Guiding principles for management of freshwaters. Stakeholder response

A personal response, Geoff Phillips
Research Scientist Environment Agency

What does implementing the WFD feel like as a Regulator ?

Was it was *Red Hot* legislation ?

Raised expectations
Ecologists gained a voice
Catchment management became an objective
Recognition that many people need to be involved in the solutions

BUT

- Complexity of the directive and a total lack of understanding of how to deal with the apparent complexity of ecology remains an issue.
- In the pursuit of uniformity we distilled Ecology to the number 0.6.
- The *One out All out* approach is encouraging a diagonosis of what Quality Element is causing the problem and we seek a simple fix.

What do we need

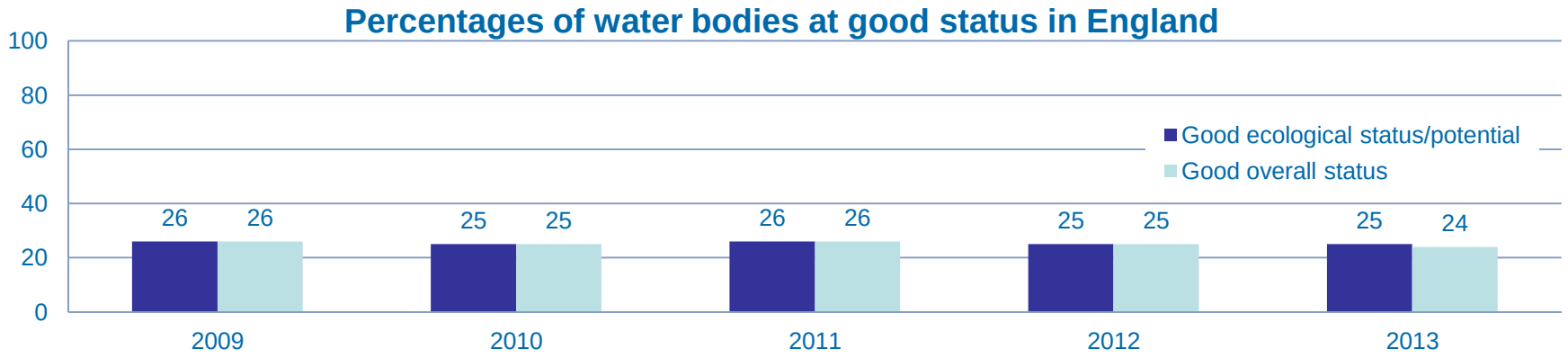
- ***Evidence*** that if we change X then our river/lake will be noticeably different.
- Evidence
  - Experimental work
  - Data - space for time substitution
  - Case studies
- Level of certainty is important
  - Only take expensive action where we are certain there is a problem (certain we can achieve a beneficial change)
- Time scales – how long will it take ?

The Environment Agency Ambition

- In 2009 we set a target that 31% of waters in England classified under the WFD classification system would reach “good status” or “good potential” by 2015

Current position

- We expect that the work carried out to date will deliver the 31% target but later than at first thought.



Progress is slow !

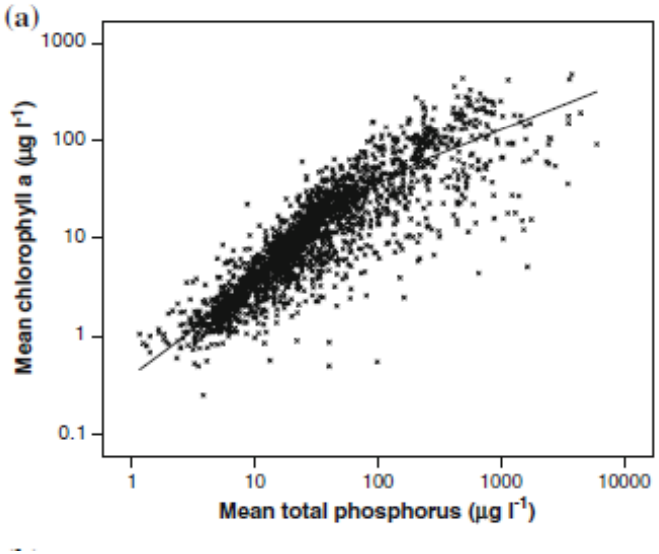
Delivering expectations for WFD remains a challenge, before we consider implications of climate change.

