BLUE BIOECONOMY – TRENDS AND OPPORTUNITIES IN ESTONIA

Liisi Lees, Jonne Kotta

Estonian Marine Institute, University of Tartu

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Topics covered

- What is blue bioeconomy
- Overview of blue bioeconomy in Estonia:
  - Focus on *fish farming, mussels, algae*
- Challenges
- Opportunities
- Conclusion

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Blue bioeconomy

Blue biotechnology is the application of science and technology to living aquatic organisms such as fish, mussels, algae for the production of knowledge, goods and services (OECD, 2016).

The blue economy plays an important part in the European Green Deal: it has a central role in reducing the pressure on the EU's land resources and tackling climate change.

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Estonian sea area

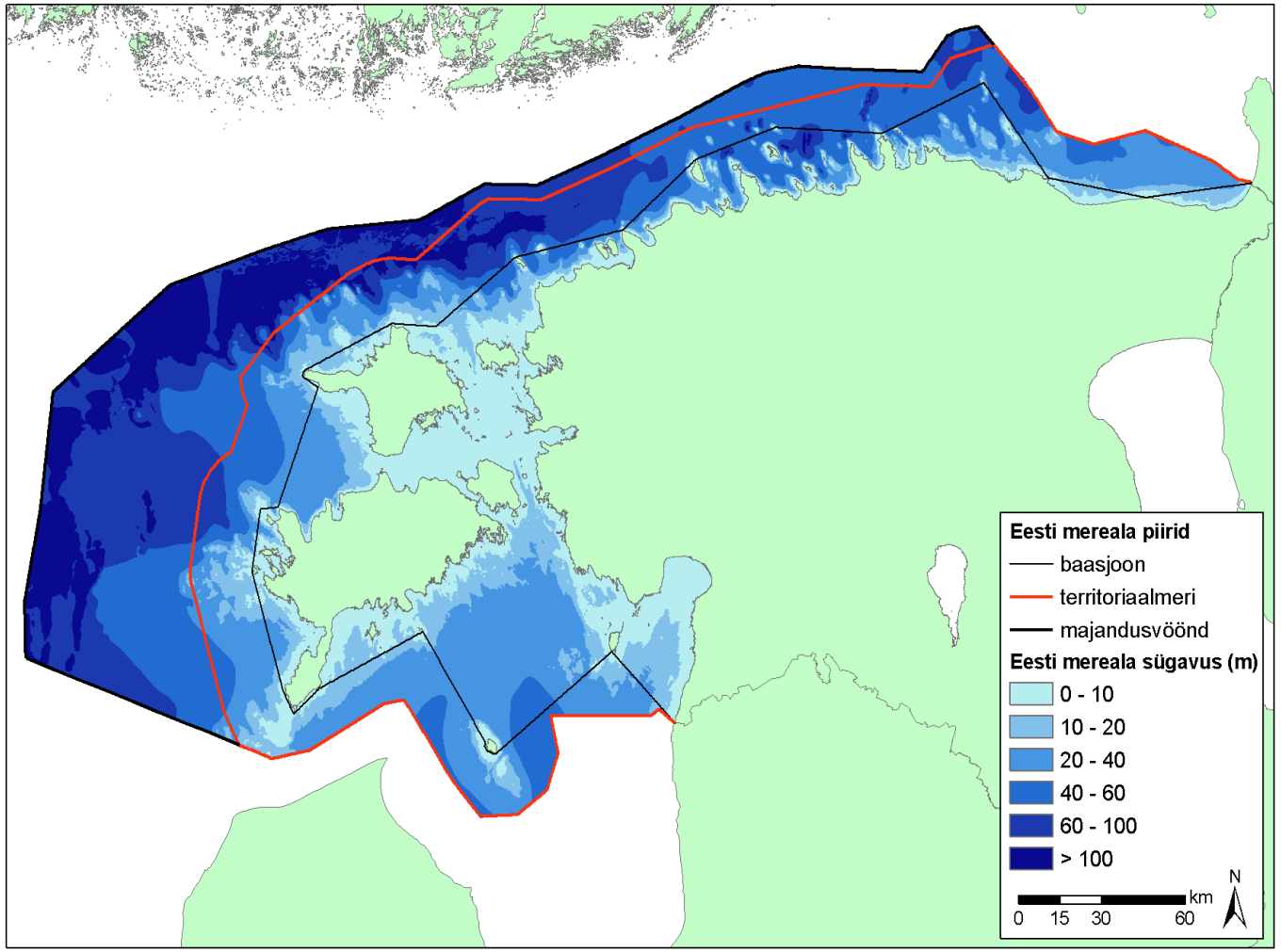
Total area: 36 500 km2

Territorial sea: 25 200 km2

Mean depth: 30 m

EEZ: 11 300 km2

Mean depth: 80 m



Consumer attitude

International for National Marine Fisheries Research Institute conducted a study in 2019 in Sweden, Finland, Estonia, Latvia, Lithuania, Poland, Denmark and Northern Germany.

Tab. 9 The percentage of consumers who do not buy seafood at all in the various age groups of respondents

	Age					
	18-24	25-34	35-44	45-54	55-59	60+
I do not buy any seafood products	33.0%	19.7%	13.2%	12.2%	7.4%	6.8%

Source: CAWI study conducted in the countries of the Baltic Sea Region by IMAS International for NMFRI, 2019, n = 2040

