WP6: Attributing the causes of lake response to environmental change

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NERC Centre for Ecology & Hydrology

Strong collaboration with Universities of Glasgow and Dundee

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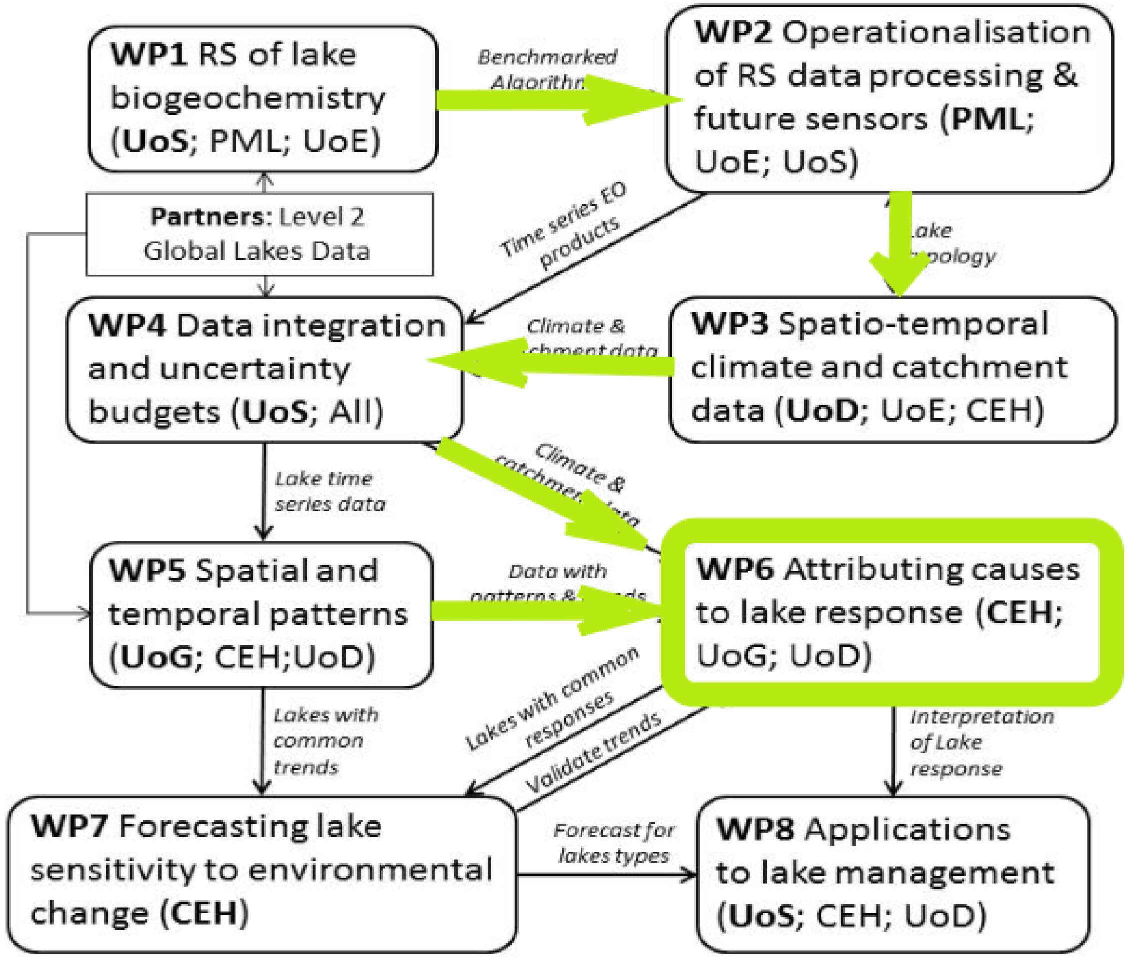
WP6 within GloboLakes



