

# Chlorophyll-a in the Kennet catchment

Attila Lazar, Prof. Paul Whitehead, Dr Andrew Wade  
Aquatic Environments Research Centre, University of Reading

## Aims/Objectives

The aim of this study is to assess Chlorophyll-a concentrations, and hence the algal behaviour in the Kennet catchment.

Chalk stream malaise (increased siltation, loss of fish and valued macrophyte species, algal growth) has been observed in southern England. The objectives of this work are: (1) to make a data-based assessment of the factors and processes controlling macrophyte and phytoplankton growth in Chalk streams, and (2) to develop a mathematical model to simulate coupled macrophyte-algal dynamics

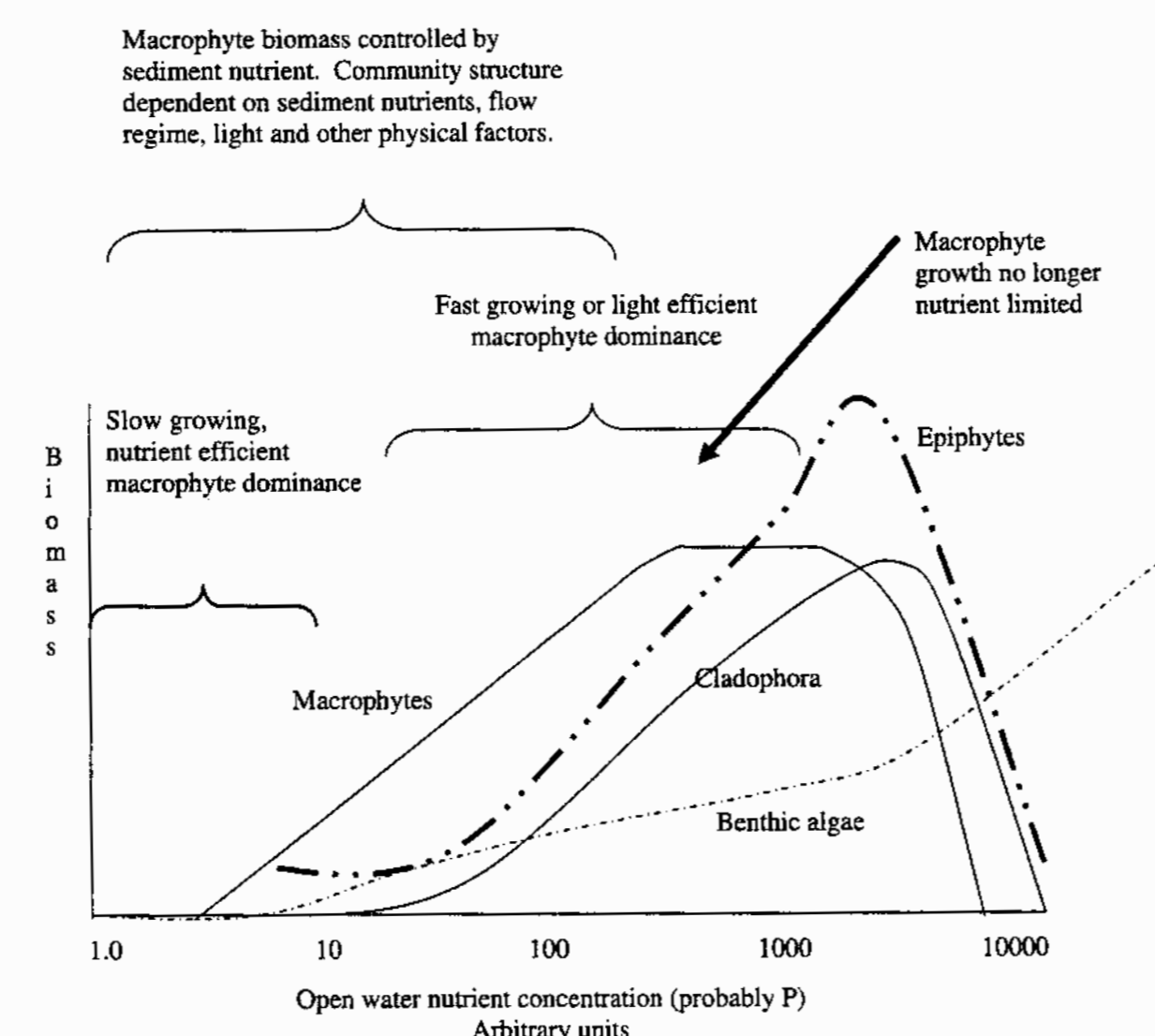


Fig 1. Hilton, J., M. O'Hare, et al. (2006): "How green is my river? A new paradigm of eutrophication in rivers." Science of the Total Environment 365(1-3): 66-83

## Study area

The River Kennet (Fig.3) is an important tributary of the Thames.

