{rokbox title=|Graphical Abstract :: Image: Authors| thumb=|images/stories/ieo/imagenespublicaciones/centro-oceanografico-baleares-ieo-carbon-footprint-mussel-food-chain-spain-saralegui-et-al-2026-thumb.jpg|}images/stories/ieo/imagenespublicaciones/centro-oceanografico-baleares-ieo-carbon-footprint-mussel-food-chain-spain-saralegui-et-al-2026.jpg{/rokbox}

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The carbon footprint of the mussel food chain in Spain
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Abstract: The global food system is a major contributor to greenhouse gas emissions (GHG), and there is increasing interest in identifying sustainable protein alternatives. Mussels are often promoted as an environmentally friendly source of seafood. However, comprehensive assessments of its carbon footprint, which consider the entire food chain, remain limited. This study estimates the carbon footprint of the mussel food chain in Spain, focusing on its product forms—fresh, frozen, and canned— by reconstructing the mussel supply chain, integrating national production and trade data, and modelling its logistics across international, national, and intraprovincial transport. The relationship between fresh, frozen and processed mussel allows to articulate a consumption approach taking into consideration the interconnections between industrial processing, global supply chains and mussel production. Total GHG emissions reached 287.8 $GgCO_2eq.yr^{-1}$, with the main contributions from aquaculture production (45 %), industrial processing (43 %), and transport (12 %). Emissions linked to domestic consumption are 190.1 $GgCO_2eq.yr^{-1}$, representing 6.3 $kgCO_2eq.kg^{-1}$ edible mussel meat, with pickled mussels representing the most impactful product (8.5 $kgCO_2eq.kg^{-1}$ edible mussel meat), followed by mussels in brine (6.7 $kgCO_2eq.kg^{-1}$ edible mussel meat), fresh mussels (4.1 $kgCO_2eq.kg^{-1}$ edible mussel meat), and frozen mussels (3.6 $kgCO_2eq.kg^{-1}$ edible mussel meat). Although Galicia accounts for 99 % of domestic mussel production, only 25 % of available fresh mussels are destined for direct domestic consumption. The remainder feeds industrial processing or is exported, revealing a structure highly dependent on international trade and interprovincial transport. Our findings show that processing and transport are key contributors, and that the most consumed forms present the highest carbon footprints. We highlight the need to promote more sustainable consumption patterns, enhance local consumption of lower-impact forms, and reconfigure industrial and trade strategies to reduce environmental impacts while maintaining the sector’s economic viability.

Keywords: Mussel aquaculture, Greenhouse gas emissions, Seafood sustainability, Life cycle assessment, Processed seafood, Dietary transitions