

Annual reporting year 1- HYPER project

WP1 - Trends of hypoxia	
Reporting period	Months 1 - 12
Gained scientific results during the reporting period	We have planned and completed a successful research cruise in summer 2009 (25 May - 5 June). During this cruise, twenty-six 6m-long gravity cores covering the post-glacial period and additional multi-cores were retrieved from the Baltic Proper, Bothnian Sea and Bothnian Bay. These sediment cores form the material basis for WP1 in HYPER. WP1 follows the original research plan and met the first deliverable D1.1. The planned analysis of these sediment cores are now in progress.
Comparison with the original research and financial plan	WP1 has met all the outcomes identified in the original research plan for the reporting period.
Statement if the research plan and schedule of deliverables had to be adapted (if yes please mention the consequences)	The research plan and schedule of deliverables has not been adapted and continues as planned..
Do results of third parties have influence on the working programme?	No.
Are any changes in the future working plan expected?	No.
Are any changes expected for the deliverables?	No.

WP2 - Biogeochemical processes	
Reporting period	Months 1 - 12
Gained scientific results during the reporting period	<p>Natural nitrogen removal was quantified on 5 cruises, covering Gulf of Finland, Baltic Proper and Southern Baltic Sea, both on sediments and in the water column. The effects of short and long-term anoxia and benthic fauna loss on nitrogen processes was studied on coastal area. A comparative study to identify differences between batch mode denitrification rate measurements with flow-through mode were carried out along an estuarine gradient in cooperation with the GKSS coastal research institute. Moreover, samples from the redoxcline of the central Baltic Sea were taken on two cruises for analysis of stable isotope signatures in nitrate. Pore water samples for the same analyses were additionally taken on the Aranda cruise.</p> <p>Sediment phosphorus dynamics and burial were studied in cores collected from the Southern Baltic, Baltic Proper, Bothnian Sea and Gulf of Finland (from 3 cruises). Batch and flow through reactor experiments were performed to further assess P release mechanisms under anoxia. A scientific paper describing P recycling burial at 6 locations in the Baltic over the past century was published.</p>
Comparison with the original research and financial plan	<p>Nitrogen loss quantification was carried out on four instead of two cruises and work on phosphorus was done on three instead of two cruises.</p> <p>The isotopic fingerprinting analysis will be carried out in 2010 (collected have been samples and the method set up on 2009).</p>
Statement if the research plan and schedule of deliverables had to be adapted (if yes please mention the consequences)	<p>Measurements were done not on planned two cruises (spring and autumn) but on altogether four cruises for nitrogen and three cruises for phosphorus. The schedule of deliverables did not change.</p>
Do results of third parties will have influence on the working programme?	No (I assume other WPs are not third parties)
Are there any changes in the future working plan expected?	There will be yet another cruise in June-July 2010
Are there any changes expected for the deliverables?	The deliverable D2.3 will include all the cruises performed in 2009.

WP3 - Physical and biogeochemical modelling	
Reporting period	Months 1 - 12
Gained scientific results during the reporting period	<p>Task 3.1: The physical part of Baltsem, with a simplified oxygen submodel, has been used to investigate causes of variations in hypoxia during the past 2000 years. In addition, a test simulation of the Baltic Sea circulation 5500 years from now has been performed.</p> <p>Task 3.2: A first workshop was held in Stockholm in March, a follow up meeting between ÅA and SU was held during Autumn when more specific workplan were initiated. A model design will soon be available.</p> <p>Task 3.3: The reactive transport model has been developed and implemented for Baltic Sea sediments. Validation is on-going using geochemical data from Arkona and Baltic proper.</p> <p>Task 3.4: Will start as soon as the RTM gives useful results.</p>
Comparison with the original research and financial plan	All task progress according to plan, except some delay in Task 3.1. Here we wait for additional information from the long core's that were sampled in WP1. As soon this is available no additional delays are anticipated.
Statement if the research plan and schedule of deliverables had to be adapted (if yes please mention the consequences)	Deliverable 3.1 will be subdivided into three reports. Presently there are a manuscript of modeling hypoxia the past 2000 years available and a brief report of a time-slice simulation of the Baltic 5500 years ago. The final report of the complete 8000 year simulations are due once data is available, which will be around month 24-30.
Do results of third parties will have influence on the working programme?	No
Are there any changes in the future working plan expected?	No
Are there any changes expected for the deliverables?	No

