**Justification statement**

Transforming global food systems towards low-emissions while improving healthy diets is a significant challenge. We collated data on the nutrients, greenhouse gas emissions and production of UK seafood to evaluate its low-carbon health potential in the context of consumer availability. Pelagic fish and bivalves provided **111% more nutrients than beef and lamb, for 97% lower emissions**. Only four fish species were high production, nutritious, and low-emissions, suggesting these products could **already contribute to reducing population-level nutrient deficiencies (selenium, iodine), with low emissions**. However, trade-offs between nutrients, carbon, price, production, and sustainability suggest most consumers cannot (yet) access healthy, sustainable seafood products.

Our study places nutrient profiles and carbon footprints in the context of real-world seafood production to reveal opportunities for transitioning towards zero-carbon seafood systems. This analysis addresses issues of environmental sustainability, climate change, nutrition, human health, and fisheries, and can contribute to policy on food and health.