Total carbohydrate concentrations of Bransfield Strait sediment

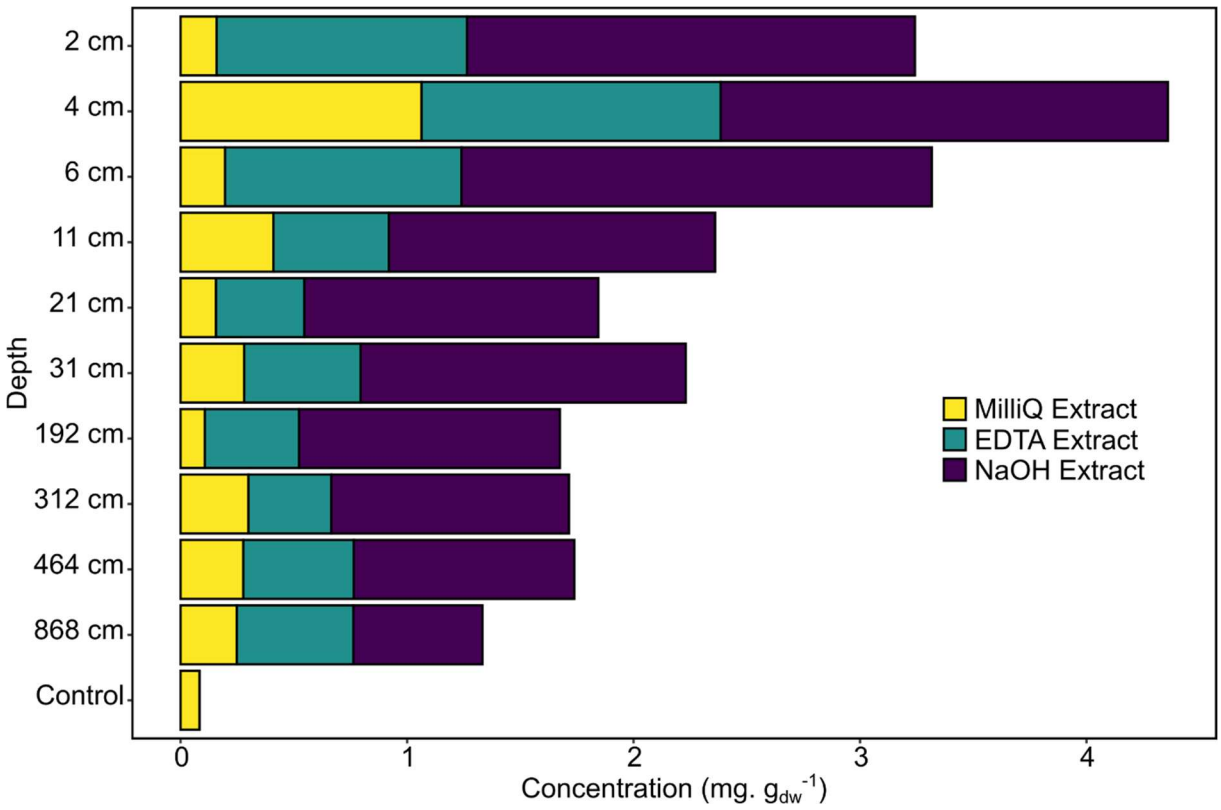

Figure S1: **Carbohydrate concentrations in each sequential extract.** Carbohydrate concentrations are shown as glucose equivalent weight per gram dry sediment. The NaOH extracts (purple) show the highest concentrations followed by EDTA extracts (blue), and the MilliQ extracts (yellow).

Sample collection from the Wadden Sea (Cuxhaven, Germany)

Sediment sample was collected from the intertidal region of the Wadden Sea (Latitude: 53.8877, Longitude: 8.6433). Sediment sample from ca. 5- 10 cm below the surface of diatom mat was scooped into a Nalgene bottle using a clean spatula. The samples were then frozen at -80° C until freeze drying. The permit to sample sediment for research purposes was provided by the Nationalpark "Niedersächsisches Wattenmeer" (NWattNPG; Wilhelmshaven, Germany).

