

Distribution patterns of the ‘red tide’ dinoflagellate *Scrippsiella hangoei* in the Baltic Sea

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Introduction

The cold-water medium-sized (15-30 µm) dinoflagellate *Scrippsiella hangoei* (Fig.1) is one of the most important spring bloom species in the brackish water Baltic Sea area. Earlier, before its redescription by Larsen *et al.* (1995) the species was probably recognized under different taxonomical names (*Peridinium* sp., *Gymnodinium* sp., cf. *Glenodinium* sp.). Such confusion considerably hampers the assessment of *S. hangoei* distribution and quantitative characteristics and leads to a certain underestimation when compared with the earlier periods.

There are also some unpublished data indicating that *S. hangoei* comprises several species. As the systematical allocation of the species is still under discussion, the use of cf. *S. hangoei* in the following could be justified as well.

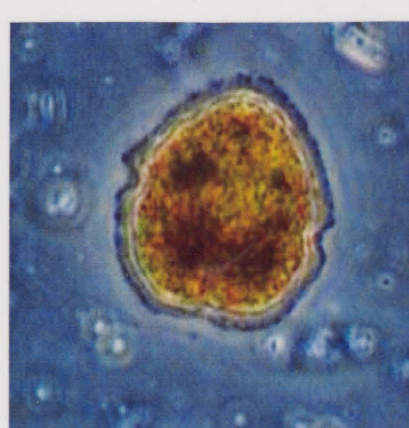
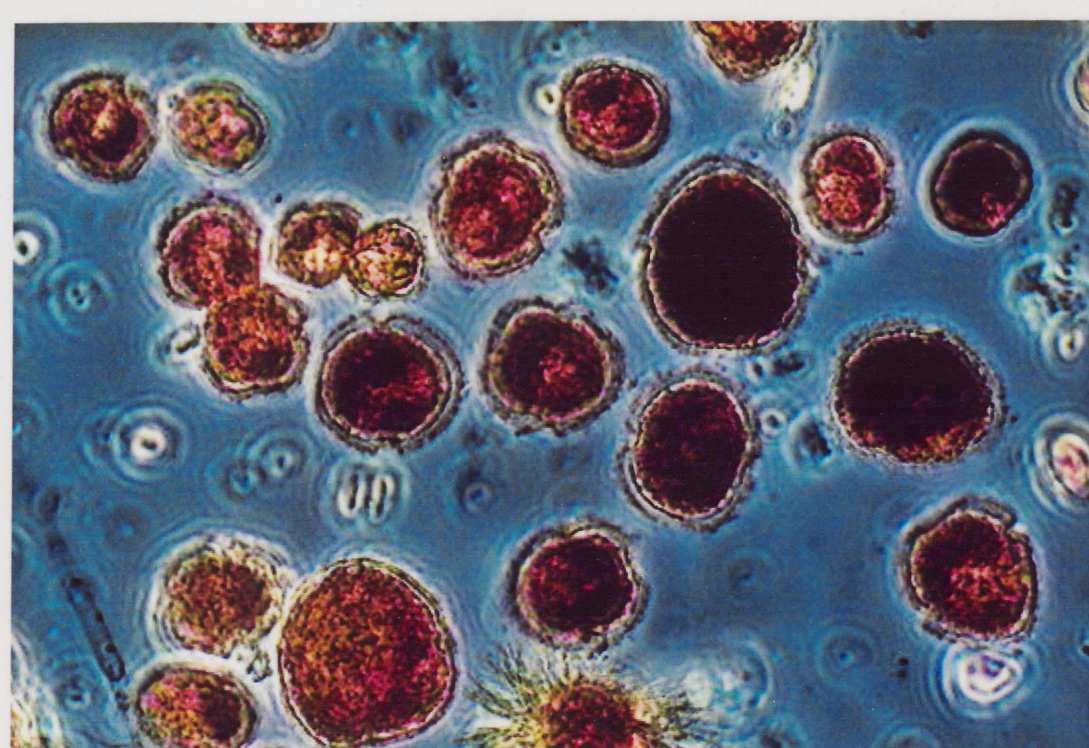


Fig. 1. *Scrippsiella hangoei* cells under microscope.

