

***Interactive comment on* “The carbon budget of the North Sea” by H. Thomas et al.**

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Received and published: 7 September 2004

I would like to briefly comment on a statement made by Thomas et al. in their reply to an interactive comment by Andersson et al. on their paper in review in *Biogeosciences Discussions*. The statement is that *“Traditionally, the trophic state of coastal areas has been relied on as an indicator to assess or estimate at least the direction of the CO₂ air-sea fluxes, since on a global scale, the knowledge on the coastal nutrient conditions is much more profound than those of the carbon cycle”*. They then state that carbonate system data collected in coastal waters during the past decade have demonstrated that *“the trophic state not necessarily serves as a reliable indicator for the direction of the CO₂ air-sea fluxes”*.

I am not sure about what the authors mean by “knowledge of the coastal nutrient conditions” and assume that they refer to metabolic properties. Some authors may have assumed that autotrophic systems were sinks for atmospheric CO₂ and that heterotrophic systems were source of CO₂ to the atmosphere. However, the definition of these terms is very clear (e. g. Odum 1983):

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- In autotrophic (= self-nourishing) systems, production of organic matter is larger than consumption and there is a build-up of organic substances (*GPP*, gross primary production, is higher than *R*, respiration). Such systems can export all or some of the excess organic matter available.
- In heterotrophic (= other-nourishing) systems, decomposition of organic matter predominates ($R > GPP$), and such systems must therefore be supported by external subsidies of organic matter.

These definitions have long been acknowledged, including in papers which reviewed the trophic status of coastal ecosystems (e. g. Smith and Hollibaugh, 1993; Gattuso et al. 1998). Similarly, it has been acknowledged for quite some time that the contribution of biological processes to air-sea CO₂ fluxes is superimposed on the pre-existing pCO₂ of the water mass. For example, upwellings are most often source of CO₂ despite their autotrophic status. It is therefore incorrect to suggest that the direction and magnitude of air-sea CO₂ fluxes in coastal ecosystems has traditionally been inferred from their trophic state. It is nevertheless a good idea to remind these simple and basics definitions and facts.

References

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