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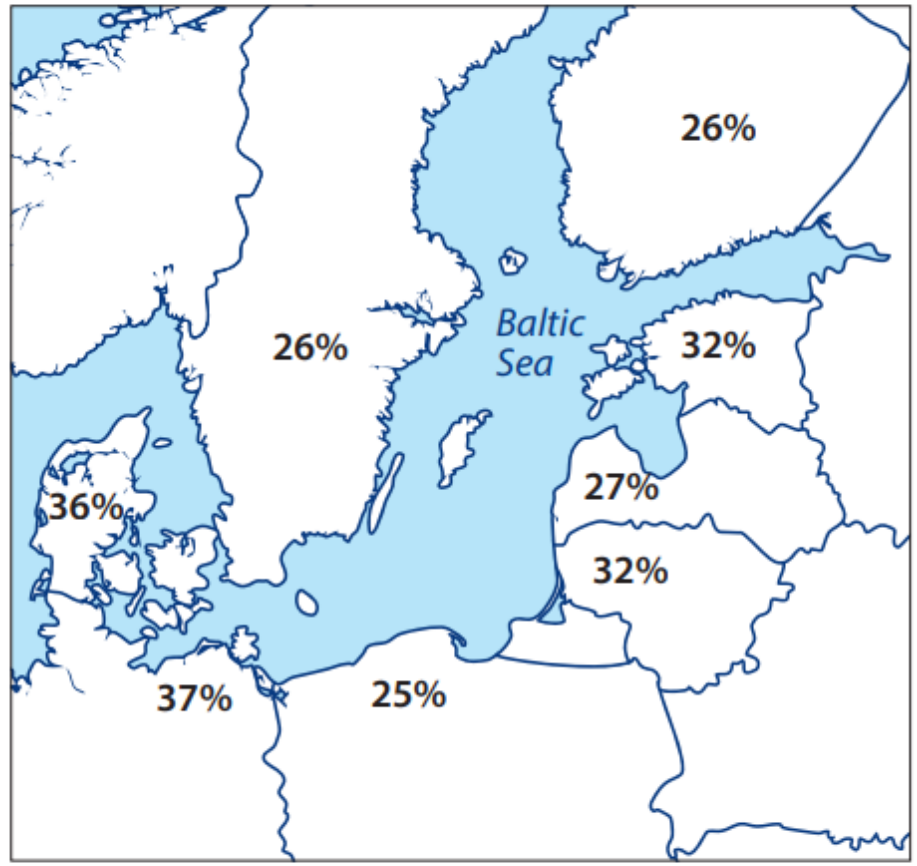
Fig. 33 Map showing the percentage of consumers who consider seaweed food products to be very healthy



Source: CAWI study conducted in the countries of the Baltic Sea Region by IMAS International for NMFRI, 2019, n = 2040

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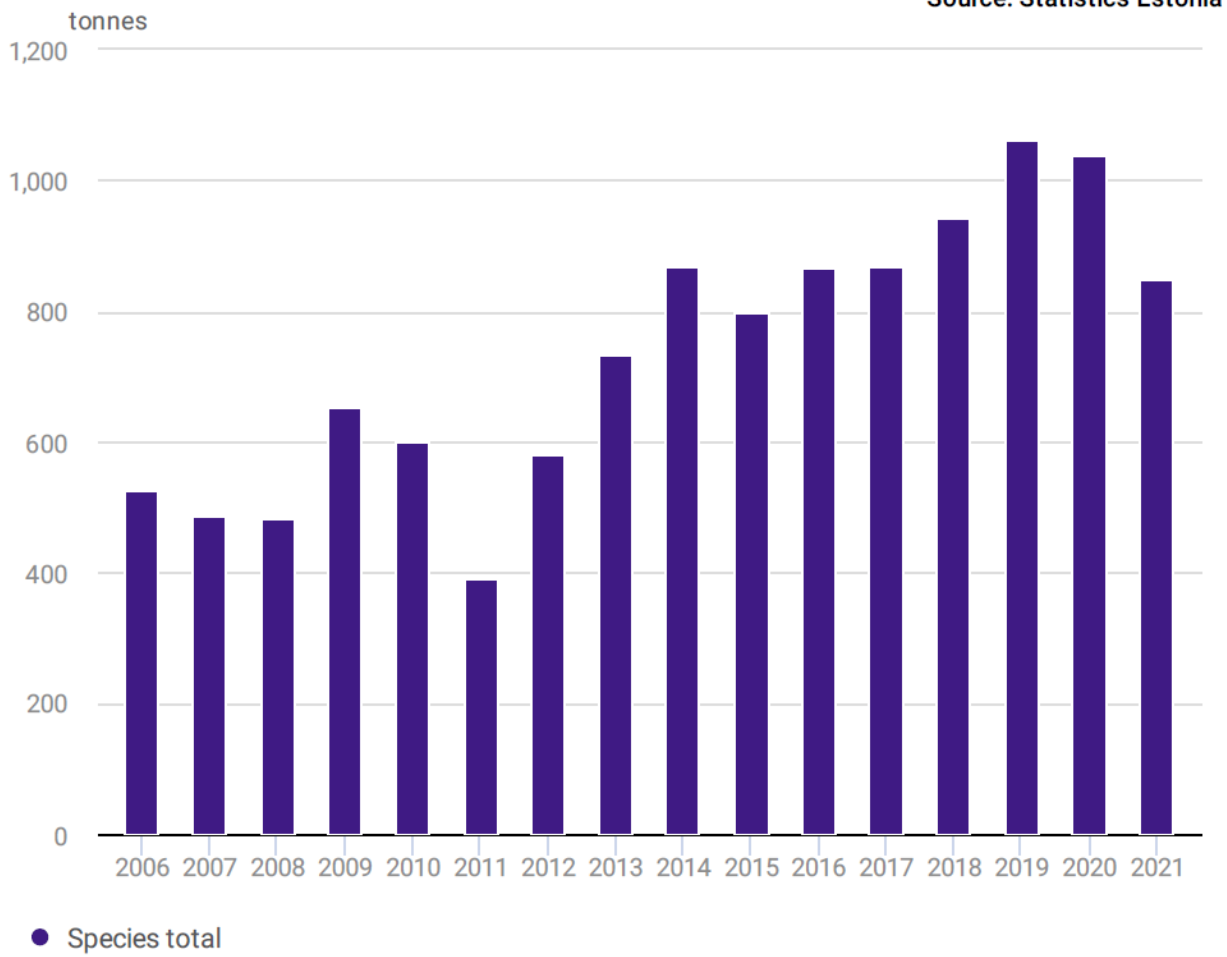
Fish farming 1/3

