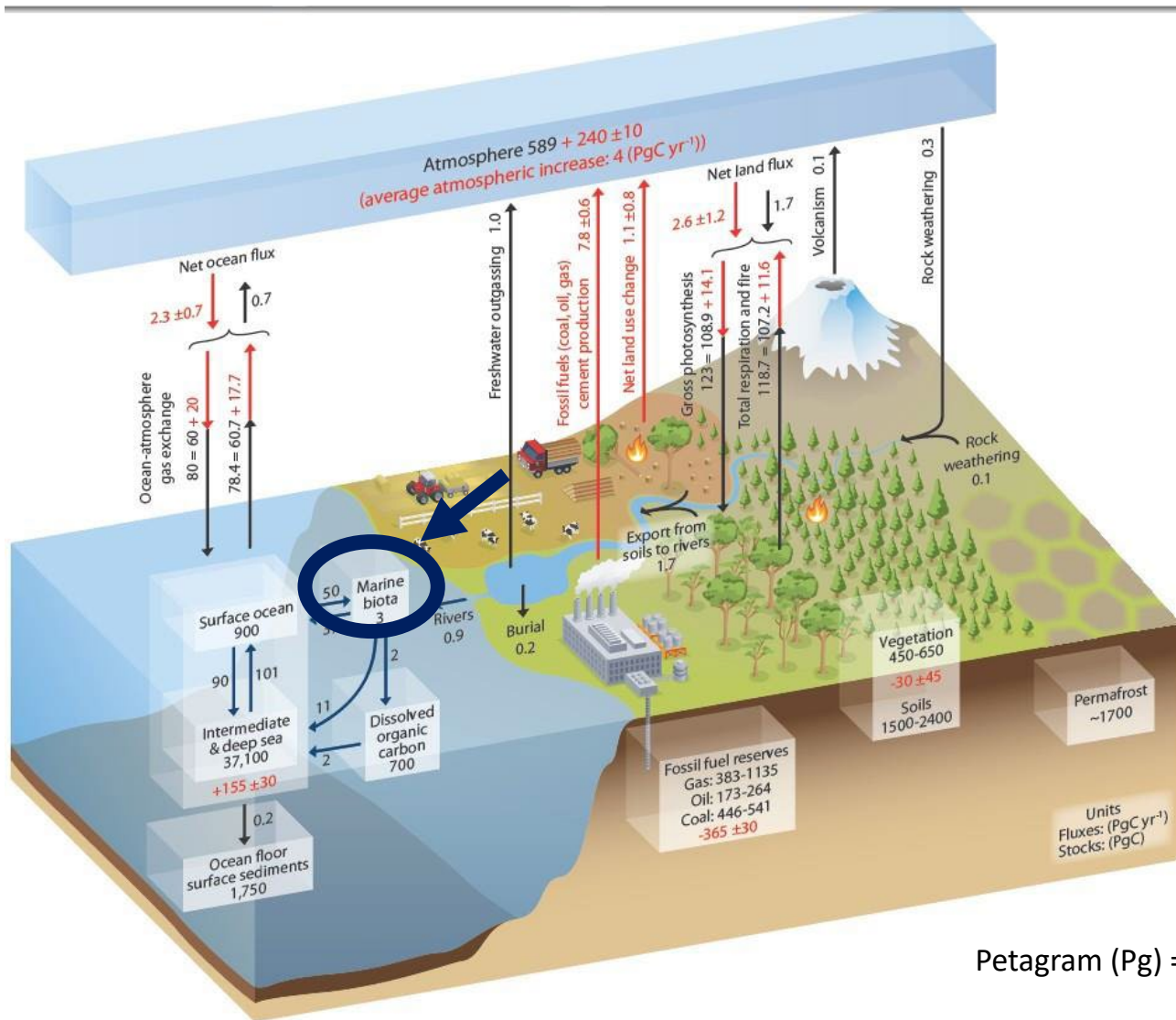


Nordic perspectives on the development of macroalgal aquaculture

