BLUE MISSION BANOS

2nd MISSION ARENA
25-26 April 2024 | Riga, Latvia

Workshop: Solutions for circulation of nutrients:

Sea and Land Reducing nutrients in the Baltic Sea and inlands waters

THEME: Resource circulation/ Regeneration ocean and inland waters

#Arena2

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Workshop: Solutions for circulation of nutrients: Sea and Land Reducing nutrients in the Baltic Sea and inlands waters?

Theme: Nutrients flows in the Baltic Sea region – past and present

Gun Rudquist, Head of Policy, Stockholm University Baltic Sea Centre, April 25th 2024

Research by: Eva Ehrnsten1,2, Bo Gustafsson 1, Erik Gustafsson 1, and Christoph Humborg 1.

1. Stockholm University Baltic Sea Centre and 2. Universität Greifswald.

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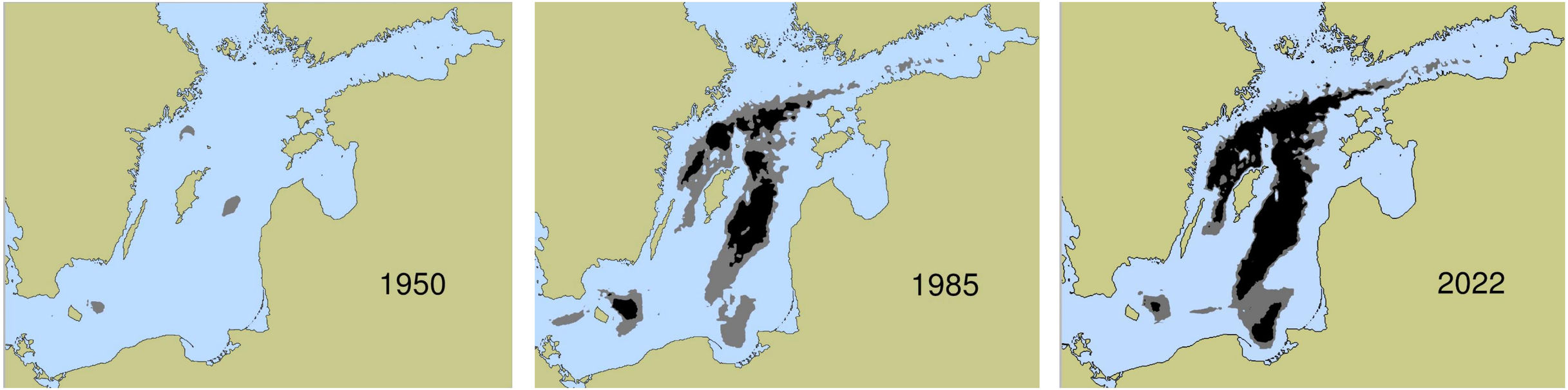
The Baltic Sea today

...many eutrophication symptoms worse than ever!

Oxygen-depleted “dead bottoms”

- $O_2 < 2$ ml l^{-1}
- $O_2 = 0$ ml l^{-1}



Bo Gustafsson, unpubl.

Baltic Sea eutrophication

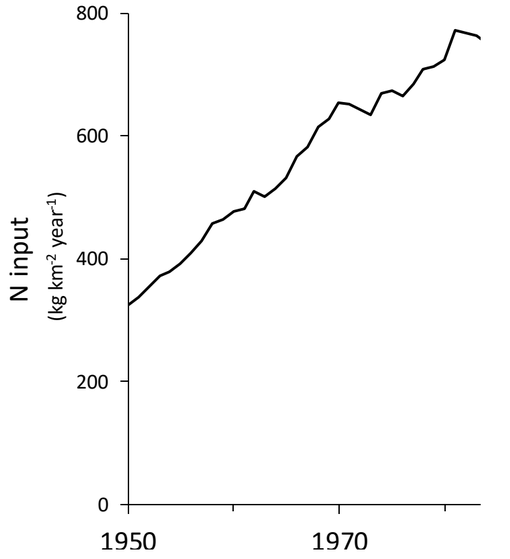
Accelerating nutrient inputs 1950s – 1970s