Fish farming production sold | 2006–2021

Source: Statistics Estonia



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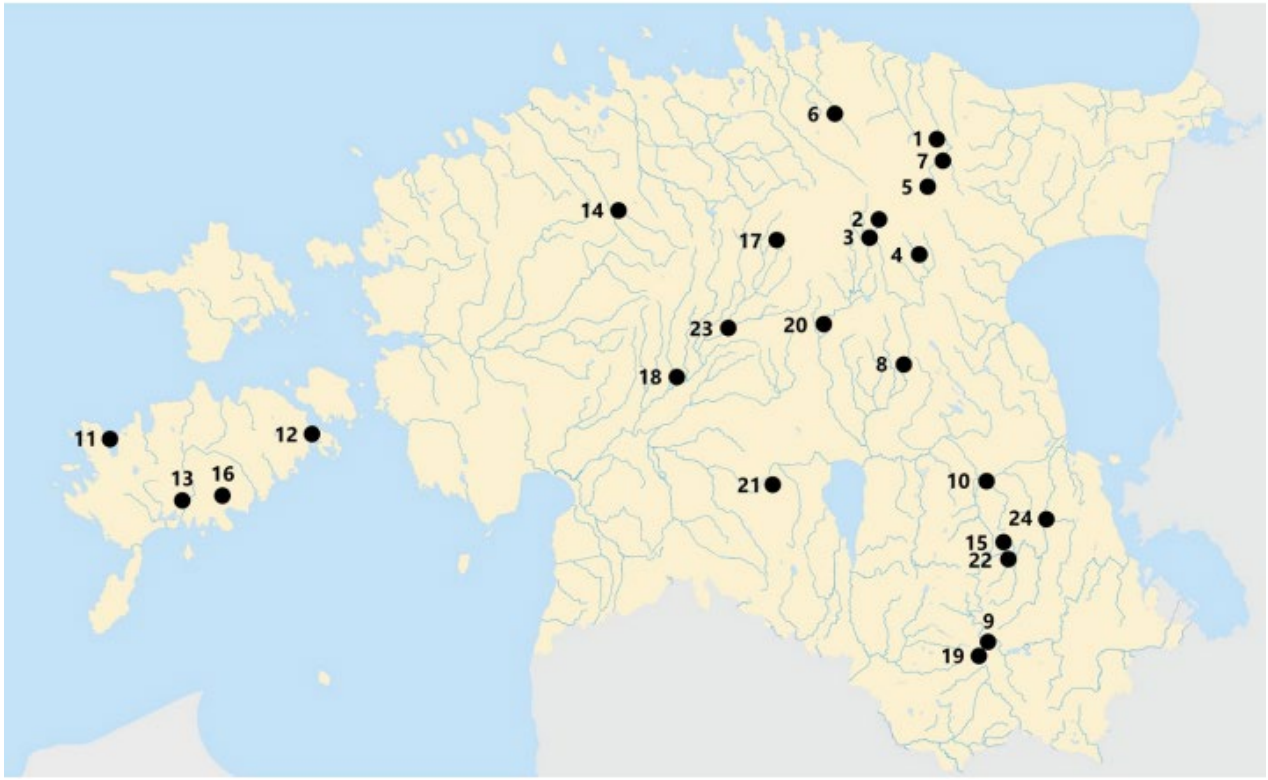
Fish farming 2/3

- 2020: 24 registered farmed fish producers
- 84% rainbow trout
- Only one fish farming in sea cage (300 t, 2020)
- Fish farming production sold in Estonia: 849 t (2021)



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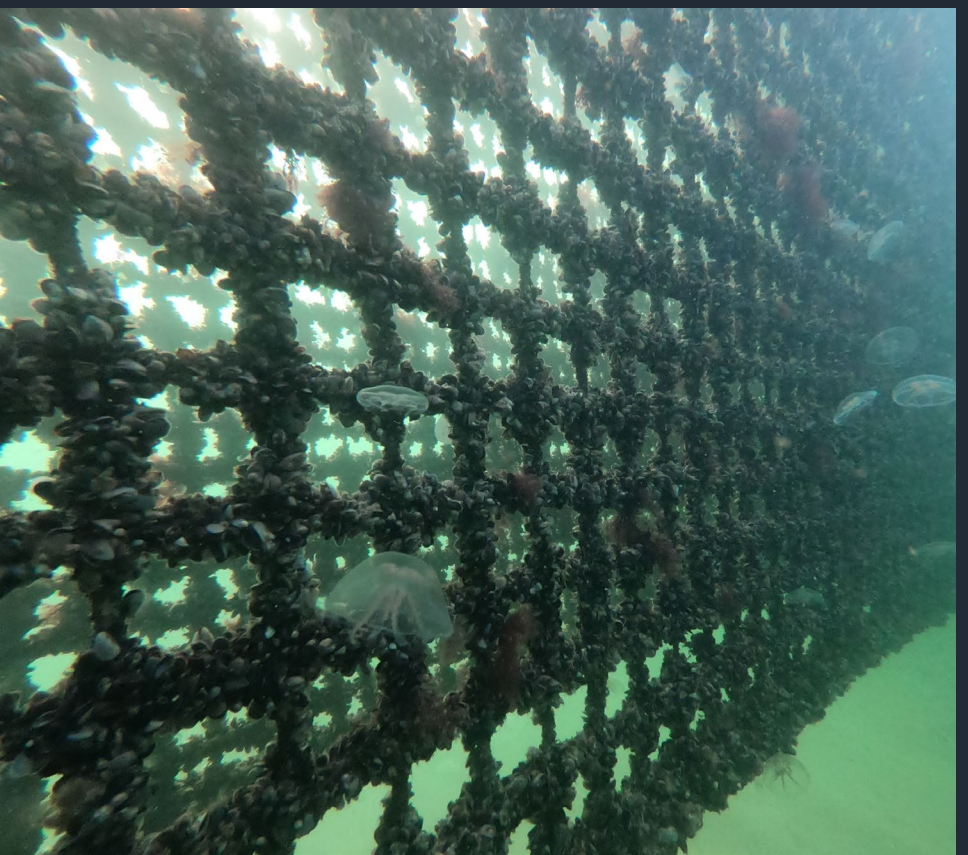
Fish farming 3/3



Tagalaht case: Mussel farming as an enabler of fish farm at sea

Mussel farm compensate for the discharge of nutrients from fish farms and thereby provide a solution for sustainable fish farming in the Baltic Sea region