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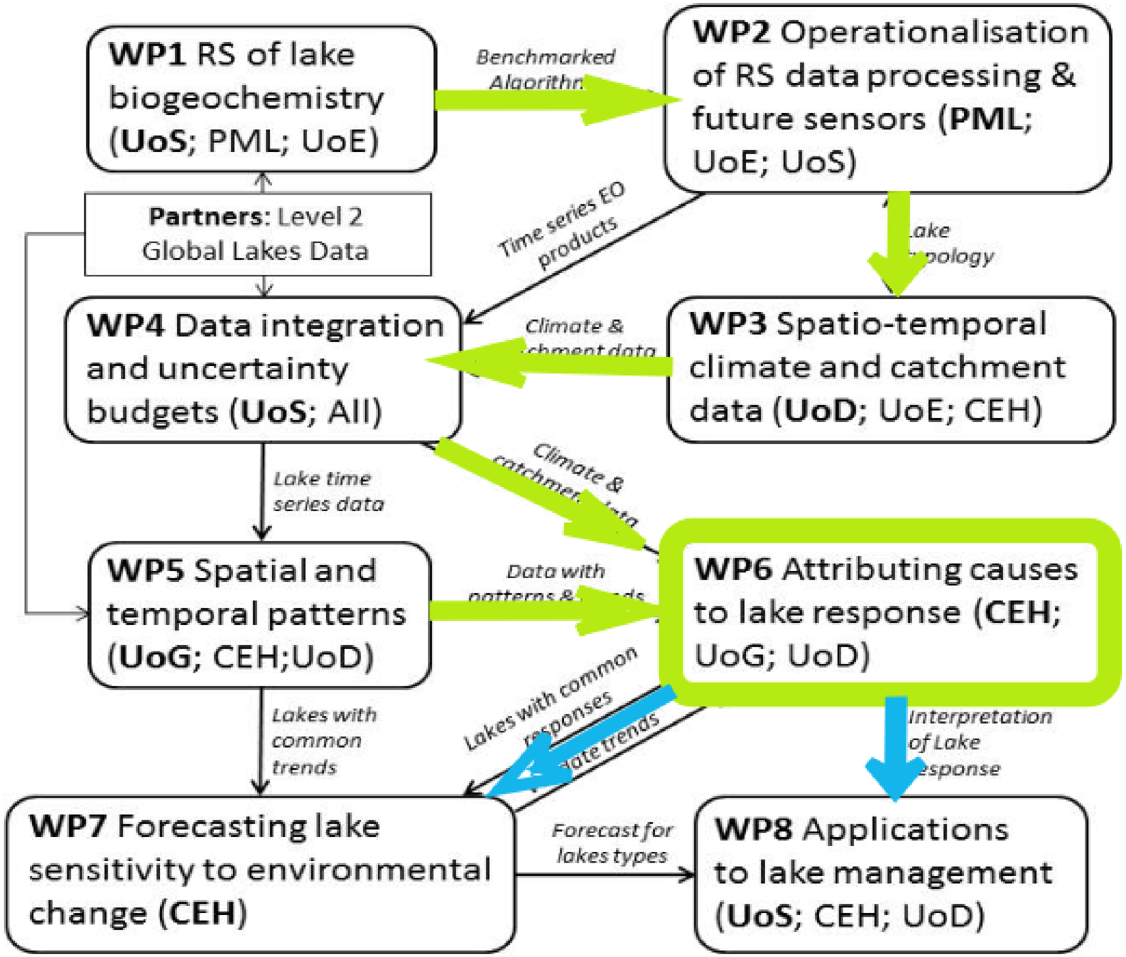

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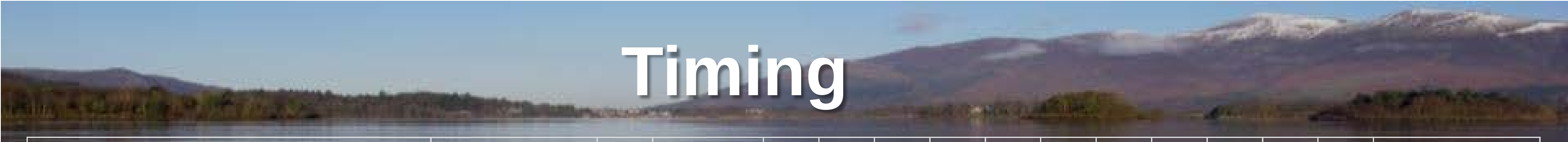