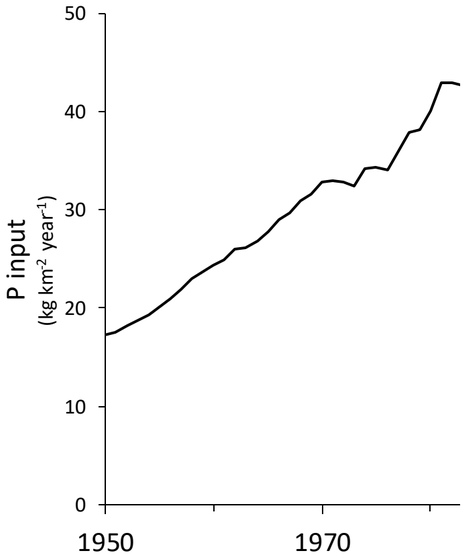
- Population increase, urbanisation
- Intensification of agriculture, increased fertilizer consumption

1980s – today: reduction phase

- Measures to reduce nutrient loads across sectors
- Baltic Sea Action Plan (2007): Ambitious goals for nutrient load reductions

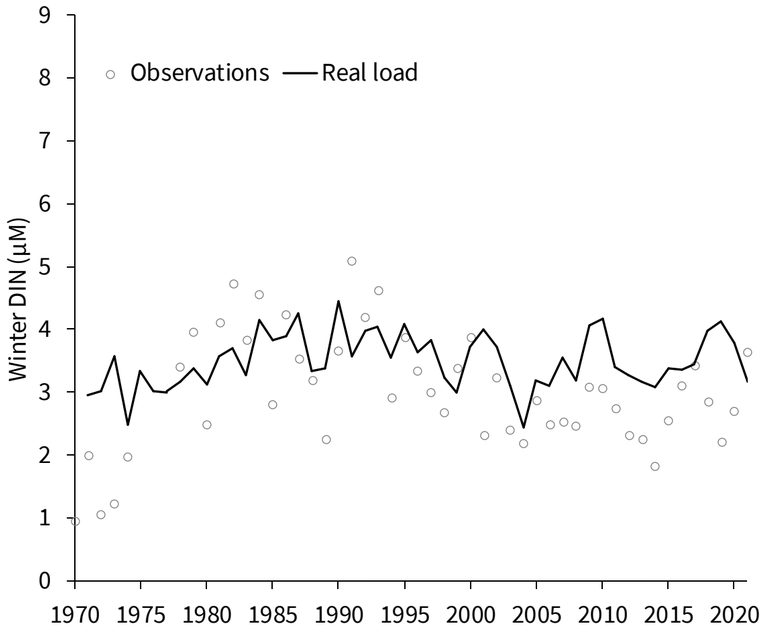
→ N and P loads now back to levels of 1950s/1960s





Results

While the state has not improved...



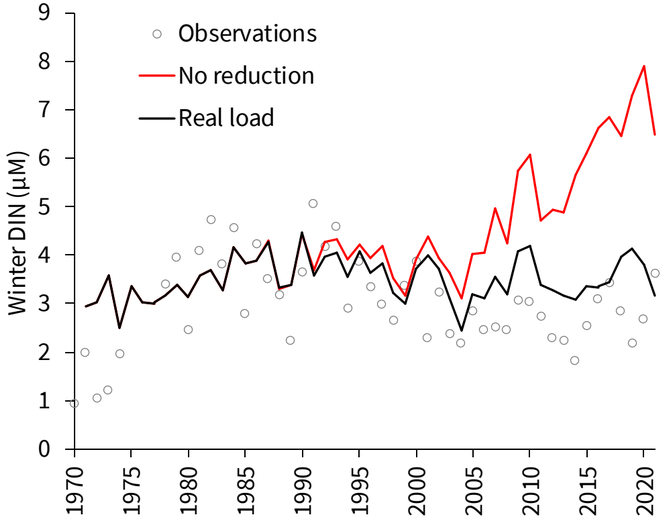
Winter concentrations of dissolved inorganic nutrients in the Baltic Proper

