

Scaling up marine aquaculture

Unlocking the potential of Algae & Shellfish in the EU

A NEW ERA FOR SUSTAINABLE AQUACULTURE

The European Union (EU) is facing increasing challenges related to food security, environmental sustainability, and the growing demand for renewable resources. Marine aquaculture offers an opportunity to alleviate pressure on land-based food production while fostering sustainable economic growth. However, scaling up shellfish and algae farming requires careful assessment of ecological, economic, and regulatory factors.

ESTIMATING THE BENEFITS OF SCALING UP AGAINST ENVIRONMENTAL COSTS

This study aims to provide an overview of how increased low-trophic level aquaculture production could be planned in the future to contribute to the blue economy under the EU's Green Deal. More in detail, this study assesses the potential of shellfish and algae to recycle nutrients and estimates the greenhouse gas emissions generated by their production, while taking into account the impact of the uptake of the key toxic and mineral contaminants from the marine environment that could affect the marketing of the algae or shellfish as food or feed.

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Study report



https://cinea.ec.europa.eu/publications/digital-publications/study-scaling-eu-cultivation-shellfish-and-algae_en

KEY INSIGHTS

Production

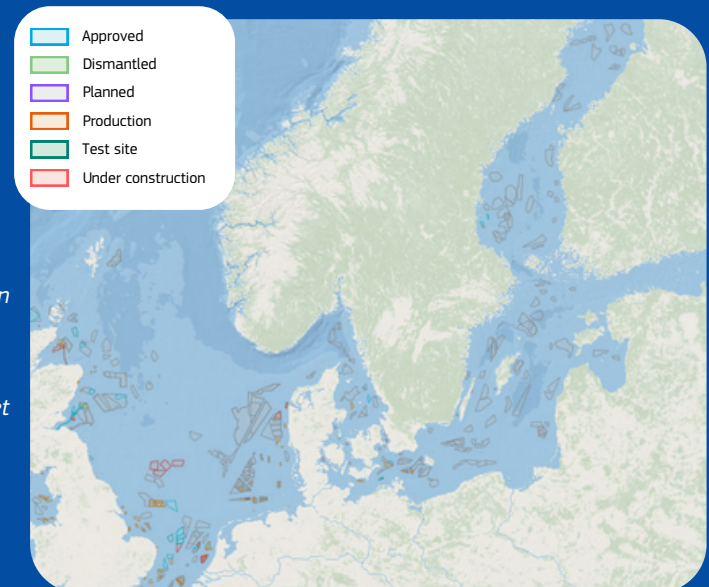
The study simulations highlight a huge potential for macroalgae and shellfish production in wind farms in the Baltic and North Seas, which could place the EU as one of the major global macroalgae producers.

Contaminants

Our median-case mapping of contaminant risks reveals that there is no situation in which we would expect unsafe values in seaweed or bivalves, and this is true for all contaminants included in the study (cadmium, lead, mercury and benzo(a)pyrene). In the high-end contaminant scenario, given that wind-farm sites tend to be some distance offshore, away from coastal sources, even in most of the most polluted areas, the majority of shellfish and seaweeds produced are likely to be safe with respect to the 4 contaminants evaluated.

THE STUDY AREA

The study focused on offshore wind farms planned, under construction or in operation in the North Sea and Baltic Sea (source EMODnet 2025).



THE PLATFORM

The study updated and developed two models to estimate:



The production potential of shellfish and algae



The risk of potential over-threshold concentrations of contaminants.

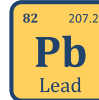
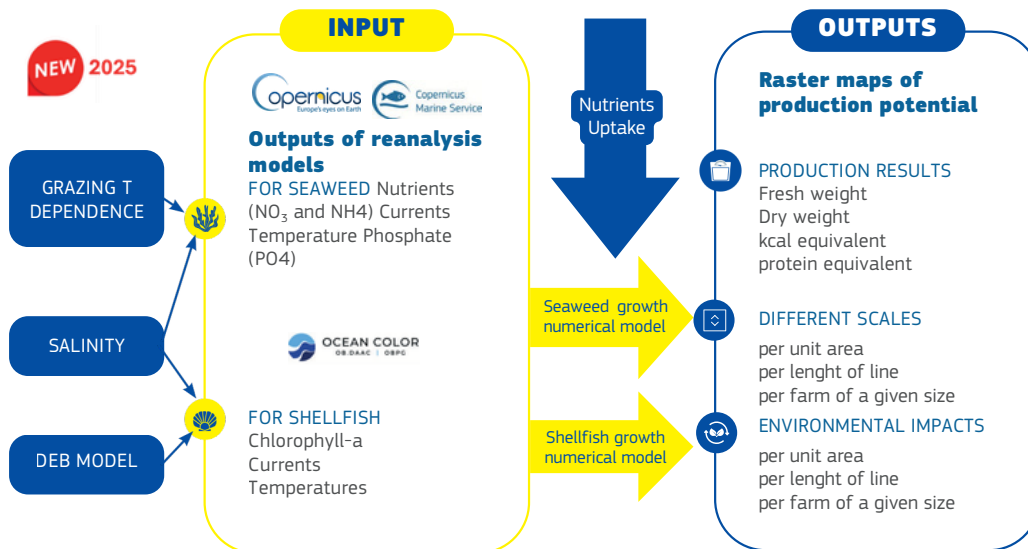
Both models are publicly available on the project's platform, run by ACRI-ST.



