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Natural vs. trawling-derived transport of sediment and particulate organic matter in a submarine canyon

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Deep bottom trawling often occurs in the vicinities of submarine canyons since these morphological features act as nursery areas for commercial species. Previous studies in the submarine canyons incising the NW Mediterranean margin have highlighted that bottom trawling resuspends large volumes of sediment which are partly transported downcanyon as sediment gravity flows. To assess the contribution of downward particle fluxes in La Fonera Canyon (NW Mediterranean) linked to natural sediment transport events and bottom trawling, a near-bottom mooring equipped with a 24-cup sediment trap, a current meter, and a turbidimeter was deployed during 2017 in its axis (1200 m water depth), next to a trawling ground. Temporal variations in the quantity and composition of trapped particulate organic matter were assessed through the analysis of organic carbon (OC), total nitrogen (TN) and several biomarkers (lignins, cutin acids, p-hydroxybenzenes, benzoic acids, amino acid-derived products, dicarboxylic acids, and fatty acids).

High downward particle fluxes ($60\text{--}100\text{ g}\cdot\text{m}^{-2}\cdot\text{d}^{-1}$) were registered in autumn and winter associated to torrential river discharges, seasonal storms and dense shelf water cascading. During these natural events, sediment transported downcanyon had high organic matter contents that were mostly terrigenous in origin. However, the highest downward particle flux ($>140\text{ g}\cdot\text{m}^{-2}\cdot\text{d}^{-1}$) was recorded in the onset of the bottom trawling season in March, after a 2-month seasonal trawling closure. During the following summer months no major natural sediment transport events occurred, but the high frequency of bottom trawling activities ($10\text{--}26\text{ hauls}\cdot\text{week}^{-1}$) near the sediment trap caused considerably high downward particulate fluxes ($80\text{--}125\text{ g}\cdot\text{m}^{-2}\cdot\text{d}^{-1}$) during this season. Compared to autumn and winter months, sediment transferred downcanyon caused by trawling had lower organic matter contents, mostly consisting in refractory compounds (i.e. lignins, p-hydroxybenzenes and benzoic acids) with similar concentrations to those observed in the bottom sediments of the trawling grounds, confirming that this material originates from these areas. During periods with less trawling activity, lower sediment fluxes ($30\text{--}50\text{ g}\cdot\text{m}^{-2}\cdot\text{d}^{-1}$) with higher organic matter contents enriched in labile compounds (i.e. amino acid-derived products, dicarboxylic acids, and fatty acids) were recorded. These results highlight how bottom trawling activities on the flanks of submarine canyons modify the supply of sediment and organic matter

downcanyon. The low-quality of organic matter transferred by bottom trawling activities may ultimately affect the fragile ecosystems dwelling in these deep environments.