

A Changing Ocean

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POSTERS

to remain coherent and do not mix with the surrounding waters; this is due to the existence of LCSs that form barriers around the eddies. This mechanism could contribute to the maintenance of the OMZ off Peru.

- 5 [Bhavya P.S., S. Kumar, G.V.M. Gupta, V. Sudheesh, K.V. Sudharma, D.S. Varrier and K.R. Dhanya](#)
Nitrogen uptake dynamics in a tropical estuary and adjacent coastal Arabian Sea: Influence of anthropogenic activities

Estuaries and adjacent coastal regions are among the most vulnerable ecosystems due to increased nutrient loading because of anthropogenic and tidal activities. In order to understand the nitrogen (N) uptake dynamics in such a coupled ecosystem, ¹⁵N tracer experiment was conducted in Cochin estuary, India and two transects (Off Cochin and Off Mangalore) in the adjacent coastal Arabian Sea during April (pre-monsoon) and September (monsoon) 2012. In the estuary, relatively higher average nitrate (2.48 ± 1.48 mmolN m⁻³d⁻¹) and ammonium (11.72 ± 4.39 mmolN m⁻³d⁻¹) uptake rates were observed during the pre-monsoon than the monsoon (1.79 ± 2.1 and 6.16 ± 4.1 mmolN m⁻³d⁻¹ for nitrate and ammonium, respectively). During pre-monsoon, ammonium uptake rates showed significant positive relationship with salinity ($R^2 = 0.88$; salinity range 1.58 - 15.17), chlorophyll ($R^2 = 0.94$), and pH ($R^2 = 0.69$), indicating importance of factors other than substrate in modulating N uptake rates under nutrient replete conditions. Between coastal transects, nearby station Off Cochin, which received direct N loading from the estuary, showed higher surface N uptake rates than Off Mangalore stations which do not have estuarine influence. For near coast (13 m depth) stations, surface nitrate (April: 1.62 ± 0.08 mmolN m⁻³d⁻¹; September: 10.59 ± 1.1 mmolN m⁻³d⁻¹) and ammonium (April: 11.16 ± 1.1 mmolN m⁻³d⁻¹; September: 6.88 ± 0.15 mmolN m⁻³d⁻¹) uptake rates Off Cochin were higher than that of Off Mangalore nitrate (April: 0.34 ± 0.03 mmolN m⁻³d⁻¹; September: 0.13 ± 0.01 mmolN m⁻³d⁻¹) and ammonium (April: 0.34 ± 0.03 mmolN m⁻³d⁻¹; September: 5.54 ± 0.55 mmolN m⁻³d⁻¹) uptake rates. These higher uptake rates in the estuary and adjacent coastal waters influenced by estuary possibly indicate the effect of anthropogenic activities in modulating nitrogen uptake dynamics of coastal ecosystems.

- 6 [Boyen C.](#)
IDEALG project: 10 years to make the best of algal genomics and post-genomics for the development of seaweed aquaculture and associated biotechnologies

In response to the constant increasing demand of seaweed biomass on an international level, the need to upscale or develop cultivation methods of native seaweeds in Europe is becoming urgent. The French large integrated long-term research project "IDEALG" proposes to tackle issues related to seaweed aquaculture and biomass exploitation. Special attention will also be addressed to economic, social and environmental impacts of such developments on other maritime activities, conservation and bio-safety issues.

IDEALG project will help improve algal bioresources and seaweed domestication as well as boost seaweed biotechnologies by making the best of genomics and post-genomic research. Indeed, metagenomic approaches applied on seaweed biomass and closely associated micro-organisms will bring progress to seaweed crops and developing blue and white technologies. First results have already brought light on strategic species to study, on algae genotyping, on nutritional characteristics of local seaweed and on green algae aquaculture. Social and economic aspects of the seaweed industry in France have also been reported but will continue to guide IDEALG along strategic decisions in order to ensure a sustainable development.

- 7 [Caballero A., A. Rubio, L. Ferrer, J. Mader, U. Cotano, M. Santos](#)
Southeastern Bay of Biscay mesoscale structures and their role in the physics and biogeochemistry

Mesoscale structures located in the southeastern Bay of Biscay have been analysed by means of satellite, in situ and model results. On the one hand, a quasi-stationary and recurrent anticyclonic eddy located around 44°30'N-4°W during 2003-2010, has been analysed. This type of eddy is present almost every year from the end of winter-beginning of spring, to the start of fall. A detailed monitoring of this structure during 2008 shows its origin from shelf/slope warm water flow in mid-January and that remains until August around the same area. An eddy tracking method, applied to the outputs of a numerical model is able to reproduce this type of eddy; and the satellite images indicate that it has a marked influence on the Sea Level Anomaly, Sea Surface Temperature and surface Chlorophyll-a concentration. The different behaviour on the doming of the seasonal thermocline within this structure and the associated cyclones has effect in the surface signal of the spring phytoplankton bloom. The analysis of this type of structure will be completed with a Glider mission during summer 2013. On the other hand, mesoscale and submesoscale structures have been detected by means of HF radars and satellite imagery further east, around 43°30'N-44°N and 2°W. The two HF radar stations are working operationally in the southeastern Bay of Biscay since 2009. This system provides hourly maps of high