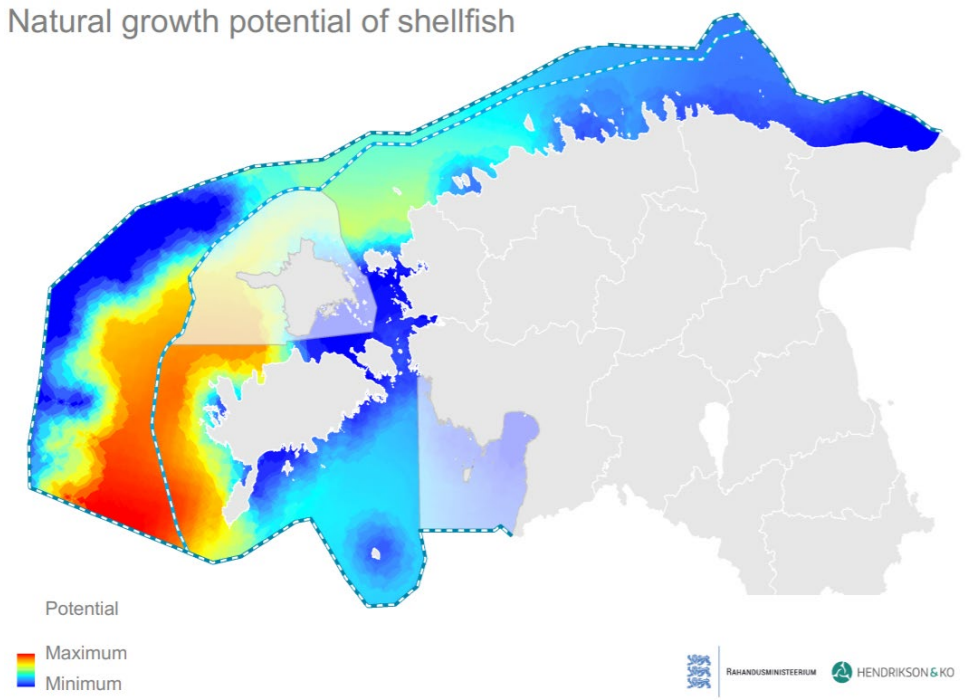
Mussel farming 1/5

Tagalaht farm is the only mussel farm in Estonia.

In the immediate vicinity of aquaculture cages.

Compensatory measure that increases the sustainability of the cage farm through the intake of nutrients by mussels.

To date, vastly untapped potential.



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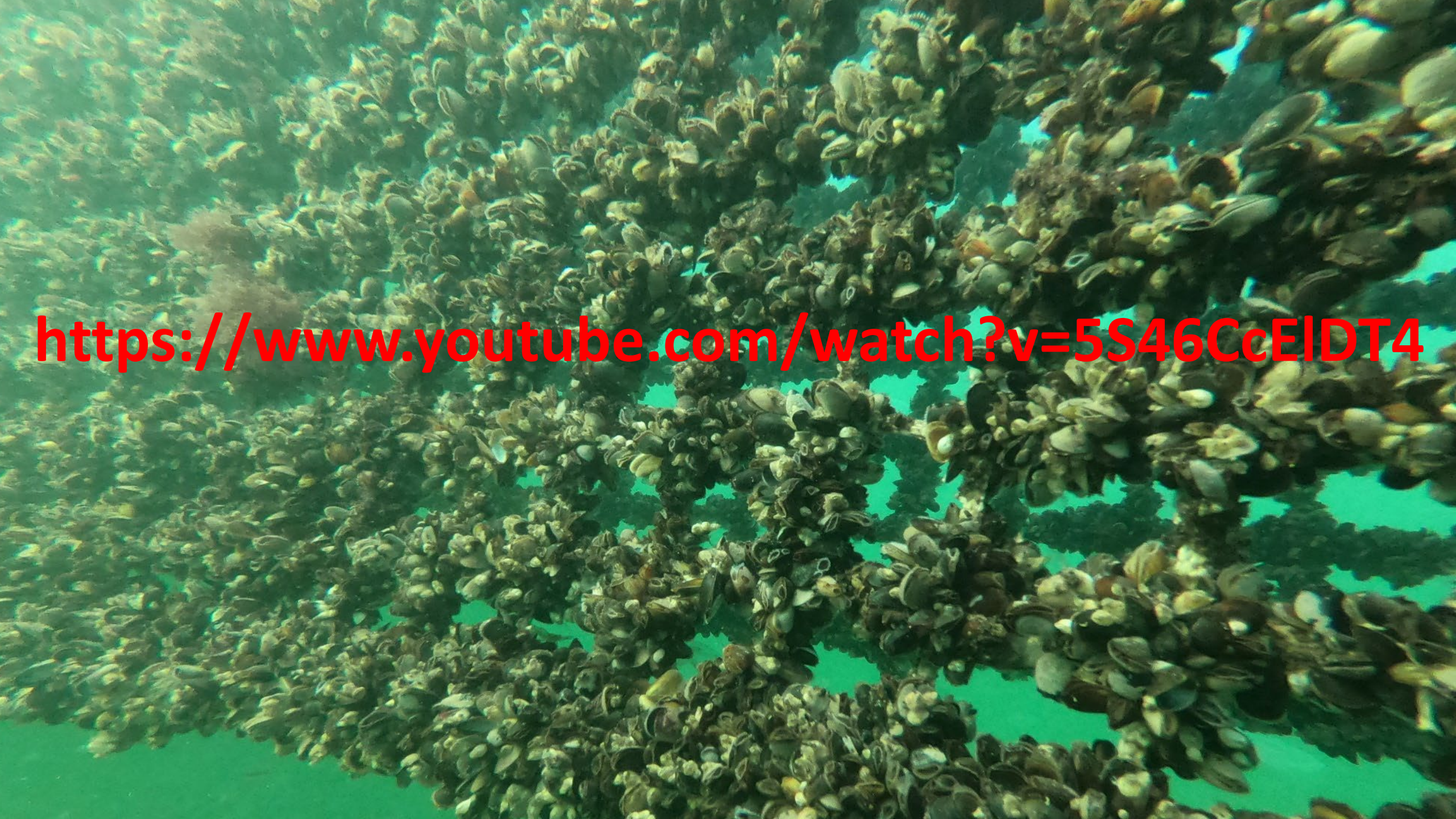
https://www.youtube.com/watch?v=5S46CcElDT4

Mussel farming 3/5

- Mussel farming is a viable internal measure to address the Baltic Sea eutrophication
- Rates of nutrient removal depend on salinity at the regional scale and food availability at the local scale

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Cleaning up seas using blue growth initiatives: Mussel farming for eutrophication control in the Baltic Sea

