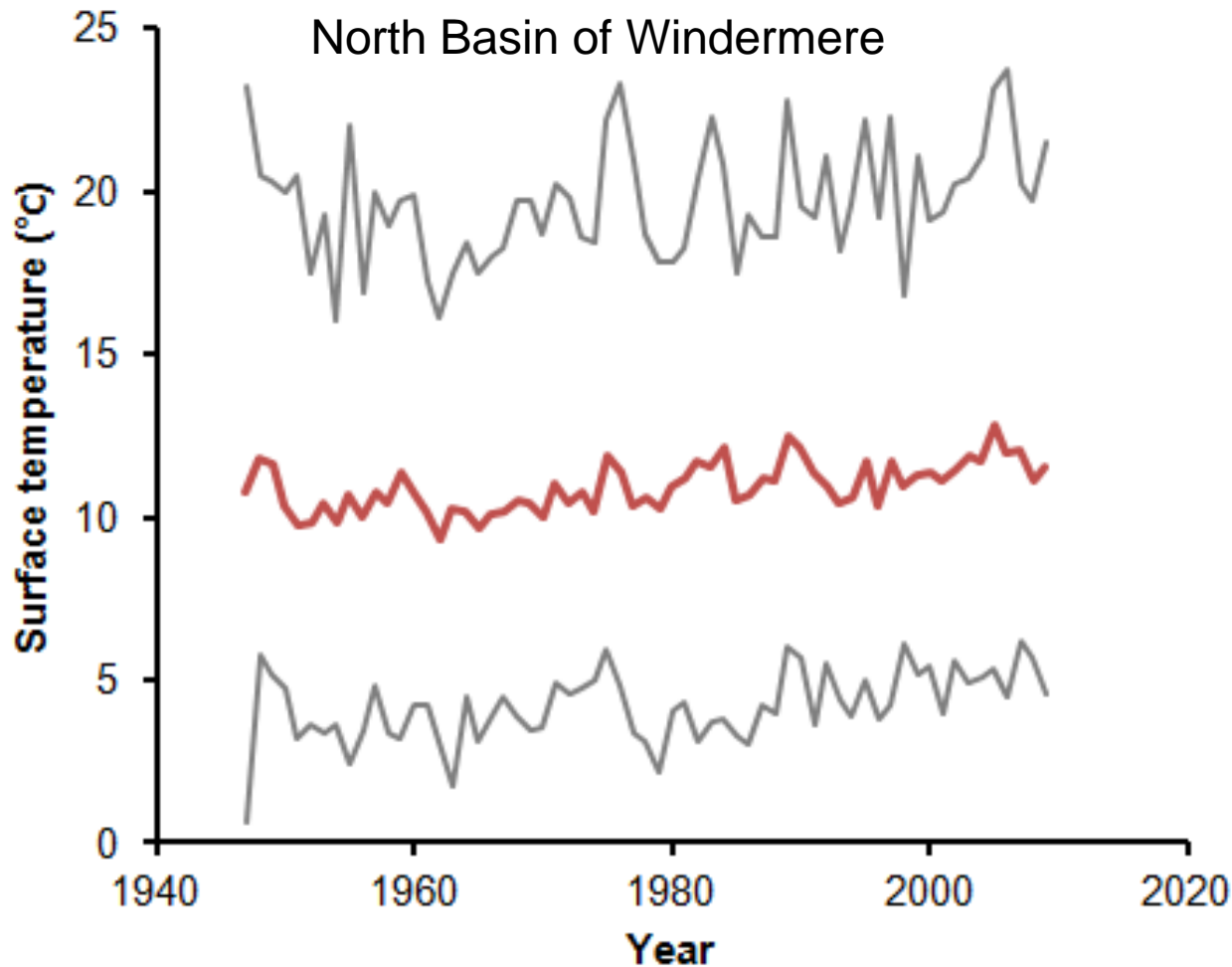


Long-term data on Windermere

- Windermere is one of the best studied lakes in the world
- Research on different aspects of the lake was initiated by various members of staff of the Freshwater Biological Association in the 1940s
- Since 1989, the NERC Centre for Ecology & Hydrology (CEH; and its predecessor the Institute of Freshwater Ecology) has maintained this research
- Details of the Lake Ecosystems Group at CEH Lancaster that carry out the research can be found here:
http://www.ceh.ac.uk/sci_programmes/water/lakeecosystems.html
- Some of the data contribute to the Environmental Change Network run by CEH (<http://www.ecn.ac.uk/>)
- A Special Issue of the journal *Freshwater Biology* was published in February 2012 to celebrate over 65 years of research in the Windermere catchment
- Contact Stephen Maberly for more information (scm@ceh.ac.uk)

