temporal and spatial changes in macroinvertebrate populations of the Bourne Rivulet over the last 20 years corresponded with changes in farm management practice to improve the watercress farm discharge quality. In particular, the abundance of *G. pulex* had dramatically increased from 205 individuals in Spring 2007 to 2405 individuals in Autumn 2008 after factory wash water discharge was 'treated' by recirculation through watercress beds. *In situ* testing may be used at watercress farms to identify where PEITC has the potential to cause an unsustainable population. Recirculation of wash water through watercress beds, as a surrogate wetland treatment system, is a straight forward and practical mitigation measure to implement.



Aims of the PhD

- identify & quantify levels of PEITC from water in which watercress had been washed
- establish whether isothiocyanates produced by watercress have a detrimental effect on *G. pulex* survival and reproductive behaviour
- establish whether mitigation measures in place at Lower Link Farm to reduce the impact of water used in the production and processing of watercress on the receiving water are successful
- in the receiving water, to explore the changes to the macroinvertebrate community below Lower Link Farm.

Phenethyl isothiocyanate



PEITC consistently found in watercress wash water

397-696 μg per g watercress
washed



Reproductive behaviour of Gammarus disrupted



Factory wash water

Untreated washwater – 18% mortality

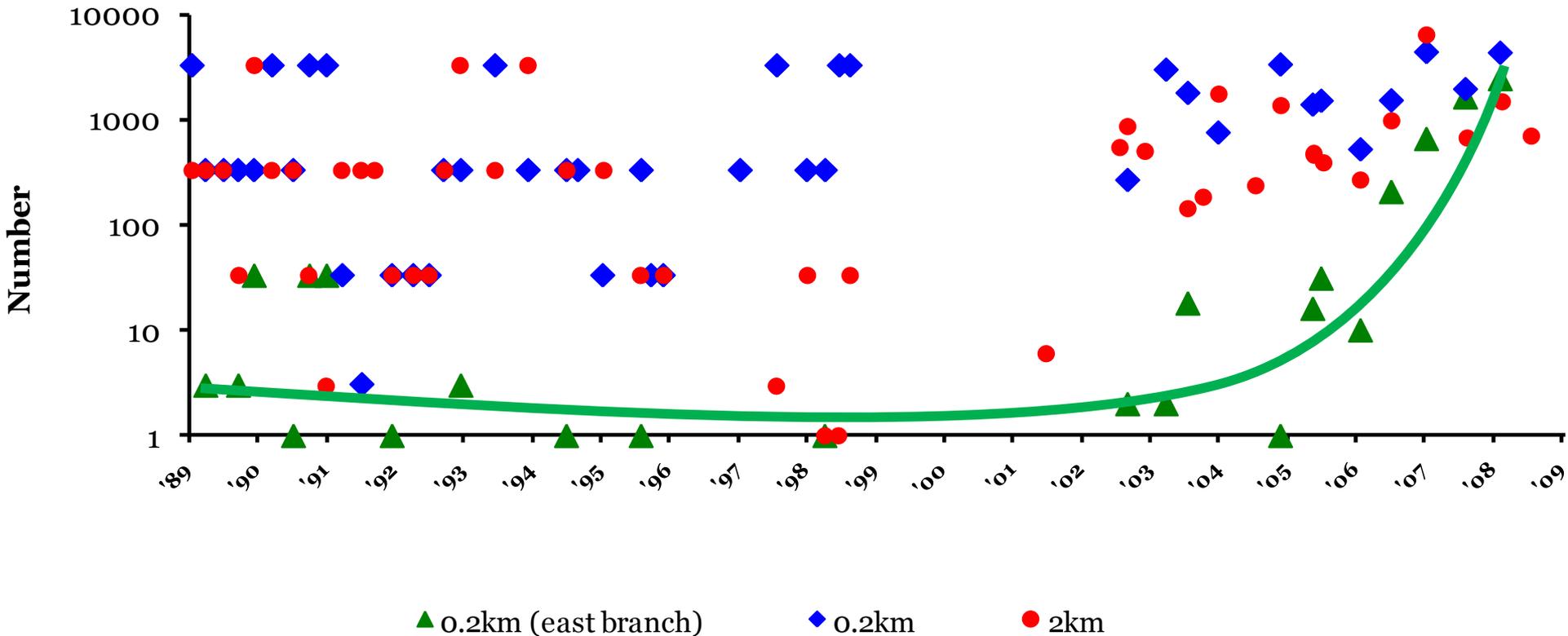
Re-circulated washwater – 3% mortality



Latest Information – Bourne significantly improved

Data courtesy of Environment Agency

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Bourne Rivulet – Gammaridae

Fish community surveys

- Fish are good indicators of overall ecosystem health and key to the value of chalk headwaters
- Data on fish in chalk headwaters are relatively scarce
- Need for whole community data on fish in the Bourne Rivulet – including “minor” species that elude catching & catch records





Quantitative fishing surveys

- Depletion fishing in netted (defined and repeatable) reaches
- ***Three locations***: eastern channel, western channel, plus downstream of their confluence
- ***Twice yearly surveys*** (May/June and November)
- Hopefully long-term monitoring & evaluation
 - More funding required

Phosphorous what we plan to do

- Strategic assessment of the relative contributions of P sources (e.g. farming, sewerage)
- Speciation (dissolved, organic-bound, particle-associated) of P relative to source
- Transport, mobility and sources in relations to surface water hydrology and hydrogeology
- Help identify actions to mitigate impacts

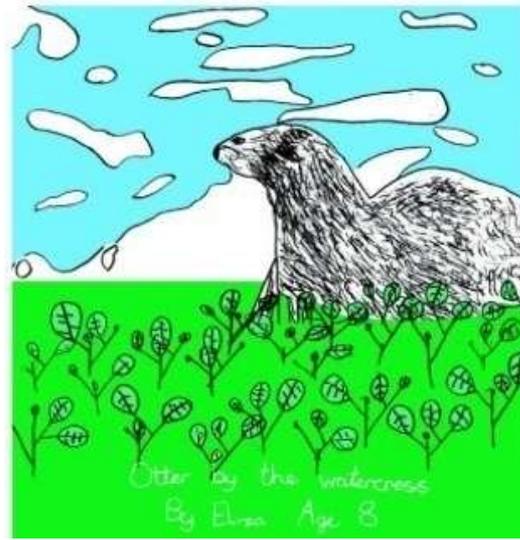
Funding? Southern Water, University, VCT

St Mary Bourne – sewage, overpumping and flooding to homes

- Flooding to the village when ground water is high
- Infiltration of sewer and overpumping to the bourne
- Plans to build new pumping station abandoned
- 14 households at risk are the focus of current activity
- The consequences of this for bourne water quality remain unquantified



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PhD Funding
Vitacress Conservation Trust
Valued at £60,000



Summary

- Completed PhD on Gammarus and impacts of watercress
- Significant improvements in the Bourne
- New PhD on phosphorous in chalk stream
- A programme of electro-fishing, contributing to '*Good Environmental Status*'



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Thank you!

