

Costa, M. J., Instituto de Oceanografia, Faculdade de Ciências da Universidade de Lisboa, Lisbon, Portugal, mjcosta@fc.ul.pt;
 Silva, G., Instituto de Oceanografia, Faculdade de Ciências da Universidade de Lisboa, Lisbon, Portugal, gcsilva@fc.ul.pt;
 Pereira, T., Instituto de Oceanografia, Faculdade de Ciências da Universidade de Lisboa, Lisbon, Portugal, tpereira@fc.ul.pt;
 Azeda, C., Instituto de Oceanografia, Faculdade de Ciências da Universidade de Lisboa, Lisbon, Portugal, ccazed@fc.ul.pt;
 Chainho, P., Instituto de Oceanografia, Faculdade de Ciências da Universidade de Lisboa, Lisbon, Portugal, pmchainho@fc.ul.pt;
 Almeida, P. R., Departamento de Biologia, Universidade de Évora, Évora, Portugal, pmra@uevora.pt;
 Costa, J. L., Instituto de Oceanografia, Faculdade de Ciências da Universidade de Lisboa, Lisbon, Portugal, jcosta@fc.ul.pt

THE IMPORTANCE OF A LONG-TERM MONITORING PROGRAM IN THE ASSESSMENT OF BENTHIC RECOVERY TRENDS IN THE TAGUS ESTUARY (PORTUGAL)

A monitoring program of the area where EXPO'98 took place (Tagus estuary, Portugal) was developed during twelve years (1996-2007). Seasonal samples of intertidal macroinvertebrate communities were collected to assess changes related to recovery after major human impacts. Multivariate analyses was used to investigate major trends (i) in the structure of the macroinvertebrate communities and (ii) in the ecological quality assessed using some invertebrate attributes, including biotic indices (density, biomass, richness, diversity, W-Statistic, AMBI). Although seasonal changes occurred for most species, no seasonal aggregation was identified, but ordinations showed a clear separation between two different periods. The first period (1996/2002) was characterized by the occurrence of several anthropogenic interventions in the area and the invertebrate community was dominated by small size annelids. In the second period (2003/2007), a significant increase in density, biomass and richness, and an improvement of the AMBI results were observed, associated with a significant reduction of human pressure. This study demonstrated the importance of long-term datasets in the assessment of benthic recovery trends, which could be misidentified when examining only seasonal or short-term interannual changes.

Cotner, J. B., University of Minnesota, Saint Paul, USA, cotne002@umn.edu;
 Domine, L., University of Minnesota, Saint Paul, USA, lauri050@umn.edu;
 Theissen, K., University of Saint Thomas, Saint Paul, USA, KMTHEISSEN@stthomas.edu;
 Zimmer, K. D., University of Saint Thomas, Saint Paul, USA, KZIMMER@stthomas.edu;
 Sugita, S., Institute of Ecology, Tallinn, Estonia, sugita@tlu.ee

ORGANIC CARBON BURIAL AND INTERNAL DYNAMICS IN PRAIRIE POTHOLE LAKES

Small lakes have been recognized as a potentially important organic carbon sink globally. Here we try to answer three questions regarding organic carbon burial in shallow, small wetland lakes (<25 ha): (1) What are the primary sources for the buried material?; (2) What mechanisms facilitate burial efficiency?; and (3) How much organic carbon is buried in these shallow systems? We used stable isotopes and elemental stoichiometry of material collected in the water column and sediments to study two lakes in the southeast portion of the Prairie Pothole Region of North America, one dominated by macrophytes and the other by phytoplankton. Primary production in these two systems is very similar. We found that the primary sources of buried material was of mixed composition with an increased burial of phytoplankton organic carbon since human settlement (ca. 1880 A.D.). The latter trend was most obvious in the phytoplankton-dominated lake where sediment organic matter had a C:N signature of ca. 11-14 (mean 12.1). Both lakes had $\delta^{13}C$ isotope ratios most similar to terrestrial organic matter especially downcore. Furthermore, both lakes have had increased the rate of organic matter burial since human settlement by about a factor of 10. Current organic carbon burial rates are approximately 149-265 g C m⁻² yr⁻¹. Assuming similar burial rates in small wetland lakes across the Prairie Pothole Region, current burial rates are approximately 4-5 Tg OC per year.

Cottrell, M. T., University of Delaware, Lewes, USA, mattcott@udel.edu;
 Kirchman, D. L., University of Delaware, Lewes, USA, kirchman@udel.edu

PHOTOHETEROTROPHIC MICROBES IN THE ARCTIC OCEAN

Photoheterotrophic microbes, which are capable of utilizing dissolved organic materials (DOM) and harvesting light energy, include cyanobacteria (*Synechococcus* and *Prochlorococcus*), aerobic anoxygenic phototrophic (AAP) bacteria, and proteorhodopsin (PR)-containing bacteria. Our knowledge of photoheterotrophic microbes is largely incomplete, especially in high latitude waters such as the Arctic Ocean where photoheterotrophs may have distinct biogeochemical impacts due to extremes in day length and seasonal ice cover. We used flow cytometry, infrared epifluorescence microscopy and quantitative PCR (qPCR) to examine photoheterotroph abundance in coastal Arctic Ocean waters in summer and during winter darkness below the ice. The abundances of AAP bacteria and PR-containing bacteria decreased between summer and winter in parallel with a 4-fold decrease in the total prokaryotic community. In contrast, *Synechococcus* did not decrease in winter, suggesting metabolism supported by organic substrates. qPCR targeting winter and summer clades revealed no substantial shifts in community structure of AAP bacteria and PR-containing bacteria. Our results suggest that photoheterotrophic microbes successfully compete with strict heterotrophs during winter darkness below the ice, but AAP bacteria and PR-containing bacteria are not superior competitors during summer.