Timing

Gantt Chart

WP	Tasks	YEAR 1				YEAR 2				YEAR 3				YEAR 4				YEAR 5			
	month of project activities	1 - 2 - 3	4 - 5 - 6	7 - 8 - 9	10 - 11 - 12	1 - 2 - 3	4 - 5 - 6	7 - 8 - 9	10 - 11 - 12	1 - 2 - 3	4 - 5 - 6	7 - 8 - 9	10 - 11 - 12	1 - 2 - 3	4 - 5 - 6	7 - 8 - 9	10 - 11 - 12	1 - 2 - 3	4 - 5 - 6	7 - 8 - 9	10 - 11 - 12
WP1	**RS Algorithm Development**																				
D1.1	Space-time variability in lake optical properties								D1.1												
D1.2	Intercomparison and benchmarking of algorithms								D1.2		D1.2										
D1.3	Ensemble algorithm for global scale operation										D1.3										
D1.4	Extend ARC-Lakes LSWT data set								D1.4												
WP2	**Algorithm Operationalisation**																				
D2.1	Automated data processing Chain											D2.1									
D2.2	Consistent MERIS and Sentinel 3 data sets																D2.2				
D2.3	Operational Global Lakes Observatory													D2.4							
D2.4	Archived Data dissemination																				D2.4
D2.5	LSWT time series 1991-2007																				D2.5
WP3	**Climatic & Nonoclimatic Drivers**																				
D3.1	Selection of sentinel lakes	D3.1																			
D3.2	Datasets of long term trends in climatic variables			D3.2																	
D3.3	Characterisation of landcover/land use trends									D3.3											
D3.4	Modelling run off, sediment & nutrient inflow												D3.4								
D3.5	Hydromorphological alteration assessment							D3.5													
WP4	**Data Integration & Uncertainty Budgets**																				
D4.1	QA'd intercomparable and documented datasets								D4.1				D4.1								
D4.2	Measures of uncertainty on lake observations								D4.2												
D4.3	Uncertainties with catchmen and climate drivers		D4.3						D4.3		D4.3		D4.3								
D4.4	Measures of uncertainty on EO products												D4.4								
WP5	**Detecting Spatial and Temporal Patterns**																				
D5.1	Inventory of lake condition > 1000 global lakes												D5.1								
D5.2	Indentification of long term patterns of change																	D5.2			
D5.3	Identification of clusters of common signals																	D5.5			
D5.4	Identification of non conforming lakes																	D5.6			
WP 6	**Attributing Causes of Lake Response**																				
D6.1	Causes of coherence for different senssed lakes characteristics																				D6.1
D6.2	Causes of phenological change																				D6.2
D6.3	Factors controlling cyanobacterial blooms																				D6.3
D6.4	Assessment of factors controlling CDOM																				D6.4
WP 7	**Interpretation and forecasting Lake sensitivity**																				
D7.1	The identification of lake types vulnerable																				D7.1
D7.2	Cyanobactria risk under a range of scenarios																				D7.2
WP 8	**Apply Data for Lake Management**																				
D8.1	Stakeholder requirements and research capabilities	D8.1						D8.1					D8.1								D8.1
D8.2	UK wide understanding of change in lake condition	D8.2						D8.2					D8.2								D8.2
D8.3	Future threats to lakes at a global scale																				D8.3
D8.4	A sustainable future for Globolakes																				D8.4
Project Meetings (T = Teleconference; M = meeting)																					
	GloboLakes Team)	M	T	T	T	M	T	T	T	M	T	T	M		T	T	T	M	T	T	M
	Project Advisory Board	M				M				T			M					T			M
Dissemination of Outputs																					
DO.1	Project Web Site	DO.1																			
DO.2	News Letters	DO.2				DO.2				DO.2				DO.2				DO.2			DO.2
DO.3	Publications																				
Impact Plan																					
DI.1	Project launch	DI.1																			
DI.2	End User Workshops	DI.2											DI.2								DI.2
DI.3	Partners Workshop Calibration	DI.3							DI.3				DI.3								DI.3
DI.3	Partners Workshop Validation												DI.4				DI.4				DI.4
DI.4	Secondments				DI.5					DI.5								DI.5			

