

Immigration of alien plankton algae into the North Sea: Sensitive indicators for effects of recent climatic changes on the pelagic ecosystem?

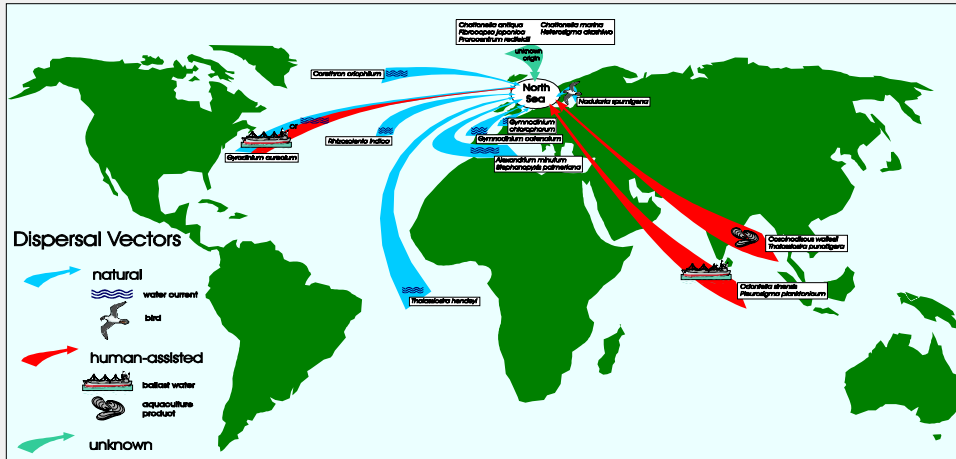


Fig. 1: Global map summarizing assumed introduction / immigration of alien phytoplankton species into the North Sea.

INTRODUCTION

In contrast to elements of the terrestrial fauna and flora, which have been used as bioindicators for climate change in Northern Europe already for some time, all reflections about the "global change" and a shift in the distribution of aquatic fauna have remained purely hypothetical so far.

The following presentation of findings about the occurrence of new plankton algae in the North Sea, and in particular in the German Bight, intends to raise interest and to identify the needs for more research.

NEW PHYTOPLANKTON SPECIES IN THE NORTH SEA: INTRODUCED OR OVERLOOKED ?

Over the past 100 years, a multitude of plankton algae, that had not yet been observed in the North Sea, has emerged, although by far not all of them are genuinely new immigrants to these waters. However, in relation to the water volumes moved over decades and the diversity of algae it contained, the infection rate for the German coast can be rated as low.

Three possibilities of the emergence of new species in the open water zone should be distinguished:

- I. Previously overlooked plankton species
mainly morphologically conspicuous species (e.g. *Chrysochromulina*, *Pirsonia*)
- II. Newcomer species that cannot survive in the long run
Relatively low water temperatures in winter, the absence of certain trace elements, etc. prevent the development of permanent populations (e.g. *Dinophysis odiosa*).
- III. Newcomer species that can survive in the long run
By today's knowledge 18 plankton species must be considered as immigrants into the area of the North Sea over the past 100 years. 13 species have colonized in the German Bight and one species in a semi-enclosed brackish basin on the German North Sea coast (Fig. 1 & 2).

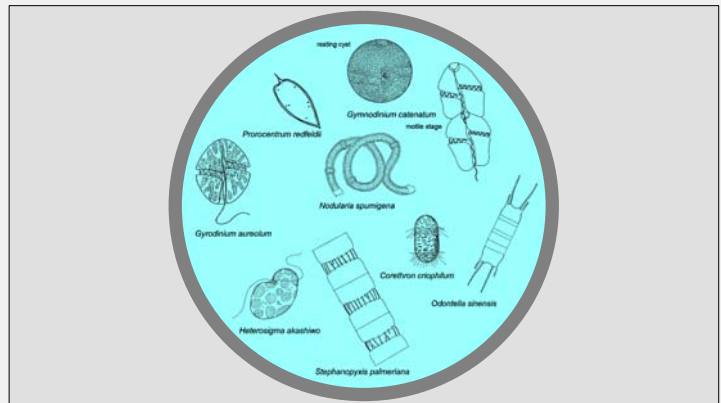


Fig. 2: New plankton algae in the North Sea, a selection.

CLIMATE-INDUCED CHANGES IN THE PELAGIAL OF THE NORTH SEA ?

However, it is striking that especially during the past 30 years a multitude of warm-water plankton algae emerged for the first time in the North Sea and in particular in the German Bight. Simultaneously a minimal increase in temperature is noticeable in the northern oceans (Fig. 3), what is probably mainly due to the mild winters. No knowledge has been gained yet about a decline of cold-water species, so that on the whole an increase in species diversity can be noted in the North Sea (for the German Bight by approximately 1 %).

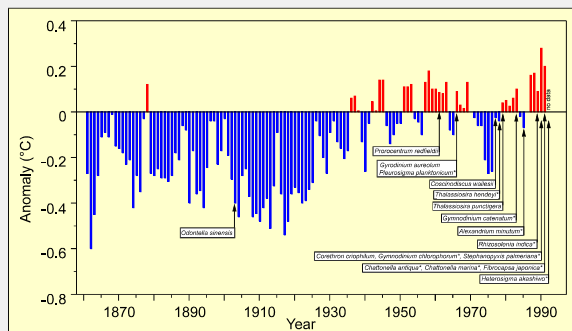


Fig. 3: Time-series of Northern Hemisphere sea surface temperature anomalies (1861-1991) relative to 1951-1980 (after HOUGHTON ET AL. 1992) with indication of the first finding of alien phytoplankton species in the North Sea (* thermophilic).

HYPOTHESIS

One can formulate the hypothesis that the newcomer species in the North Sea / German Bight ecosystem might be sensitive indicators for long-term changes in climate which could not yet be identified by technical measuring methods. When the warming continues, the species diversity of phytoplankton will probably increase further, with natural drift in marine currents being the main vector of the immigration of alien species.