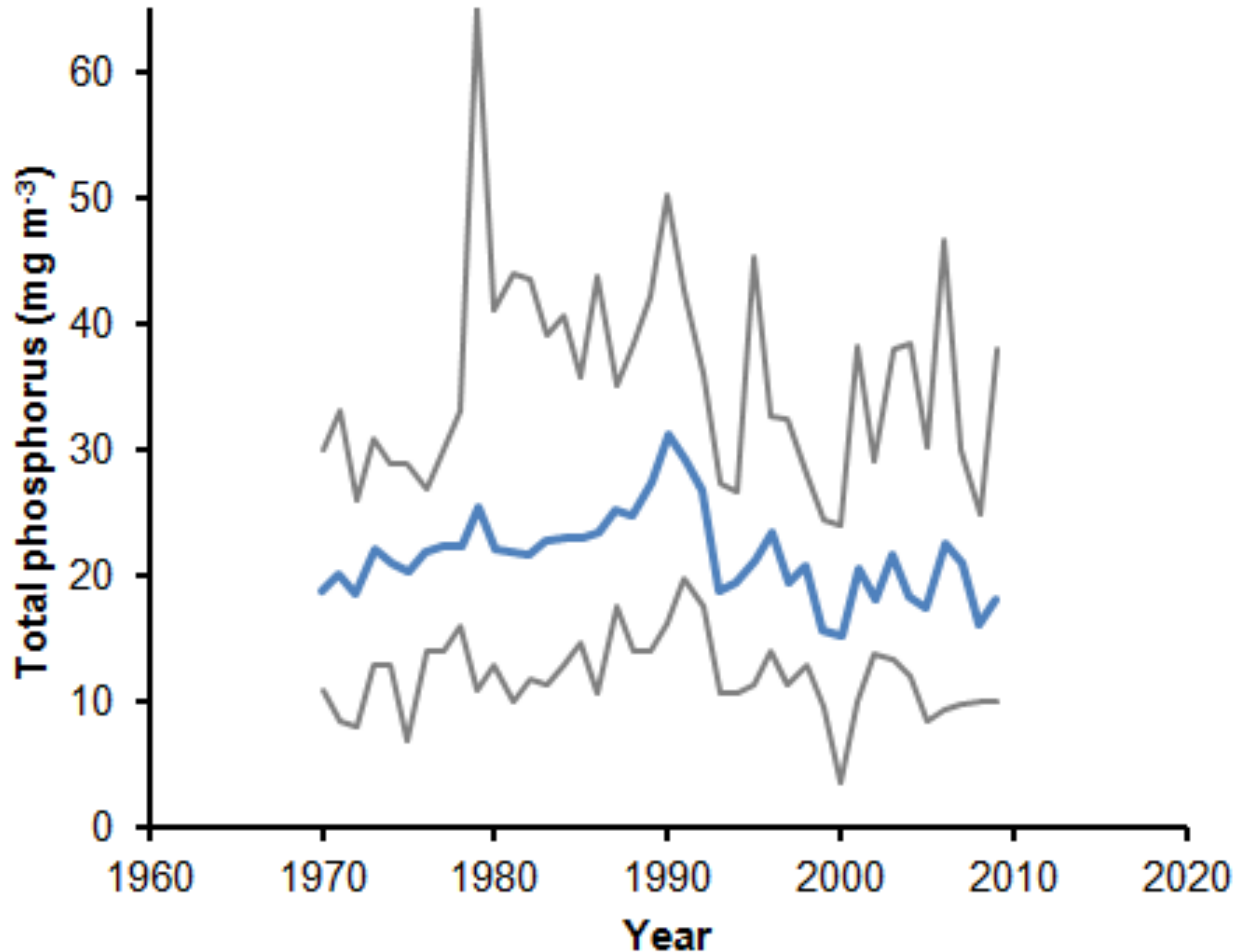
Responses to weather & climate: changes in surface water temperature



