
Demonstration of Innovative Functional food production systems based on more sustainable value chains of marine and freshwater raw materials for conscientious EU consumers

A large, stylized graphic on the left side of the slide, consisting of a green leaf-like shape at the top, a blue water droplet in the center, and three curved blue lines at the bottom, mirroring the NOVAFOODIES logo.

2.0 Processing techniques of marine and algae products in the context of sustainability

2.2 Application of micro- and macroalgae in different branches

Main objective

 Know diverse applications of micro- and macroalgae in different industry sectors

Learning outcomes

 Learn about novel/innovative applications of algae (in different industry sectors)

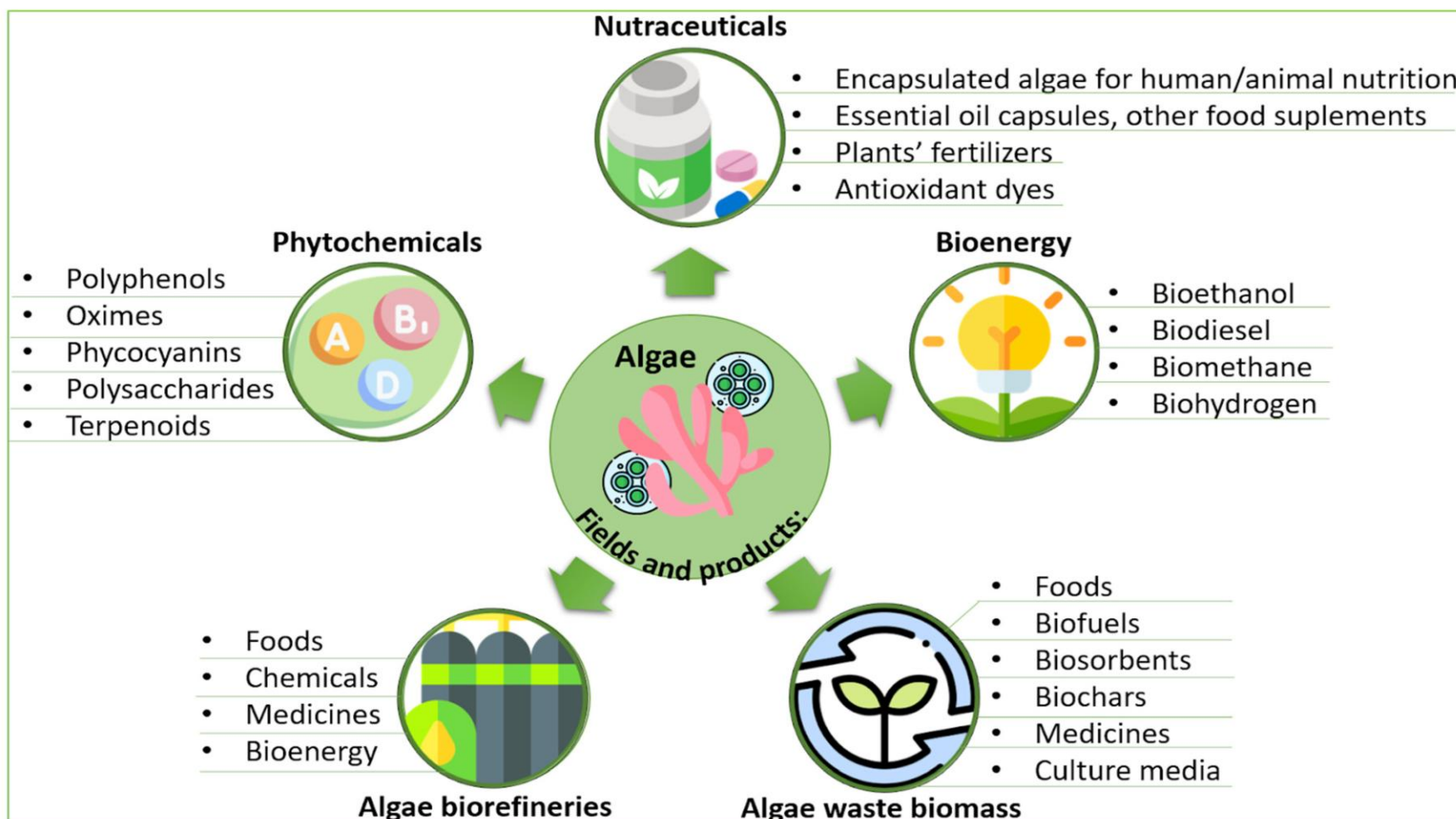
 Analyse the opportunities and risks of those applications

