

A systematic literature review

Impacts of Offshore Wind Energy on Ecosystems



28 November, 2025

National Institute of Aquatic Resources, Technical University of Denmark (DTU Aqua)

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The Growth of Wind Energy

- Key to EU energy strategy
 - European Wind Power Action Plan: COM/2023/669
- Undoubtedly, important role in reduction of CO2 emissions.
- Trade-offs with other industries and conservation goals.



European Commission, 2023

[IMMC.COM%282023%29669%20final.ENG.xhtml](https://immc.com/282023%29669%20final.ENG.xhtml)
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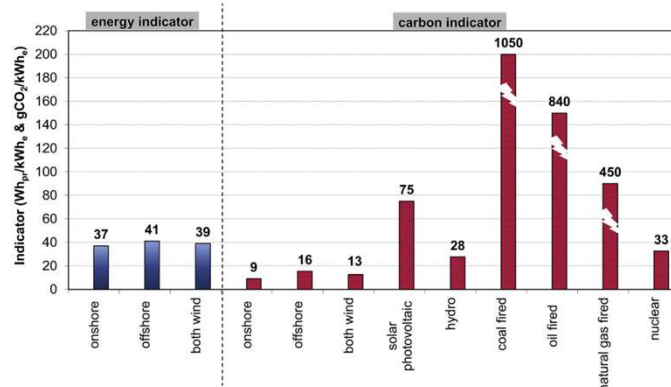
Impacts of Offshore Wind Infrastructure on Ecosystems

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The Growth of Wind Energy

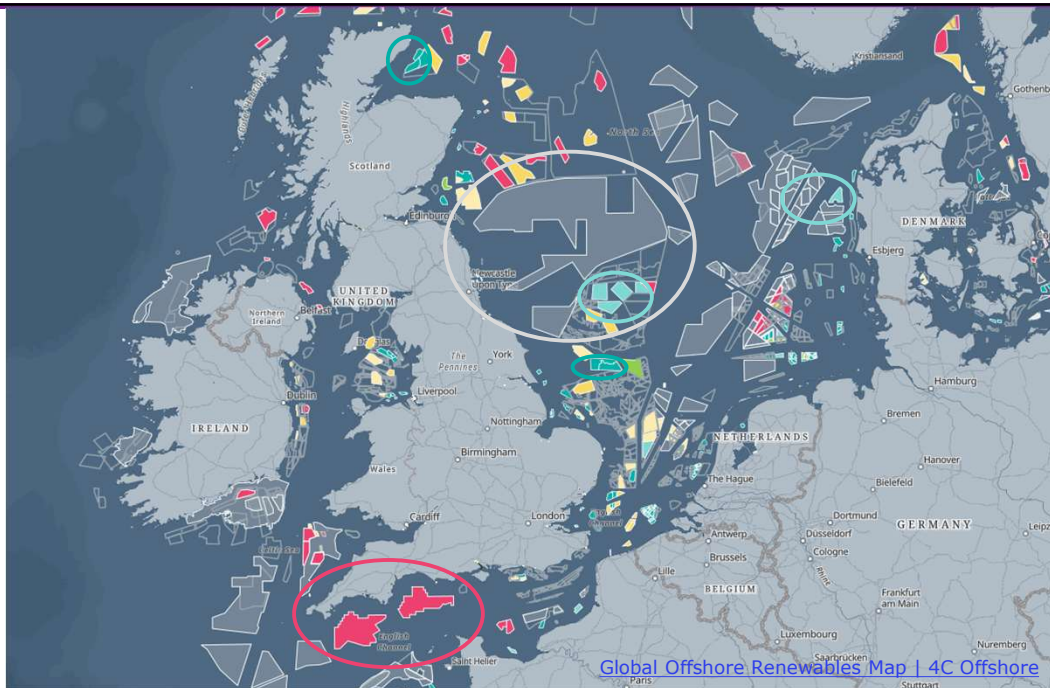
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Kaldellis & Apostolou, 2017