Anion exchange chromatography of Wadden Sea Sediment

1 gram each of Wadden Sea sediment and combusted sand (negative control) were weighed in three replicates. Glycans were sequentially extracted from samples as described in the main text (see Sect. 2.3). 30 mL of pooled extracts (water and EDTA) was filtered through a 0.22 µm syringe filter and loaded on the HiTrap ANX FF (high sub) columns. Column equilibration, loading, and elution was done as described in the main text (see Sect 2.5). Fucoidan purification was confirmed using ELISA, deoxyhexose assay, and monosaccharide quantification (see Sect 2.6- Sect 2.9).

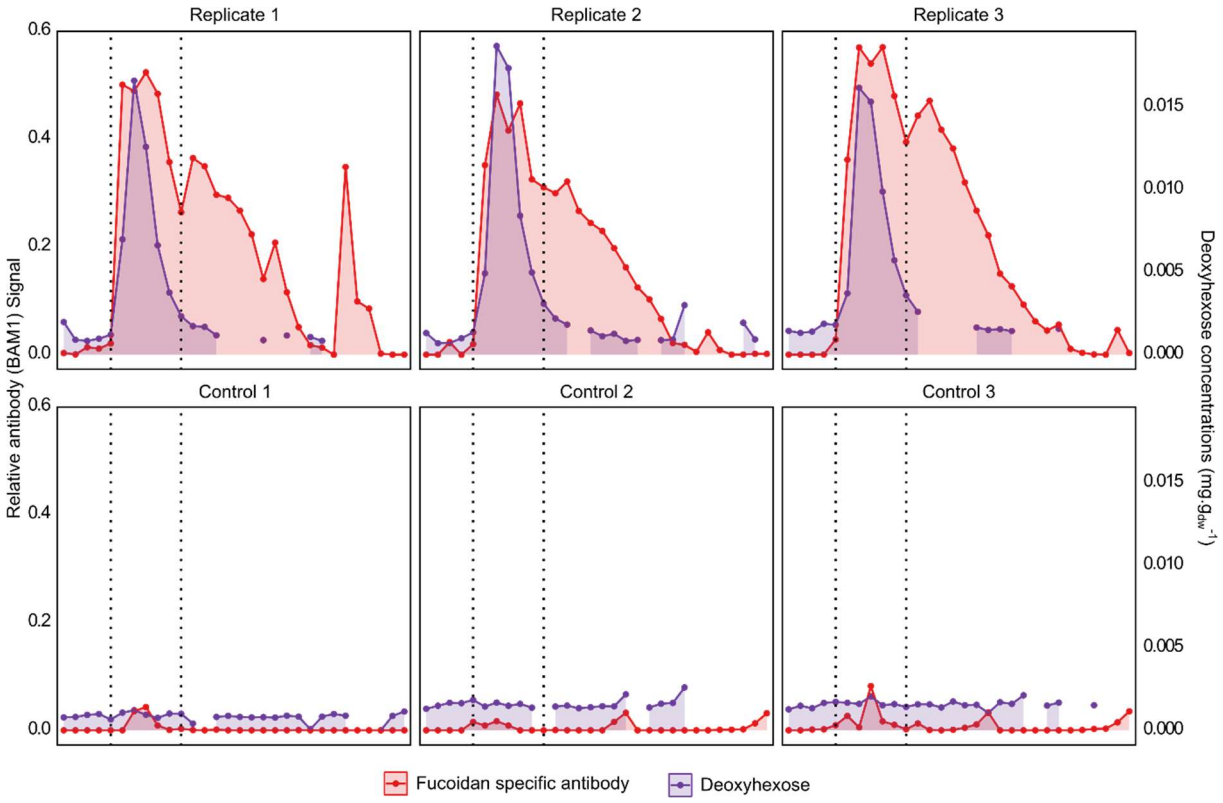

Figure S2: Fucoidan purification from Wadden Sea sediments confirmed in three replicates. Fractions were probed for fucoidans using monoclonal antibody BAM1, and deoxyhexose concentrations were measured with deoxyhexose assay in Wadden Sea replicates (top) and negative control replicates (bottom). The relative monoclonal antibody signals in each fraction are shown in red, while the deoxyhexose concentrations are shown in purple. The three sediment replicates show comparability in the antibody signals and deoxyhexoses, while the negative controls show negligible signals. The region where the relative antibody signals and the deoxyhexose concentrations peak and overlap are indicated by the vertical dotted lines in each facet. This region signifies the fucoidans isolated from the corresponding replicate.