Results

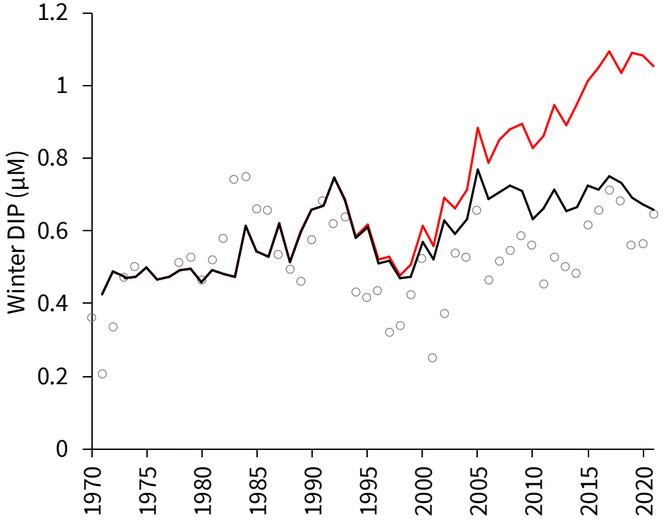
While the state has not improved...

...it would be considerably worse without human intervention to reduce nutrient loads

105% higher nitrogen



60% higher phosphorus



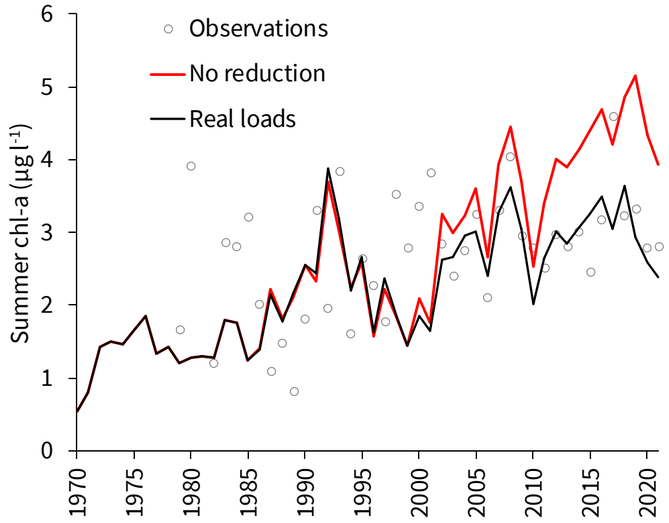
Winter concentrations of dissolved inorganic nutrients in the Baltic Proper

Results

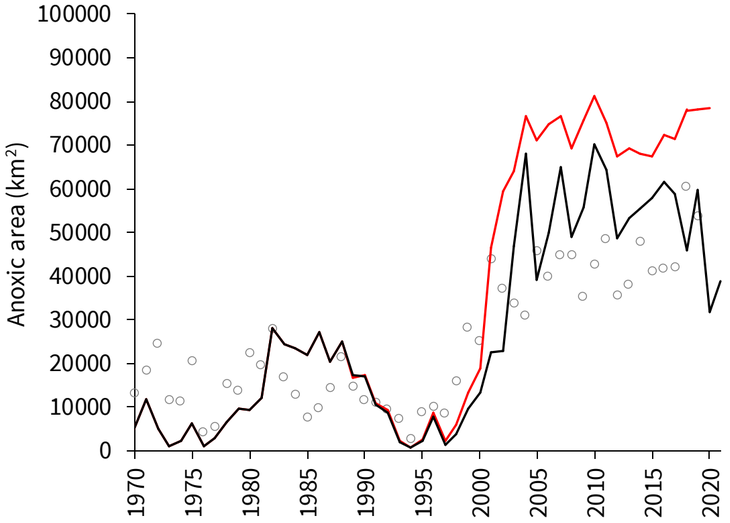
While the state has not improved...

...it would be considerably worse without human intervention to reduce nutrient loads