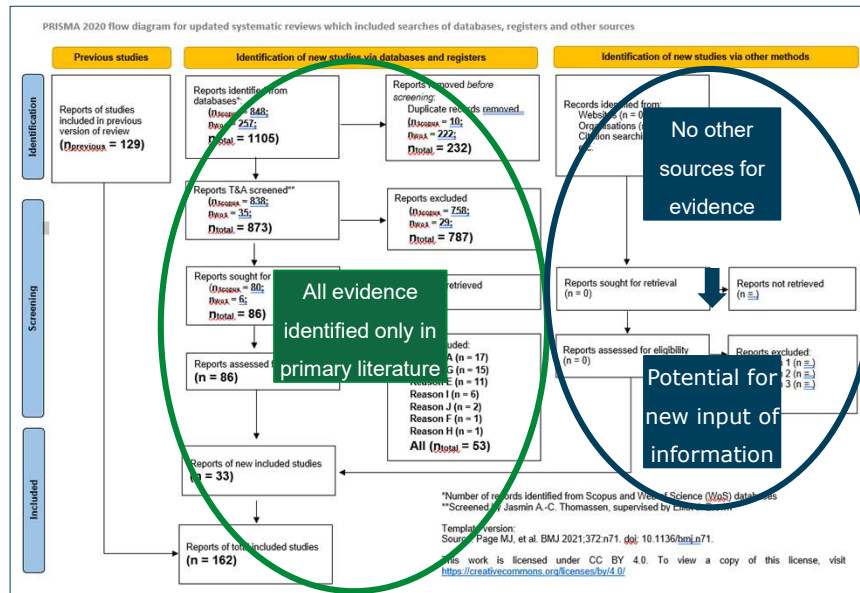
<https://doi.org/10.1016/j.renene.2017.02.039>

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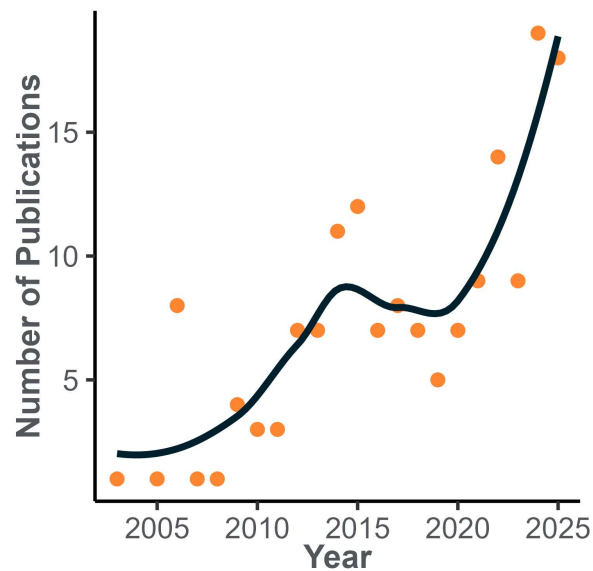
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Systematic review process



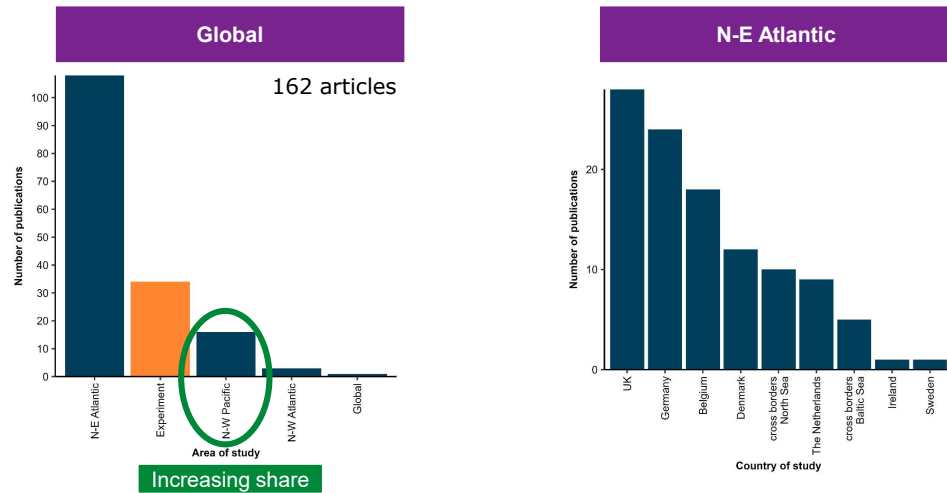
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Systematic review process



