GREEN MARITIME TRAFFIC:
THE UNKOWN IMPACTS OF EMISSION REDUCTION ON MARINE BIODIVERSITY

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STARTING POINT

- Maritime decarbonization cuts CO_2 and greenhouse gases (GHG) to mitigate climate change, but broader ecological effects on biodiversity and ecosystems remain unclear, even though research regarding these topics has grown since 2015.
- For example, some alternative fuels produce different types of emissions, and open-loop scrubbers discharge pollutants into the sea.
- This study reviews scientific literature to explore how emission cuts and biodiversity trade-offs are addressed.
- The study aims to identify knowledge gaps and support more sustainable maritime solutions.

METHODS

- A list of GHG emission-reduction solutions and measures was compiled from several sources.
- Solutions were grouped into four categories:
  1) Energy efficiency in operations
  2) Alternative fuels
  3) Air emission mitigation technologies
  4) Alternative energy sources.
- The categorization guided a systematic literature search, conducted in June 2024.

RESULTS

- Key pressures on marine biodiversity from emission reduction efforts:
  1) Waterborne discharges (scrubber effluent, ballast water, antifouling paint, and chemicals).
  2) Underwater noise.
- Biodiversity assessment methods varied. Direct metrics were rare, and biodiversity was often addressed indirectly within Life Cycle Assessment, Environmental Impact Assessment, or qualitative approaches.
- Regulatory tools for marine biodiversity risk assessment are constrained by data gaps (e.g., limited species and ecosystem monitoring) and uncertainties in technology adoption, fuel emissions, and evolving regulations.

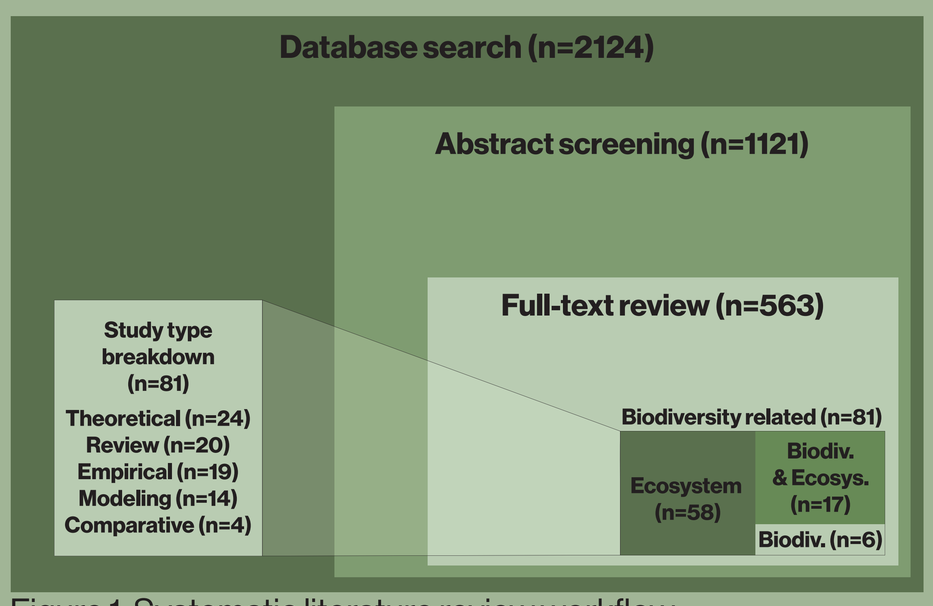

Figure 1: Systematic literature review workflow

SELECTED TRADE-OFFS IN THE BIODIVERSITY RELATED LITERATURE (n=81):

1) Biodiesel and methanol: Lower CO_2, but higher NO_x may increase eutrophication and acidification risks.
2) Hydrogen and ammonia: Reduce GHGs, but leaks could cause local toxicity and affect aquatic life.
3) Antifouling coatings: Improve fuel efficiency, but may leach biocides harmful to marine species.
4) Battery-electric vessels: Reduce underwater noise, but battery production and disposal may release heavy metals into coastal waters.

BIODIVERSITY SHOULD BE MORE EXPLICITLY INTEGRATED INTO MARITIME DECARBONIZATION RESEARCH AND FUTURE EMISSION REDUCTION EFFORTS.

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