
# Trends in Blooms of the Nuisance Phytoplankton Species *Phaeocystis* in Belgian, Dutch and German Waters

MSFD Descriptor: 5 - Eutrophication

MSFD Criteria: 5.2 - Direct effects of nutrient enrichment

OSPAR COMMISSION

**Key Message** There are no observed temporal trends in the annual blooms of the nuisance phytoplankton species *Phaeocystis* along the Belgian, Dutch and German coast; nevertheless abundance is high

## Background

OSPAR's strategic objective with regard to eutrophication is to combat eutrophication in the OSPAR Maritime Area, with the ultimate aim to achieve and maintain a healthy marine environment where anthropogenic eutrophication does not occur. Trends in blooms of nuisance phytoplankton species *Phaeocystis* is one of a suite of five eutrophication indicators. When assessed and considered together in the OSPAR Common Procedure in a multi-step method, the suite can diagnose eutrophication.

Excessive enrichment of marine water with nutrients may lead to algal (phytoplankton) blooms, with the possible consequence of undesirable disturbance to the balance of organisms in the marine ecosystem and overall water quality. Undesirable disturbance includes shifts in the composition and extent of flora and fauna and depletion of oxygen caused by decomposition of accumulated organic material produced by phytoplankton or seaweed communities during their growing seasons. *Phaeocystis* is a widespread marine phytoplankton. As it breaks down at the end of a bloom foam can form. It is used as an indicator of eutrophication because increased concentrations of more than $10^6$ or $10^7$ *Phaeocystis* cells per litre of seawater and increased duration of Phaeocystis blooms per year are an indication of nutrient enrichment.

Image (left): *Phaeocystis,* shown here on the beach of Spiekeroog, Germany ©Wera Leujak, Umweltbundesamt

## Results

Three countries' *Phaeocystis* monitoring data are used in this assessment; Belgium (1990–2009), the Netherlands (1990–2014) and Germany (2001–2014).

Monitoring sites with available *Phaeocystis* data are located in coastal waters; these are mostly inshore and along some transects perpendicular to the coast (**Figure 1**).

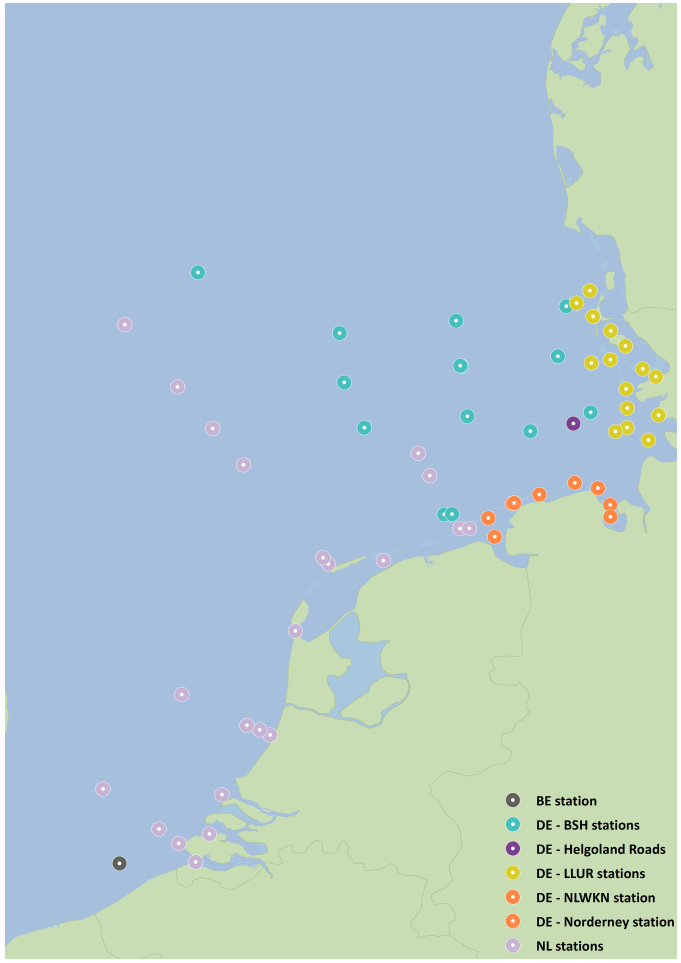


Figure 1 (right): Sites monitored for Phaeocystis by Belgium (BE), the Netherlands (NL) and Germany (DE) (2003–2012)

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## Results cont...

At all Dutch (1990–2010) and Belgian (1988–2009) monitoring sites and at most German (2003–2012) monitoring sites, concentrations of *Phaeocystis* cells peak each year during the growing season, April–May. At the northern part of the German coast (**LLUR, Figure 1**) the peak is later, usually during June.

Since *Phaeocystis* species generally reach seasonal maxima during April and May, the focus for assessment was on spatial gradients of *Phaeocystis* abundance and temporal trends in this season. No statistically significant temporal trends were observed in the analysed data. The spatial distribution of maximum *Phaeocystis* concentrations sampled during spring and summer (April–August) 1990–2014 is shown in **Figure 2**. *Phaeocystis* abundance during this period was high along the Dutch and German south-east coast of the North Sea. Maximum abundances show regional 'hot spots' where locally *Phaeocystis* cell concentrations can exceed 100 million cells per litre.