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The geographical distribution of sites studied

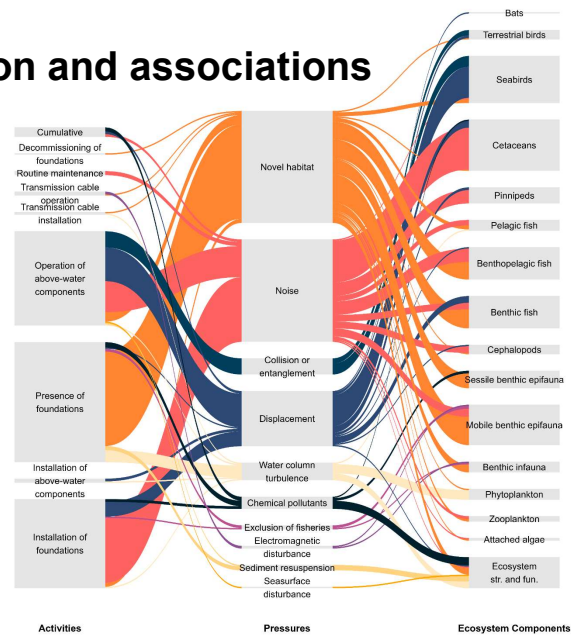


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Methodology: Data extraction and associations

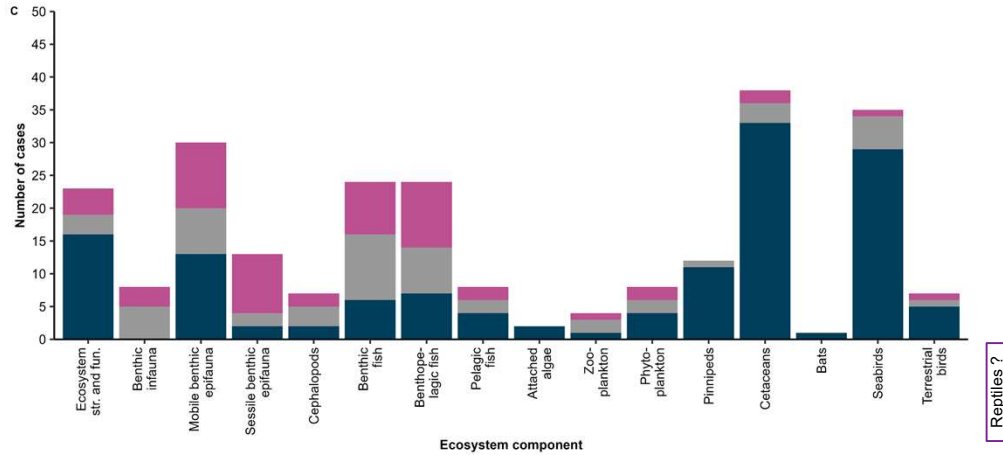
Offshore Wind:

- Activities
- Pressures
- Ecosystem components



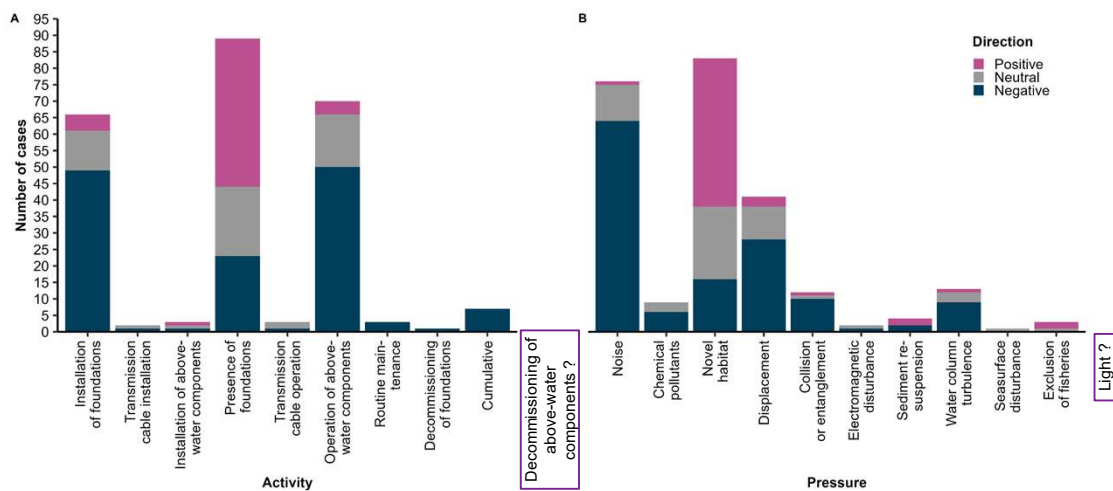
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The Direction of the Impact



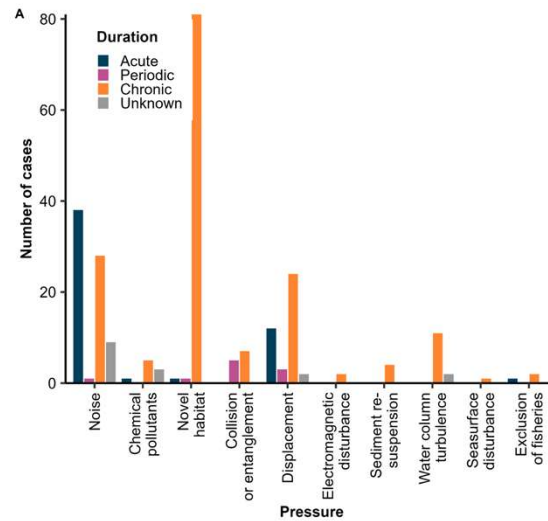
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The Direction of the Impact



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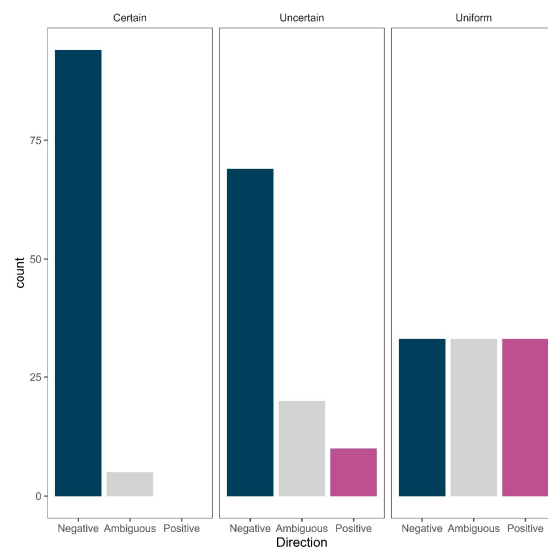
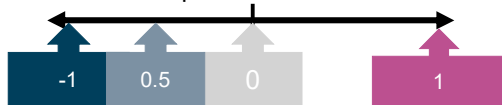
The Duration of the Impact



