

anammox rates. Both experiments showed that anammox remained the dominant process. A final experiment showed that denitrification dominated over anammox in electron donor incubated OMZ water. This suggests that the limited supply of electron donors in the OMZ limit denitrification to such extent that anammox becomes the dominant N_2 producing process.

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TIMING AND PLACING SAMPLINGS TO OPTIMALLY CALIBRATE A REACTIVE TRANSPORT MODEL: EXPLORING THE POTENTIAL FOR *ESCHERICHIA COLI* IN THE SCHELDT ESTUARY

For the calibration of any model, measurements are necessary. As measurements are expensive, it is of interest to determine beforehand which kind of samples will provide the maximum of information. Using a criterion related to the Fisher information matrix, it is possible to design a sampling scheme that will enable the most precise model parameter estimates. This approach was applied to a reactive transport model (based on SLIM) of *Escherichia coli* in the Scheldt Estuary. As this estuary is highly influenced by the tide, it is expected that careful timing of the samples with respect to the tidal cycle will have an effect on the quality of the data. The timing and also the positioning of samples were optimised according to the proposed criterion. In the investigated case studies the precision of the estimated parameters could be improved by up to a factor of ten, confirming the usefulness of this approach to maximize the amount of information that can be retrieved from a fixed number of samples.

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POTENTIAL NUTRIENT RETENTION IN RESTORED FLOODPLAINS AND STREAM BEDS

Floodplain restoration is often carried out for hydrological and/or nature development reasons. However, the nutrient retention capacity of restored floodplains and streambeds is rarely taken into account. In this study the potential of these restoration projects to retain nutrients is explored, based on analysis of field data and modeling the nutrient cycling. Predominant mechanism is the increase in time of travel or hydrological residence time. Also, the increase of sites that promote sedimentation and denitrification contribute to nutrient retention. Retention capacity from different lowland catchments is calculated from mass budgets and estimated process rates. In addition, a hydrodynamic model of a river and a lowland stream are constructed and run for different options. With this, the effect of re-meandering, floodplain reconnection, period and frequency of inundation are studied. Also seasonality is addressed. Field data analysis and modeling results are used to set up simple relationships for estimating retention rates based on major catchment and stream properties.

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PART 2. PREVIOUS HYDRO-CHEMICAL CONDITIONS, MONITORING METHODS AND SIBEO EFFECTS IN DILUTION AND LARVAE PUMP.

The natural resources and environmental diversity of Mexico's coastal zone, have experienced changes and deteriorations of different magnitude in its circulation dynamics, geology, physico-chemistry, biology, as well as in the natural resources, due to different human activities. In order to rehabilitate these environments, or to allow a sustainable use, it is necessary to apply technologies like the Wave Energy Pumping System (SIBEO, as Spanish acronym), that allows for exchange between coastal water bodies and the ocean without artificial opening of sandbars. In the present work the theoretical effect of the SIBEO is evaluated in the water circulation, hydrochemistry and metabolism of two coastal water bodies chosen by their environmental challenges and fisheries management (Ensenada Port, Baja California and Lagartero Lagoon, Oaxaca). Recommendations for the optimal management based on the SIBEO from hydrological parameters analysis for these ecosystems are provided.

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PAST PERIODS OF VARIABLE ACIDITY IN THE EASTERN MEDITERRANEAN

Present assessments of ocean acidification usually refer to the Mediterranean as a carbonate oversaturated thus not so endangered ocean basin, whereas the short ventilation time of ~50 years suggests a rapid potential response to changing

environmental conditions. However, when looking into past records, clearly rapid variations in Mediterranean acidification state have occurred. Considerable decreases in sedimentary carbonate are known to occur in organic-rich units (sapropels). Obviously, such events are not limited to these intervals but occur more regularly. Part of these observations may be related to changes in ecology but partly also to dissolution events. These variations must be related to the very subtle balance in the eastern Mediterranean where slight environmental/climatic disturbances have resulted in major and abrupt system perturbations with dramatic consequences. Not only such major changes on the ~20 kyr but also higher frequency, distinct but more delicate, variations appear to occur.

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EVOLUTION OF PLANKTON CELL SIZE IN TURBULENT WATERS

The balance between size-related metabolic activities and sinking is known to affect size composition of planktonic communities both on the ecological and the evolutionary timescale. It is believed that the major driver towards reducing plankton size is the fact that larger cells with negative buoyancy sink below the mixed layer. In this work, we address the role of small-scale turbulence and of its temporal fluctuations in the adaptive evolution of cell size. We show that the outcome of the evolutionary dynamics, that is the prevalence of small or large-sized particles, depends both on the turbulent state of the mixed layer, affecting the dependence of the sinking rate on the cell size, and on the frequency of periodic changes in turbulence properties. In general, larger-size plankton is favoured for higher turbulence and for fast changes in the turbulent state. This opens a question on whether one can recognise regional-level processes whereby the properties of small-scale turbulence (modulated by wind, for instance) cause an inversion of the evolutionary trend towards small sizes, and on the time scale of evolutionarily relevant variations in turbulence.

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RNA INTERFERENCE IN THE MARINE DIATOM PHAEODACTYLUM TRICORNUTUM

Diatoms are a key phytoplankton group in the contemporary ocean. In the last years, different laboratories have put a lot of efforts to develop molecular-based techniques and to make diatoms accessible to genomics technologies. However, still a major limitation for the study of their biology is the lack of tools to generate targeted gene knock-out or knock-down mutants. We have recently demonstrated that it is possible to inhibit gene expression in *Phaeodactylum tricornutum* using RNA interference, a double-stranded RNA triggered post-transcriptional gene silencing process that efficiently works in many organisms. In particular, we have shown that it is possible to silence a GUS reporter gene, expressed in transgenic diatoms, by introducing into the cells a vector containing an antisense or inverted-repeat fragment of the GUS gene. Remarkably, RNAi seems to work also on endogenous target genes. The data open the way for functional genomics studies and represent a major advance for understanding diatom biology and ecology. In addition, the presence of poorly conserved silencing machinery in diatoms provides further information for the continued investigation of evolution and diversification of RNAi pathways in eukaryotes.

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DECOUPLING AND ADAPTATION OF TROPHIC INTERACTIONS IN AQUATIC FOOD WEBS UNDER CLIMATE CHANGE

Climate warming has been shown to advance the seasonal timing of life cycle events. Species-specific differences in these changes in phenology may result in a decoupling of trophic relationships in food webs and subsequent cascading effects on community structure. For the timing of life cycle events each species requires specific cues, used as proxies for the suitability of the environment for their reproduction and growth. Climate change may change the validity of the proxies different species use. The fundamental questions underlying our research are threefold: 1) What proxies do different members of the aquatic food web use to estimate the suitability of environmental conditions for successful reproduction and growth? 2) Could projected climate warming invalidate the use of these proxies and lead to a decoupling of trophic interactions? 3) Can adaptation to projected climate warming maintain or restore trophic interactions? We have tested