65% more phytoplankton
(algae & cyanobacteria) in summer



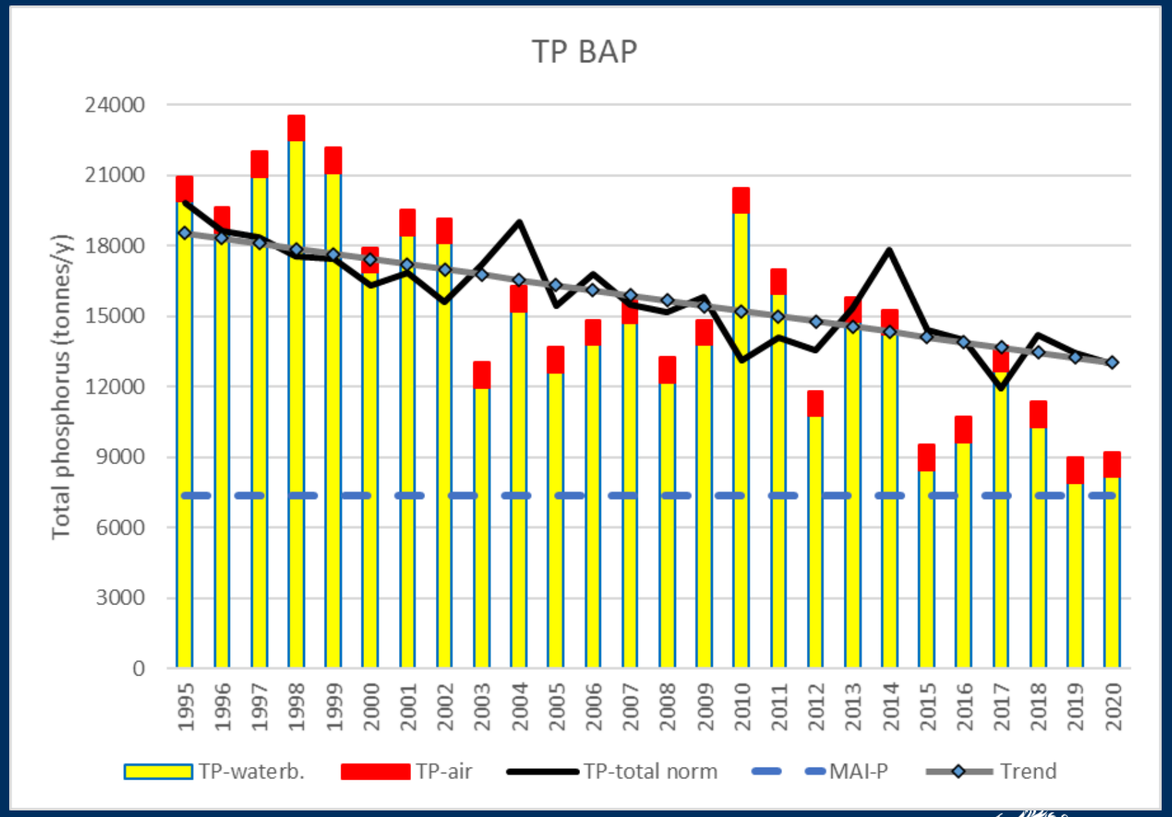
44% larger anoxic area
(O_2 = 0 ml l^{-1})



Trends in Baltic Proper inputs
HELCOM PLC assessment

Total phosphorus input trends

- Steady decrease
- Decrease in recent years dominated by few catchments



Baltic Nest Institute

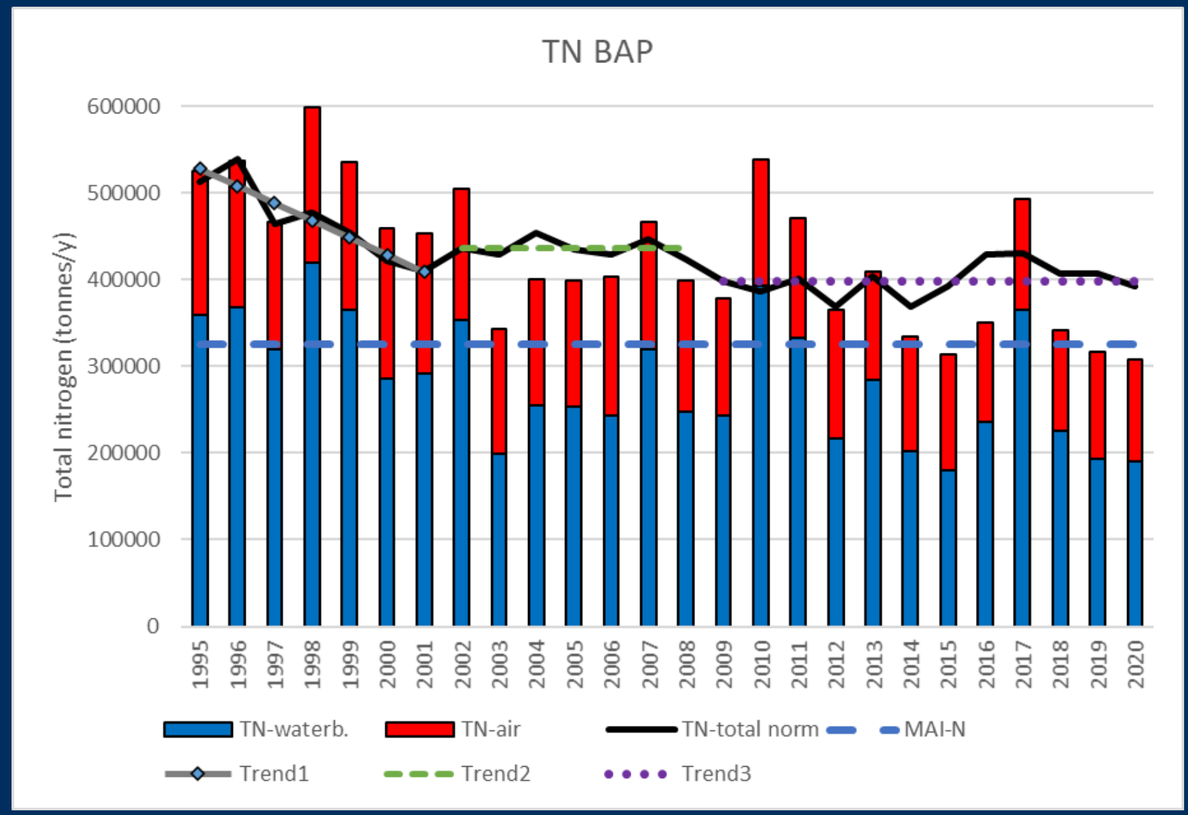
HELCOM (2023) Inputs of nutrients to the sub-basins (2020). HELCOM core indicator report. https://indicators.helcom.fi/indicator/inputs-of-nutrients/