KEY: [dark grey] Workpackage effort; [D1.1] Timing of individual components and month of deliverable, i.e. D1 (e.g. start, mid or end quarter)

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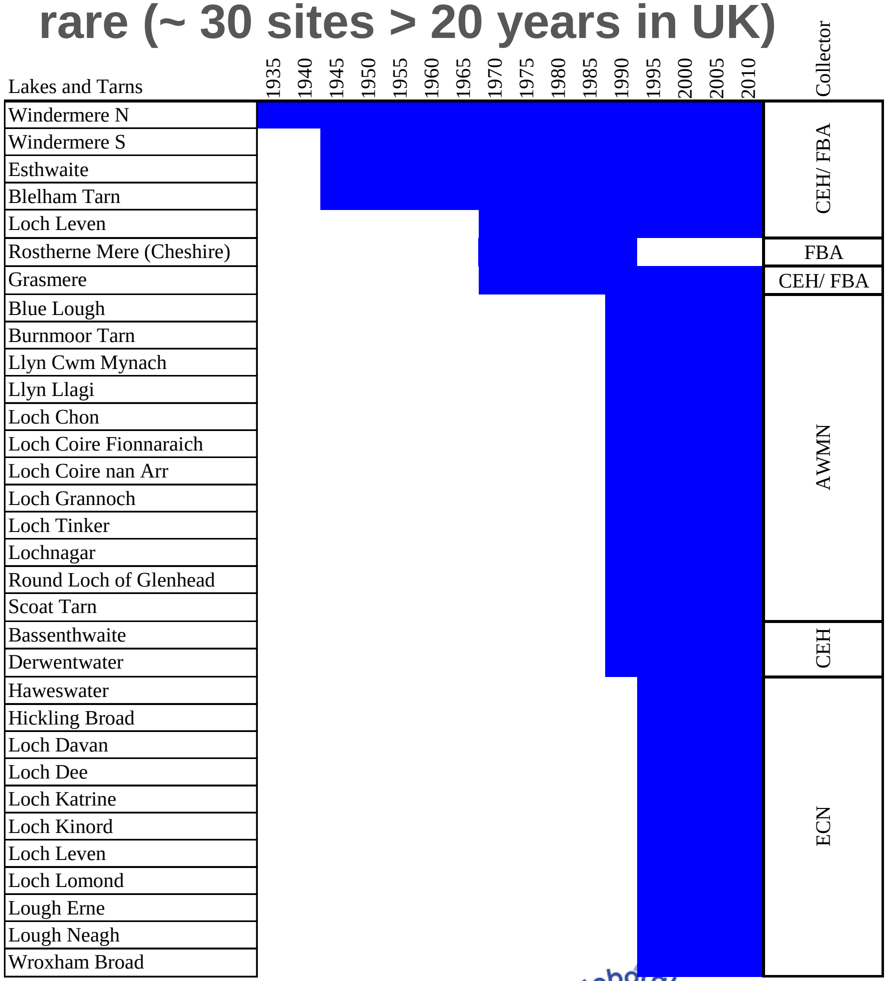
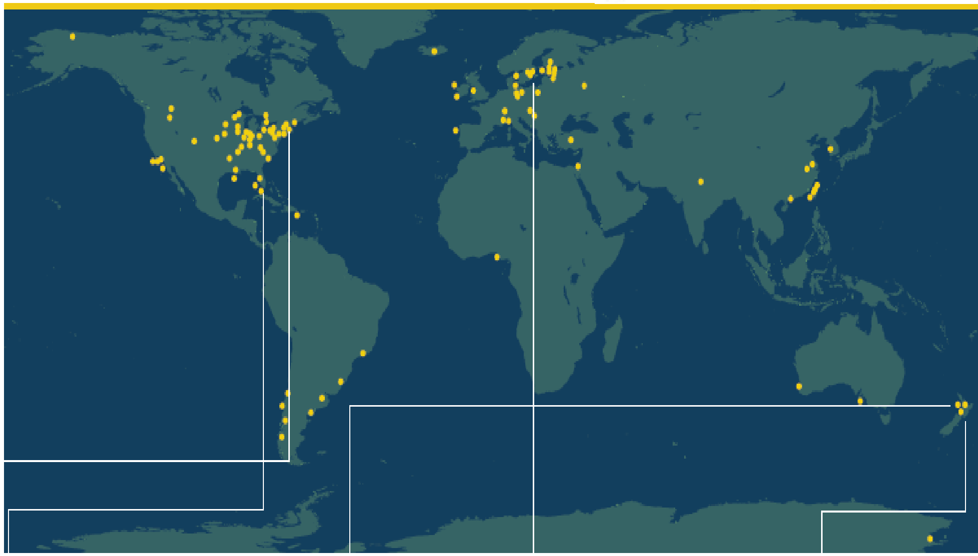
Global lake datasets

