Ocean Multi-Use: Can Seaweed Farms be Co-Located with Offshore Wind in New Jersey?

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INTRODUCTION

New Jersey's wind energy sector provides an opportunity to advance the blue economy through ocean multi-use. With its low carbon footprint, seaweed farming could provide various ecosystem services, including climate mitigation, food production, and water quality improvement, when co-located with offshore wind. Yet, constraints to implementing offshore wind multi-use in NJ remain uninvestigated. In this study, a multifaceted socioecological approach was used to assess the potential to co-locate seaweed farms with NJ offshore wind.

METHODS

1. **Data Synthesis:** Physiological tolerance limits of two native seaweed species, *Saccharina latissima* (sugar kelp) and *Fucus vesiculosus* (bladderwrack), were mined from published literature. Oceanographic data for NJ offshore waters were extracted from the World Ocean Atlas (WOA) database to assess whether conditions are appropriate for seaweed growth. Seasonal temperature and salinity data at coordinates closest to the Ocean Wind 1 site were averaged across 0–25 m depth.
2. **Quick Scoping Review (QSR):** To assess constraints/risks and knowledge gaps for seaweed farm–offshore wind multi-use, a systematic search of 8 key terms was conducted using SCOPUS (n=634) and Web of Science (n=667) databases. Results were imported to EndNote, where duplicates were removed (n=727) and screened using exclusion/inclusion criteria to determine eligibility for the study (n=317). Remaining results were exported to Excel, where 13 were identified to consider co-location of wind and seaweed farming sites. Those 13 papers were further screened for constraints/risks and knowledge gaps.
3. **Stakeholder Survey:** Regional stakeholders were identified to be eligible for the study. An online survey was constructed to assess stakeholder's sector, knowledge of the wind industry or seaweed farming industry, and views on co-location benefits and risks, and policy limitations.

RESULTS

1. **Data Synthesis:** Temperature and salinity tolerance limits of seaweed species and oceanographic data from WOA indicate the potential for seasonal seaweed cultivation in NJ offshore waters (Fig. 1).
2. **QSR:** Environmental, Economic, Technical, Social, Political, and Legal constraints/risks and knowledge gaps were identified (Fig. 2). Constraints/risks were predominantly Environmental, with ecosystem shifts as the primary concern. Knowledge gaps were primarily Economic and Technical, with a need for improved product marketability and financial feasibility.
3. **Survey:** Data not yet available. Results should identify strengths/weaknesses/benefits/risks of local multi-use.

DISCUSSION

These findings should be of interest to policy makers and aquaculturists looking to forward the NJ blue economy. Next steps may include piloting seaweed farms offshore to assess production capacity and the environmental and social effects.

AUTHOR AFFILIATIONS

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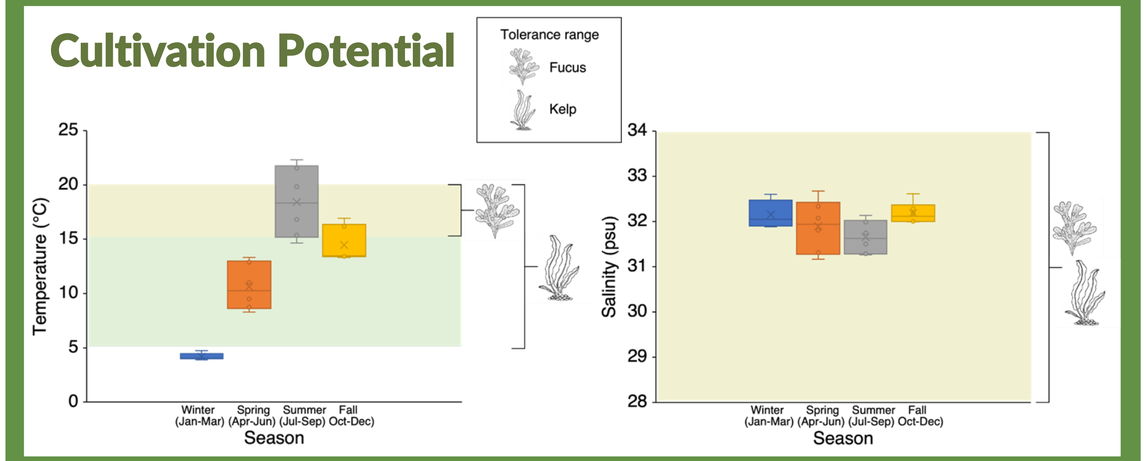

Fig. 1 Boxplots of seasonal temperature (°C) and salinity (psu) near Ocean Wind 1 with overlayed tolerance ranges of Kelp and Fucus (colored bands). Temperature tolerances indicate the potential for seasonal cultivation, while salinity aligns across all seasons.

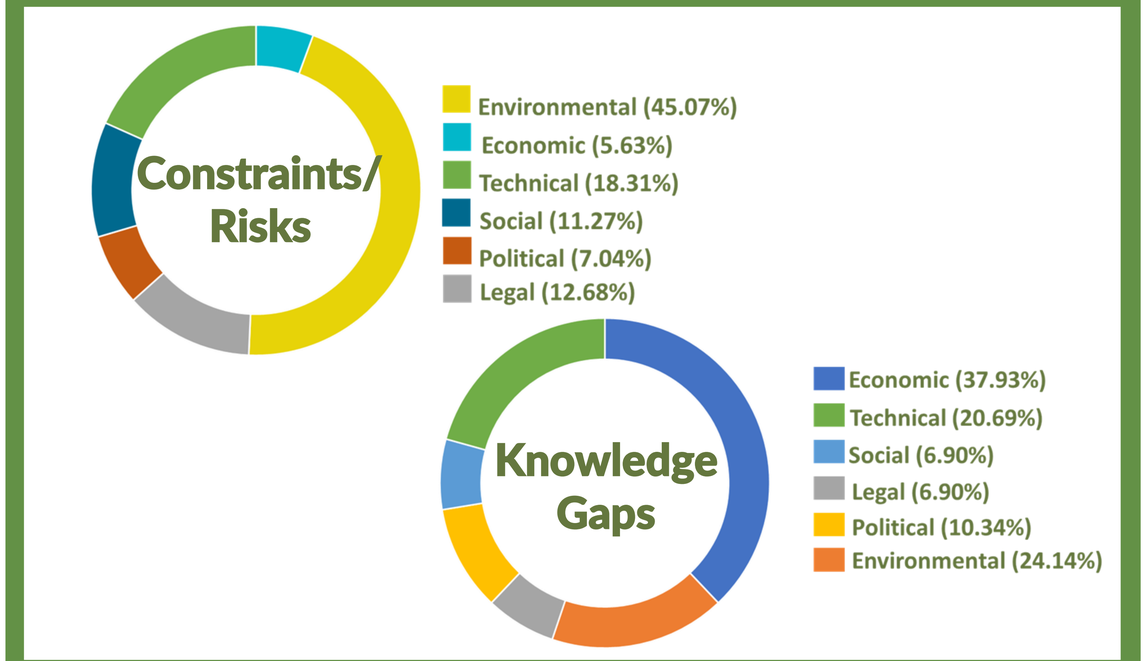

Fig. 2 Constraints/risks and knowledge gaps for seaweed farm–offshore wind multi-use identified through the QSR.

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