Stockholm University

Trends in Baltic Proper inputs
HELCOM PLC assessment

Total nitrogen input trends

- No trend!
- Decrease in atmospheric deposition
- Increase in flow normalized river loads (dry recent year with increasing TN concentrations)



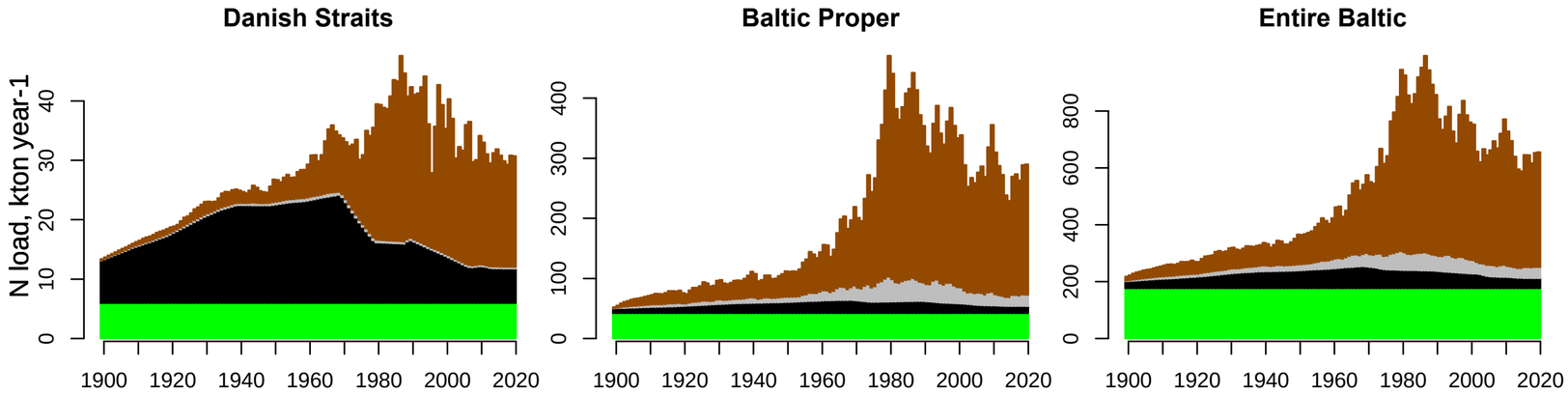
Baltic Nest Institute

HELCOM (2023) Inputs of nutrients to the sub-basins (2020). HELCOM core indicator report. https://indicators.helcom.fi/indicator/inputs-of-nutrients/