Agenda

-  Different sectors and products for which algae can be used
-  Group exercise – algae market in Europe
-  Risk assessment
-  Group exercise – “Mini risk assessment - Algae-based product”

***What uses of algae do you know?
Which of them do you use in your daily life?***

Applications of micro- and macroalgae



New fields of research and development:

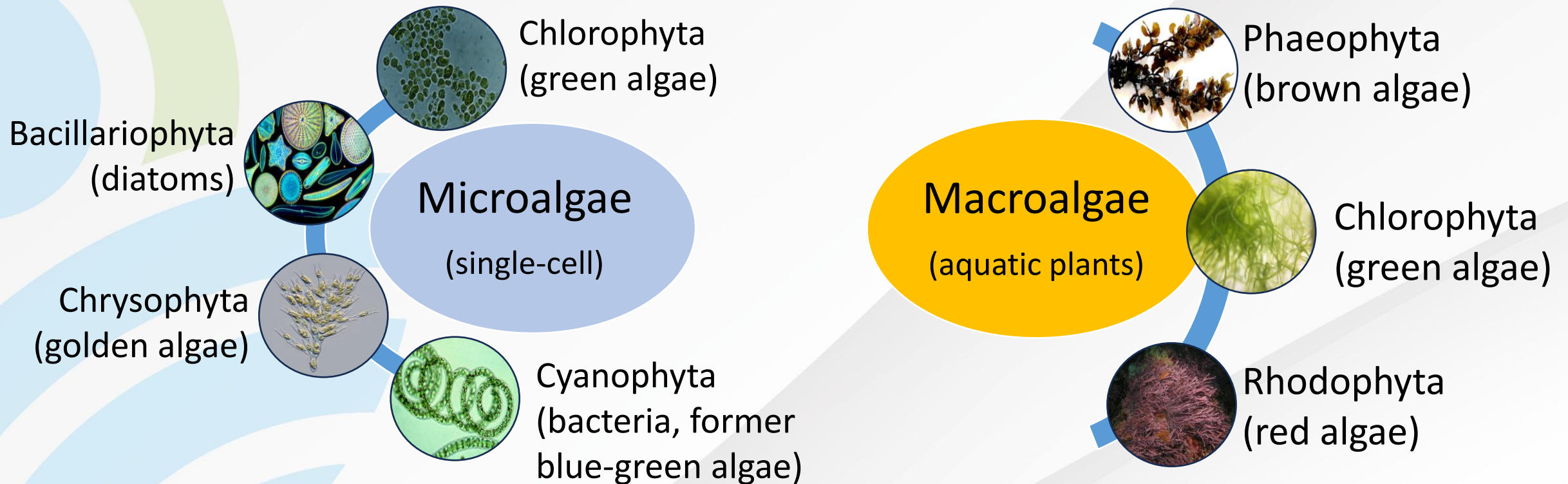


Eco-packaging

