

The Coastal and Marine Ecosystem of Woodfjorden, Northern Svalbard

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Abstract

Fjords on the west and north coast of the Svalbard are currently experiencing a steadily warming mainly due to raising temperatures and increased influx of warm Atlantic waters. This warming, along with glacial retreat and associated freshwater influx, modifies fjord hydrology, stratification, and water turbidity, and thus primary production patterns, which further cascade to the whole ecosystem functioning. Woodfjorden, a long fjord north of Spitsbergen, is located at the northern edge of the West Spitsbergen Current, includes the main fjord, fed by multiple small rivers, and the two tributary fjords impacted tidewater glaciers.

We conducted a complex, multidisciplinary coastal and marine research in Woodfjorden, during r/v Oceania (IO PAS) cruise in August 2024. A wide range of physical and biogeochemical measurements were taken along the fjord axes including temperature, salinity, light penetration, dissolved oxygen, nutrients (NO_2^- , NO_3^- , NH_4^+ , PO_4^{3-} , DSi), pH, total alkalinity, pCO_2 , phytopigments, Dissolved Organic and Inorganic Carbon in the water column, and Total Organic Carbon, grain size and phytopigments in the sediments. We measured primary

production rates (*in situ*), and assessed zooplankton, and macro- and meiobenthic community structures. *Ex-situ* experiments were performed to measure sediment respiration rate, and carbon and nutrient fluxes. Littoral zone sampling included shallow waters measurements (temperature, salinity, light penetration), algal physiology and biochemistry (*Fucus distichus*, *Saccharina latissima*), and zoobenthic studies.

Here we present the first synthesis of results from a multidisciplinary field campaign designed to help understand the consequences of ongoing environmental shifts for Woodfjorden ecosystem functioning, both in the shallow littoral zone and deep central parts of the fjord. Our findings offer new insights into the physical and biogeochemical setting of the Woodfjorden ecosystem and their influence on biological communities in shallow coastal areas and across the fjord. Together, collected datasets provide a comprehensive overview of the marine carbon cycle and ecosystem structure in this relatively understudied region of Svalbard.

Acknowledgments. This study is a part of the Horizon 2023 project SEA-Quester (Grant Agreement No. 101136480).

Received 15 September 2025

Accepted 20 October 2025