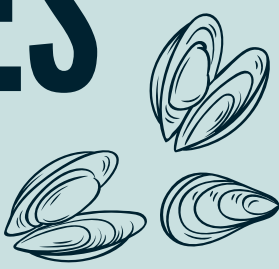
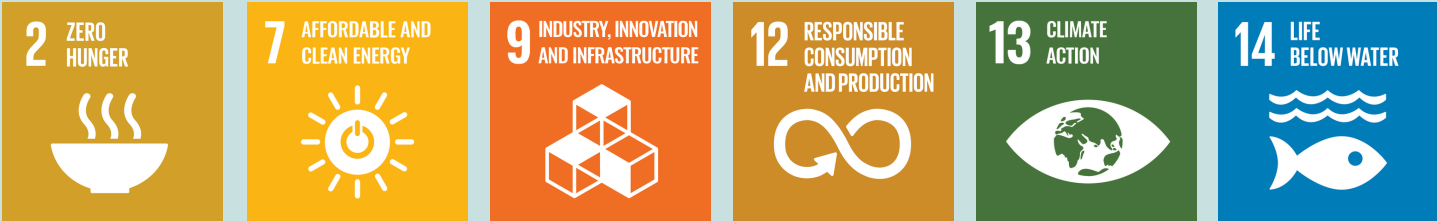


# MULTI-USE OF OFFSHORE WIND FARMS WITH BIVALVES



Caroline Svane Neby, Tsang Wing Cheung, Finn Corus, Sofie Karlstad, Svenja Forstner, Synne Skadberg  
SDG214

## What to know



- human activity causes heavy exploitation of coastal zones
  - produces increased stress on ecosystems
  - need for sustainable and area-efficient solutions
- Idea: use offshore wind farms together with farming of mussels & kelp (low-trophic aquaculture)

## Advantages



### People

- Additional food resources for a growing global population
- Job opportunities where traditional fishing activities may be declining
- Involves local communities in renewable energy and aquaculture projects



### Planet

- Ecosystem building: increased biodiversity, biomass & species abundance
- Bivalves are filter feeders and depend on available phytoplankton (abundant in many areas)
- Improves sustainable use of marine resources in coastal areas



### Profit

- Economic study finds positive internal rate of return and net present value for bivalve farming
- Bivalve farming: requires minimal gear & simple structures (e.g. ropes, frames)
- Requires little maintenance
- Bivalve aquaculture as a profitable addition to offshore wind farms

## Disadvantages



### People

- Concerns about noise pollution and changes in cultural practices
- Visual and aesthetic impacts from offshore wind infrastructure
- Requires adaptation & retraining for fishermen to engage in bivalve aquaculture activities



### Planet

- Disruption of marine ecosystems & migration routes, potentially harming local fish populations
  - Construction & maintenance can disturb marine habitats and cause sedimentation
  - Introduces invasive species to the area



### Profit

- Requires comprehensive regulatory frameworks to ensure environmental protection and sustainable use of resources
- Initial investment and infrastructures development costs might be high
- Requires partnership for successful research for integration of bivalve aquaculture with offshore wind farms

Sugar kelp and mussels absorb CO<sub>2</sub> from the surrounding water.

CO<sub>2</sub>

SUGAR KELP

MUSSELS

C + N + P

N + P

Harvesting of mussels and sugar kelp removes organic carbon (C), nitrogen (N) and phosphorous (P) from the sea.

Mussels and sugar kelp filter nitrogen (N) and phosphorous (P) out of the surrounding water.

## Possible in Norway?

### Northern Europe (NE):

- offshore wind farm areas to increase x9 (2013-2030)
- Ideal growing conditions for suitable bivalves (salinity level, temperature, nutrients)
- Norway could provide a large space for wind farms combined with bivalves

## Concept in practice

**Most suitable species:** Blue Mussel, Flat Oyster & Pacific Oyster

**2000s:** first tests in European waters

**2017:** first cultivation of mussels in offshore wind farms in Belgium

**2024:** 2-year Dutch test project & planned project in Germany

⚠ Large knowledge gaps still present



Sources:

- bluegent.ugent.be "Edulis: mosselen kweken in volle zee tussen de windturbines" (2017)
- Buck, B. H. et al. "Lessons from stakeholder dialogues on marine aquaculture in offshore wind farms: Perceived potentials, constraints and research gaps" (2014)
- Buck, B. H. et al. "Mussel cultivation as a co-use in offshore wind farms: Potential and economic feasibility (2010)
- Buck, B.H. et al. "The German Case Study: Pioneer Projects of Aquaculture-Wind Farm Multi-Uses"
- De Borghe, Emil et al. "Offshore Windfarm Footprint of Sediment Organic Matter Mineralization Processes" (2021)
- Degraer, Steven et al. "Offshore Wind farm artificial reefs affect ecosystem structure and functioning" (2020)
- De Mesel, I. et al. "Succession and seasonal dynamics of the epifauna community on offshore wind farm foundations and their role as stepping stones for non-indigenous species" (2015)
- Maar, M. et al. "Multi-use of offshore wind farms with low-trophic aquaculture can help achieve global sustainability goals" (2023)
- Metcalfe, Julian et al. "Movements, migrations and space use of fish in the North Sea in relation to offshore wind farms" (2015)
- www.vessellinder.com "OOS International announce the launch of test OOS-SMF (pilot)" (2024)