

Phytoplankton phenology on the decadal scale: lessons from Helgoland Roads, North Sea

Mirco Scharfe, Karen H. Wiltshire

Abstract

The annual and periodical recurrence of events and processes in marine plankton populations plays a central role in pelagic food webs. Annual cycles of light and temperature trigger the seasonality of marine plankton populations. Here we analyse phenological variability of 26 phytoplankton species (diatoms and dinoflagellates) monitored at Helgoland Roads during the period 1962-2014. We derive temporal indices based on the cumulative percentage of annual abundance to approximate timing and length of annual growth periods. Differences in species-specific preferences in combination with seasonally varying trends in environmental parameters led to a non-homogeneous phenological response on the decadal scale. The median phenological response of spring species (diatoms) is reflected by a shift towards earlier timing due to warming and improved light conditions, but single species show a remarkable constancy in timing over the entire period. During early summer several diatoms and dinoflagellates exhibit a trend towards earlier timing, responding to the temporal expansion of the warm water phase around the annual maximum. Related to this during late summer and early autumn several species show prolonged growing periods. These displacements are characterized by shifts in the centre or the end of the growing period. Cross-comparisons with the total abundances associated with the individual timing points show that phenological trends are not necessarily related to shifts of relevant proportions in phytoplankton abundance. We outline the uncertainty of drawing conclusions about ecological consequences in the light of the debate about the response of coastal ecosystems to climatic fluctuations.

Keywords: Phytoplankton, phenology, species-specific differences, climate variability, North Sea, Helgoland Roads time series

Contact author:

Mirco Scharfe
Biologische Anstalt Helgoland
Alfred Wegener Institut Helmholtz-Zentrum für Polar- und Meeresforschung
P.O. Box 180
27483 Helgoland, Germany
Phone: +49 4725 819 3239
Mail: mirco.scharfe@awi.de