Key Message: Climate change signal not expected to differ from human pressures

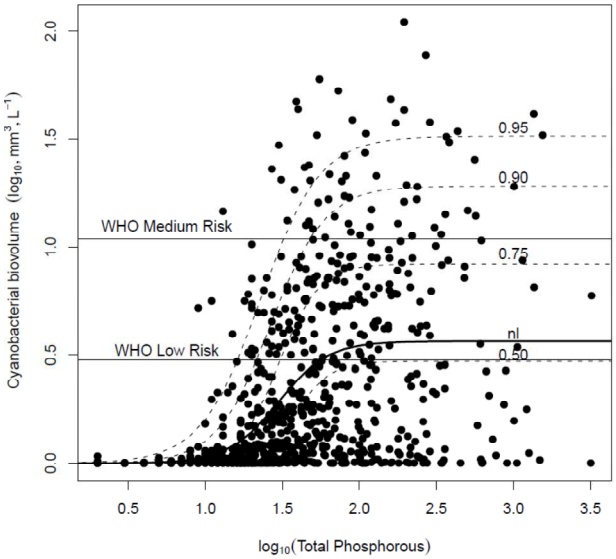
- Reference conditions do not need to be updated
- But the climate will complicates interpretation of change.
  - influence the ecological impacts of anthropogenic pressures
- Need to evolve management responses in an area of high uncertainty.

Guiding principle 1: Nutrient loads to lakes need to be lowered.

- Natural mechanisms reducing phytoplankton weaken.
  - Clearly a likely outcome, but difficult to predict responses.
  - How much uncertainty in our models can be attributed to climate ?



Relationship between chlorophyll and total phosphorus in European lakes
From Phillips et.al. (2008)