- There is a large amount of weather-related interannual variation in annual maximum (upper line) and minimum (lower line) water temperature
- There is a trend of increasing average temperature of about 0.02 °C yr^{-1} over this time period (red line)

Responses to changed catchment & wastewater management: nutrient enrichment

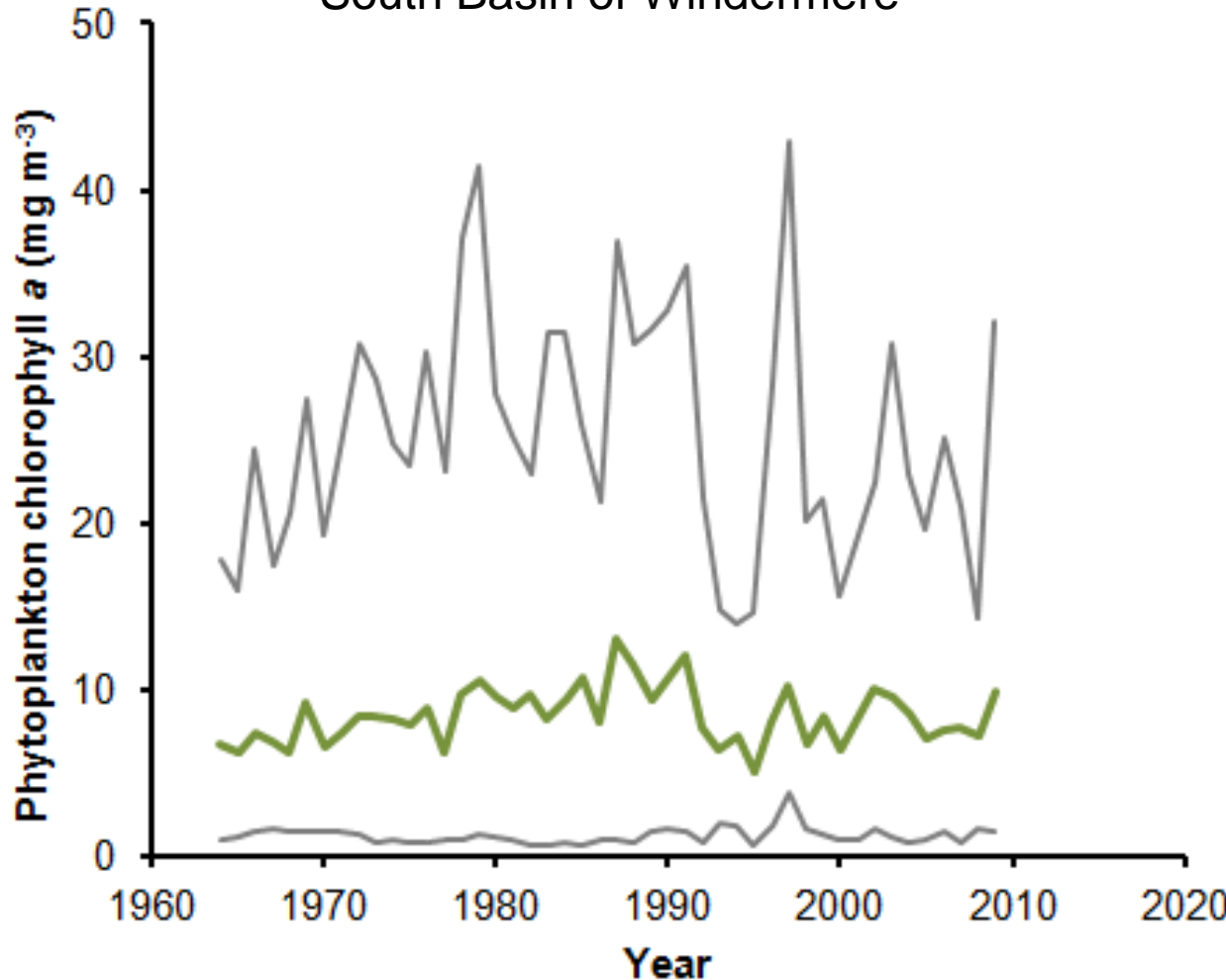
South Basin of Windermere



- The annual average concentration of total P (blue line), increased gradually as a result of increased inputs from the catchment and two wastewater treatment works (WwTW).
- Since 1992, tertiary treatment to strip out P has caused a step-reduction in average, maximum and minimum concentrations (grey lines)

Responses of the phytoplankton