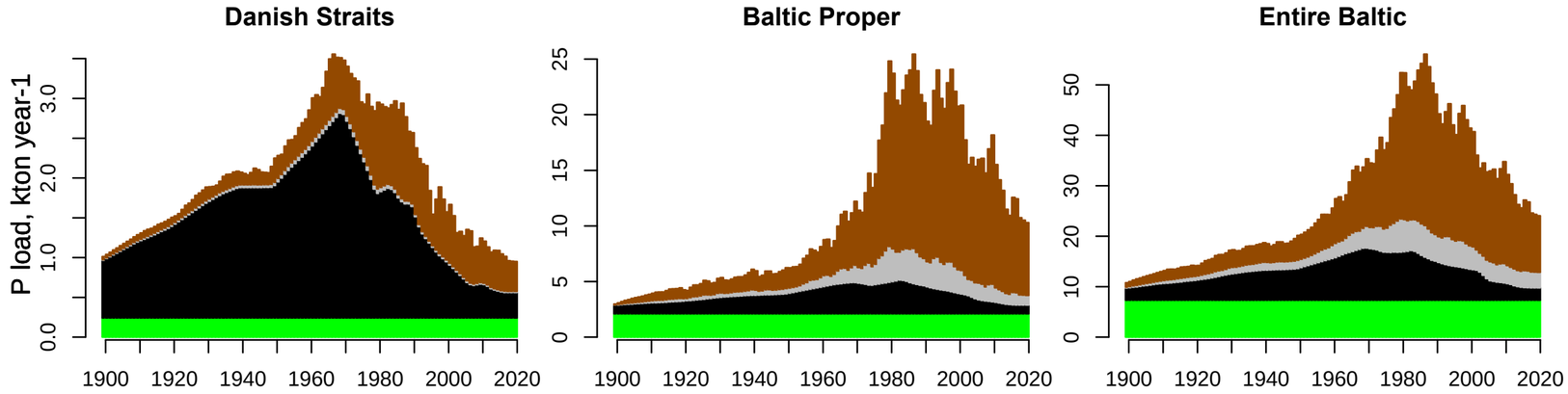
Stockholm University

Waterbourne load of phosphorous and nitrogen to the Baltic Sea

Phosphorus



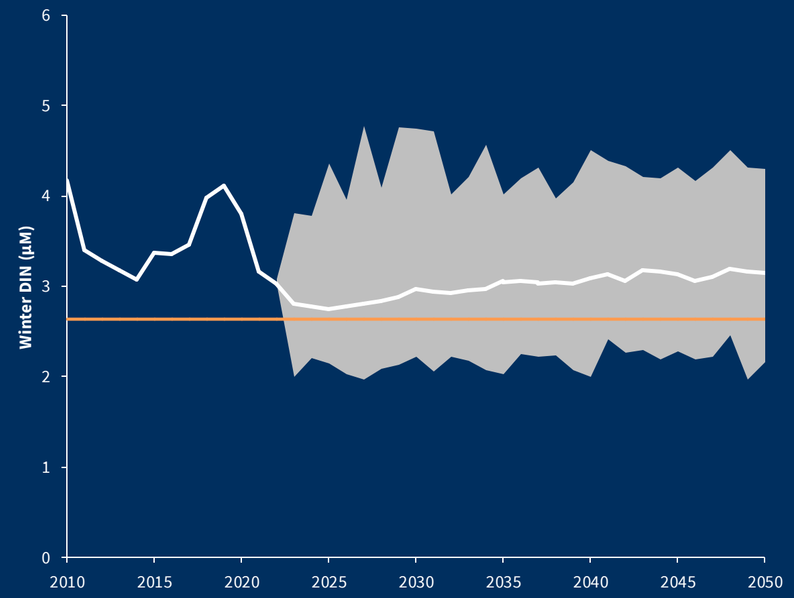
Nitrogen

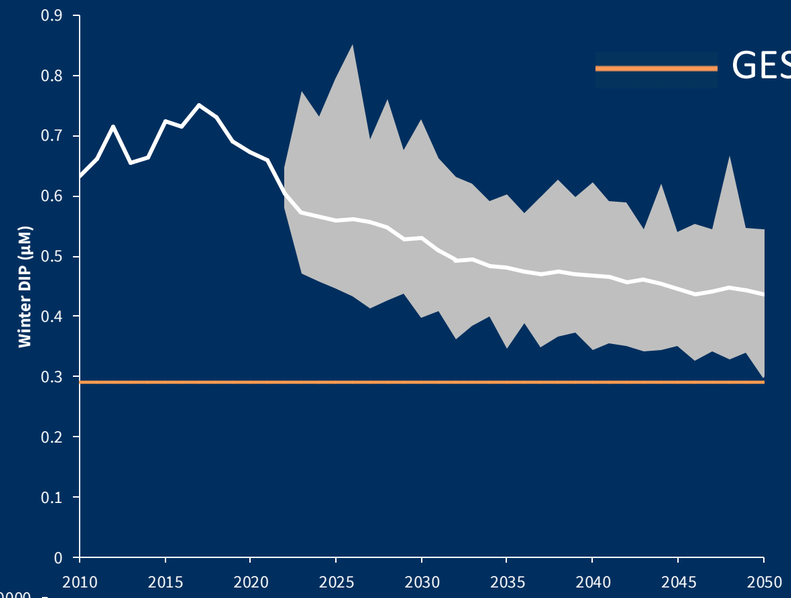