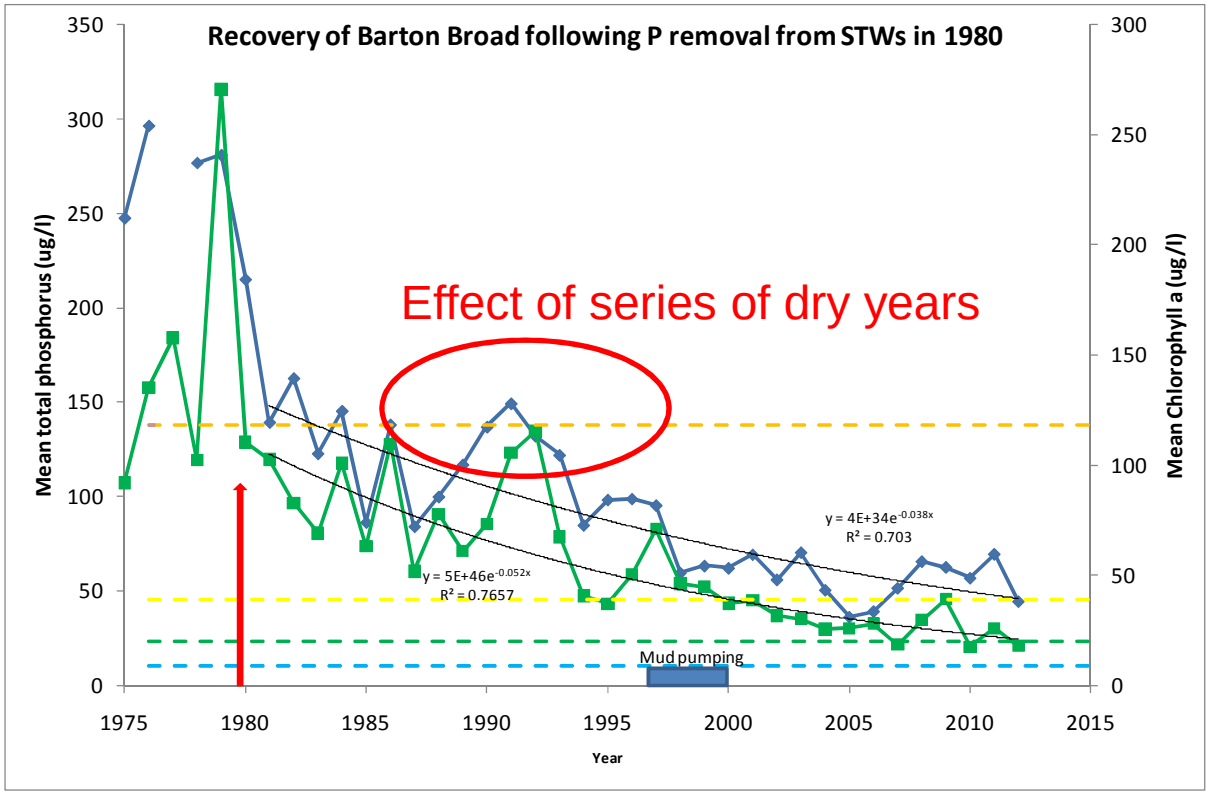


Relationship between cyanobacteria biomass and total phosphorus in European lakes
From Carvallho et.al. (2013)

Environment Agency

Time scale of change

- We have an expectation that our environment can be managed to achieve short-term goals
- What is the time scale of change ?
  - 15+ years for lakes ?
- Is the response to nutrients linear ?
  - For lakes response levels when P > 100ug/l
- We expect to use water body specific models to support a case for action.
  - Need to accept more general models and take actions based on general behaviour.



Reduction in total phosphorus (blue line) and chlorophyll a (green line) in Barton Broad following the introduction of phosphorus removal at sewage treatment works in the River Ant catchment in 1980. Dotted lines show WFD boundary values for chlorophyll a, solid lines are trend lines (exponential fit) (Data for 1975,1976 from UEA studies)

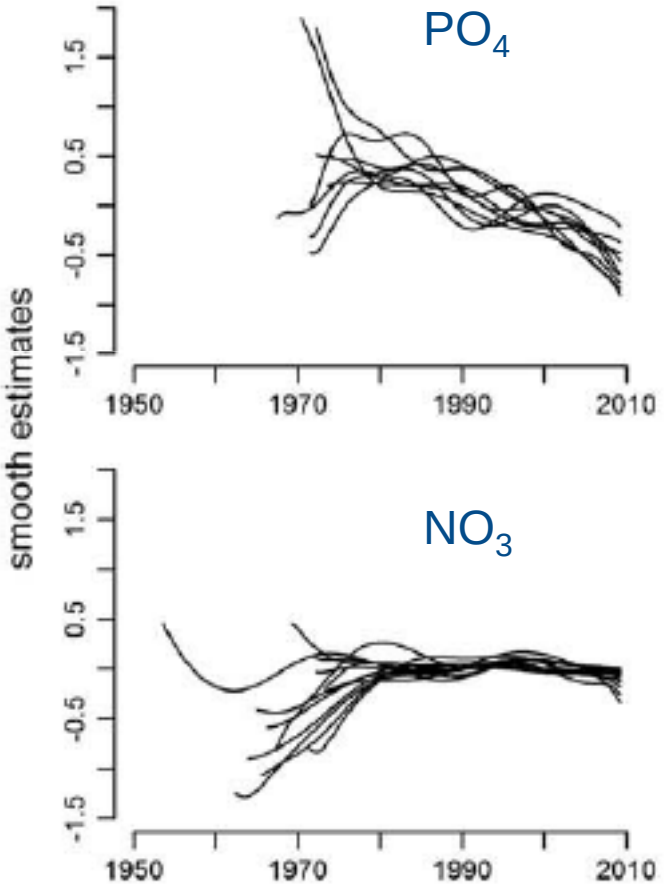
In 40 years we have changed from Poor to Good/Moderate boundary by action on point sources.

Progress on nutrients

P is improving – control of point sources

NO_3 is showing no change

Future reductions will be more challenging.



Smoothed temporal trends for a)Phosphate b)Nitrate in large hydrometric areas of England (Miller et.al., 2014 *Science Total Environment*)

Guiding principle 2: Rehabilitate zooplankton !

- As a limnologist, Yes, Yes & Yes !
- Zooplankton play a pivotal role
  - Shallow lake in Norfolk Broads (UK)
  - Spring Chla ~ Biomass large cladocera + TP
    Standardised regression coefficients
    -0.59 (Lclad), +0.49 (TP)
  - Summer Chla ~ Biomass large cladocera + TP + % Colder
    Standardised regression coefficients
    -0.70 (Lclad), +0.34 (TP) +0.24 (% Colder)
  - Particularly important in the summer, as is temperature

Guiding principle 2: Rehabilitate zooplankton !