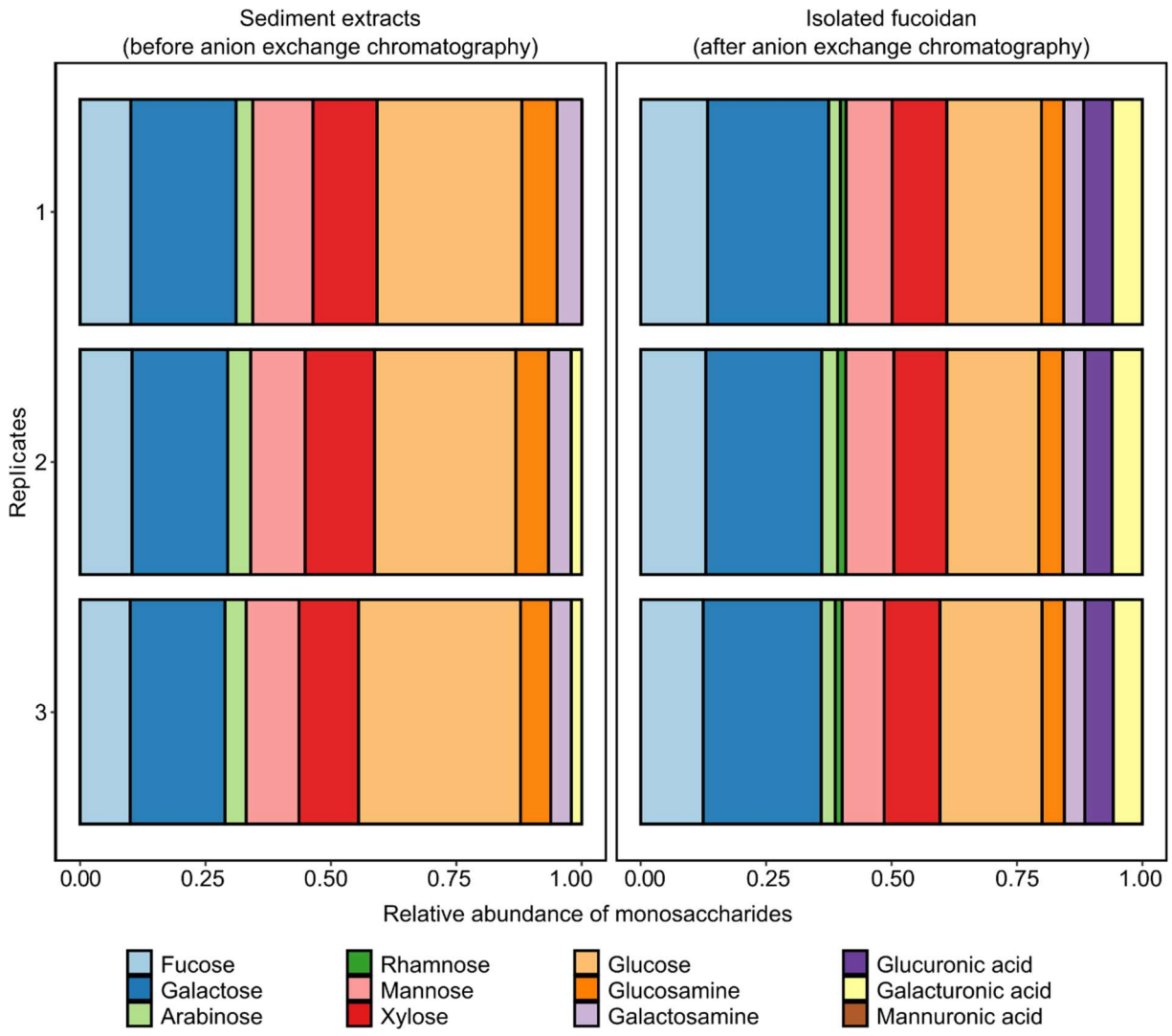

Figure S3: **Fucoidan monosaccharides enriched after anion exchange chromatography in three Wadden Sea sediment replicates.** Relative abundances of monosaccharides before (left) and after (right) anion exchange chromatography in three replicates are compared. Certain monosaccharides like fucose, galactose, and uronic acids are enriched after anion exchange chromatography, while others like glucose and arabinose have a lower abundance.