Natural background
Diffuse sources
Sewage inland
Sewage coastal

Stockholm University

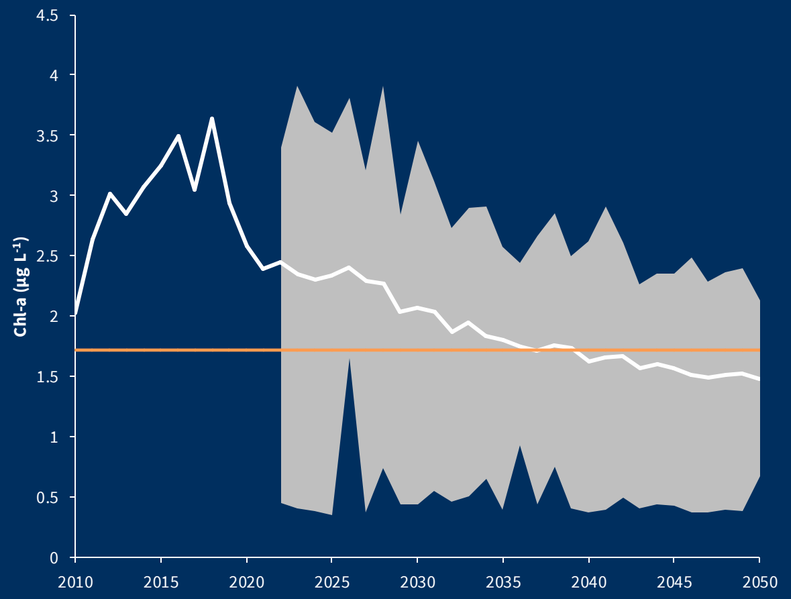
We can expect a gradual improvement with current nutrient inputs