The spatial pattern of *Phaeocystis* concentrations reflects the average salinity regime in the southern North Sea, which is influenced by river discharges within the residual coastal current. Similar spatial patterns in nutrient concentration have also been identified (see nutrient concentrations).

There is moderate confidence in the data availability and moderate confidence in the methodology.

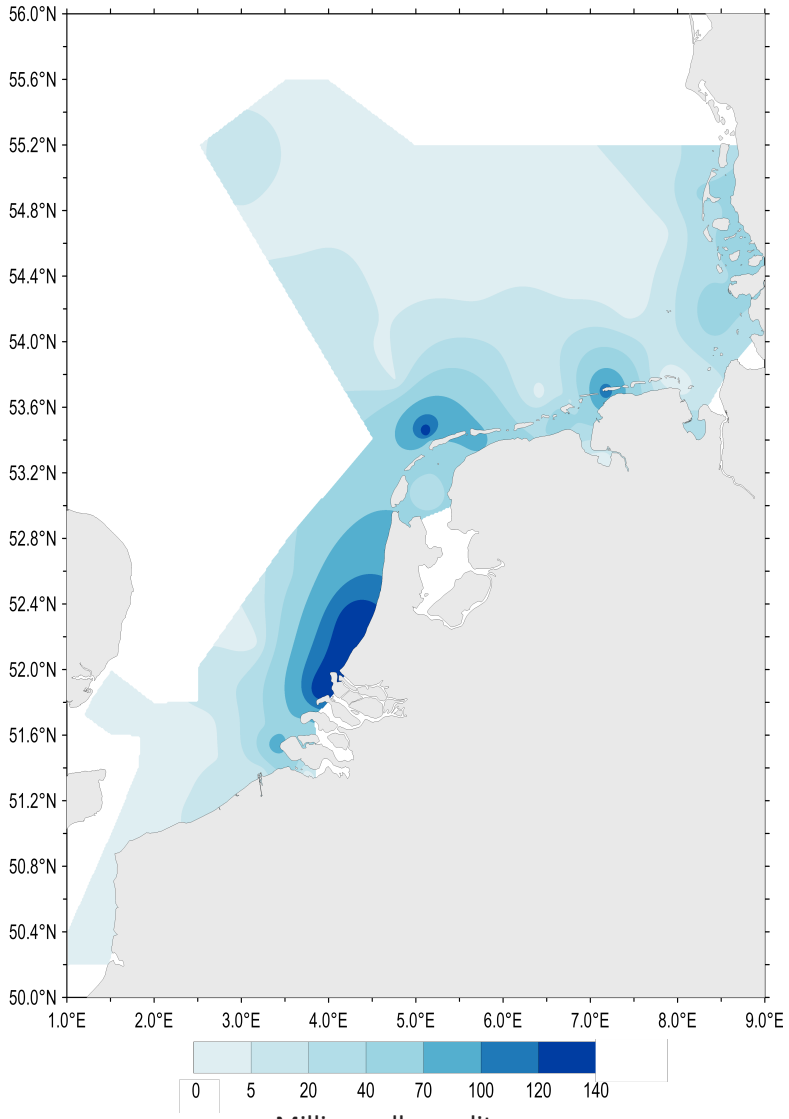


Figure 2: Gradients of maximum *Phaeocystis* concentrations (million cells per litre) in the period April–August (all available years and monitoring sites 1990–2014)

## Conclusion

High concentrations of the nuisance marine phytoplankton *Phaeocystis* in coastal waters (often above one million cells per litre with peaks of up to 100 million cells per litre), with concentrations decreasing offshore, can occur in response to high nutrient concentrations, and may be indicative of eutrophication.

This assessment shows *Phaeocystis* blooms peak during the summer growing season (April–June) in the southern North Sea. The size of the blooms varies widely from year to year with seasonal average concentrations from near zero to over five million cells per litre. These fluctuations are probably affected by a combination of different factors, such as light, temperature, salinity, other hydrodynamic influences and nutrient availability. However, nutrient concentrations were more consistent and less variable than *Phaeocystis* concentrations in the southern North Sea (see nutrient concentrations assessment). Furthermore, no statistically significant temporal or spatial trends could be observed in the analysed data.

## Knowledge Gaps

The availability of *Phaeocystis* data for the assessment was regionally restricted to the southern North Sea. The duration of blooms was difficult to determine owing to restricted sampling. Recent *Phaeocystis* data have yet to be fully reported and stored at the International Council for the Exploration of the Sea (ICES). The contributions of *Phaeocystis* to total phytoplankton biomass should be estimated to allow representative assessment in relation to chlorophyll-a concentrations.

Further research is needed to identify the reasons for the strong interannual variability in cell concentrations.

This document was published as part of OSPAR's Intermediate Assessment 2017.
The full assessment can be found at www.ospar.org/assessments