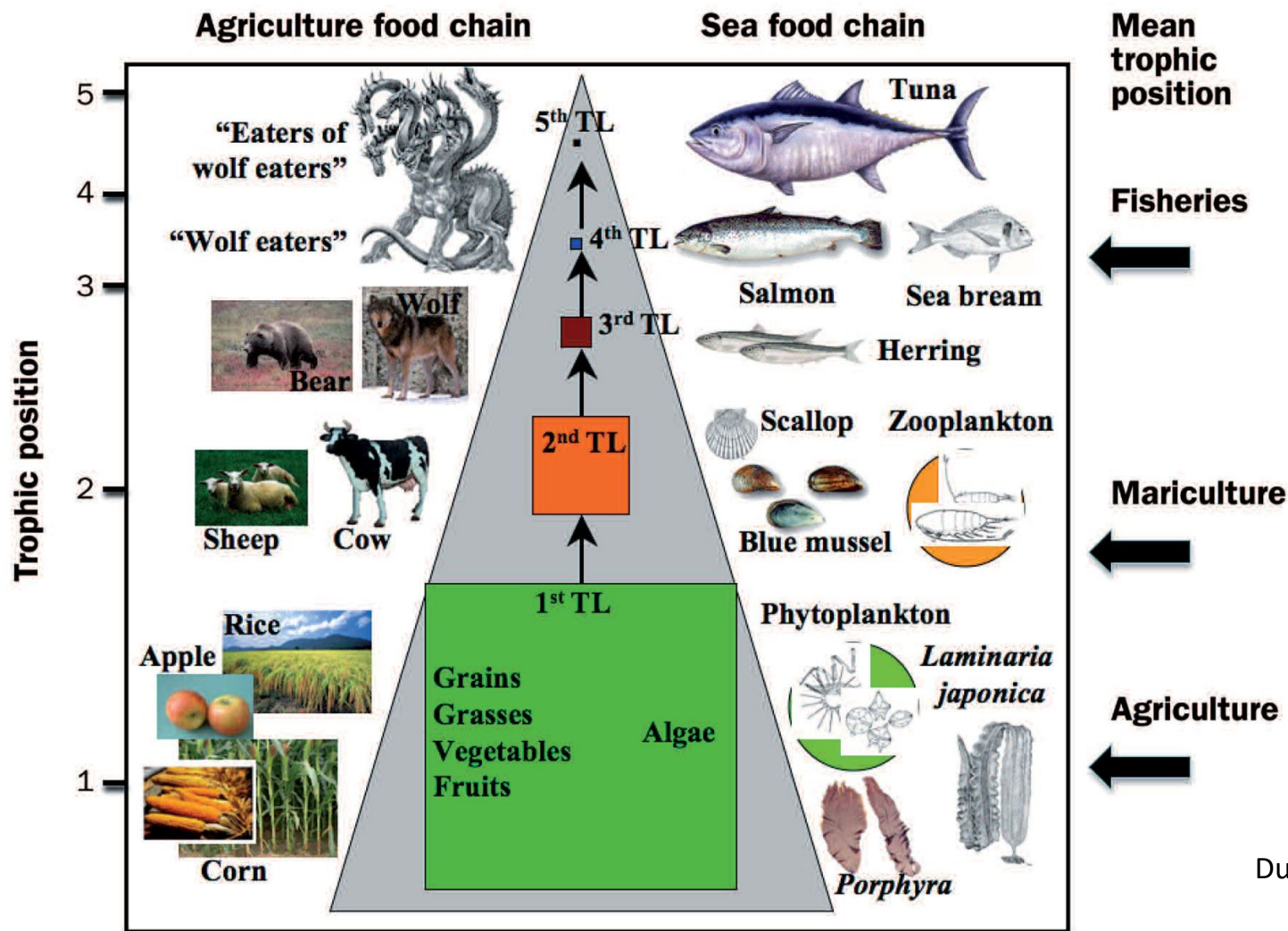
Kristian Spilling
Finnish Environment Institute - SYKE

