

{rokbox title=|(a) Standard deviation (2016–2018) of carbon released from the seafloor ($\text{gC m}^{-2} \text{yr}^{-1}$). (b) Coefficient of Variation referred to the mean carbon release at each grid cell :: Image: Authors|images/stories/ieo/imagenespublicaciones/centro-oceanografico-baleares-ieo-csic-carbon-footprint-economic-muñoz-2023-thumb-et-al.jpg|images/stories/ieo/imagenespublicaciones/centro-oceanografico-baleares-ieo-csic-carbon-footprint-economic-muñoz-2023-et-al.jpg{/rokbox x}

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Abstract: Ensuring an economically viable, sustainable and low CO₂ emission extractive fishery is critical in order to achieve the life below water UN sustainable development goals and the climate change commitments of Paris agreement. This challenge is even more relevant in the most overexploited region of the world: The Mediterranean Sea. Here, we use the socio-ecological system of the Spanish Mediterranean commercial fisheries (Northern Alboran Sea, Northern Spain and the Balearic Islands) to develop an integrative impact assessment, including detailed socio-economic, ecosystem indices of the trophic structure of extractive fishery and CO₂ emission analyses combining different gear, vessel size classes as well as a wide range estimation of carbon release from the seafloor by bottom trawling. Northern Alboran Sea preferentially requires reduction in purse seine fishery while in Northern Spain bottom trawling should be reduced first to reach sustainable exploitation. Fuel CO₂ footprint of purse seine and bottom trawling are among the lowest footprints of animal protein production, but considering sweeping released CO₂ from the seafloor the bottom trawling footprint becomes the animal protein production with the highest footprint. Moreover, the lowest bottom released CO₂ estimation overrides 2.7–10 times the CO₂ buried in the seafloor through the biological pump in trawled areas potentially turning the continental shelf from a CO₂ sink to a CO₂ source. Net profit per fuel derived CO₂ emission for all fleets is lower than 1€ kgCO₂⁻¹, being lowest for large bottom trawler (0.025 € kgCO₂⁻¹). Thus, urgent mitigation and adaptation measures are necessary to obtain sustainable fishery in terms of net profit, sustainable seafood extraction and CO₂ emission reduction. Our study provides scientific bases to develop these measures such as the restriction of harmful fishing gear in carbon rich river influenced areas, reduction of bottom contact of the fishing gear, favouring purse seine fishery and smaller bottom trawlers.

Keywords: Bottom carbon release, Trophic level, Primary production required, CO₂ footprint, Fuel consumption.