Long-term datasets on lakes are incredibly rare (~ 30 sites > 20 years in UK)



Good lake datasets are also limited and comparisons across sites have issues of data comparability

global lake ecological observatory network



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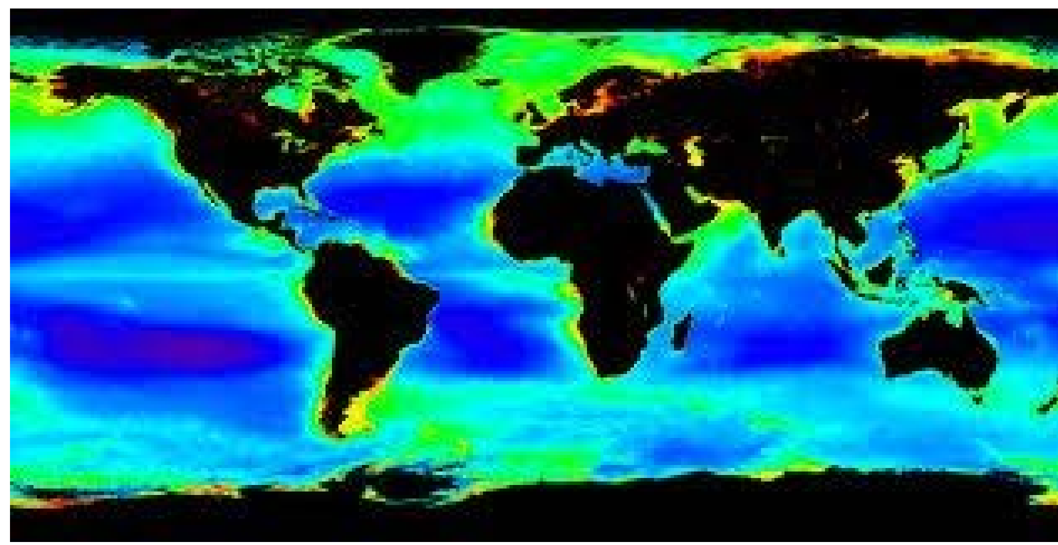
GloboLakes’ ambition

- ~1000 lakes across the world
- ~ monthly or better frequency
- ~15 years
- information on surface values for:
  - water temperature
  - chlorophyll a
  - phycocyanin
  - coloured DOM
  - total suspended solids
  - (primary production)



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Objectives

6.1 Determine the causes of coherence for different sensed lake characteristics

6.2 Assess the causes of changing phenology

6.3 Assess the factors controlling cyanobacterial blooms

6.4 Assess the factors controlling coloured DOC

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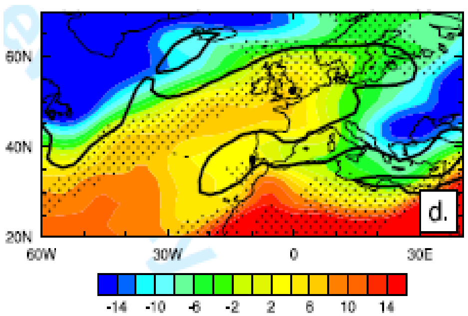
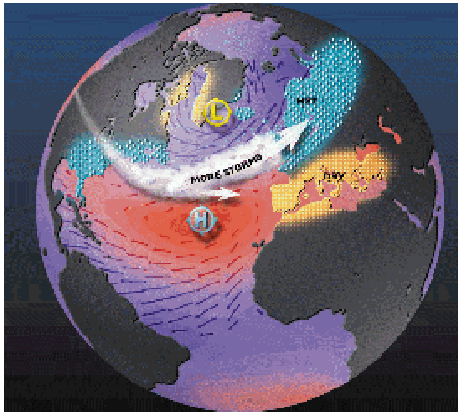
6.1 Determine the causes of coherence for different sensed lake characteristics