Turku, 23 August 2022



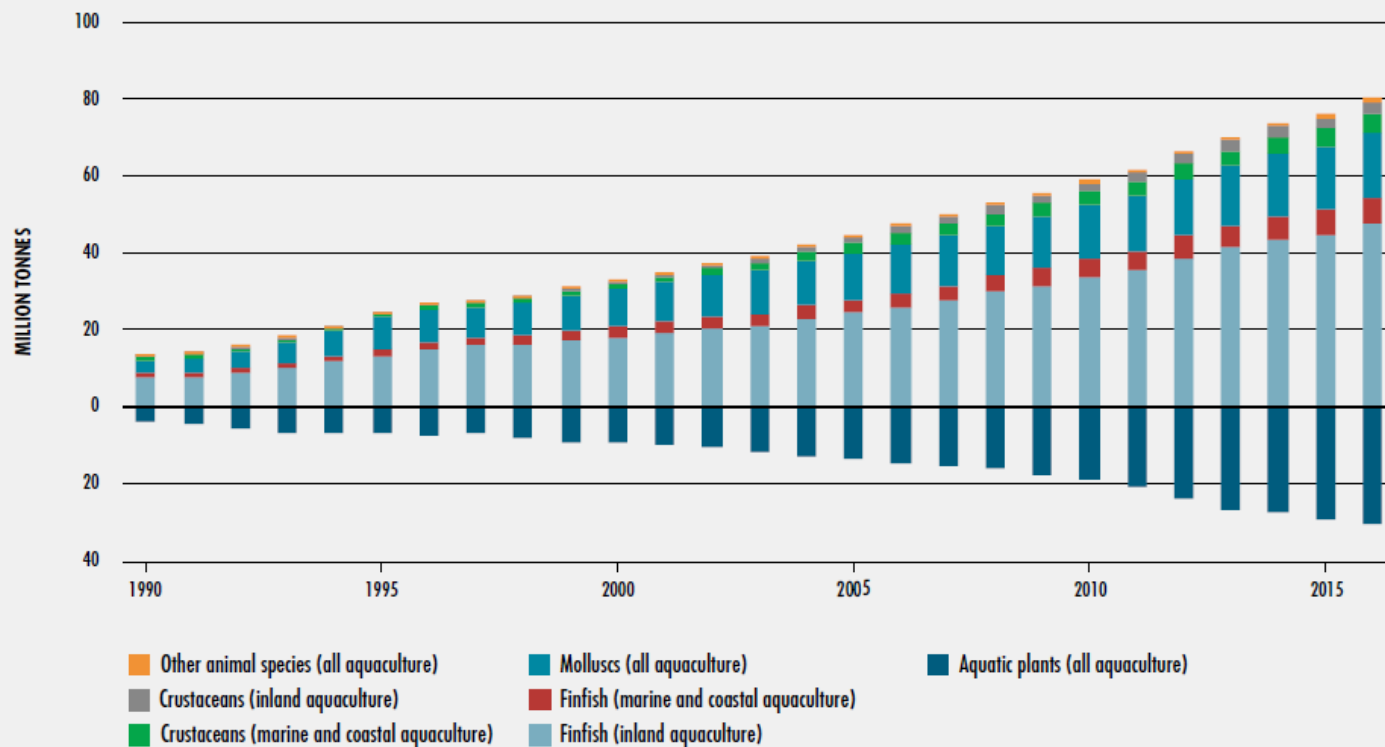
IPCC

Petagram (Pg) = billion tonnes (10^{15} g)



Duarte et al 2009

FIGURE 5
WORLD AQUACULTURE PRODUCTION OF FOOD FISH AND AQUATIC PLANTS,
1990–2016




FAO 2018

- EU InterReg project GRASS
<https://www.submariner-network.eu/grass>
- Nordic Council of Ministers project SUSCULT





European Union legislation on macroalgae products

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Macroalgae production in Northern Europe: Business and government perspectives on how to regulate a novel blue bioeconomy

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EU legislation relevant for macroalgae



Commission Regulation (EC) No 710/2009
organic aquiculture animal and production



Maritime Spatial Planning Directive 2014/89/EU
management of the marine spaces: ecosystem approach



Regulation (EU) 2018/848
organic production and labelling of organic products



Marine Strategy Framework Directive 2008/56/EC
achieve or maintain Good Environmental Status



Regulation 2015/2283
on novel food

Water Framework Directive 2000/60/EC
achieve good status of all water bodies

**Not specific EU legislation
on macroalgae**

Regulation 708/2007
use of alien or absent species
in aquiculture

Habitats Directive 92/43/EEC
conservation of natural habitats
and wild fauna and flora

Recommendations 218/464
monitoring metals and iodine



Alien Species Regulation 1143/2014
management of invasive alien species introduction

Commission Regulation No 1881/2006
Maximum arsenic, cadmium and lead levels

Regulation EC No 396/2005
Maximum levels of mercury



Environmental Impact Assessment Directive 2014/52/EU
assess the potential environmental impact of private and public projects

Adapted from *Barbier et al 2020*



MSP and national marine strategies

GRASS	MSP	MARINE STRATEGIES	SEAWEED CULTIVATION
FINLAND	YES; MSP 2030*	Finnish Bioeconomy Strategy 2014* National Aquaculture Strategy 2022 Marine Strategy River Basin Management Strategy	*Mentioned as part of blue biotechnology: potential biomass with high level added value and removing nutrients *Potential in energy production
SWEDEN	Proposed in 2019; In process of adopting*	Maritime Strategy* Food Strategy	*Potential aquaculture activity to obtain ingredients for food, feed, medicine or energy industry, and potential to reduce nutrients. *Macro- and microalgae with potential in aquaculture activity
GERMANY	YES	National Bioeconomy Strategy*	Unknown in MSP *Potential source of raw materials for different industries
ESTONIA	Proposed in 2019; In process of adopting*	Agriculture and Fisheries development plan until 2030 *	*Potential aquaculture activity. Includes natural growth potential and suitable cultivation sites. Potential Cluster-solutions: combining fish and algae farms *Seaweed as an aquaculture activity
LATVIA	YES; MSP 2030	Bioeconomy Strategy 2030*	Not in the MSP *Seaweed with potential in chemical and pharmaceutical industry
POLAND	Proposed in 2019; In process of adopting	National Smart Specialization Strategy Maritime Policy of the Republic of Poland until 2020	Not mentioned
RUSSIA	No legally defined	Strategy for the Socio-Economic Development	Not mentioned



