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BASIN SCALE ANALYSIS, SYNTHESIS AND INTEGRATION

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Deliverable 8.10 Range of costs caused by North Atlantic Carbon budget changes, based on predictive modelling of future ecosystem states

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Dissemination Level		
PU	Public	
PP	Restricted to other programme participants (including the Commission)	X
RE	Restricted to a group specified by the consortium (including the Commission)	
CO	Confidential, only for members of the consortium (including the Commission)	

Deliverable 8.10 Range of costs caused by North Atlantic Carbon budget changes

is a contribution Task 8.1 Estimate the economic impact of change in the North Atlantic carbon cycle

Executive Summary:

The ocean plays a major role in the global storage and cycling of carbon: it contains ~55 times more carbon than the atmosphere and ~30 times more than the terrestrial biosphere, and it has absorbed ~25% of all anthropogenic CO2 emissions, thereby slowing the increase in atmospheric concentration of this greenhouse gas (Le Quéré *et al.*, 2009; Williamson *et al.*, 2013).

It is important to monitor and assess the impacts of climate change on the stocks and flows of carbon in the NA, and estimate how these are affected by other C stressors. Processes that can affect C balance in the NA include changes in biological production, export and extractions such as fisheries. The monetary value of the NA, in terms of its capacity to provide gas and climate regulation, can be calculated based on C fluxes changes.

We estimated changes in C fluxes in the NA based on two biochemical models: ERSEM and MEDUSA (Yool *et al.*, 2013). In this report we present results based on the MEDUSA runs. These runs are forced with two different IPCC AR5 Representative Concentration Pathways of greenhouse gas emissions, RCP 2.6 and RCP 8.5. Changes in surface and 500m fluxes were then transformed into economic costs based on the non-traded C costs (Beaumont *et al.*, 2014). The differences in 500m fluxes between scenarios range between 0.02 PgC and 0.16 PgC per decade with aggregated actualized values of £ billion 1.2, 6.3, and 35.2 by 2020, 2050 and 2100 respectively. If we consider surface fluxes, then the difference between scenarios is up to 1.4 PgC per decade with aggregated actualized values of £ billion 0.4, 59.2, and 46.2 by 2020, 2050 and 2100 respectively.

A sensitivity analysis was conducted to assess the role of differential plankton mortality in the model, a proxy for differential fish biomass. The ERSEM sensitivity analysis showed that the POC at the sea floor was reduced by up to 2-3% and inter-annual variability was increased with the introduction of plankton natural mortality.

Looking at fish biomass estimates, increase of POC sinking from fish due to fish natural mortality could be less than 1% of fish biomass. Modelled fish catches represent an insignificant percentage of carbon in relation to POC sinking in the NA, but this removed fish cannot be considered permanently sequestered for valuation purposes. However, fish could play an important role through faecal pellet production (Saba & Steinberg, 2012) which is not considered in these models.

Relevance to the project & potential policy impact:

This work helps to contextualize and show the relevance of work from different working packages in terms of carbon sequestration and the cost for the society to remove or avoid that carbon. This work uses carbon fluxes from WP6 (see Deliverable 6.6) where it has been found a higher relationship of projected primary production with fluxes at 500m than with the seas surface fluxes. This work also uses data collected in WP7 related to carbon removed by fishing (see Deliverable 7.4 and D7.5). That data and model projection are also highly linked with primary production. Therefore, this work helps to contextualize those processes in terms of economic value and cost/benefit to the society.

FULL REPORT: the content is Confidential to the consortium. Please contact the authors for full report, until it is published in early 2015.