LTLS:
Exploring potential implications of spatial and temporal variation in LTLS output for river biodiversity

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Key questions:

- What are the implications of changes in macronutrient concentrations for stream/river biodiversity in time and space, at regional-national scales?

- Can we exploit known (or develop new) relationships between nutrient chemistry and river biodiversity parameters in order to translate nutrient levels generated by the LTLS model into biodiversity metrics to inform stake holders?

Stages of eutrophication in rivers
(from Hilton et al., 2006)

A — Tall submerged plants – e.g. water starwort, Fontinalis etc.

B — Floating leaved plants e.g. *Nymphoides peltata, Polyganum amphibium*

C — Emergent plants, e.g. Sparganium emersum, mixed with tall submerged plants
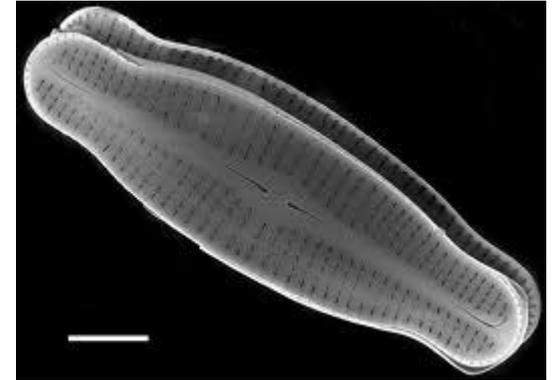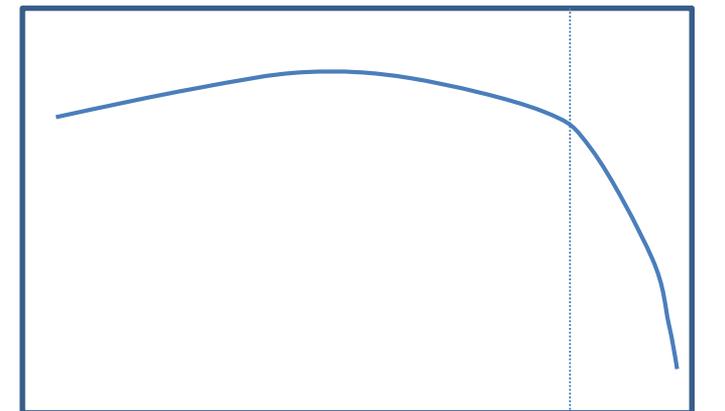
D — Filamentous algae

algal assessment of nutrient status

- A few ubiquitous diatom taxa show strong relationships with SRP concentration

- Basis of the WFD Trophic Diatom Index Tool

- Relative importance of T & N not always clear due to strong spatial co-variance