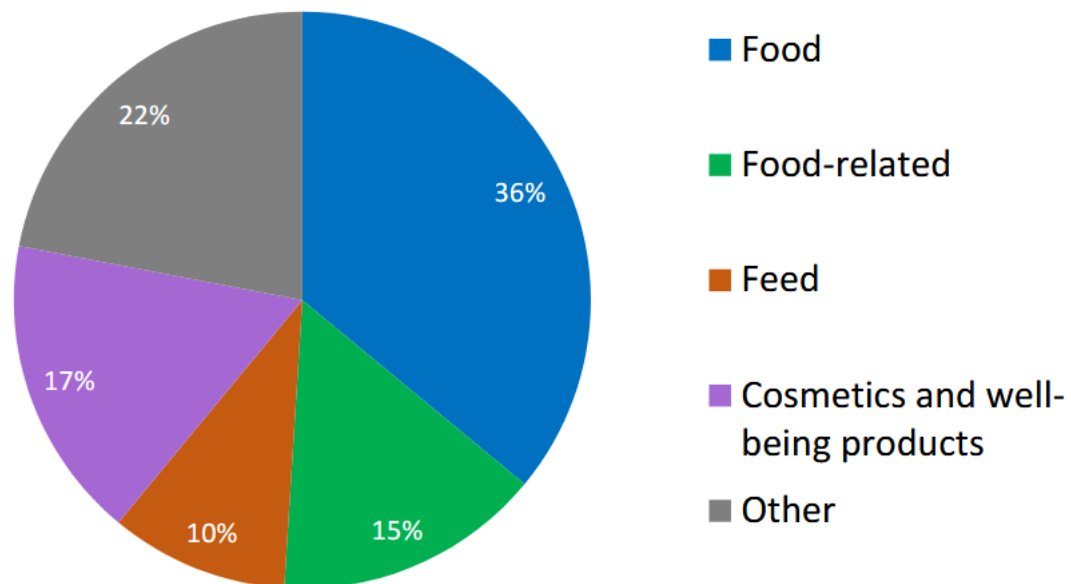


Plant-based products

Algae classification



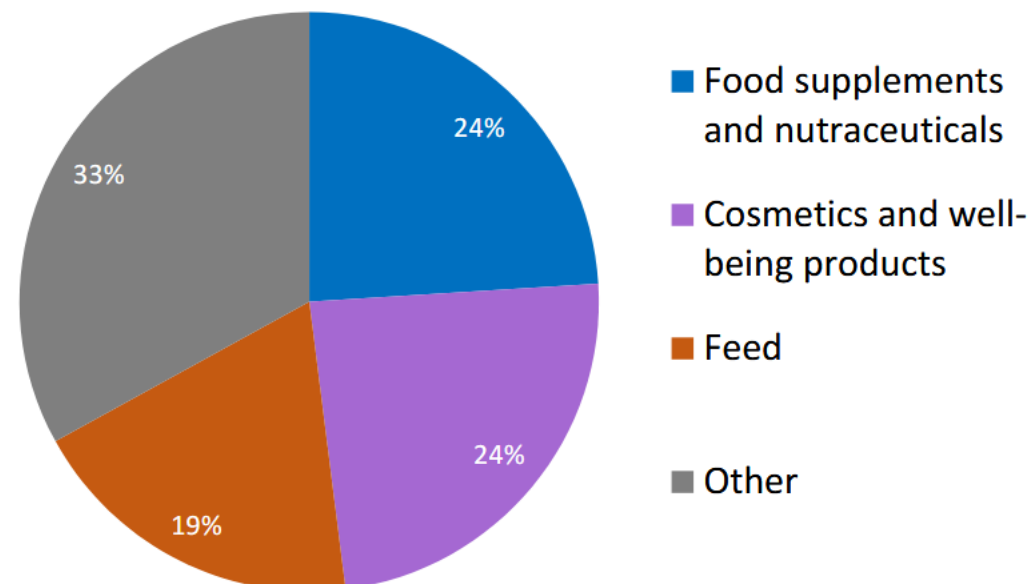
Macroalgae applications across Europe



Policy Department for Structural and Cohesion Policies, 2023

Others: e.g. fertiliser, biofuel ...

Microalgae applications across Europe



Policy Department for Structural and Cohesion Policies, 2023

Others: e.g. biofuel, pharmaceuticals ...