Couceiro, F., University of Portsmouth, Portsmouth, United Kingdom, faycouceiro@port.ac.uk;
 Fones, G. R., University of Portsmouth, Portsmouth, United Kingdom, ;
 Black, K., Partrac, Glasgow, United Kingdom, ;
 Helsby, R., Partrac, Glasgow, United Kingdom, ;
 Statham, P. J., National Oceanography Centre Southampton, Southampton, United Kingdom, ;
 Amos, C. L., National Oceanography Centre Southampton, Southampton, United Kingdom, ;
 Kelly-Gerrey, B., National Oceanography Centre Southampton, Southampton, United Kingdom, ;
 Thompson, C., National Oceanography Centre Southampton, Southampton, United Kingdom, ;
 Sivy, D., CEFAS, Lowestoft, United Kingdom, ;
 Parker, R., CEFAS, Lowestoft, United Kingdom,

RESUSPENSION EVENTS AND THEIR EFFECTS ON NUTRIENT FLUXES ACROSS THE SEDIMENT-WATER INTERFACE IN THE SOUTHERN NORTH SEA

Traditionally, marine nutrient fluxes and mass balances have been calculated from riverine inputs with little attention paid to benthic inputs. Where sediment-water column nutrient exchange has been evaluated the focus has been on diffusive fluxes and the influence of bioturbation and bioirrigation. However, southern North Sea near bed velocities are often above the critical erosion threshold suggesting that resuspension effects should be also considered in ecosystem modelling. Physical and chemical data were measured during resuspension experiments on southern North Sea sediments ranging from sand to mud. An in-situ annular benthic flume was deployed at various sites and used to characterise the sediment and its physical properties. To compliment the in-situ benthic flume a number of collected box cores were used to determine the change in nutrient flux during resuspension events using a series of ship based experiments. Pore water profiles and diffusive fluxes were also determined on collected cores for comparison. The obtained physical and chemical data will be used in new and existing models to incorporate the impact of resuspension on nutrient release.

Couture, R. M., Université du Québec, Québec, Canada, raouil.couture@ete.inrs.ca;
 Gobeil, C., Université du Québec, Québec, Canada, charles.gobeil@ete.inrs.ca;
 Tessier, A., Université du Québec, Québec, Canada, andre.tessier@ete.inrs.ca

LAKE SEDIMENTS AS ARCHIVES OF ATMOSPHERIC ARSENIC CONTAMINATION

Current emissions of arsenic (As) into the atmosphere are thought to globally increase as a result of human activities but temporal trends at regional scales are not well defined. We have determined the profiles of this redox-sensitive metalloid in dated (210Pb and 137Cs) sediment cores and in sediment porewater from Canadian Shield lakes, where atmospheric deposition is the only input of anthropogenic As. A one-dimensional transport-reaction equation was applied to the porewater As profiles in order to quantify the post-depositional addition or removal of As to the solid phase and estimate the sedimentary As concentrations at the time of deposition. By multiplying these concentrations by sediment mass accumulation rates, variations over the last two centuries in As fluxes at the sediment surface were estimated. The resulting chronological profiles in all lacustrine basins reveal that atmospheric As contamination was at its maximum in the 1950s and significantly decreased since then; such a trend is consistent with the history of specific markers of coal combustion at the same sites.

Cox, T., Centre for Estuarine and Marine Ecology (NIOO-CEME), Yerseke, Netherlands, tom.cox@ua.ac.be;

Maris, T., University of Antwerp, Antwerpen, Belgium, tom.maris@ua.ac.be;
 Soetaert, K., Centre for Estuarine and Marine Ecology (NIOO-CEME), Yerseke, Netherlands, k.soetaert@nioo.knaw.nl;
 Conley, D., GeoBiosphere Science Centre, Lund, Sweden, daniel.conley@geol.lu.se;
 Van Damme, S., University of Antwerp, Antwerpen, Belgium, stefan.vandamme@ua.ac.be;
 Meire, P., University of Antwerp, Antwerpen, Belgium, patrick.meire@ua.ac.be;
 Struyf, E., GeoBiosphere Science Centre, Lund, Sweden, eric.struyf@geol.lu.se

A REGIME SHIFT IN A FRESHWATER ESTUARINE ECOSYSTEM RECOVERING FROM HYPEREUTROPHICATION?

After decades of hypereutrophication, with strong hypoxia and elevated ammonia concentrations, water quality in the freshwater part of the Schelde estuary changed rapidly. Average May-Sep oxygen concentrations more than quintupled, from 8% of saturation (1996) to 51% (2007). Ammonium concentrations decreased from a 296 μM May to Sep average (1996) to 16 μM (2007). Average May-Sep chlorophyll a concentrations increased from 15 $\mu\text{g/l}$ (1996) to 178 $\mu\text{g/l}$ (2007). From 2006 oversaturated oxygen concentrations are occasionally observed, caused by algal primary production. We hypothesise that inhibition of primary production and algal growth due to anoxia and/or ammonia toxicity prevented the build-up of algal biomass until a decade ago. We study the steady states and dynamics of a simple mathematical model, including this algal growth inhibition. It displays a regime shift from a heterotroph state to an autotroph state, when ammonia load is reduced below a threshold. At intermediate loads it predicts fluctuations in oxygen concentration in response to discharge peaks. Data and model results are consistent, and thus indicate a possible regime shift from heterotrophy to autotrophy in this ecosystem.