resolution surface ocean currents, invaluable for the study of high resolution ocean processes. A primary analysis indicates that the mesoscale structures observed by the HF radars in this area have much shorter lifetimes than the one observed around 4°W; although, they show an influence on Sea Surface Temperature and Chlorophyll-a distributions. Future work will be focused on the possible impact of these mesoscale structures on commercial fish species.

- 8 Chust G., E. Villarino, C. Castellani, P. Licandro, L. Ibaibarriaga, X. Irigoien

Modelling the response of zooplankton habitat to present and future climate change

Habitat modelling is a valuable tool for detecting climate change signals and to assess its future impacts on species distribution. The main objectives of this study were: 1) to verify the poleward shift of *Calanus* species (*Calanus finmarchicus*, *C. glacialis*, *C. helgolandicus*, *C. hyperboreus*) in the North Atlantic Ocean between 1959 and 2004, using Generalized Additive Models (GAM); 2) to assess how much of this shift may be due to sea warming, and 3) to evaluate the impacts of future climate change in occurrence distribution of 19 copepod species, using the coupled physical-biogeochemical model (POLCOMS-ERSEM). First, the population gravity centre of observed data from the Continuous Plankton Recorder (CPR) survey was compared with that predicted from a series of simulation experiments based upon: 1) a model using only climate factors (i.e. niche-based model) to simulate species habitat suitability, and 2) a model using temporal and spatial terms to reconstruct the population distribution, validated with a sub-set of independent observations. Our findings show that only *C. finmarchicus* had a consistent poleward shift estimated as 8.1 km per decade in the North Atlantic (16.5 per decade for the Northeast Atlantic) which could be associated with sea warming. This value is lower than that reported by previous studies for zooplankton assemblages in the Northeast Atlantic. In contrast, we found that *C. helgolandicus* population has been expanding in all directions. *C. glacialis* and *C. hyperboreus*, based on the CPR data, which have their geographic centres of population mainly in the NW Atlantic, showed a slight southward shift, probably responding to cool water penetrating southward in the Labrador Current. Our approach, supported by high model accuracy, represents a powerful tool for detecting species latitudinal shifts, and identifying its possible causes.

- 9 Cianca A., J.M. Martín-González, M.D. Gelado, M.J. Rueda, O. Llinás

Exploring the interannual variability of the dissolved oxygen content for the upper waters in the North Atlantic subtropical gyre

The temperature increases and the enhanced stratification of the upper ocean which have been observed during the last decades are likely leading to the diminishing of the Dissolved Oxygen (DO) in the ocean interior. This decreasing is likely having implications for ocean productivity, nutrient and carbon cycles, as well as affecting the marine life. The subtropical gyres of the world oceans are critical regions for understanding biogeochemical processes in the global ocean. The observation in these regions is fundamental to confirm the consequences of these ocean changes such as the acidification or deoxygenation. The surface water acidification has already been confirmed in the west and east sides of the subtropical North Atlantic Ocean. A similar interannual decrease of 0.0017 pH units yr⁻¹ has been reported at both regions. These results force to keep the observations on these processes over the areas which monitor the progress of the harmful effects on the ecosystem.

The opportunity to analyze two similar ship-based time-series at particular sites and the comparison with the largest unquestionable dataset in the ocean (the World Ocean Database) permits the characterization of the oxygen inventory and its time variability for the upper waters (0- 800m). We realize the limitation to examine the long- trend due to the length of the time-series. However, we consider the results from the comparison very valuable in order to improve our understandings in the regional context.

This study presents and compares a 15yr record of DO observations from ESTOC (European Station for Time-Series in the Ocean, Canary Islands) at the eastern subtropical North Atlantic with a 20yr record from BATS (the Bermuda Atlantic Time-series Study) on the western side of this region. These results are determined by analyzing the time-series using a Discrete Wavelet Transform (DWT) method. The DWT analysis shows the trends in DO anomalies which are dominated by long-term perturbations at a basin scale at both sites. These long-term perturbations are likely associated with ventilation of the main thermocline.

- 10 Degen R., A. Vedenin, M. Guský, A. Boetius and T. Brey

Arctic benthos and climate change - The red queen's race

Currently Arctic ecosystems seem to change much faster than new research and expeditions can be planned, conducted and evaluated. Under these dynamic conditions, it is almost impossible to establish a baseline that represents pre-change system state. Our initiative of a "pan-Arctic benthic database" intends to overcome this problem by combining all available biological and ecological data (published and unpublished) in one geo-