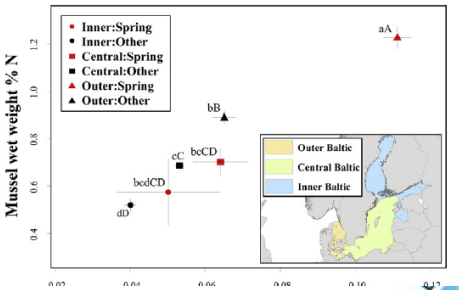
Jonne Kotta [a,*], Martyn Futter [b], Ants Kaasik [a], Kiran Liversage [a], Merli Rätsep [a], Francisco R. Barboza [c], Lena Bergström [d], Per Bergström [e], Ivo Bobsien [c], Eliecer Díaz [f,1], Kristjan Herkül [a], Per R. Jonsson [e,q], Samuli Korpinen [g], Patrik Kraufvelin [h,2], Peter Krost [i], Odd Lindahl [j], Mats Lindegarth [e], Maren Moltke Lyngsgaard [k], Martina Mühl [i], Antonia Nyström Sandman [l], Helen Orav-Kotta [a], Marina Orlova [m], Henrik Skov [n], Jouko Rissanen [g], Andrius Šiaulys [o], Aleksandar Vidakovic [p], Elina Virtanen [g]

[a] Estonian Marine Institute, University of Tartu, Mäealuse 14, EE-12618 Tallinn, Estonia
[b] Department of Aquatic Sciences and Assessment, Swedish University of Agricultural Sciences, Box 7050, SE-75007 Uppsala, Sweden
[c] GEOMAR Helmholtz Centre for Ocean Research Kiel, Düsternbrooker Weg 20, DE-24105 Kiel, Germany
[d] Department of Aquatic Resources, Swedish University of Agricultural Sciences, Skolgatan 6, SE-74242 Öregrund, Sweden
[e] Department of Marine Sciences – Tjärnö Marine Laboratory, University of Gothenburg, Tjärnö, SE-45296 Strömstad, Sweden
[f] Novia University of Applied Sciences, Raseborgsvägen 9, 10600 Ekenäs, Finland
[g] Marine Research Centre, Finnish Environment Institute, FIN-00790 Helsinki, Finland
[h] Novia University of Applied Sciences, Raseborgsvägen 9, 10600 Ekenäs, Finland
[i] Coastal Research and Management, Tiessenkai 12, D-24159 Kiel, Germany
[j] Musselfeed AB, Hallgrens väg 3, SE-47431 Ellös, Sweden
[k] Orbicon, Department for Nature and Environment, Jens Juuls vej 16, 8260 Viby J., Denmark
[l] AquaBiota Water Research, Löjtnantsgatan 25, SE-11550 Stockholm, Sweden
[m] Sankt-Petersburg Research Centre of Russian Academy of Science, University embankment 5, 199034 St.-Petersburg, Russia
[n] DHI, Agern Alle 5, 2970 Hørsholm, Denmark
[o] Marine Research Institute, Klaipeda University, Universiteto ave. 17, LT-92294 Klaipėda, Lithuania
[p] Department of Animal Nutrition and Management, Swedish University of Agricultural Sciences, Box 7024, SE-75007 Uppsala, Sweden
[q] Environmental and Marine Biology, Åbo Akademi University, Finland

HIGHLIGHTS

- Mussel farming is a viable internal measure to address Baltic Sea eutrophication.
- Rates of nutrient removal depend on salinity at the regional scale and food availability at the local scale.
- Cost effectiveness of nutrient removal by mussel farming depends also on farm type.
- Total farm area needed for achieving HELCOM nutrient reduction targets is realistic.

GRAPHICAL ABSTRACT



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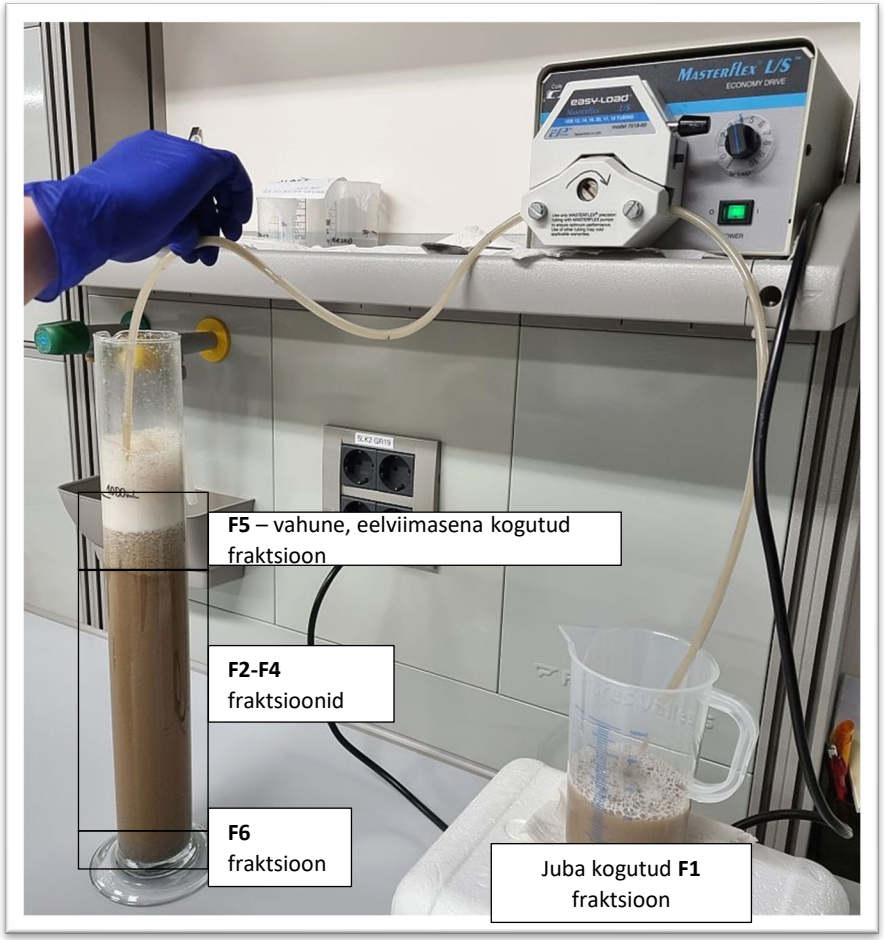
Mussel farming: Novel food and feed (4/5)

