



Stratification, mixing and mussel food supply: fasting and feasting in a Danish fjord

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Many shallow estuaries are characterised by large populations of mussels. In such systems the shellfish largely determine the ecosystem dynamics, flows of carbon and nutrients, as well as the biodiversity in plankton and benthos. The mechanisms for this control depend on the interaction between physical factors (currents, turbulence, mixing), biogeochemistry and the biology of the organisms.

In a predominantly wind-driven Danish fjord we investigated the relationship between the external forcing factors, flow velocities, large- and small-scale turbulent mixing and the food supply for the benthic filter feeders. These shallow systems react extremely rapidly to changes in weather conditions. Wind is the main driving force for water column mixing. Under calm conditions the water column is stratified and a strong depletion layer develops near the bed. Soon after the wind picks up, turbulence increases, stratification is broken down and particulate material is redistributed over the water column.

Long periods of stratification will be detrimental for mussel stocks. Not only will the mussels not get sufficient food, but the reduced mixing can also lead to anoxia in the lower water layers. However, when the water column is fully mixed and the mussels have access to algae throughout the water column, they can reduce stocks of algae to very low levels. Brief periods of stratification may provide the algae with a spatial refuge, allowing stocks to recover. Preliminary modeling indicates that occasional restricted access to food may ultimately lead to increased mussel growth rates. Whether this is applicable to other systems remains to be tested.