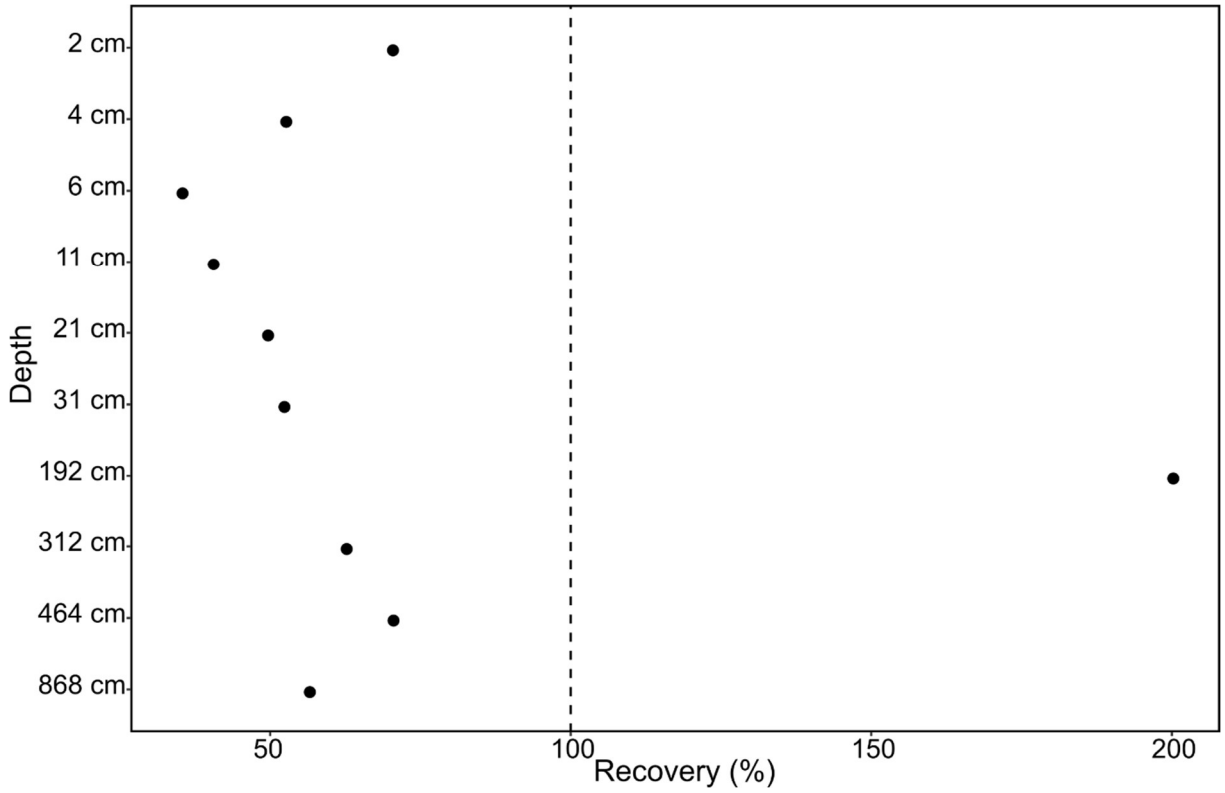

Figure S4: Recovery of deoxyhexoses after anion exchange chromatography. Except at 192 cm depth, 35-70% of the deoxyhexoses in the MilliQ and EDTA extracts were captured using anion exchange chromatography. At 192 cm depth there was a 200% recovery, indicating under estimation in the extracts due to matrix effects or an over-estimation in the purified samples. The vertical dotted line indicates a 100% recovery.