1. Mussels smaller
2. Optimize meat separation technology



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Mussel farming: Novel food and feed (5/5)

Article

Optimizing the Processing of Shellfish (*Mytilus edulis* and *M. trossulus* Hybrid) Biomass Cultivated in the Low Salinity Region of the Baltic Sea for the Extraction of Meat and Proteins

Indrek Adler [1], Jonne Kotta [1,2,*], Rando Tuvikene [3] and Katrin Kaldre [4]

1 Estonian Maritime Academy, Tallinn University of Technology, Kopli 101, 11712 Tallinn, Estonia; indrek.adler@taltech.ee
2 Estonian Marine Institute, University of Tartu, Mäealuse 14, 12618 Tallinn, Estonia
3 School of Natural Sciences and Health, Tallinn University, Narva mnt 25, 10120 Tallinn, Estonia; rando.tuvikene@tlu.ee
4 Institute of Veterinary Medicine and Animal Sciences, Estonian University of Life Sciences, Kreutzwaldi 46A, 51006 Tartu, Estonia; katrin.kaldre@emu.ee
* Correspondence: jonne@sea.ee; Tel.: +372-50-56-583

Abstract: Mussel farming is a novel and growing aquaculture field in the Baltic Sea. Nevertheless, there is very little published evidence on the processing of shellfish biomass in the region. The aim of this study is to develop a methodology for the extraction of organic-rich fractions from small-sized blue mussels of the Baltic Sea region that is applicable and economically viable for the feed and food industry. The efficiency of mussel meat separation was evaluated using different processing,

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Macroalgae (1/4)

- Part of human diets
- People have used beach cast (mostly bladder wrack) as fertilizer in their gardens.

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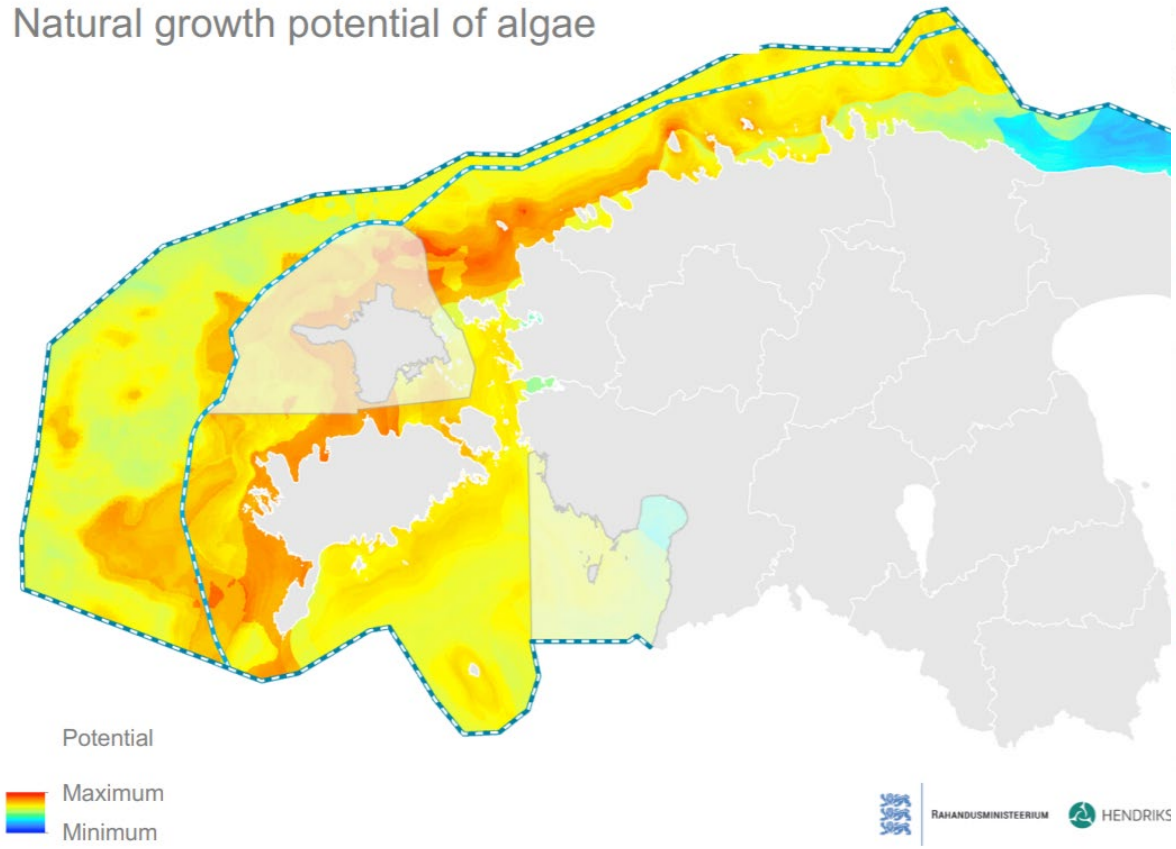
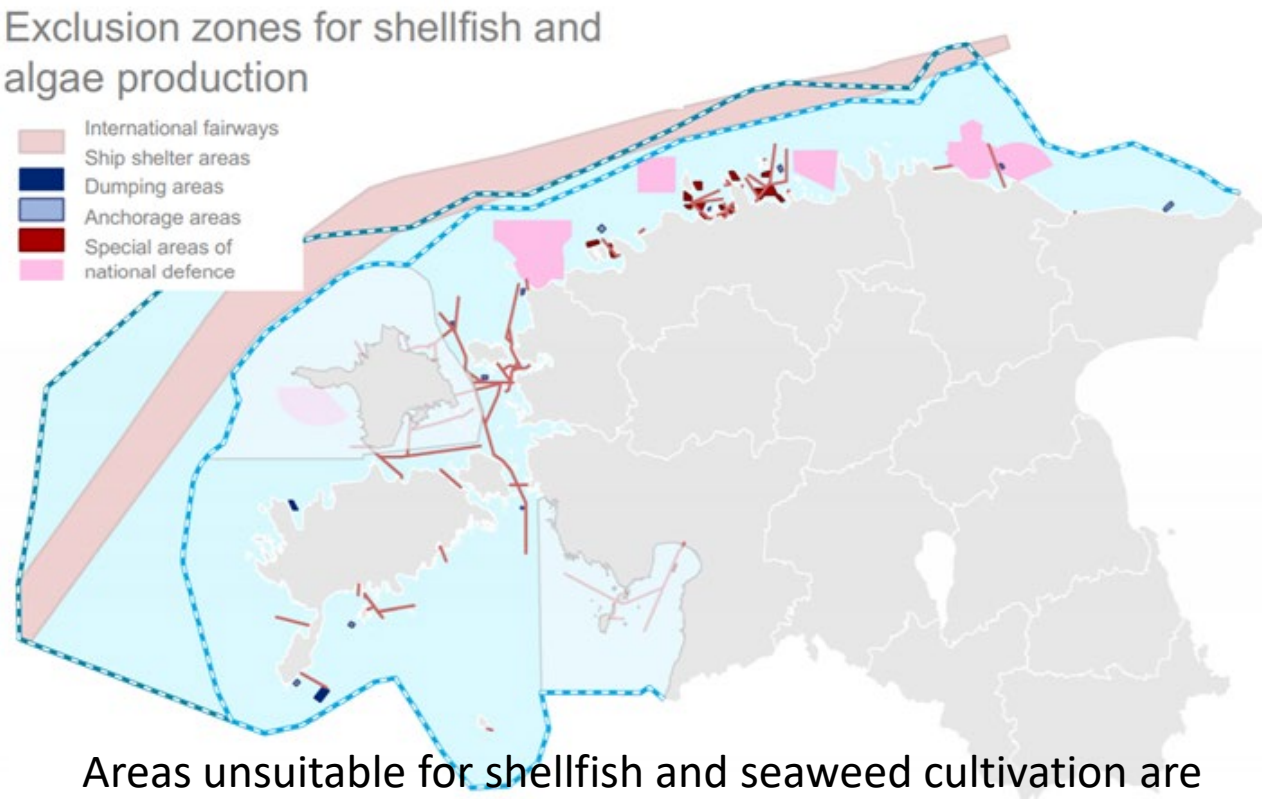
Macroalgae (2/4)