THE PRODUCTION MODEL

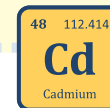
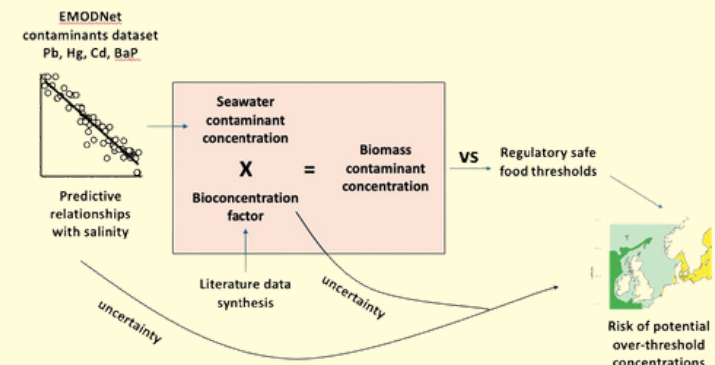
The production potential was estimated through numerical modelling based on data from the Copernicus Marine Service (CMEMS).

The model also offers insights on the environmental outcomes of shellfish and algae species, such as uptake of CO₂, uptake of nutrients (for seaweeds) and uptake of chlorophyll (for shellfish).



THE CONTAMINANTS MODEL

The study developed a policy-relevant, novel, empirical risk evaluation methodology which can be applied for additional contaminants and with increasing certainty as data on seaweed and shellfish contaminant levels become more frequent. The contaminants included in the study are cadmium, lead, mercury and benzo(a)pyrene.



THE RESULTS

PRODUCTION POTENTIAL,

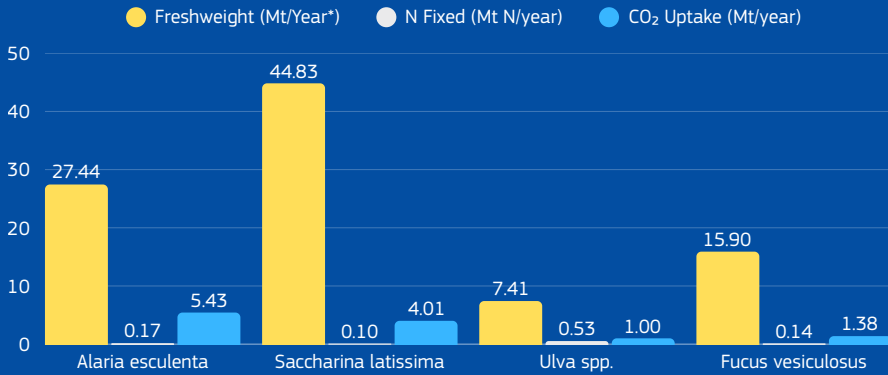
CO₂ UPTAKE AND N FIXATION (OR STORAGE)



Macroalgae

EU production : 87 000 tonnes*

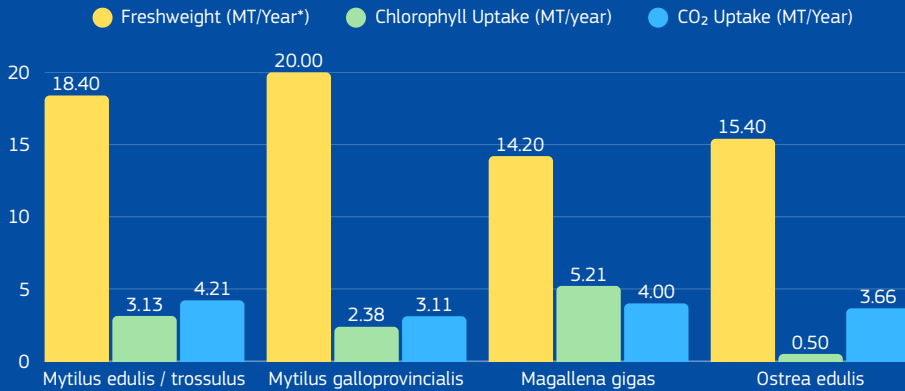
(FAO, 2021) - *nearly all originating from wild harvesting