- Zooplankton play a pivotal role, but
  - We need metrics (biomass, size ?)
  - Affordable monitoring strategies (zooplankton are highly variable in space and time)
  - Do they provide an opportunity to replace assessment of fish
- We need to simplify our WFD assessments

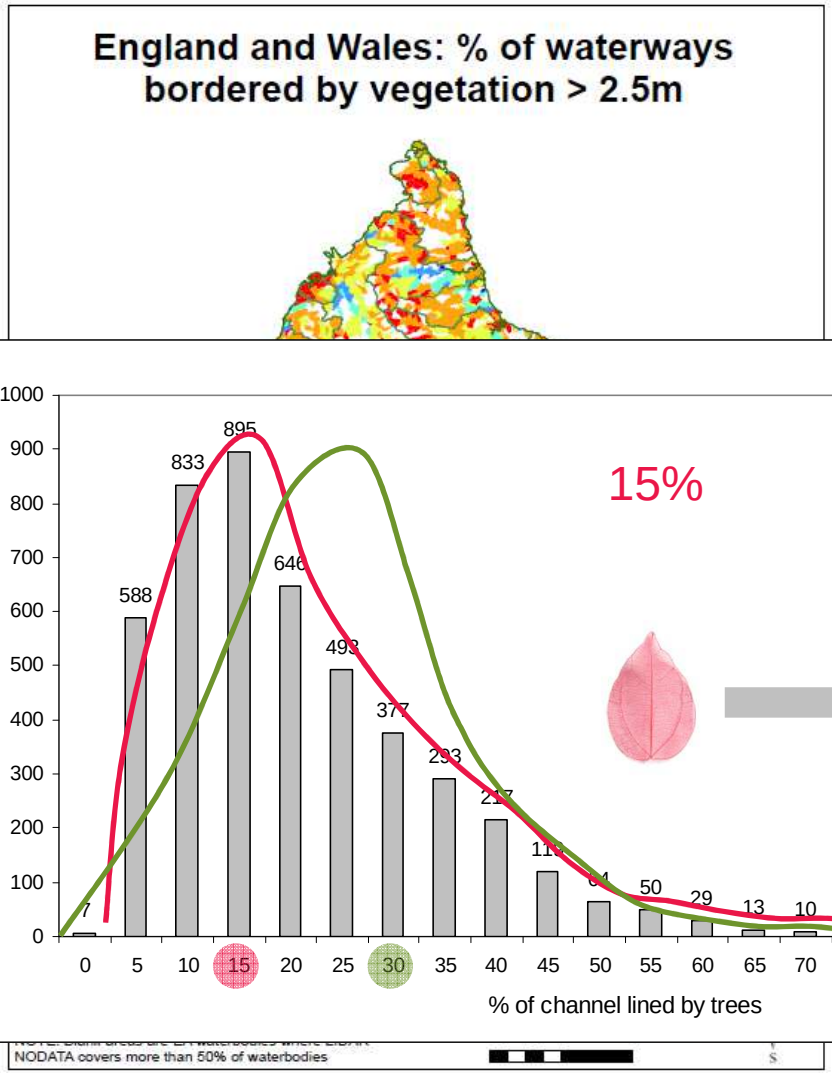
Guiding principle 3: Consider geographic and type specific differences

- Yes, but do we have the necessary understanding ?
- Intercalibration exposed country specific and regional differences in biological communities.
- Pressure – Impact responses are largely similar
- Will this complicate the process and reduce the likelihood that Europe moves in the same direction.

Guiding principle 4. Encourage riparian shade

- Example of an adaptive response
- Environment Agency is working with local people (River Trusts) to increase shade in selected Salmonid streams