South Basin of Windermere



- Phytoplankton abundance as chlorophyll *a* concentration increased steadily as phosphorus availability increased

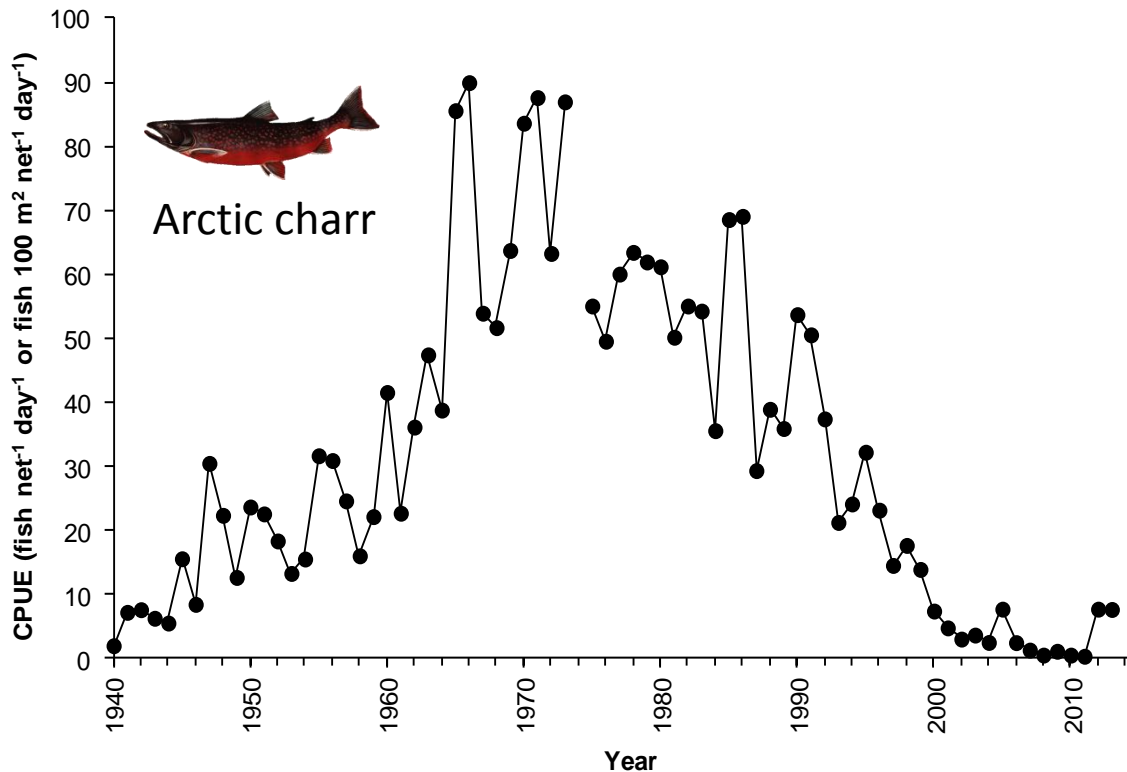
- It declined sharply following P-removal in 1992 but has since edged up very slightly- possibly as a direct or indirect effect of climate change

- See:

<http://www.windermere-science.org.uk/>

Arctic charr

North Basin of Windermere



- Arctic charr numbers increased at the start of the record probably because of pike removal and a mild increase in lake productivity

- Since the mid 1970s the population has declined as a result of increased water temperature and de-oxygenation at depth

- There are some slight signs of a small recovery in very recent years