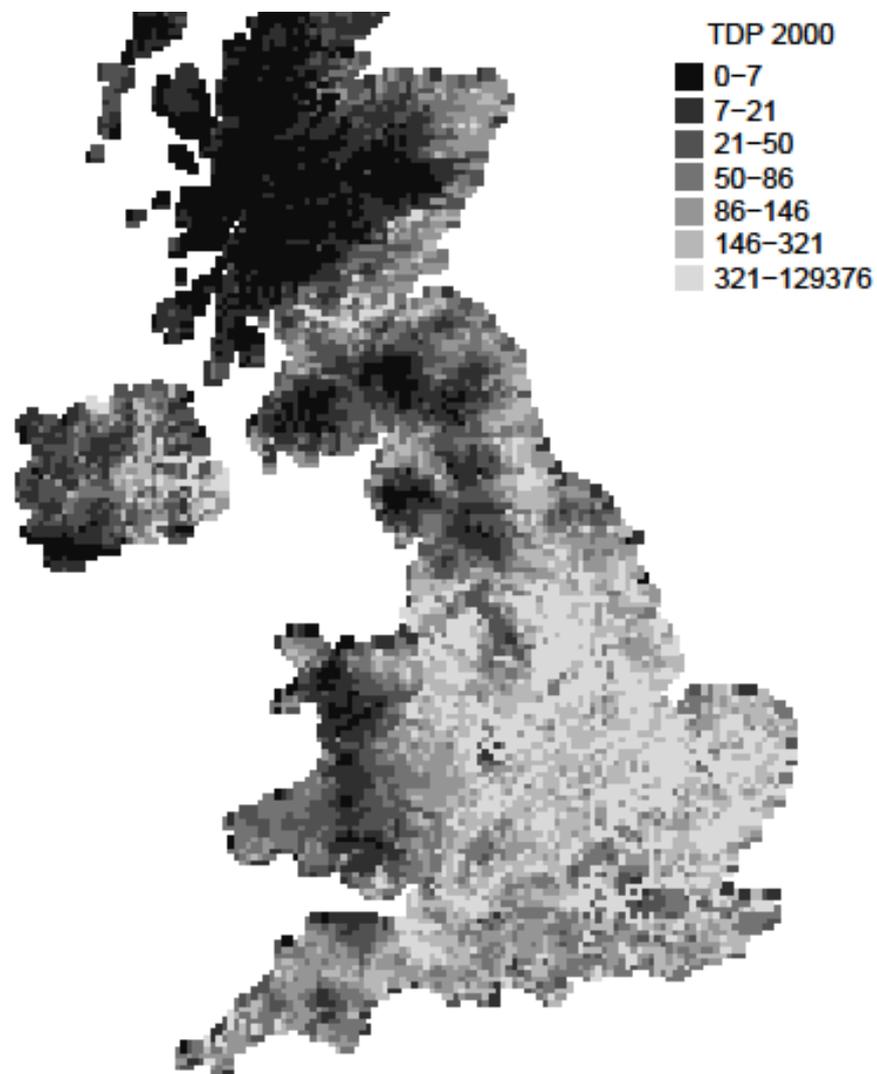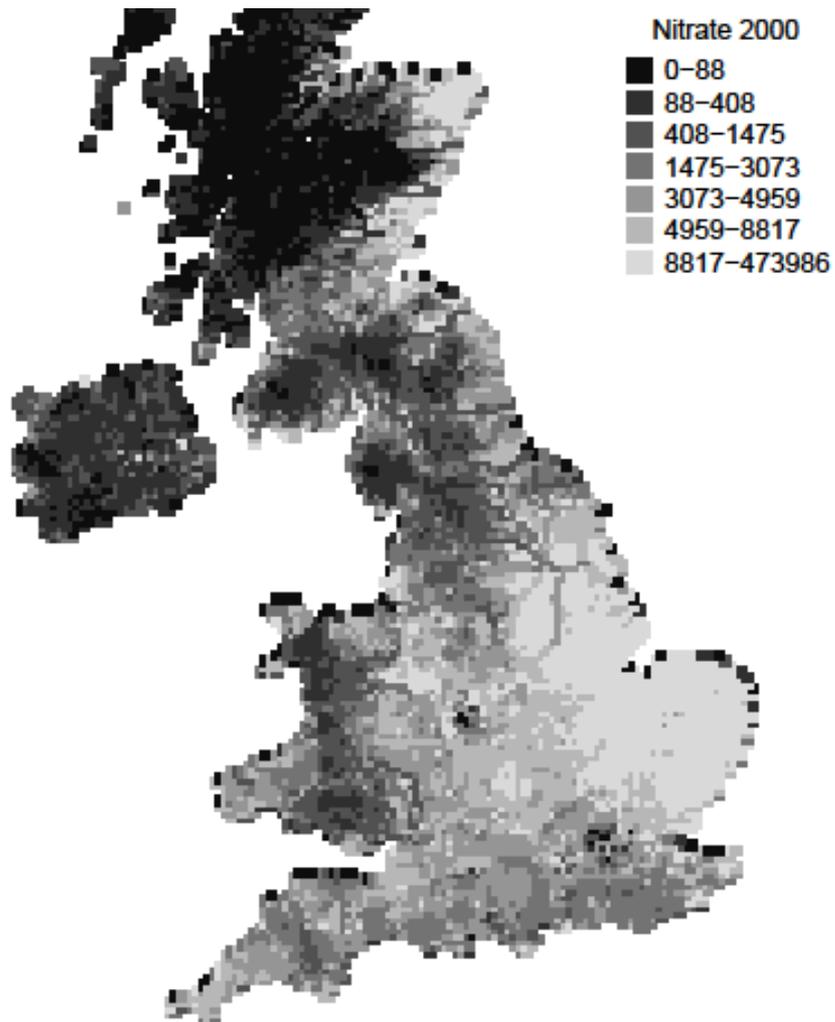*Achnanthidium minutissimum*

