

Management goals for the Seine estuary: the importance of silica dynamics in tidal marshes

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Incorporating current uses and ecosystem perspectives, rather than an attempt at restoration of pristine conditions, is of vital importance in an estuary management plan. The Sigma plan for the Scheldt estuary includes such considerations. In the case of the Seine however, restoration efforts lack a holistic framework based on ecological functioning. Based on an inter-estuarine comparison, it is the aim to extrapolate methods and ecological objectives from the Scheldt estuary to the well documented Seine estuary.

Although Scheldt and the Seine share similar human pressures, their ecological functioning reveals major differences. An extremely turbid zone near the Seine mouth prevents primary production, while the short residence time of the water in the Seine estuary hampers the build-up of phytoplankton biomass. Nutrients are flushed out into coastal Seine Bay where large scale algal blooms are observed. Notably, these are also characterized by shifts of diatom to non-diatom communities as dissolved silica is often depleted. Losses of pelagic diatom production resulting from silica limitation have not only been blamed for toxic algal blooms, but for the reduction in ability of coastal food webs to support higher trophic levels (Jacobs et al 2008).

The N:Si ratio (Redfield-Brzezinski) observed in diatoms is 16:15, and Si limitation is known to occur at N:Si ratio larger than 4:1 (Gilpin et al 2004). As Si input has remained steady while N input has climbed (Billen et al 2001), diatoms are put at a competitive disadvantage. Tidal marshes have been reported to be a net sink for biogenic silica, storing it in phytoliths of silicified plants (e.g. reed; *Phragmites australis*), and releasing it gradually as dissolved silica. Especially during summer and spring, when diatom growth reduces DSi availability, this internal recycling mechanism is of crucial importance for preventing Si limitation (Struyf et al 2005).

Balancing the demand and supply of DSi will be approached by calculating the area of marshes required to enhance internal recycling of Si to the point where harmful algal blooms are inhibited via competition with diatoms. The calculated marsh area will feature as one element within the systemic restoration framework of the Seine. Moreover, the comparison between Seine and Scheldt of the demands and supplies will indicate a ranking of estuarine system resilience and vigor.

References

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Keywords: tidal marshes; Si; Seine; estuary management