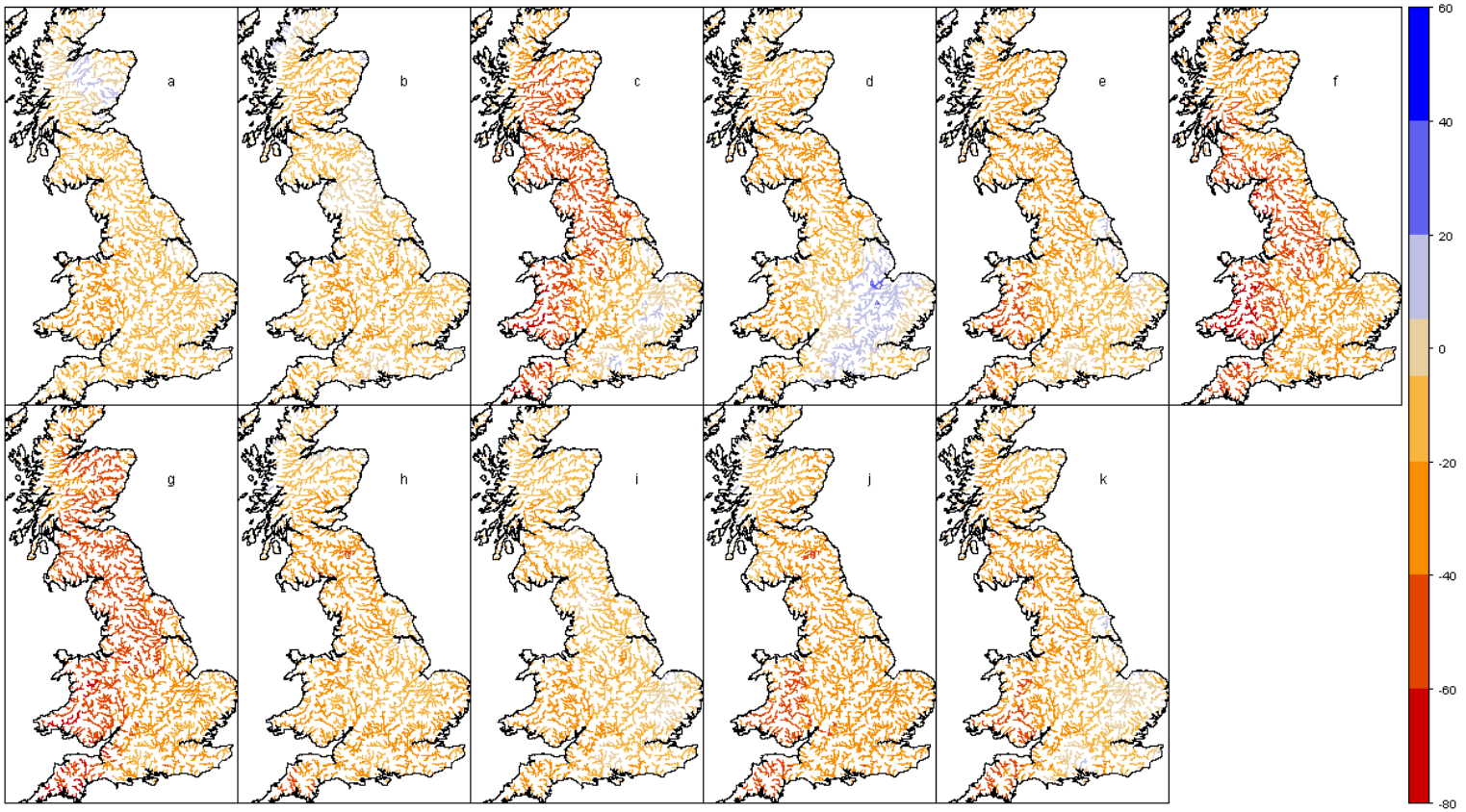
Do we need more riparian vegetation in England and Wales?



Keeping River Cool

- Opportunity to work with local people
  - Measures are simple to understand – plant trees
- Aim to reduce peak summer temperatures which influence salmonid success
- May be less effective if winter temperature is important
- Will this also reduce impact of nutrients?

Guiding principle 5: Maintain environmental flows



Prudhomme et al. 2012.The drying up of Britain? A national estimate of changes in seasonal river flows from 11 Regional Climate Model simulations“.Hydrological Processess Today

Environmental Flows

- A challenging requirement given predictions
- Need for clearer understanding of the interaction between flow, habitat and other pressures (e.g. Nutrients)

Summary

- REFRESH and similar projects are vital in developing our understanding.
- Messages need to remain simple
- Need for predictive models
  - Move beyond space for time substitution models
  - Particular need in relation to rivers, where interactions are more complex.
- Improve public understanding of the importance of healthy rivers and lakes & gain their involvement

Thank you for inviting my comments