Relative abundance

100 µg P L_1

SRP Concentration

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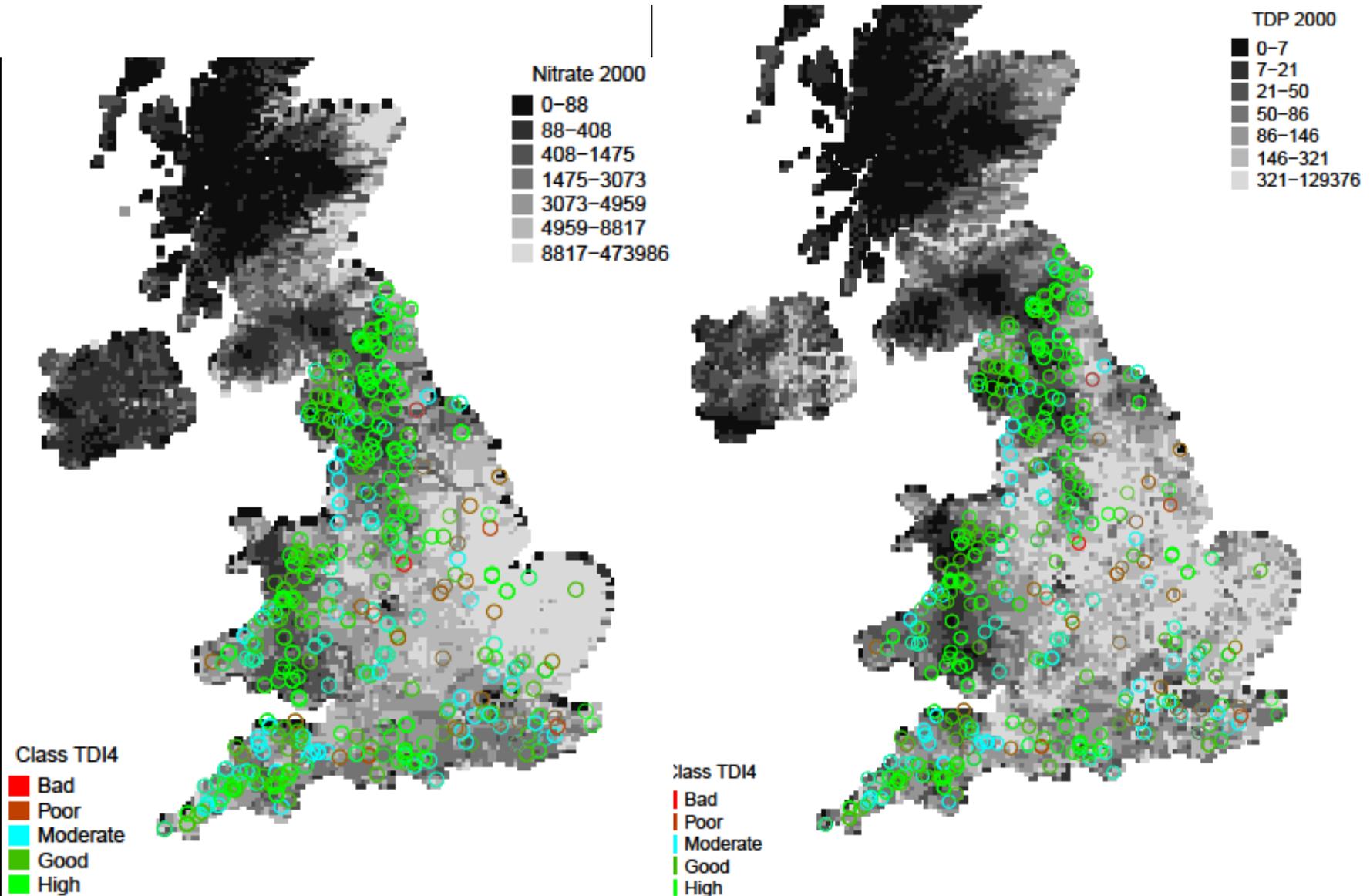NATURAL ENVIRONMENT RESEARCH COUNCIL

Final Approach

- EA provide diatom WFD metrics (DARES tool) for >1000 river/stream sites in England and Wales

- Includes Ecological Quality Ratio (EQR) estimates – i.e. High/Good/Moderate/Poor/Bad status relative to "unimpacted" condition

- Map diatom metrics onto LTLS 5 km grid of average "modern" Total Dissolved Phosphorus TDP and nitrate mean annual concentration (annual flux/annual flow)