Rossby wave breaking at level of jet-stream

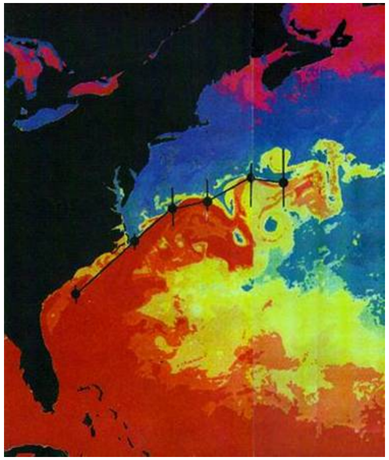


Strong & Maberly (2011) *Global Change Biol*.

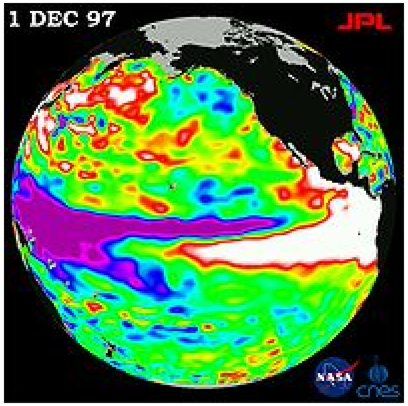
North Atlantic Oscillation



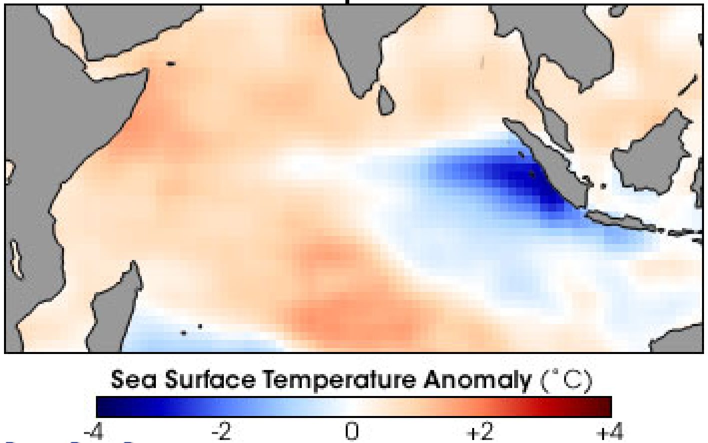
Position of Gulf Stream



ENSO