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Meta-analysis

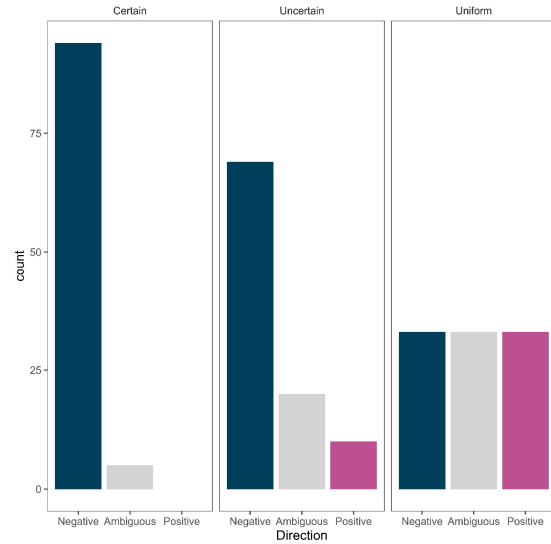
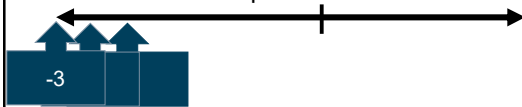
- Continuum of scores
- Three possible relationships
- Use entropy (order / disorder)
 - Positive = 1
 - Neutral = 0
 - Negative = -1
- Weighted by quality of the studies on
 - Methodology
 - Spatial scale
 - Temporal scale



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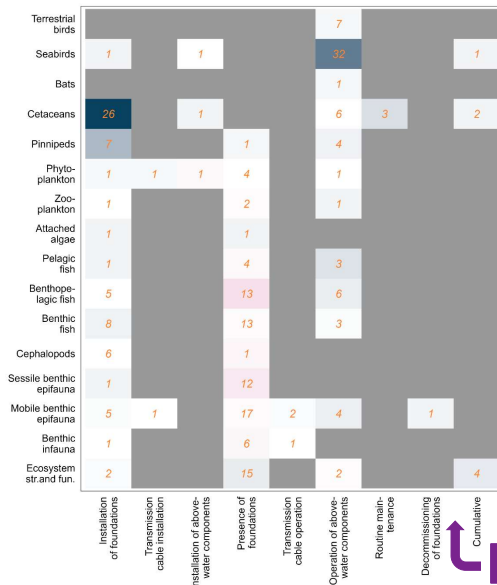
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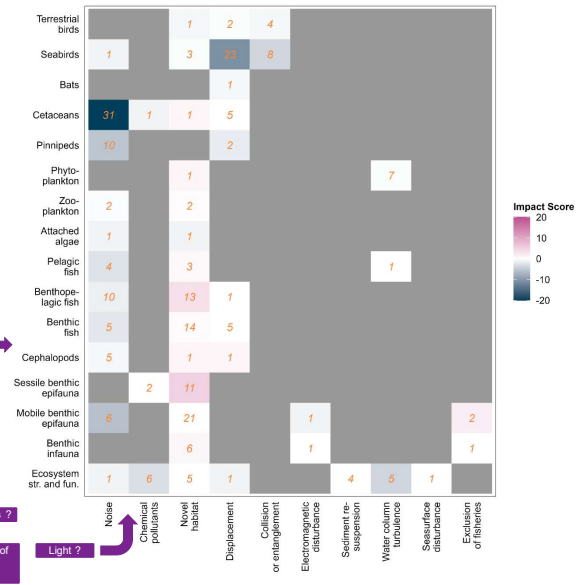


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Activities



Pressures



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Conclusions

- **Evidence** is becoming **available** to inform decisions about wind infrastructure in relation to other environmental objectives:
 - Continuing to update our database.
- All indications of impacts, be they **positive or negative**, are a perturbation to the natural state and these should be considered in the **context of local conservation objectives**.
- In the absence of specific knowledge, **our synthesis provides decision makers with evidence** from other contexts, and an indication of the certainty/uncertainty in these generalisations.
- In some cases, **local specific knowledge is necessary**, as generalisations are too uncertain.
 - E.g. benthic organisms, including fish, around foundations.
- More installations = **more opportunities to study impacts** and mechanisms of impacts, to fill the **many knowledge gaps** that still exist.
 - Including the socio-economic trade-offs for energy security and community resilience.
- Shared methods for literature reviews across **different sectors** for **future studies** of **cumulative impacts**.

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Thanks for
listening



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