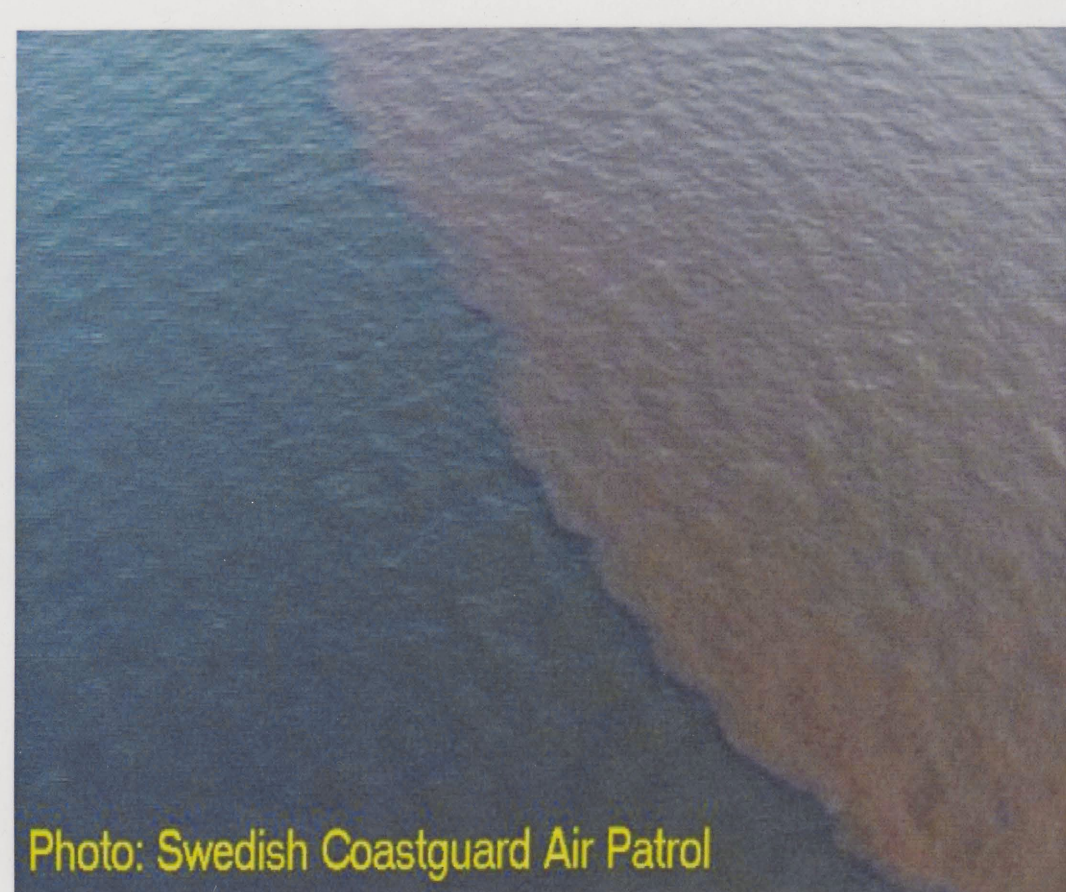


Figure 2. Accumulation of mainly cysts of the dinoflagellate *Scrippsiella hangoei* and living cells of *Peridiniella catenata* and *Mesodinium rubrum* at the sea surface (27 April 2000, open Baltic Sea). These species dominated 90% of the total phytoplankton biomass at that time.

Physical environment

In our presentation, the materials collected within the frame of national, HELCOM and Algaline monitoring programmes during 1997–2003 are discussed. Altogether 776 phytoplankton samples from 22 stations (representing surface layer 0-10 m, station BY31 and B1 0-20 m) locating from the Swedish coast to the eastern Gulf of Finland are included. *S. hangoei* has been probably found in the major part of the brackish Baltic Sea water (salinity 3-10), but it forms intensive blooms (‘red tides’) only within the narrow salinity limits (4.5–5.5(6)) as seen in Fig.3.

