Trawling Impacts on Benthic Carbon Sequestration, Storage, and Processing: A Systematic Review

EGU24 – 12798

Stacey Felgate*, Michel Kaiser, and Marija Sciberras

Background: Marine sediments represent one of the planet's largest carbon stores. Bottom trawl fisheries constitute the most widespread physical disturbance of these stores, exerting a potentially significant influence over the oceanic carbon dioxide (CO_2) balance. Recent research has sparked concern that seabed disturbance from trawling can therefore turn marine sediments into a large source of CO_2 to the atmosphere, but the calculations involved carry a high degree of uncertainty. This is primarily due to a lack of quantitative understanding of the cascade effects which occur when benthic systems are disturbed, resuspended, and mixed.

We are using a systematic review approach to ask: how does mobile bottom fishing affect benthic carbon processing and storage?

Answering this requires an understanding of the complex interactions which occur between chemical, physical, and biological elements (Figure 1).

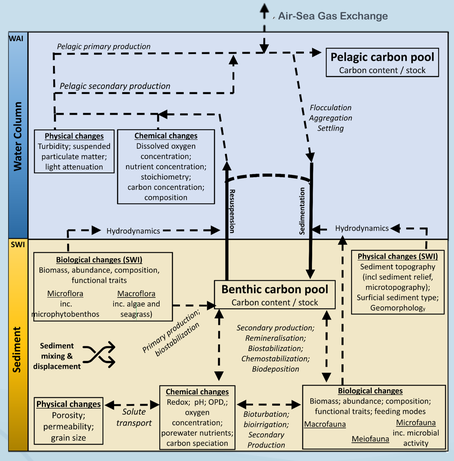
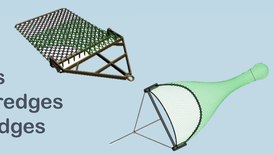


Figure 1: Schematic representation of pathways through which bottom fishing might influence benthic carbon processing and storage. SWI = Seawater Interface; WAI = Water Air Interface; OPD = Oxygen Penetration Depth. Arrows = Interactions.

Interventions: For a study to be included, it must include primary data from a disturbance that has been caused by mobile bottom-contacting fishing gears, including:

- Beam Trawls
- Otter Trawls
- Bottom Seines
- Mechanical Dredges
- Hydraulic Dredges



We are also gathering studies which contain data of analogous natural or anthropogenic disturbances for future investigations.

Comparators: Acceptable study designs may be experimental or observational, and field or lab based, but must allow a comparison between fished and non-fished areas, or between fishing intensities:

- Control Impact (CI)
- Before After (BA)
- Before After / Control Impact (BACI)
- Gradient Studies

Modelling studies are not included unless they include new data, but their reference sections are checked for useful sources.

Populations and Outcomes: We are interested in any population (parameter) that directly or indirectly controls carbon processing in benthic systems (Figure 1). The associated outcomes (units) are clearly defined, and include

- Concentration (mg/L)
- Flux (mg / m^2 / day)
- Content (%)
- Dry weight (%)

A full list of populations and outcomes is provided as a supplementary file.

This work is being conducted in consultation with a Scientific Advisory Panel of subject experts: John Aldridge, Stefan Bolam, Sarah Breimann, Emil de Borger, Jolien Claes, Jochen Depestele, Graham Epstein, Clement Garcia, Natalie Hicks, Jack Laverick, Gennadi Lessin, Finbarr (Barry) O'Neill, Sarah Paradis, Ruth Parker, Ryan Pereira, Alex Poulton, Claire Powell, Craig Smeaton, Paul Snelgrove, Justin Tiano, Johan van der Molen, and Sebastiaan van de Velde.

Stage One: We sent a questionnaire out to > 30 subject experts, asking them to help us identify the key processes through which bottom trawling might influence benthic carbon processing

Stage Two: A 2-day hybrid workshop, translating and augmenting the questionnaire responses into a theoretical schematic and co-creating a search string and systematic review protocol (*in review).*

Stage Three: Literature searches produced 150,000 hits, which became 50,000 (title screen), 7,000 (abstract screen), 800 (full text screen), and ultimately yielded 390 studies suitable for data extraction.

Stage Four: Data extraction is underway, allowing creation of a database which will allow us to calculate the effect size of demersal trawling on a wide range of benthic carbon-relevant parameters.

Stage Five: Our work will identify knowledge clusters and gaps, informing future prioritisation of research. We will present this work through a database, knowledge map, and meta-analysis.

Methodology: A systematic review and meta-analysis of all existing peer-reviewed and grey literature containing primary data on the effect of mobile bottom contact fishing on benthic carbon processing.

Figure 2: Flow chart showing steps involved in a typical systematic review process, from development of a research question to publication of the finalised output.

This method is designed to minimise bias and provide robust outputs. For more detailed information on the process, we suggest the Collaboration For Environmental Evidence (CEE).

s.felgate@hw.ac.uk www.staceyfelgate.com @staceyfelgate