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HUMIC SUBSTANCES AS LIGANDS FOR IRON AND OTHER METALS IN SEAWATER

Preliminary measurements showed that iron is complexed with humic substances (HS) in waters from coastal and oceanic origins. The limited data set for iron-HS species in ocean waters has been explored using samples from the Southern Ocean. Reference methods for HS and metal binding studies were used for isolation of HS fractions which were labeled for Fe-HS binding capacities by titration with Fe. Comparative measurements using complete complexes titrated with detection by cathodic stripping voltammetry showed that the Fe-HS species account for a major proportion of the iron binding in the system. Development in investigating the distribution of Fe-HS in the presence of ESDD showed that ligand competition for iron reaches equilibrium in a time frame of hours. These kinetics are faster than expected for these highly stable complexes. The reaction kinetics to exchange Fe for copper and zinc are also very rapid, reaching equilibrium within seconds. The competition between these metal ions and iron it possible to determine the complex stability of humic and fulvic acid with copper and zinc in seawater.

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A NEW METHOD IN PERITIDAL STUDIES USING ECOLOGICAL-ECONOMIC DATA

Aquatic food producers such as common carp and harbour seals acquire organic carbon directly from water or indirectly via food. To assess bioaccumulation of carbon in an estuarine environment, a pilot survey was conducted in the contaminated Wahrmünde-southwest (south-west Netherlands) in 2005. In 2007 and 2008 more detailed surveys were conducted. A variety of samples were taken ranging from sediment and suspended matter to different types of fish, such as sprat, wrasse, dogfish, cod, several species of fish, common eel and harbour seals. Isotope signature (delta D/C, delta 15N) were measured in all samples. Trophic levels were calculated using the cowdewald model as a baseline measurement. The chemical result shows that consumers such as PCB, PBDE, HBCD and POPs are easily transferred and biomagnified in most prey species. By coupling trophic levels and contaminant concentrations a further insight can be gained into the trophic relations in estuarine environments.

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DERIVATION OF THE MAXIMUM ALLOWABLE TEMPERATURE AS A STANDARD FOR THE GOOD ECOLOGICAL STATUS OF DUTCH LARGE RIVERS

Non-optimal temperature conditions may negatively affect diversity of ecosystems. The European Water Framework Directive (WFD) requires a Good Ecological Status (GES) for surface waters in terms of plant and animal species composition and abundance. To support this GES, standards for physico-chemical parameters that ensure a GES must be derived. Including temperature, RIVM recommends the maximum temperature standard for the GES of Dutch large rivers to be set at 28°C based on literature and measurement data for benthic invertebrate fauna and fish. For existing a linear maximum temperature of 20°C is recommended to ensure reproduction and growth of organisms. The standard recommended here, applies to the GES for natural waters and is lower than the current standard of 28°C, which does not take into account the demands of the WFD. A standard for non-natural waters (such as the Dutch large river) will be derived by the water managers, using the recommendations for GES as a starting point. The ecological standards are presently composed of plant and animal species composition and abundance. Possibilities of adding also some functional parameters are discussed.

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CAN OCHROMONAS SP., A MIXOTROPHIC CHLOROPLASTIC CONTROL TOXIC MICROCYSTIS POPULATIONS

Grazing experiments with Ochromonas, a mixotrophic chlorophyte, were performed in the laboratory to test whether this flagellate can control cyanobacteria. We investigated three Microcystis aeruginosa strains that varied in toxicity and morphology and also one filamentous cyanobacterium, Phormidium. Furthermore, we analyzed the co-occurrence of Ochromonas and Microcystis in natural systems. Microcystis was able to grow on all four cyanobacteria tested and showed high growth rate on all of them by reducing the net growth rates of the cyanobacteria significantly. Furthermore, we observed that after four days of incubation with Ochromonas the total microcystin content in the Microcystis strain was reduced by more than 90% compared with the controls. Analysis of the field data from 460 Norwegian lakes showed that Microcystis was present in almost all lakes, while the distribution of Microcystis was linked to higher TN, TP, temperature and pH. Ochromonas occurred in 99% of the lake samples, while Microcystis was found in only 7%. Ochromonas co-occurred in 84% of the samples in which Microcystis was present and the promotion of both species might be more important in natural systems.

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PIV PATCH WORK- ANALYSIS OF SURFACE FLOW AROUND PATCHES OF SALTMARSH VEGETATION

In the past decade the effects of saltmarsh vegetation on currents and waves have been studied in three series. In humans, water is forced through the vegetation. In the field, water may either flow through or around a patch. We tested the effect of patches of vegetation on hydrodynamics in a large-scale engineering facility. Due to the large spatial heterogeneity, measurements with current meters give limited information about the shape and size of waves. We used large-scale Particle Image Velocimetry (PIV) to analyze the surface flow. The surface flow is very shallow water, the water behind a patch of Spartina anglica is surprisingly deep. The limited water depth restricts the formation of Kelvin-Helmholtz instabilities. Even surface flow PIV was a valuable addition to analyse spatial flow patterns, but is not a substitute for conventional flow measurements.

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ZOOPLANKTON GRAZING MEDIATES INTRASPECIFIC INTERACTIONS IN MICROCYSTIS POPULATIONS

We conducted two laboratory experiments to investigate intraspecific interactions within Microcystis populations and the impact of zooplankton grazing on these interactions. In a first experiment, we investigated interference induced by microcystis filaments of different species of Microcystis in Microcystis strain that differs in important ecological relevant traits. In a second experiment, we studied interactions between Microcystis strains in mixed population in presence and absence of Daphnia magna. The relative abundances of the strains were followed through time using Denaturing Gradient Gel Electrophoresis, and the growth rate of each strain in the populations was compared to the monoculture growth rate to determine the sign and magnitude of the interactions. Our data suggest that cooperation has a relatively weak and strain-specific influence on the growth rates, microcystis production and colony formation. In Microcystis strains compared to intraspecific differences in these traits. Grazing also impacted the interactions between strains in important ways. The presence of Daphnia resulted in weaker competitive interactions between strains and in strain-specific cases of facilitation. We interpret these results in the light of the maintenance of genetic diversity in cyanobacterial populations.

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linking physical processes to higher trophic levels results from coupling hydrological, biogeochemical and size-based food web models

To predict changes and improve understanding of North Sea ecosystem structure and function, the General Estuarine Transport Model (GETM, see www.getm.eu) has previously been coupled to the Biogeochemical Flux Model (BFM, the successor to FRGEM, see www.bmrc.ac.uk). The BFM model incorporates the cycles of C, N, P and C02 and has a functional group approach. The highest trophic level included in the BFM model is zooplankton (5 functional groups), while phytoplankton (4 groups) and benthos (5 groups) are also represented. Application of the coupled model provided 3D spatial and temporal fields of biomass for functional groups in the North Sea. Deep integrative biomass fluxes