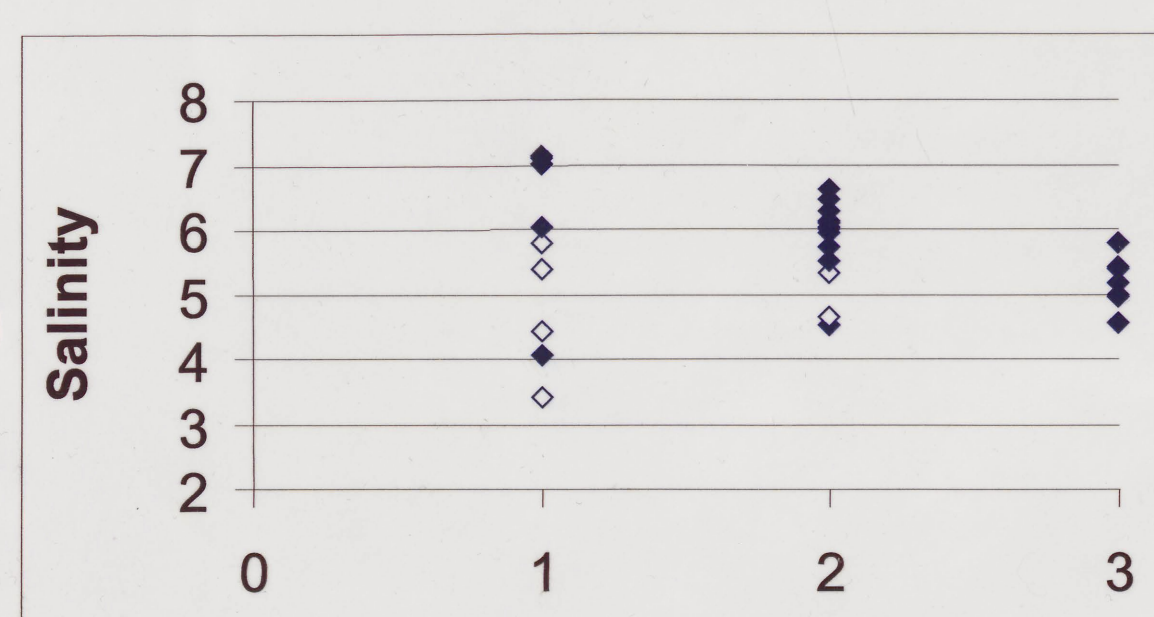


Fig. 3. Mean surface layer (0-10 m) salinity at stations of moderate (2) and strong blooms (3). 1- species is present. Empty diamonds represent the stations in the Gulf of Riga.

Strong blooms with $>10^6$ cells per litre have been recorded only in the Gulf of Finland and likely in the Archipelago Sea. Surface accumulation can, however, colour the water red even with lower number in the 0-10 m surface layer (Fig. 2). At the same time, in the Gulf of Riga, the basin with similar upper mixed layer salinity, *S. hangoei* does not form blooms and is either dominant during spring bloom.

S. hangoei may be the predominant species over the whole spring period from March to the end of May and form more than one biomass peak. Our records still indicate that the maximum of *S. hangoei* cell density occurs about surface water temperature 3-6 °C (Fig.4). On the latitude 58-60° N that period falls to the end of April or to the beginning of May. The growing season of *Scrippsiella*

