Godhe, Anna 2002. Benthic and pelagic dinoflagellate stages: environmental settings, cyst viability, and molecular identification.
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Abstract
Dinoflagellates can cause harmful algal blooms (HABs) and some species form cysts as part of their life cycle. Toxins of HAB species may accumulate in marine organisms and human health can be affected after ingestion of contaminated shellfish.
The relation between planktonic dinoflagellates, cysts and environmental factors was investigated in a sediment trap study in Gullmarfjord, Swedish west coast. No density dependent relation between the abundance of planktonic cells and their counterpart cysts was observed. The variation in cyst yield from the traps was correlated to surface temperature, light radiation and the depth of the halocline. Nutrient concentrations correlated poorly to the number of cysts encountered in the traps.
Viable diatom and dinoflagellate resting stages were recovered from ^{210}Pb-dated sediment cores from Koljöfjord. To determine maximum survival time, samples from sediment depths down to 50 cm were incubated. Dinoflagellate cysts were viable down to 15 cm, or 37 years old. Resting stages of diatoms were viable to over 40 cm, and may have been buried for many decades. These results are ecologically important since spores and cysts form seed banks, able to repopulate waters if resuspended and exposed to suitable conditions.
Abundance and frequency of dinoflagellate cysts in 19 sediment samples along the Swedish Bohuslän coast was related to physical and chemical characters of the same sediment, the hydrography of the overlying water and phytoplankton monitoring data. Environmental variables were tested for their respective relation to the dinoflagellate cyst densities, proportion of autotrophic and heterotrophic taxa, and individual species distribution and frequencies. The density of the total cyst assemblage, which was dominated by autotrophic taxa, was primarily related to surface temperature and macronutrients, and inversely related to competitive phytoplankton. The abundance of cysts belonging to heterotrophic taxa was governed by conditions favourable for their prey, i.e. diatoms, and was most prominent at well-mixed sites.
The influence of hydrographic, biological and meteorological factors on the abundance of *Dinophysis* spp. and the concentration of Diarrhetic Shellfish Toxin (DST) in seawater were investigated in a mussel farm on the Swedish west coast. The principal variables influencing the concentration of DST in the water were the causative species and salinity. The abundance of the three *Dinophysis* species was inversely correlated to salinity. Mussels responded quickly to the high levels of DST, doubling tissue toxicity within two days of the appearance of *Dinophysis* and stayed toxic after the *Dinophysis* declined.
Species-specific PCR primers were constructed for the detection of planktonic and cyst stages of some dinoflagellates in natural water and sediment samples from the south west coast of India, and the west coast of Sweden. The primers amplified a product of expected size from natural and cultured cells of the target organisms and did not yield any product with a range of other cultured algae or negative field samples. The confirmation of PCR products was performed by digestion with restriction enzymes and/or DNA sequencing. According to the authors knowledge, detection of dinoflagellate hypnozygotes in natural sediment by molecular methods has not previously been reported.

Keywords: *Alexandrium minutum*, Arabian Sea, CCA, cyst, diatom, dinoflagellate, Dinophyceae, *Dinophysis* spp., DST, environmental factors, field samples, *Gymnodinium mikimotoi*, Kattegat, laminated sediment, MPN, *Mytilus edulis*, PCR, PLS, resting stages, sediment traps, seed bank, Skagerrak, surface sediment

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