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Climate change, estuarine hydrology and algal blooms

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Estuaries are ecosystems located at continental margins that represent transition zones at the sea-land interface. As such, estuaries are influenced both by exchanges with the coastal ocean and by inputs from the land surface. Their dynamics is basically determined by the seasonal and interannual variability in freshwater inflows.
River inflows influence the light climate, residence time, salinity regimes, and water column stability within an estuary, creating conditions that may either prevent or promote algal blooms. Estuaries located in areas of Mediterranean type climate are characterized by a marked seasonality in rainfall and receive most of their freshwater input during winter, when most of the annual rains occur. This leads to a seasonal succession of phytoplankton populations that is highly controlled by the seasonal variation of freshwater inflows. Climate change and anthropogenic impacts are known to promote shifts in rainfall patterns that have the potential to strongly influence the dynamics of highly seasonal estuaries through a number of pathways, with many ecological consequences. Global climate change, thus, significantly alters the environmental conditions controlling phytoplankton productivity.
In the Swan-Canning Estuary, a micro-tidal salt-wedge estuary located in the southwest of Western Australia (Australia), climate change has led to an increase in unseasonal rainfall events and prolonged drought periods. Associated with that, an increase in the frequency of harmful algal blooms has been observed in recent years, particularly of the gymnodinioid dinoflagellate Karlodinium veneficum.
The present study shows how hydrological changes as a consequence of climate change lead to the creation of different niche environments in turbulence, salinity, and light climate in the Swan-Canning Estuary. A comprehensive dataset will be presented, with the final aim to provide a quantitative correlation between intermittent habitat formation, that is impacted by climate change, and algal abundance and composition. This understanding is essential in order to more accurately forecast the occurrence of harmful algal blooms and predict the consequences of environmental changes for phytoplankton communities, which form the base of every aquatic ecosystem.