Indian Ocean dipole



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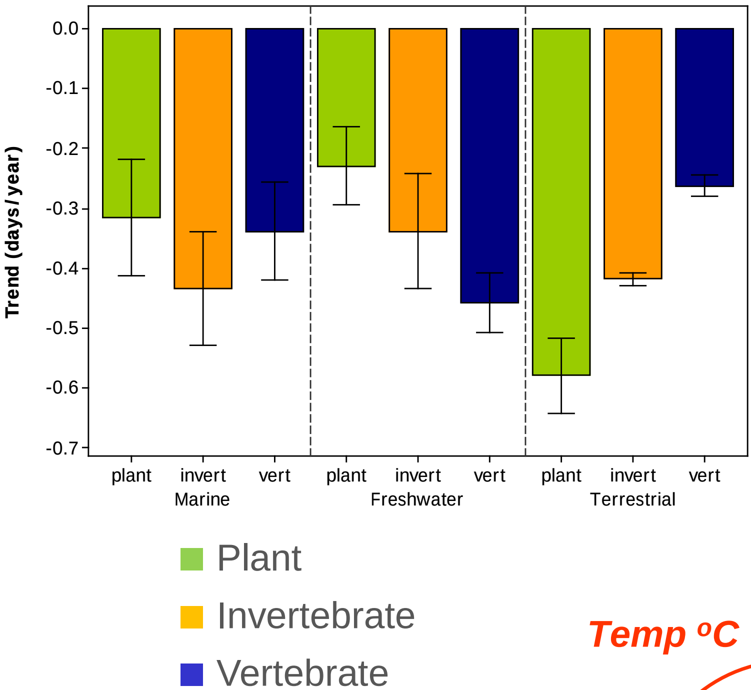
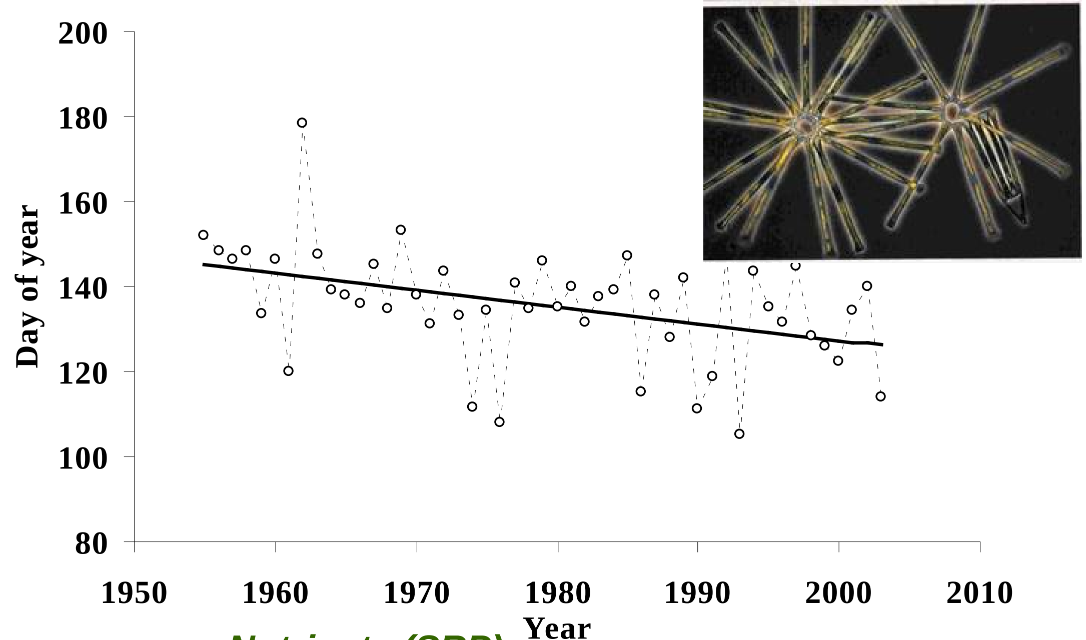
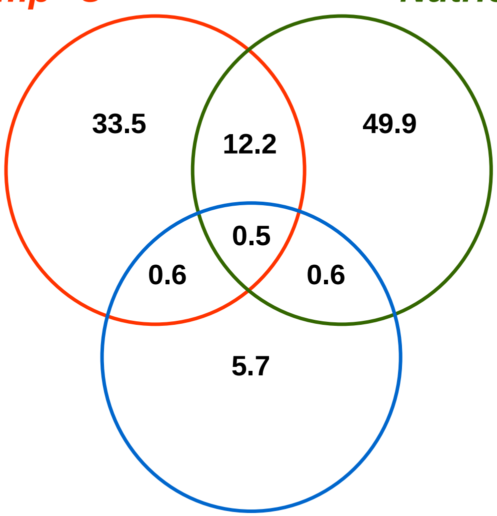
6.2 Assess the causes of changing phenology



Thackeray *et al*. (2010) *Global Change Biol*.



