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Rejoinder to "Perils of correlating CUSUM-transformed variables to infer ecological relationships (Breton et al. 2006; Glibert 2010)"

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In their comment, Cloern et al. (2011) develop theoretical evidence that cumulative sum of variability (CUSUM)-transformed variables should not be used to lead to inferences due to the increase of auto-correlation. Indeed, the use of statistical tools based on the independency between variables is misleading. The *p*-value associated to the tests described in Breton et al. (2006) and Glibert (2010) as well as in earlier papers (Ibañez et al. 1993; Le Fevre-Lehoerff et al. 1995; Choe et al. 2003) should be disregarded.

We, however, do not support the concluding remark of the paper that advises against any comparison of CUSUM-transformed variables. Indeed, such comparisons are useful as they visually accentuate transitions in time between independent variables, a task for which the CUSUM transformation is particularly efficient (Ibañez et al. 1993; Nicholls 2001; Breaker and Flora 2009). If CUSUM-transformations of two independent series show transitions at the same time periods, there is a basis for assuming a direct or indirect relationship between those variables; there is most likely a common underlying mechanism (or mechanisms) that is (are) responsible for the similar transitions in the two series. As with any correlative approach, hypotheses resulting from such relations ultimately must be demonstrated by alternate methods.

For instance, the synchronism between CUSUM of diatom biomass and of the North Atlantic Oscillation (NAO) suggested in fig. 3A,B of Breton et al. (2006) is supported by a large set of observational (Lancelot et al. 1987; Lancelot 1995) and modeling (Gypens et al. 2007; Lancelot et al. 2007) papers, all showing the importance of meteorological conditions and human activity on the watershed in driving the interannual variations of diatom and *Phaeocystis* colonies in the central Belgian coastal zone.

Similarly, long-term trends between nutrient concentrations and nutrient ratios and changes in abundances of multiple trophic levels, including fish, inferred from CUSUM analysis by Glibert (2010) in the San Francisco Estuary, have been further shown using bivariate analyses with original data as well as data adjusted for autocorrelation (Glibert et al. 2011). Glibert (2010) interpreted the change in delta smelt abundance, as well as changes in other fish species, along with other trends in nutrients, phytoplankton, and zooplankton, as an indirect effect due to multiple changes in the food web over time driven by bottom-up changes in both nitrogen and phosphorus loading, not as a singular or as a direct effect of ammonium on delta smelt.

In ecology, the application of CUSUM transformations for identifying links between meteorological, hydrological, and ecological patterns has recently been increasing (Adrian et al. 2006; Molinero et al. 2008; Breaker and Flora 2009; Briceño and Boyer 2010), and the combination of CUSUM charts and bootstrapping has been identified as an important tool in regime shift analysis (Andersen et al. 2008). Therefore, while supporting the cautious comment of Cloern et al. (2011), we agree with those who have previously used CUSUM in ecological analysis, that comparisons of transitions in time, using CUSUM transformations, are useful for the identification of synchrony between time series.

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