Algae market



Small market in Europe
in global relation

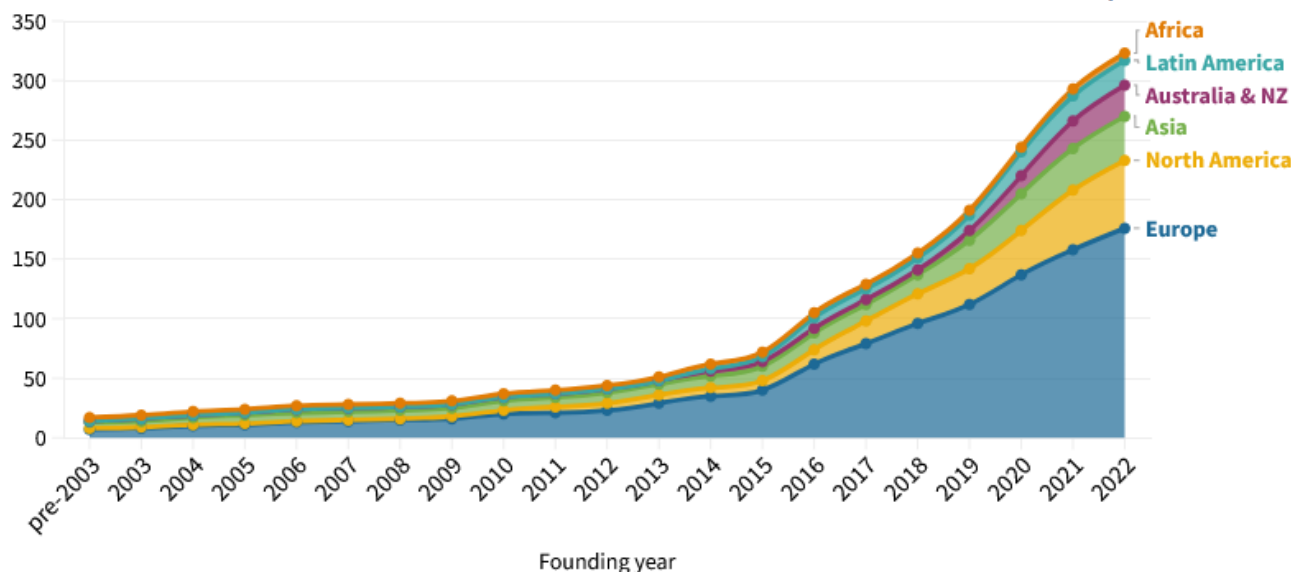


Europe with large start-up scene



Growing sector worldwide

High-growth companies per region (cumulative)



Market data:

Global algae market value by revenue, 2021:	€18.5 billion (Vantage Market Research)
Global algae market value forecast for 2028:	€33.7 billion (Vantage Market Research)
Global macroalgae biomass production, 2019:	35.8 million tonnes (FAO)
European share:	➤ 0.8%
Global microalgae biomass production, 2019:	56 456 tonnes (FAO)
European share:	➤ 0.63%
European algae biomass production, 2019:	287 390 tonnes (FAO)
Macroalgae share:	➤ 99.88%
Microalgae share:	➤ 0.12%
European algae turnover, 2018:	€350 million (European Commission)
European seaweed imports, 2016:	€554 million (Seaweed for Europe)

Policy Department for Structural and Cohesion Policies, 2023



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Group exercise

Why is the algae market in Europe so small in global relation?

-  Form groups of 4-5 people
-  Discuss the European Algae Market
-  Take into account consumer acceptance, regulation, climate etc.
-  Afterwards: One person per group gives a short summary of your assessment



Time for your presentations!

-  What reasons did you come up with?
-  Are there any factors you are not sure about?
-  Do you have own experiences to share?



Prevention of the development of the algae sector in Europe

Production & Processing	Climate & Environment	Regulation	Safety aspects	Market
Need of technological advancements to scale the sector	Climatic limitations for expanding outside production (microalgae)	New Species: administrative limitations to develop applications	High concentration of contaminants in some algae (growth conditions)	Limited market demand
Lack of necessary facilities for large-scale processing and value chain integration	Sustainability concerns for harvesting seaweed from wild stock	Licensing of production sites and admission of products is very time-consuming	High concentrations of iodine in some algae	Limited consumer awareness
Significant production, processing, infrastructure and operations costs	Sea-based cultivation: uncertainties (esp. off-shore)	Fragmented governance framework		Cultural preferences (no traditional food in Europe)
Low scalability of photobioreactors (microalgae)	Seasonal variability			Perception issues of consumer
Knowledge gaps				Uncertain profitability / limited investment

Novel food prototype development, Cluj-Napoca, Romania

 Technical University of Cluj-Napoca

 Enhanced nutritional profile of white bread



Pictures provided by Technical University of Cluj-Napoca

Key facts

Bread

Product



Alaria esculenta

Used
species



UNIVERSITATEA TEHNICĂ
DIN CLUJ-NAPOCA

Video



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Risk assessment



Identification of hazards and evaluation of risks

- **Hazards**
can be anything, that has the potential to cause harm (physical, chemical, biological, ...)
- **Risk** (high or low)
is the likelihood, that someone may be harmed by a hazard
- **Risk assessment**
is the process to (systematically) evaluate these risks



