Dissolved organic matter dynamics in the mesopelagic fish accumulation layer: implications for C cycling

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The vast majority of marine dissolved organic carbon (DOC), one of the largest reservoir of reduced carbon on Earth, is believed to be passively transported to the mesopelagic and abyssal layers of the ocean where it accumulates over timescales of decades to millennia. However, evidences are growing that the flux of organic matter actively transported every day from the surface to the mesopelagic layer through vertical migration of small animals can be significant. Whether that represents an important source of labile carbon available for the production and respiration of the active microbial community of the mesopelagic realm, and its contribution to oceanic carbon budgets and energy flows, is yet to be explored. Here we present data that suggest that mesopelagic migrating animals may produce an alternative and overlooked source of labile DOC (used at a mean rate of 2.3 μmol C L-1 d-1) that does not accumulate but fuels the metabolism of prokaryotic heterotrophs in the mesopelagic realm of the Red Sea, a particularly warm and oxygen depleted marine basin, generating a disregarded hotspot for heterotrophic prokaryotes. This study examines the DOC pool dynamics through a combination of field sampling and experimental aproaches. Changes in the optical properties of DOM (absorbance and fluorescence), together with changes in the physiological state of the prokaryotic community isolated from the surface and mesopelagic layers, are followed and evaluated. The consequences of this synergic effect in the twilight zone for the global ocean, and the impact on global biogeochemical cycles is discussed.