The area of the Kennet catchment is approximately 1200 km<sup>2</sup>. The upper two thirds of the catchment lays on Cretaceous Chalk, whereas the lower third is characterised by low permeability Eocene clays; the river flow is groundwater dominated (Fig.2).

Fig 2. Discharge along the River Kennet (data from NRFA, CEH)

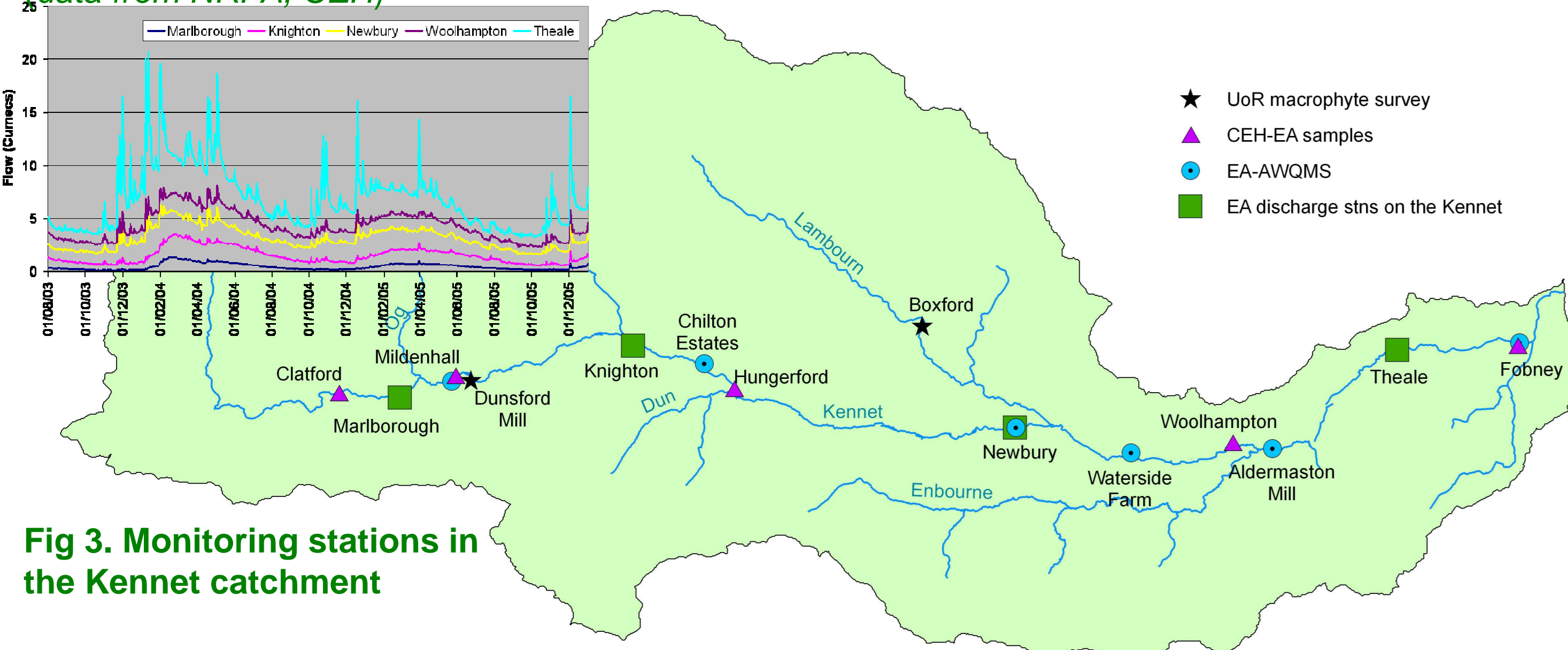


Fig 3. Monitoring stations in the Kennet catchment

canals are characterised by elevated chlorophyll-a (1-480 µg l<sup>-1</sup>) which might be an important source of phytoplankton inoculum in downstream reaches.

## Proposed methodology

1. Assessment of available data and literature to **determine the key factors** controlling macrophyte, epiphyte and phytoplankton growth along the Kennet;
2. Development of a **conceptual model** linking biological growth to flow, residence time, water quality and other physical factors;
3. **Testing** of the model to see if it can correctly predict a shift from macrophyte to algal dominance as proposed by Hilton et al. (2007; Fig. 1).