Shellfish

EU production : 536 500 tonnes

(FW, 2022)



*MT/year : million tonnes per year

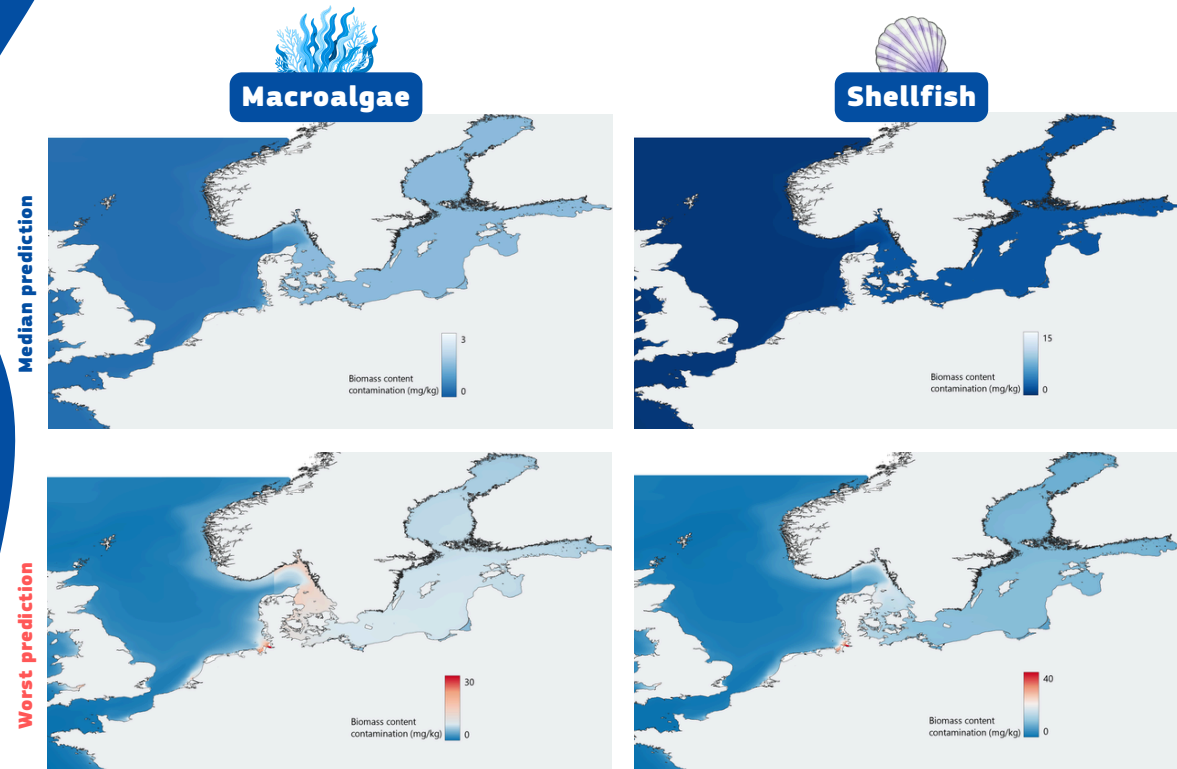
These results are to be intended as maximum theoretical potential production, as this was the scope of the study; other variables will need to be investigated in detail (e.g. actual feasibility, investment costs, profitability, etc.) in order to assess the actual potential of macroalgae cultivation in windfarms in the EU. Also, the analysis only took into account physical, chemical and biological factors, without considering distance from markets or legal restrictions.

CONTAMINANTS

The analysis of contaminant risk produced maps of likely biomass concentrations in seaweeds and bivalves in two scenarios: Median contaminant concentration, and top 10% of EMODNet contaminant concentrations. The analysis covers 4 contaminants : **lead, cadmium, mercury and benzo(a)pyrene** across two scenarios (median and worst prediction). Below, the focus is on lead pollution. The full study includes results for all analysed pollutants.



Maps of predicted concentration of lead in biomass



The expert team behind the study

This study, managed by ACRI-ST, a company specialising in earth observation, is supported by scientists specialising in the issues addressed (BMRS) and specialists in environmental socio-economics and communication (ACTeon)

