Cumulative effects of climate change and invasive species on productivity of coastal marine ecosystems

Katja Philippart[1,2,3]

[1]Waddenacademie, The Netherlands; [2]Royal Netherlands Institute for Sea Research, Coastal Ecology Department, The Netherlands; [3]Utrecht University, Physical Geography Department, The Netherlands

Shallow coastal seas with extensive tidal flats such as the Wadden Sea, offering nursery areas for fish and nourishing grounds for (wader) birds, which strongly rely on the lower trophic levels of the food web. Climate change is likely to impact on carrying capacity of estuarine coastal systems via the effects of increasing temperatures and droughts on the carbon supply available to primary consumers. An increase in the frequency and duration of heat waves may reduce the production of microphytobenthos on tidal flats during summer. An increase in droughts will reduce river discharges to the sea (m^3 y^{-1}), leading to lower riverine nutrient and carbon loads supporting primary and secondary production. Additional impacts on carrying capacity for higher trophic levels stem from invasive species, for example, as was observed for suspension-feeding bivalves such Pacific oysters (*Magallana gigas*) and American razor clams (*Ensis directus*). During their peak abundances, the consumption by Pacific oysters in the eastern Wadden Sea was more than 10% of the total consumption within this area, whilst consumption by American razor clams in the western Wadden Sea was more than 45% of the local total consumption. The success of the clams in the western Wadden Sea was probably due to their occupation of an ecological niche, which led to competitive advantage with respect to other suspension feeders. Because predation of the clams by fish and birds was limited, the carbon flows in the western Wadden Sea from secondary producers to higher trophic levels was reduced by more than 60%. During this presentation, we will discuss the mechanisms and likelihoods of cumulative impacts of future invasions and climate change on the productivity of coastal marine ecosystems.

Keywords: carrying capacity, ecological network analysis, trophic transfer, estuaries, bivalves