## Preliminary results

The preliminary assessment of the hydrochemical data indicates that algal growth might be important in the lower reaches of the River Kennet as indicated in Fig 4. Although the chlorophyll concentrations are low, a clear algal bloom is indicated by the increasing DO and pH during the elevated chlorophyll period, while conductivity shows that these changes were not caused by a storm event).

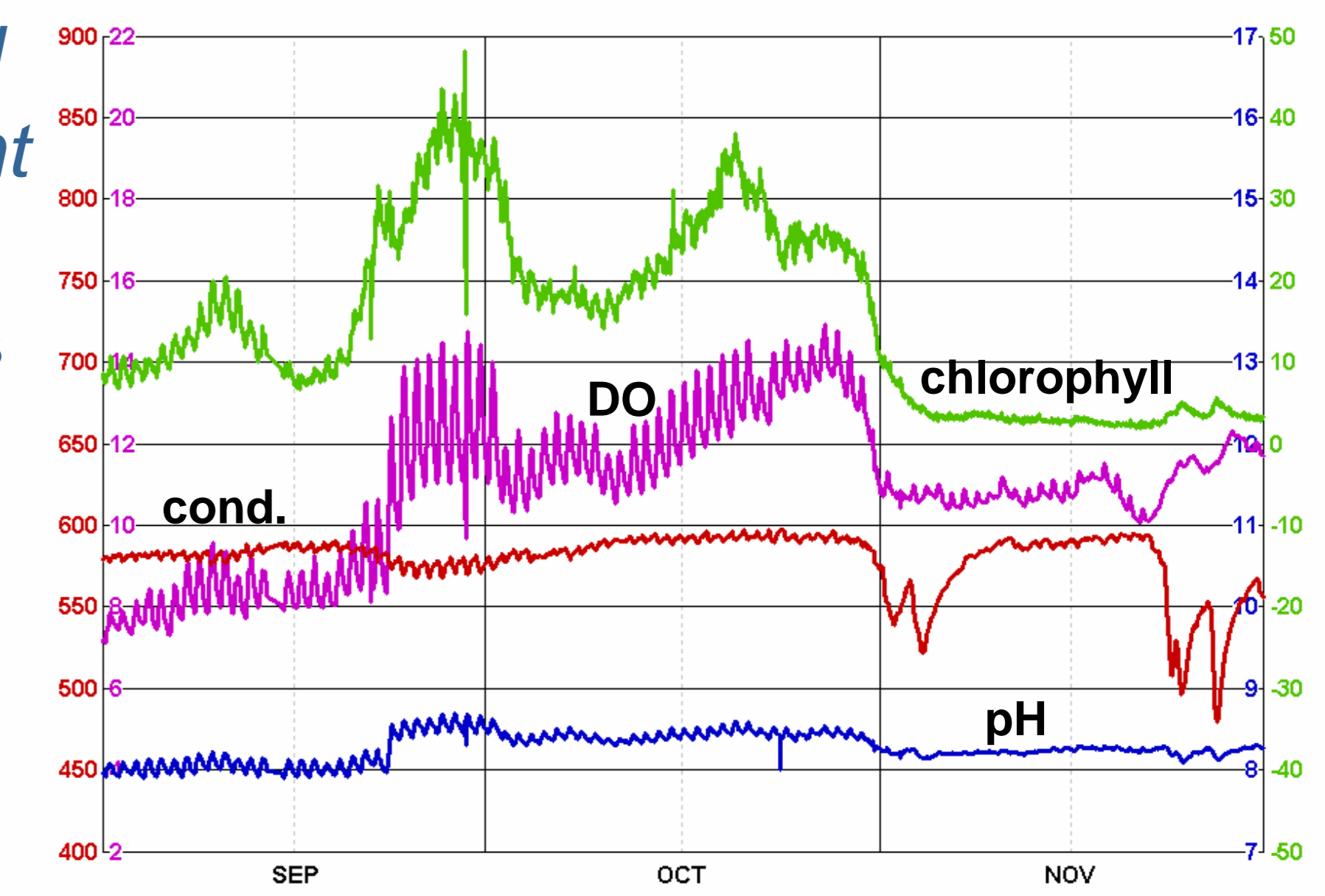


Fig 4. High frequency water quality data for Fobney (2003) (M. Loewenthal, Environment Agency)

- **Flow** is highest in Feb-Jun (upper reaches), and Dec-May (downstream reaches)
- During the vegetation growth period, the in-stream **chlorophyll-a concentrations** are higher and more variable than in winter suggesting phytoplankton activity.
- Median **SRP and NO<sub>3</sub>** concentrations are lower between March and October (but highest SRP peaks occur in August and September)
- SRP is elevated close to **effluent inputs**
- Chl-a, pH, PP, SRP, SS increase downstream
- Alk, Ca, NO<sub>3</sub>, Si, TDN decrease downstream
- Importance of **phytoplankton and removed benthic algae in SS** increases downstream (Table 1)
- Kennet: **oligotrophic-eutrophic**; Dun/Canals: **mesotrophic-hyper-trophic** according to classification in lakes (OECD, 1982, Fig 5).