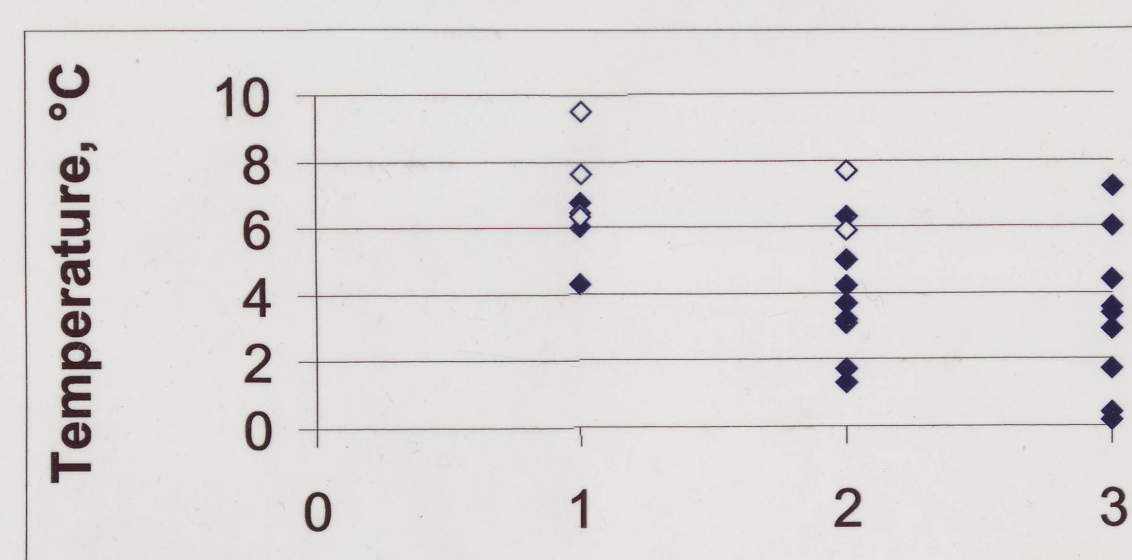


Fig. 4. Surface layer (0-10 m) water temperature by the maximum cell density in the areas of different bloom magnitude (see explanations in Fig. 3).

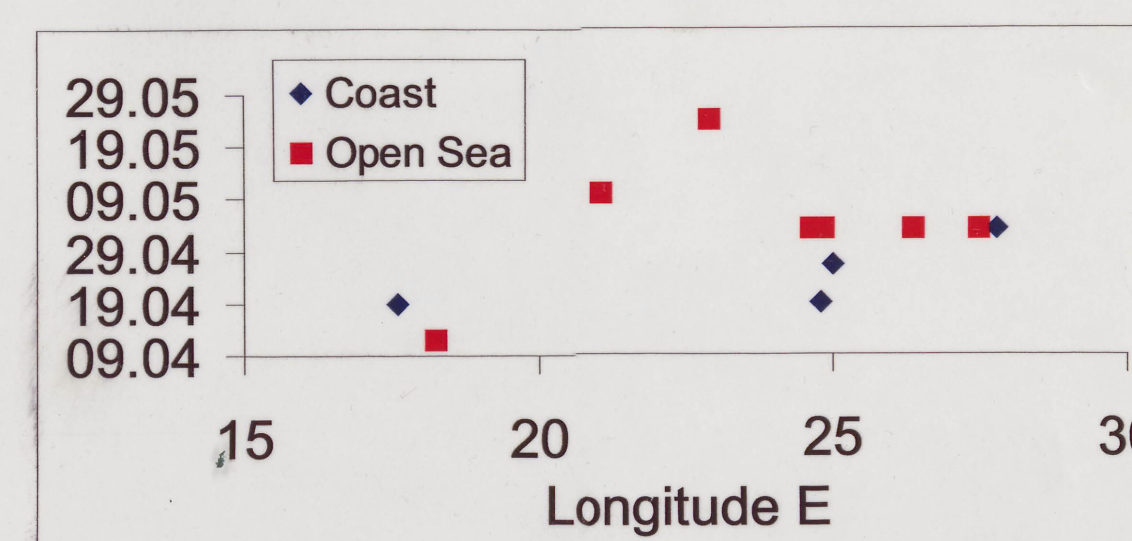


Fig. 5. Temporal subsequence of *S. hangoei* cell maximum along the west-east gradient (on the latitude 58–60° N) in the Baltic Sea.

starts from the western locations and coastal sites moving towards east and open sea like the spring bloom in the Baltic in general (Fig. 5). The different magnitude of *S. hangoei* bloom along the salinity gradient (from ~6 to 4.5) is demonstrated in Fig. 6. The role of nutrients in the bloom dynamics is not evaluated here.