MSP and national marine strategies

SUSCULT	MSP	MARINE STRATEGIES	MACROALGAE INCLUDED
ICELAND	In process; Coastal Area Plan for Westfjords and East fjords	National Planning Strategy 2015-2026	Not mentioned
NORWAY	YES ; Coastal Zone Planning for Barents Sea, Norwegian Sea, and North Sea and Skagerrak	Environmentally Sustainable Norwegian Aquaculture Industry 2009 Ocean Strategy 2019	Not mentioned
DENMARK	YES ; adopted in 2021	Danish Aquaculture Strategy 2014-2020* Marine Strategy II (2018-2024) **	Not mentioned in the MSP *Seaweed can reduce nutrients, compensatory farming, animal feed **Algae: NEGATIVE ecosystem effect due to eutrophication, harmful algae blooms
LITHUANIA	Preparing for submission; Comprehensive Plan of the Republic of Lithuania until 2030	Progress Strategy 2030	Not mentioned



National macroalgae-related laws, permits and authorities

GRASS	LAWS	PERMITS	AUTHORITY
FINLAND Cultivation	Water Act Environmental protection Act	Water and environmental permits	Application: Centre for Economic, development, Transport and Environment Granted: Regional State Administrative Agency
SWEDEN Cultivation	Environmental Code under Act on Water Operations	Water areas permit (> 0.3 ha)	Application: Land and Environmental Court Granted: County Administrative Board
GERMANY Cultivation	Federal Waterways Act Water Acts of the Länder	Water permit; IMTA also fishing permit Lease water contract	Federal Waterways and Shipping Agency + state-level authorities
ESTONIA Harvesting	Fishing Act	Fishing permit	Agriculture and Food Board
Cultivation	Water Act Natural Conservation Act	Superficies licenses, building and water permit	Consumer Protection and Technical Regulatory Agency
LATVIA Cultivation	Marine Environment Protection and Management Law Conservation of Species and Biotopes Law Environmental Impact Assessment Law Protection Zone Law	Aquaculture permit	Ministry of Agriculture: National Board of Fisheries
POLAND Cultivation	Law in cultivation of living organisms Law in Erection and exploitation of structures Water Law Nature Conservation Act	Permit for cultivation of living organisms Water permit, building permit	Ministry of Maritime Economy and Inland Navigation: Fisheries Department
RUSSIA Harvesting		Fishing permit	Department of Organization and Regulation of Fisheries Department of Development of Aquaculture and Reproduction of Aquatic Biological Resources
Cultivation		Cultivation permit	



National macroalgae-related laws, permits and authorities

SUSCULT	LAWS	PERMITS	AUTHORITY
ICELAND Harvesting	Regulation on the acquisition of Seaweed for commercial purposes no 90/2018	Contract from the landowner	Directorate of Fisheries
Cultivation	Seaweed cultivation bill in the parliament Management of Marine Resources Fisheries Management Act Fishing Fees Management Act Marine and Coastal planning Act Aquaculture Act Environmental Impact Assessment Act	Fishing permit	Application: Environmental and Health Inspection (small operations); National Planning Agency (large operations); Environment Agency Granted: National Planning Agency/ Directorate of Fisheries
NORWAY Cultivation	Aquaculture Act Pollution Control Act	Fishing and water use permits, including species-specific seaweed permit Discharge permit Environmental assessment for > 10 ha	Application: County Governor
DENMARK Cultivation	Fisheries Act Coastal Protection Act Impact on natural reserve (BEK 874/2008) Executive order on Environmental assessment (BEK 579/2013) Certificate of organic seaweed	Seaweed farming permit Environmental Impact Assessment	Application: County Council Granted: Danish Coastal Authority
LITHUANIA Cultivation	Law on Fisheries, amended in 2016	Fishing permit No license needed for aquaculture	For fishing: Fisheries Service
FAROE ISLANDS Cultivation	Act on Marine Resources Aquaculture Act	Seaweed-cultivation license	Application: Food and Veterinary Agency Granted: Ministry of Environment, Industry and Trade