WP4 - Hypoxia and benthic fauna	
Reporting period	Months 1 - 12
Gained scientific results during the reporting period	<p>Two major sampling efforts were successfully completed and thus the field data required for the completion of all deliverables of WP4 has already been secured.</p> <ul style="list-style-type: none"> - On a sampling cruise on R/V Aranda, covering all the major basins of the Baltic Sea, benthic fauna and sediment-water nutrient fluxes were measured. Analysis of samples and data is still in progress, but initial results indicate that benthic ecosystem function (measured as nutrient fluxes across the sediment-water interface) is highly variable between basins and closely dependent on near-bottom oxygen conditions and the diversity and condition of the benthic macrofaunal communities. - A large-scale manipulative field experiment was conducted at Tvärminne Zoological Station and the influence of repeated short periods of hypoxia on benthic ecosystem function was examined. Preliminary results indicate that already short periods of hypoxia may alter ecosystem functioning, highlighting the importance of mitigating the problem of hypoxia in the Baltic Sea.
Comparison with the original research and financial plan	The research has progressed in line with the original research and financial plans.
Statement if the research plan and schedule of deliverables had to be adapted (if yes please mention the consequences)	No. The Aranda cruise report was submitted month 13 instead of month 10, but this has not affected any other activities.
Do results of third parties will have influence on the working programme?	No
Are there any changes in the future working plan expected?	No
Are there any changes expected for the deliverables?	No

WP5 - Nutrient management	
Reporting period	Months 1 - 12
Gained scientific results during the reporting period	<p>Our current knowledge on engineering solutions to mitigate hypoxia in the Baltic Sea has been synthesised in two published papers (Conley et al. 2009a,b), stressing that the proposed engineering solutions are mostly unrealistic in practice or that the consequences of full scale implementation are unknown and cannot be assessed at present. We have evaluated 5 options: 1) bubbling the bottom waters with oxygen which can be ruled out as unrealistic considering the amount of oxygen needed every year, 2) increase the inflow of salt water over the sills will have the opposite effect of the intended, i.e. strengthening stratification and worsening hypoxia, 3) reduce stratification by turning the Baltic Sea into a Baltic Lake which would completely alter the whole ecosystem, 4) mixing across the pycnocline using energy from wind mills might be a solution but more calculations are needed to determine if this is realistic in practice, and 5) add chemicals to precipitate phosphate but the amount of alum, apatite and rock flour needed would be extensive and potential toxicity and binding capacity in brackish water need to be addressed.</p> <p>HYPER has connected to HYPOX, a FP7 project aiming at improved monitoring of hypoxia and related processes across European seas. Several partners in HYPOX were involved in SCOR WG128 on “Natural and human-induced hypoxia and consequences for coastal areas”.</p> <p>Partners from HYPER were involved in chairing a scientific session on integrating science and management for the Baltic Sea restoration at the CERF2009 conference in Portland, Oregon, November 1-5 2009.</p> <p>Conley et al. (2009a) Tackling hypoxia in the Baltic Sea: Is engineering a solution? <i>Env.Sci.Tech.</i> 43: 3407-3411. Conley et al. (2009b) Hypoxia related processes in the Baltic Sea. <i>Env.Sci.Tech.</i> 43: 3412-3420.</p>
Comparison with the original research and financial plan	WP5 concerns the overall project management and the upscaling of the results from the other WPs to the entire Baltic Sea. Therefore, most of the scientific work is in the last period of the project and most efforts in WP5 have been towards managing the project as such.
Statement if the research plan and schedule of deliverables had to be adapted (if yes please mention the consequences)	There has been no adaptation of the research plan.
	Yes, the continuous development of the NEST system will

Do results of third parties will have influence on the working programme?	facilitate integration with the HYPER results, particularly the transition from the coarse box-model SanBalts to a model with a fine vertical resolution (BALTSEM) allowing a much better spatial description of the pelagic-benthic interactions.
Are there any changes in the future working plan expected?	No.
Are there any changes expected for the deliverables?	No.