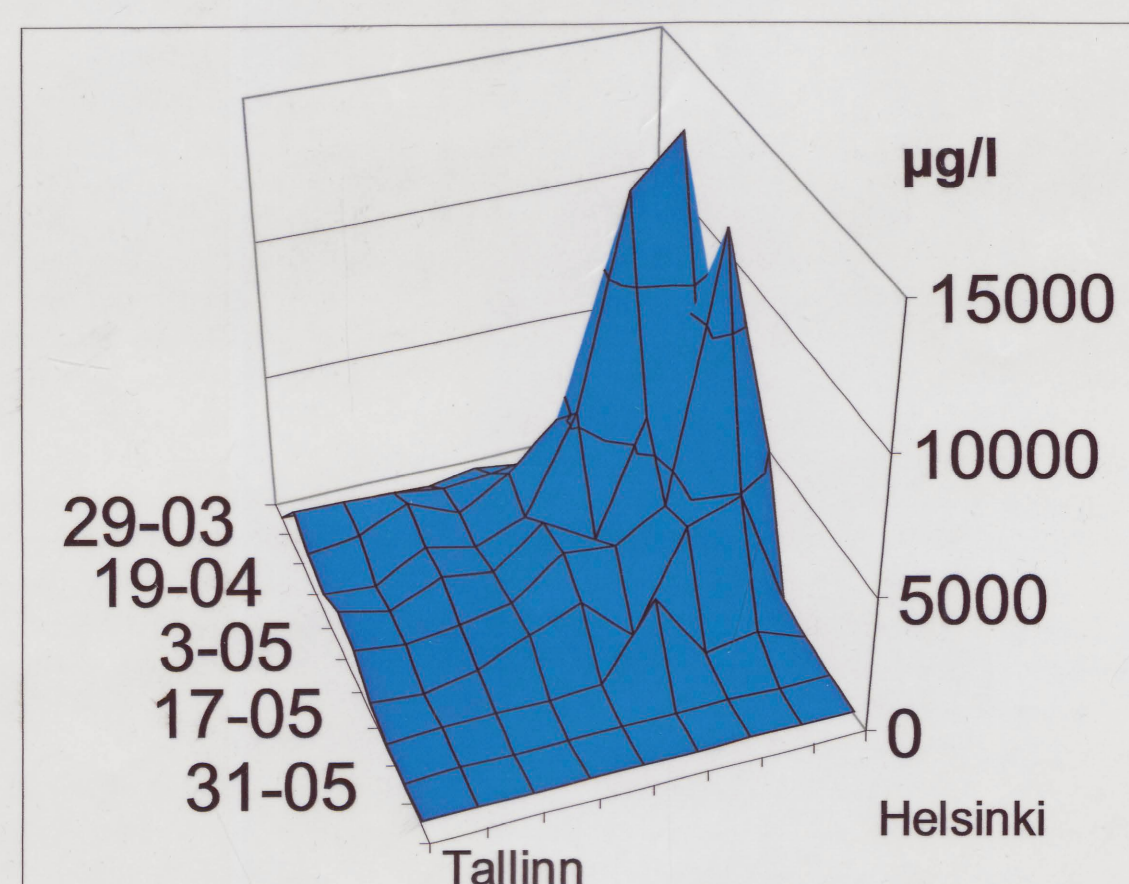


Fig. 6. *Scrippsiella hangoei* biomass (µg/l) dynamics during the spring bloom period. Averaged values for 1997-2003 from the central Gulf of Finland.