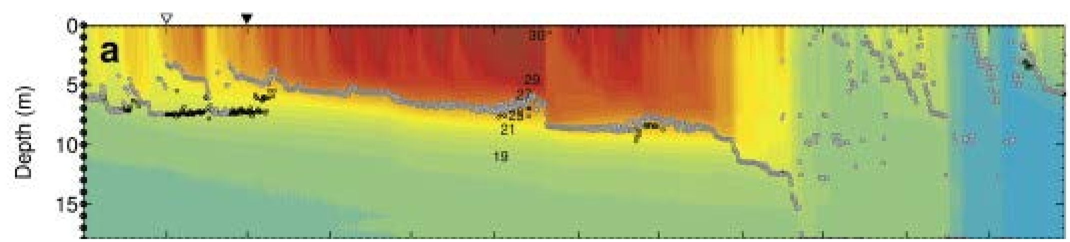
Thackeray, Jones & Maberly (2008) *J. Ecol.*



6.3 Assess the factors controlling cyanobacterial blooms

- Cyanobacterial blooms are a widespread response to local (nutrients) and global (climate) environmental change. Possible factors increasing their abundance include:

- Nutrient enrichment
- Low flows/drought
- High temperature
- Strong stratification



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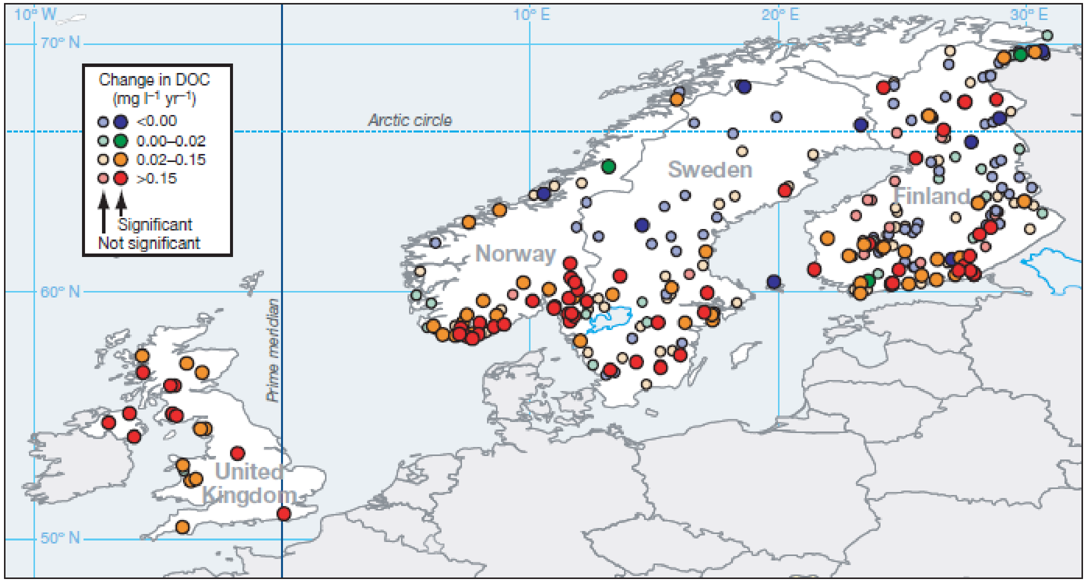
6.4 Assess the factors controlling coloured DOC



Monteith *et al.* (2007) Nature

- Recovery from acidification (left)
- Nitrogen deposition
- Climate change
- Land-use change

Before After

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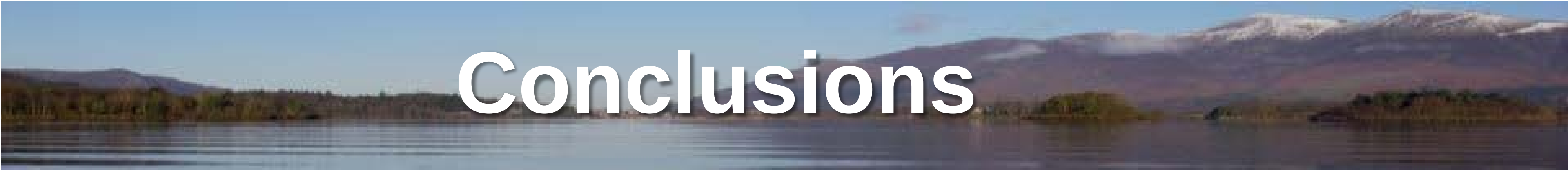

Conclusions

GloboLakes has the potential to produce a paradigm shift in our understanding of how lakes respond to environmental change at different scales and how this impacts on their status and function

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