Correlation	Mildenhall	Woolthampton
Chl-a - SS	Spr: 0.15 Sum: 0.18 Wint: 0.15	Spr: 0.44 Sum: 0.48 Wint: 0.20
Chl-a - PP	Spr: 0.46 Sum: -0.05 Wint: 0.46	Spr: 0.52 Sum: 0.63 Wint: 0.40

Table 1. Correlation between Chl-a, SS, PP (data from C. Neal, CEH Wallingford)

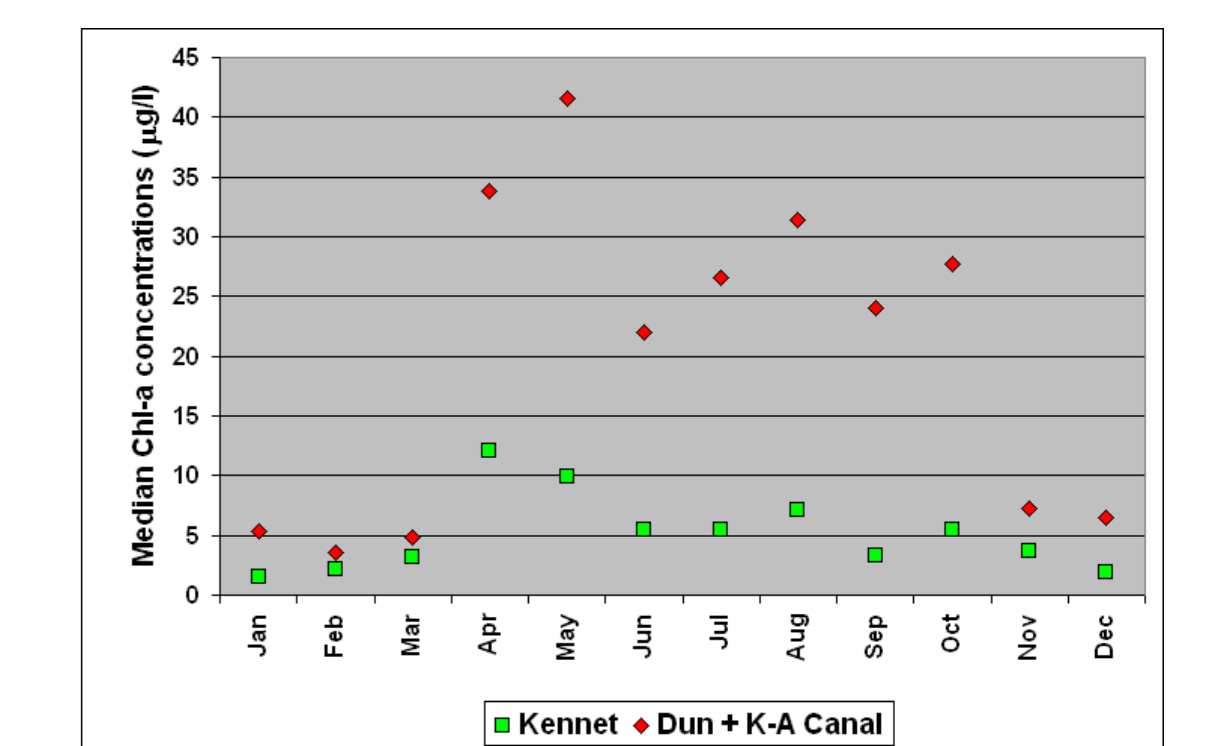


Fig 5. Statistics on lab samples (2003-2005) (data from C. Neal, CEH Wallingford)

## Next steps

- Understand the dynamics of algal blooms by using the hourly automated samples
- Compare laboratory samples with samples registered by the automated stations
- Compare the shading effect of algae and SS with the growth of macrophytes/epiphytes
- Develop the nutrient / light / hydrology limitation "theory" for a dynamic model

## Acknowledgements

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