Areas unsuitable for shellfish and seaweed cultivation are outlined in the following spatial layout.

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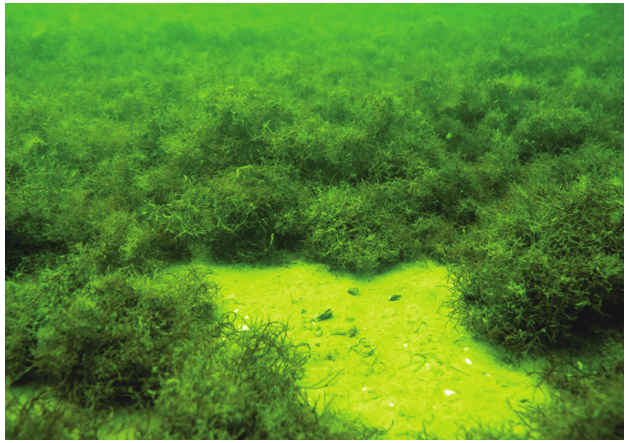
Macroalgae: long traditions of harvesting (3/4)

- Harvesting *Furcellaria lumbricalis* in Kassari Bay.
- Used as raw material for ‘agar’ (furcellaran) production already from 1966



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Macroalgae (4/4)

EstAgar AS

Only producer of the unique texturant – **furcellaran** from the red seaweed *Furcellaria lumbricalis* in the world.

Est-Agar AS main business areas are:
– Production and sale of gelling agent **furcellaran**
– Trawling, gathering, buying up, processing and sale of red seaweed *Furcellaria lumbricalis*.

http://estagar.ee/

Tinurek OÜ / Vetik OÜ

Tinurek OÜ: harvesting *F. lumbricalis*

Vetik OÜ:
– production of a natural (marine algae based) red colorant (extraction of **phycoerythrin**) which has potentially skin rejuvenating properties.

– valorization of the whole biomass of the seaweed for cosmetics and other industries e.g producing different seaweed extracts.

https://vetik.eu/

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Challenges in blue bioeconomy

- **Legislation:** Public administration capacity building & legislation readiness
- **Education**: Blue biotechnology study programmes, experts
- **Market:** We have market for certain species and products. Limited (current) demand for species which could be farmed in Baltic Proper *(Ulva intestinalis, Furcellaria lumbricalis, Fucus vesiculosus).*
- **Production economics:** small-scale production, profitability. Expensive to start.
- **Technology:** Expertimental farms to prove technology

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Opportunities in blue bioeconomy

- Support blue bioeconomy in areas that have natural preconditions (Saaremaa Island) - **communities of practice**
- Develop value chains with higher added value that are suitable for our areas
- If value chains are established: marketing and market receptivity
- New specialist jobs

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Potential new species for harvest and cultivation