- Assess spatial relationships between diatom and water chemical metrics

- Establish probabilistic relationships between chemical concentrations for each 5 km cell and co-located diatom metrics – i.e. likelihood each stream/river will belong to a particular EQR class on basis of LTLS modelled mean concentration

- Apply probabilistic relationship to model national change in EQR scores from 1850 to present – and to future scenarios
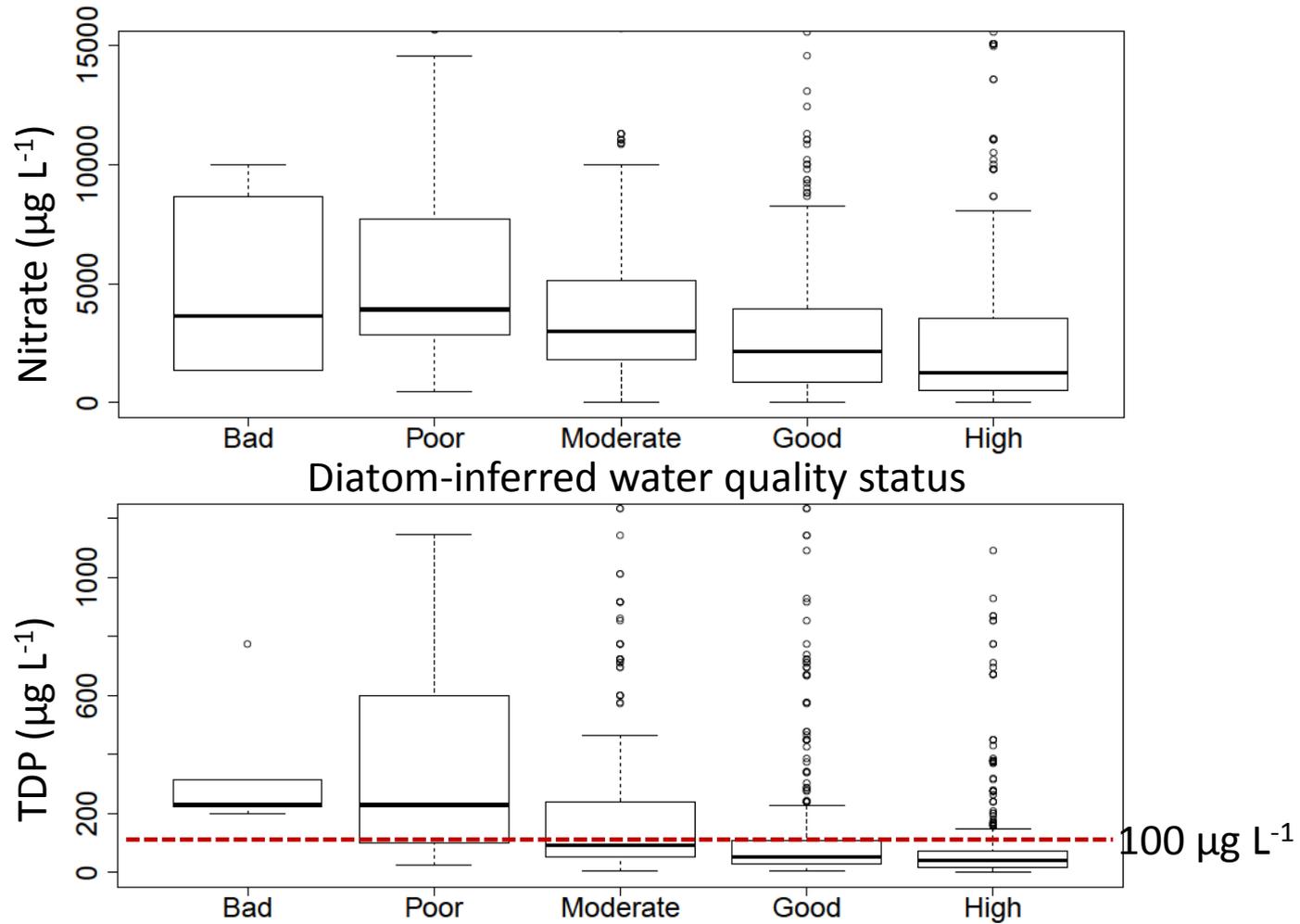
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Nitrate 2000
- 0–88
- 88–408
- 408–1475
- 1475–3073
- 3073–4959
- 4959–8817
- 8817–473986

