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TITLE: Cabled ocean observatory data reveal food supply mechanisms to a cold-water coral reef

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ABSTRACT:

We investigated food supply mechanisms to a cold-water coral (CWC) reef at 260 m depth on the Norwegian continental shelf using data from a cabled ocean observatory equipped with Acoustic Doppler Current Profilers (ADCPs), an echosounder, and sensors for chlorophyll, turbidity and hydrography in the benthic boundary layer (BBL). Tidal currents of up to tens of cm s^{-1} dominated BBL hydrodynamics while residual currents were weak ($<10 \text{ cm s}^{-1}$), emphasizing a supply and high retention of locally produced phytodetritus within the trough. A direct connection between the reefs and surface organic matter (OM) was established by turbulent mixing and passive particle settling, but relative contributions varied seasonally. Fresh OM from a spring-bloom was quickly mixed into the BBL, but temperature stratification in summer reduced the surface-to-bottom connectivity and reduced the phytodetritus supply. A qualitative comparison among acoustic backscatter in the ADCPs (600 kHz, 190 kHz) and echosounder (70 kHz) suggests that vertically migrating zooplankton may present an alternative food source in summer. Nocturnal feeding by zooplankton in the upper water column sustains downward OM transport independent from water column mixing and may dominate as food supply pathway over sedimentation of the phytodetritus, especially during stratified conditions. In addition, it could present a concentrating mechanism for nutritional components as compensation for the deteriorating phytodetritus quality. Overall, the observed patterns suggest seasonal changes in the food supply pathways to the reef communities. The moderating role of temperature stratification in phytodetritus transport suggests stronger dependence of the cold-water corals on zooplankton for their dietary requirements with increased stratification under future climate scenarios. This study demonstrates the added value of permanent ocean observatories to research based on dedicated campaigns and regular monitoring.

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