Temporal variability and life-cycle

According to Kremp and Heiskanen (1999) the spring bloom of *S. hangoei* may be divided into four distinguished period. In the beginning of the growth phase medium sized (18-22 µm) vegetative cells dominate, as the small cells (14-18 µm) representing gametes become more abundant by the biomass maximum period. Exponential growth of *S. hangoei* is followed by the formation of large sized (>22 µm) planozygotes and subsequent formation and sedimentation of resting cysts.

This ‘classical’ subsequence is also demonstrated in Fig. 7, but at several investigated stations the size-classes followed rather irregular pattern.

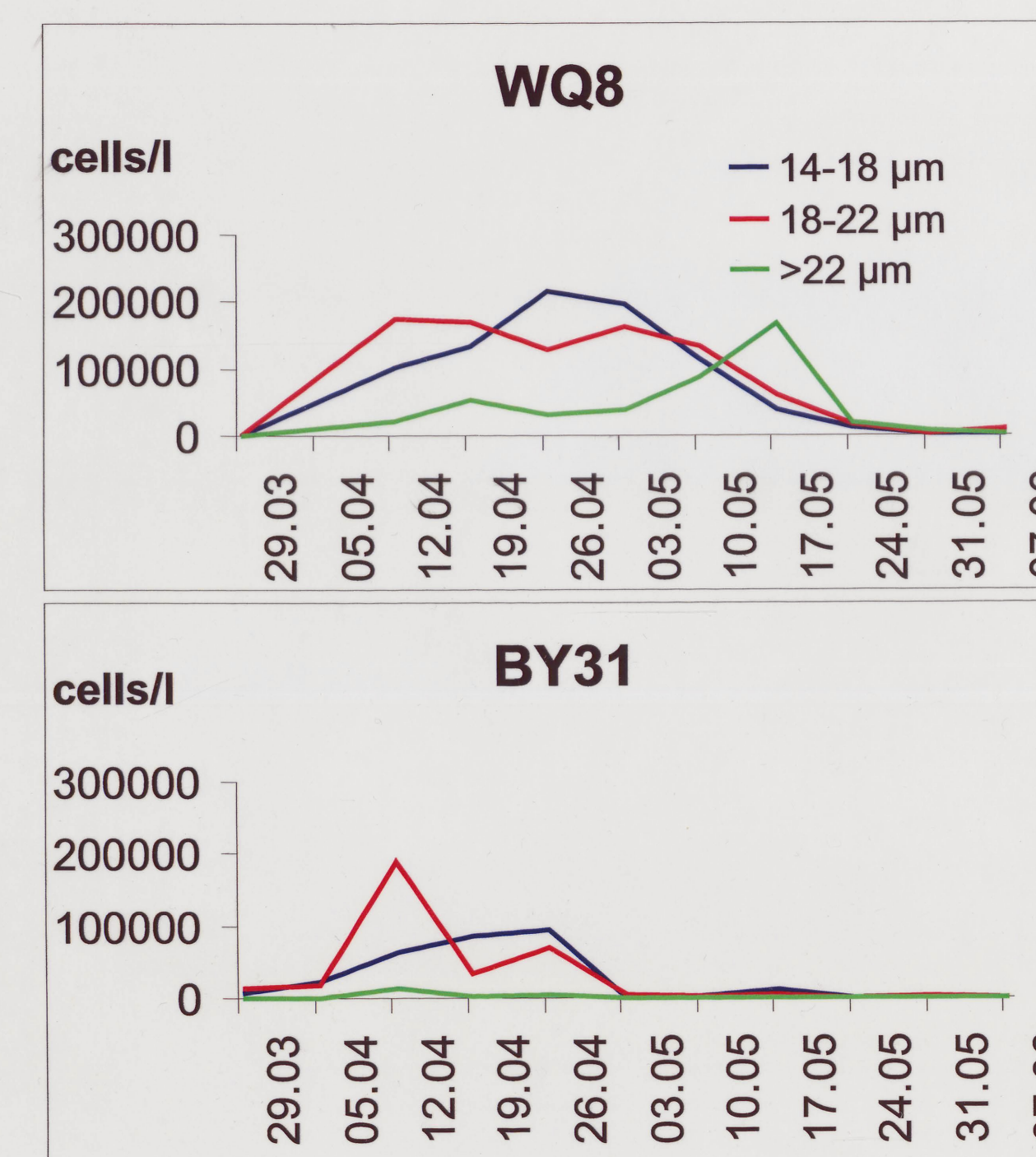


Fig. 7. Temporal dynamics of different size-classes (life cycle stages) of *S. hangoei* in the central Gulf of Finland (WQ8) and northern Baltic Proper (BY31), averaged data from 1997-2003.