TDP 2000
- 0–7
- 7–21
- 21–50
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Class TDI4
- Bad
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P & N concentration distributions
for 5 km cell specific to river/stream location

modelling changes in ecological quality
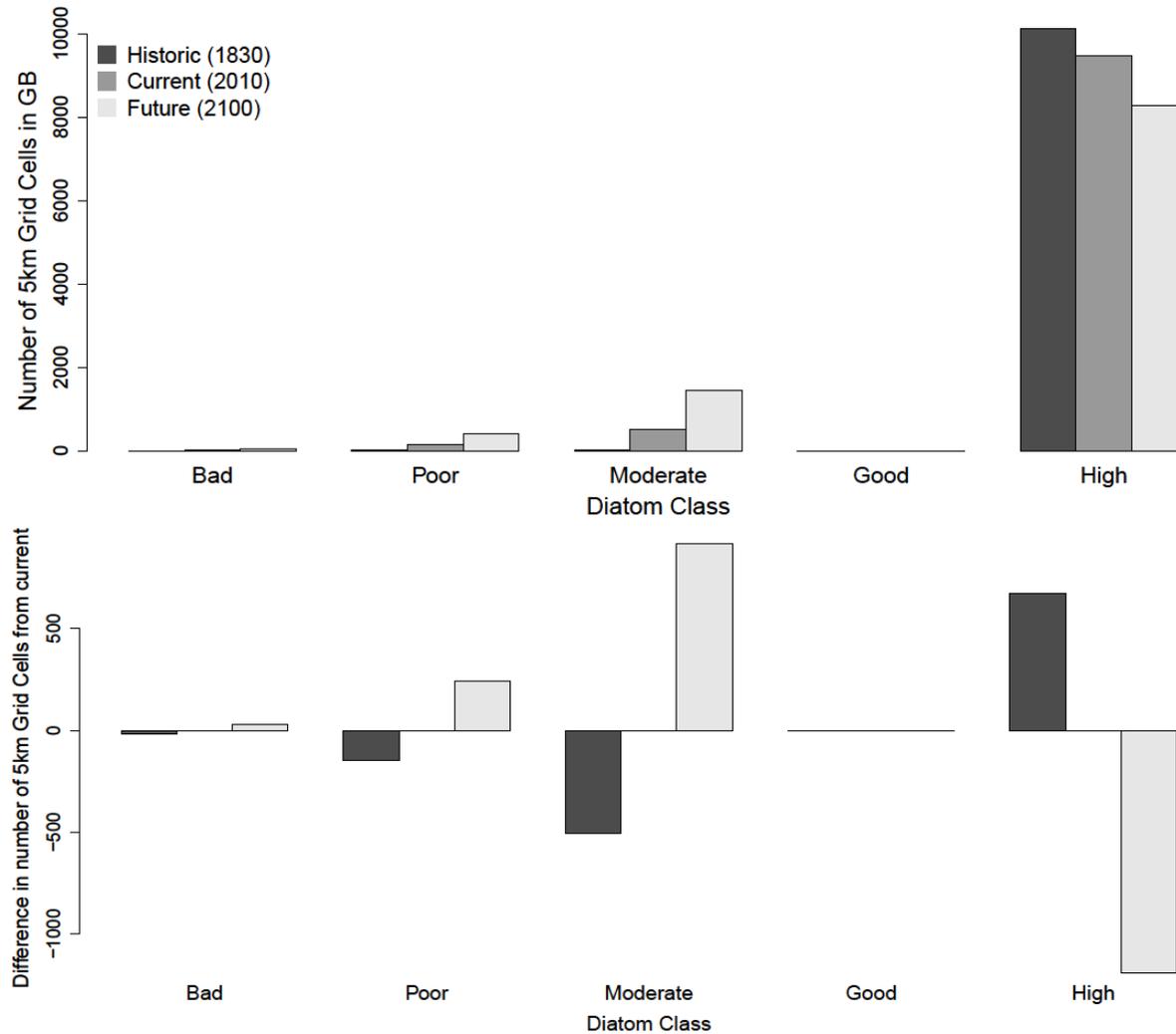
conclusions

- Diatom-inferred WFD status of streams and rivers shows striking agreement with LTLS modelled water chemistry for the co-located 5 km grid square

- Relationships much stronger for total dissolved P than nitrate (more likely due to covariance)

- Good agreement between absolute modelled TDP concentration and "expert opinion" re. key water quality thresholds

- Now possible to produce maps and statistics to assess long term impacts of cultural eutrophication on a key biodiversity metric at a national scale – and weigh up future scenarios

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