National macroalgae-related activities



Companies licensing experiences

- Based on interviews
- Showcases from FINLAND, SWEDEN, ESTONIA, GERMANY and NORWAY





National macroalgae-related activities: FINLAND

 **ORIGIN
BY OCEAN**



Founded in 2019

Activities: pilot cultivation of *F. vesiculosus*, seeding technology, harvesting of cyanobacteria, use *Sargassum* sp. from the Caribbean

End-product: biomolecules for food, cosmetics, detergents



LISENSING PROCESS

Regulation: water and environmental Act

Evaluation authorities: ELY, MMM, AVI, Vöylävirasto

Application authority: ELY

Grated authority: AVI

Form: fish farming application

Permits: water permit (ownership or contract) and environmental permit?

Application period: 8 months

License valid: unknow

*"We are building
the market"*

*"Approval processes
in Finland do not
recognize seaweed
cultivation"*

CHALLENGES

Not specific regulation

Undefined licensing process

Not suitable application form

Unknown authorities involved



National macroalgae-related activities: SWEDEN

NORDIC
SEAFARM



Founded in 2016

Activities: cultivation of *S. latissima* and *U. lactuca*
seeding material

End-product: raw material for food industry



LISENSING PROCESS

Regulation: Environmental law

Application authority: Land and Environmental Court

Form: big operations at sea (windmill park)

Grated authority: County Administrative board

Small farms (<0.3 ha): exempt of the Court revision

Permit: water permit (ownership or agreement), EIA

Application period: 15 months knowing the process

License valid: 10 years

"The EIA was
difficult and time
consuming"

"We are building
the market"

CHALLENGES

Not specific regulation

Not suitable application form

Environmental Court involved

Small operation only for testing



National macroalgae-related activities: ESTONIA



Founded in 1966 as factory; 1997 company

Activities: *F. lumbricalis*

End-product: furcellaran food industry, phycoeritrin for cosmetics



LISENSING PROCESS

Regulation: fishing, water and natural conservation Act

Application authority: Consumer Protection and Technical Regulatory

Form: big operations at sea (windmill park); IMTA

Permit: water permit (agreement from all water users) and building permits, two EIAs

Application period: still ongoing since 2018

License valid: unknown, application for 50 years

"Main problem is the Estonian law"

"We are building the market"

CHALLENGES

Not specific regulation
Not suitable application form
Long licensing process





National macroalgae-related activities: GERMANY



Kieler Meeresfarm GmbH & Co. KG

Founded in 2014 and expanded in 2020

Activities: cultivation of *S. latissimi* and mussels and pilot of *F. vesiculosus*

End-product: raw material for OceanBASIS (cosmetics)

IMTA license



LISENSING PROCESS (IMTA)

Regulation: Federal Waterways Act, Water Acts of the Länder

Authorities: 5 different agencies

Application authority: Consumer Protection and Technical Regulatory Federal Waterways and Shipping Agency + state-level authorities

Permit: Water permit (lease the water area); IMTA also fishing permit, survey about the existence of bomb; EIA

Application period: 4 years for IMTA

License valid: 15 years

"We are building the market"

CHALLENGES

Not specific regulation

Several authorities involved

Not suitable application form

Long licensing process

Not recognized as compensation measure



National macroalgae-related activities: NORWAY



OCEAN HARVEST



	Ocean Forest AS	Lerøy Ocean Harvest
Founded	2013	2018
Owner	Lerøy Seafood Group + Bellona Foundation	Lerøy Seafood Group
Activities	R&D company	Cultivation of <i>S. latissima</i>
End-product	Seeding technology; research	Fermented seaweed for animal feed

LISENSING PROCESS

Regulation: Aquaculture and Pollution Control Act

Application authority: County Governor

Evaluation authorities: 4 agencies

Form: fish farming application

Permit: fishing, water and discharge permits;
License for each farming site and macroalgae specie; EIA for > 10 ha.

Application period: 9 months

License valid: No experience day

"Authorities don't understand macroalgae"

"We are building the market"

CHALLENGES

Not specific regulation
Not suitable permits
Not suitable application form
Water permit by agreement



Conclusions

18

"The market is promising"

"We are building the market"

"Authorities don't understand what macroalgae is"

Improve the market

**Specific laws
Specific permits and forms
Include in MSP**

Macroalgae cultivation

"What is the environmental impact"



Finnish Environment Institute



Nordic Council
of Ministers



EUROPEAN UNION

EUROPEAN
REGIONAL
DEVELOPMENT
FUND

GRASS



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