HACCP – risk assessment system for/in the food industry



1,058 results for "algae risk assessment" anywhere published in "EFSA Journal"

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- ☐ Biological hazards 27
- ☐ Chemical contaminants 36
- ☐ Cross-cutting science 14
- ☐ Data 10
- ☐ Emerging risks 1
- ☐ Food ingredients and packaging 15
- ☐ GMO 13
- ☐ Methodology 5

Sorted by: Relevance

Export Citation(s)

Conclusion on Pesticide [Open Access](#)

Conclusion on the peer review of the pesticide risk assessment of the active substance sea-algae extract

European Food Safety Authority

EFSA Journal | Volume 10, Issue 1

First published: 10 January 2012

Scientific Opinion [Open Access](#)

Safety and efficacy of a preparation of algae interspersed bentonite as a feed additive for all animal species

Funded by the European Union

Received funding from the European Union under Grant Agreement N° 101084180.

EFSA Panel on Additives and Products or Substances used in Animal Feed (FEEDAP),

Guido Buihan, Gabriela Anulic, Giuseppe Arimondi, Massimo Bazzani,

Risk assessment

-  Identification of hazards and stakeholders that are vulnerable (indirectly)
 - *What could cause harm or sickness (in people or the environment)?*
-  Characterising hazards and exposure assessment
 - *Can hazards and risks be minimized or even eliminated?*
 - *Assessment of risks based on*
 - *probability of occurrence and*
 - *severity of possible harm*
-  Prioritising risks
 - ... based on importance, in reference to the risk assessment
-  Deciding on preventive action, implementing and monitoring them
 - Time to take action!
 - *What are preventive or protective measures, that should be in place to control and minimize risks?*
 - The assessment should be reviewed, to adapt it with up-to-date methods of evaluating risks and measuring critical values.





Risk level = Likelihood x Severity

***Risk
Assessment
Matrix***

Likelihood			Severity				
	Qualitative		Negligible	Minor	Moderate	Significant	Severe
			1	2	3	4	5
	Very likely	5	Medium	High/ Medium	High/ Medium	High	High
	Likely	4	Medium/ Low	Medium	High/ Medium	High/ Medium	High
	Possible	3	Medium/ Low	Medium/ Low	Medium	High/ Medium	Medium/ High
	Unlikely	2	Low	Low	Medium	Medium	Medium/ High
	Very Unlikely	1	Low	Low	Low	Medium	Medium/ High



Group exercise

Mini Risk assessment – Algae-based products



Form groups of 4-5 people



Choose a product made from microalgae or macroalgae (be creative!)



Identify 3 risks



Suggest **1 mitigation strategy for each risk**



Afterwards: One person per group gives a short summary of your assessment



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Time for your presentations!

-  What product did you choose?
-  What are the risks and mitigations you came up with?
-  Were there any challenges in defining them?



Literature

- Hernández A, González-Moya M., Márquez A., Acevedo L. (2024). Review microalgae drying: A comprehensive exploration from conventional air drying to microwave drying methods. *Future Foods*, 10(2024).
- Dias Hornes da Rosa et al., (2023). Macroalgae and Microalgae Biomass as Feedstock for Products Applied to Bioenergy and Food Industry: A Brief Review. *Energies*, 16 (4), 1820. <https://doi.org/10.3390/en16041820>
- Araújo R et al., (2021). Current Status of the Algae Production Industry in Europe: An Emerging Sector of the Blue Bioeconomy. *Frontiers in Marine Science*. 7:626389. <https://doi.org/10.3389/fmars.2020.626389>
- Kuech, A., Breuer, M., Popescu, I., (2023). Research for PECH Committee. The future of the EU algae sector. European Parliament, Policy Department for Structural and Cohesion Policies. Brussels.
- <https://www.efsa.europa.eu/en/glossary/risk-assessment>, last access 28.05.2025
- <https://www.efsa.europa.eu/en/methodology/guidance>, last access 28.05.2025



Thank you very much for your attention!

*Materials prepared by:
Lisa Meidl
LVA
lisa.meidl@lva.at*