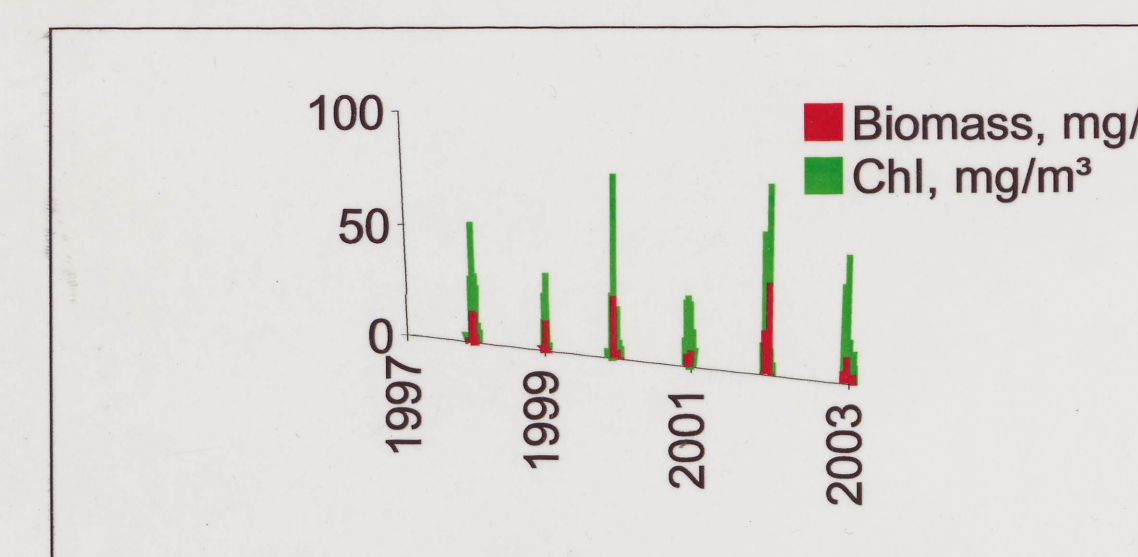


Fig. 8. *S. hangoei* wet weight biomass (mg/l) vs. chlorophyll *a* concentrations (mg/m³) in 1997-2003 in the Helsinki sea area. Automatic sampling onboard passenger ferries.

During the peak abundance of *S. hangoei* more than 10^7 cells per litre are counted from a sample. The period of exponential growth is still short with duration of about one week. Proceeding from the character of recent monitoring programmes most of strong bloom events may be missed, that is a reason we have only fragmentary knowledge about the real bloom dynamics. In last years some positive changes have been introduced to get adequate information. One of the possible ways is collecting of semi-continuously measured data along the routes of the ships of opportunity with simultaneous water sampling. The system enables to get relative phytoplankton biomass as *in vivo* fluorescence of chlorophyll *a*. One example of the results obtained is demonstrated in Fig. 8.

References

- Kremp, A. and A.-S. Heiskanen 1999. Sexuality and cyst formation of the spring bloom dinoflagellate *Scrippsiella hangoei* in the coastal northern Baltic Sea. *Marine Biology* 134: 771-777.
- Larsen, J., H. Kuosa, J. Ikävalko, K. Kivi and S. Hällfors 1995. A redescription of *Scrippsiella hangoei* (Schiller) comb. nov. – a ‘red tide’ dinoflagellate from the northern Baltic. *Phycologia* 34(2): 135-144.