Mytilus trossulus

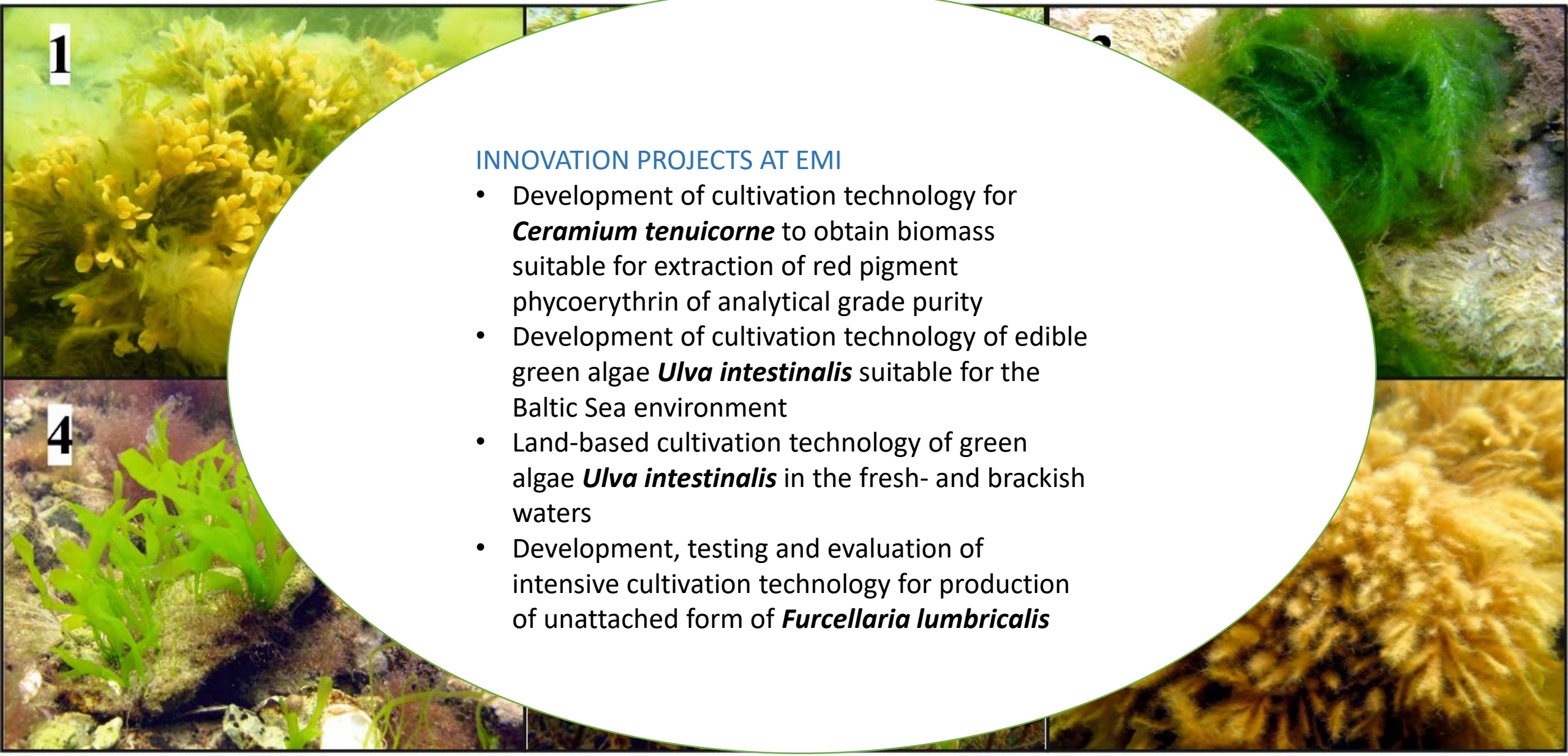
Dreissena polymorpha

Ulva intestinalis

Fucus vesiculosus

Furcellaria lumbricalis

Ceramium tenuicorne

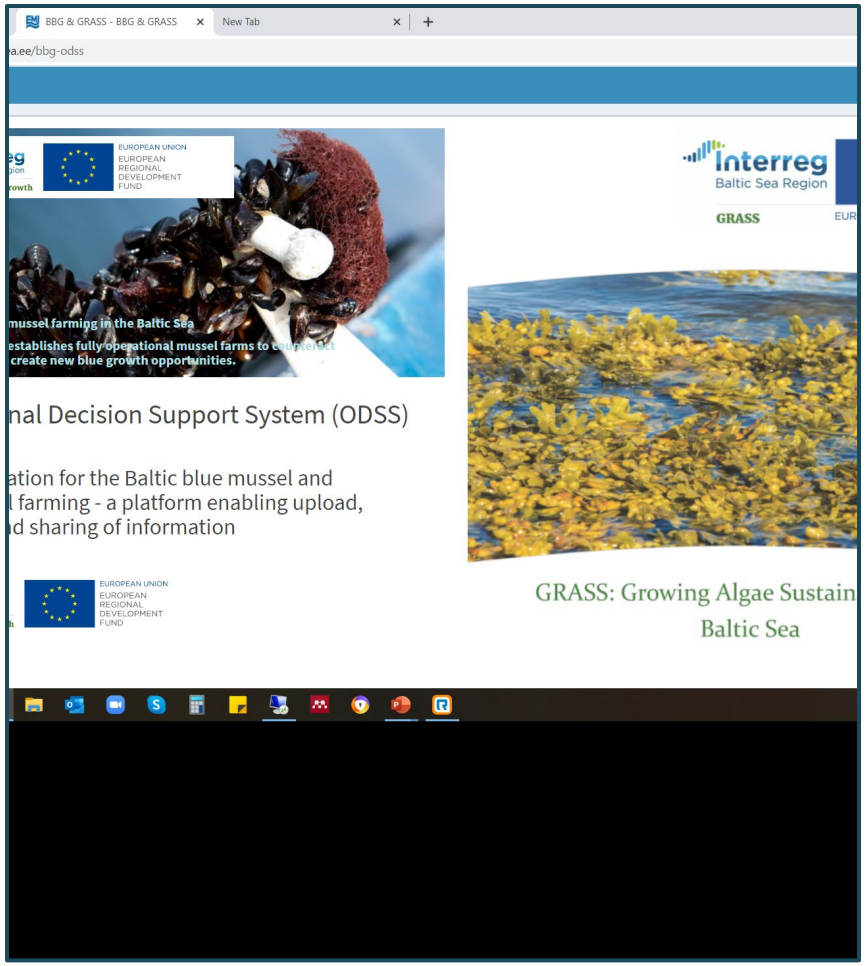


INNOVATION PROJECTS AT EMI

- Development of cultivation technology for ***Ceramium tenuicorne*** to obtain biomass suitable for extraction of red pigment phycoerythrin of analytical grade purity
- Development of cultivation technology of edible green algae ***Ulva intestinalis*** suitable for the Baltic Sea environment
- Land-based cultivation technology of green algae ***Ulva intestinalis*** in the fresh- and brackish waters
- Development, testing and evaluation of intensive cultivation technology for production of unattached form of ***Furcellaria lumbricalis***

1 Fucus vesiculosus, 2 Furcellaria lumbricalis, 3 Cladophora glomerata, 4 Ulva intestinalis, 5 Chara tomentosa, 6 Pylaiella littoralis

Operational Decision Support System (ODSS)



Helps different end-users to make effective decisions about mussel and algal farming in the Baltic Sea.

These decisions are based on the best monitoring and modelling data.

http://www.sea.ee/bbg-odss

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Conclusions

- Great potential for mussel cultivation as compensation measure, but value chains still need to be developed/upscaled + together with consumer acceptance and improved legislation
- Technologies for macroalgae cultivation suitable for Baltic Sea – ongoing but promising for *Fucus* and *Ulva*.
- Fast development of the sector: need for coordinated effort and pilot mussel and macroalgae farming units
- Cooperation + education

MARBEFES

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