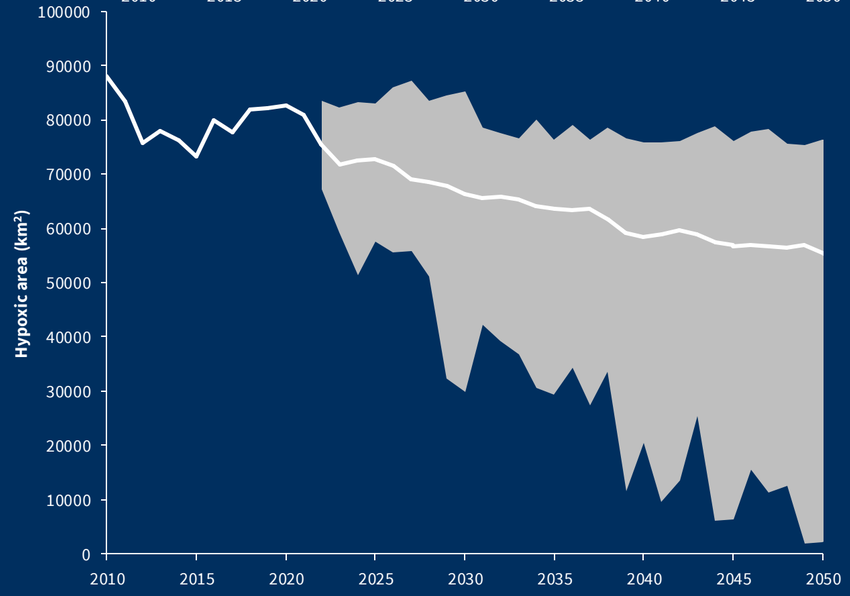




GES threshold

Shaded area represent range of “natural” variability





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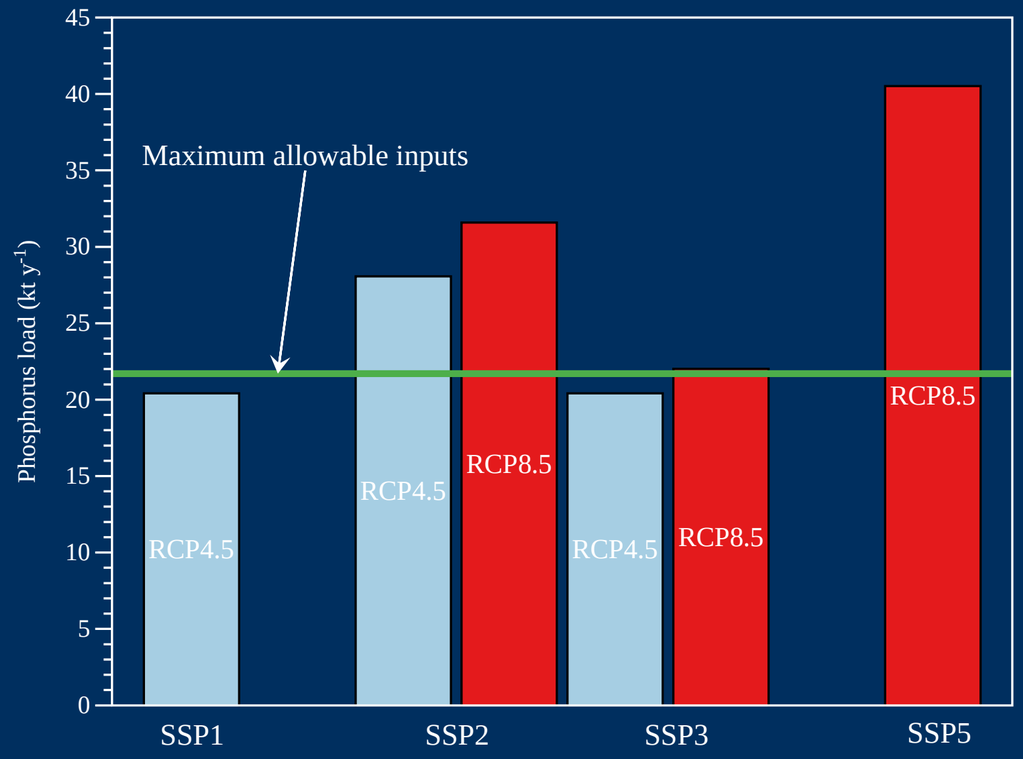
Future challenges – global + regional socioeconomic development extremely important

Phosphorus inputs 2100 for different climate change and socioeconomic development scenarios



Drawn after: Pihlainen et al., 2020. *Science of the Total Environment*

Baltic Nest Institute

Stockholm University

Concluding remarks

- **Nutrient load reductions have been successful – disaster avoided**
- **Most likely present day nutrient inputs will improve conditions with time**
- **Due to slow turnover time we do not see clear improvements yet**
- **Further load reductions are needed, unless we want to to wait for decades to see improvement**
- **New challenges may arise due to rapid climate change and political/economical development**

Baltic Nest Institute

Stockholm University

Thank you!

Contact:
gun.rudquist@su.se

Funded by Swedish Agency for Marine and Water Management

BLUE MISSION BANOS

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Sediment as a resurse Business possibilities by circular use

Johan Persson LIFE SURE , Kalmar, Sweden

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Sediment as a resurse?

Business possibillities by circular use




Building blocks, flood protection or building with nature?

We will present several innovative solutions for the use of sediment that can be of interest for stakeholders such as landowners, companies and authorities.

LIFE SURE

Sediment Uptake and Remediation on Ecological basis

The project has developed a cost-effective and ecologically sustainable way to absorb and recycle bottom sludge from shallow water areas affected by eutrophication.
The test has been performed in the Malmfjärden bay at the city of Kalmar, Sweden.

Web page: http://life-sure.eu

Film about the project: https://youtu.be/77a0u9iQS24

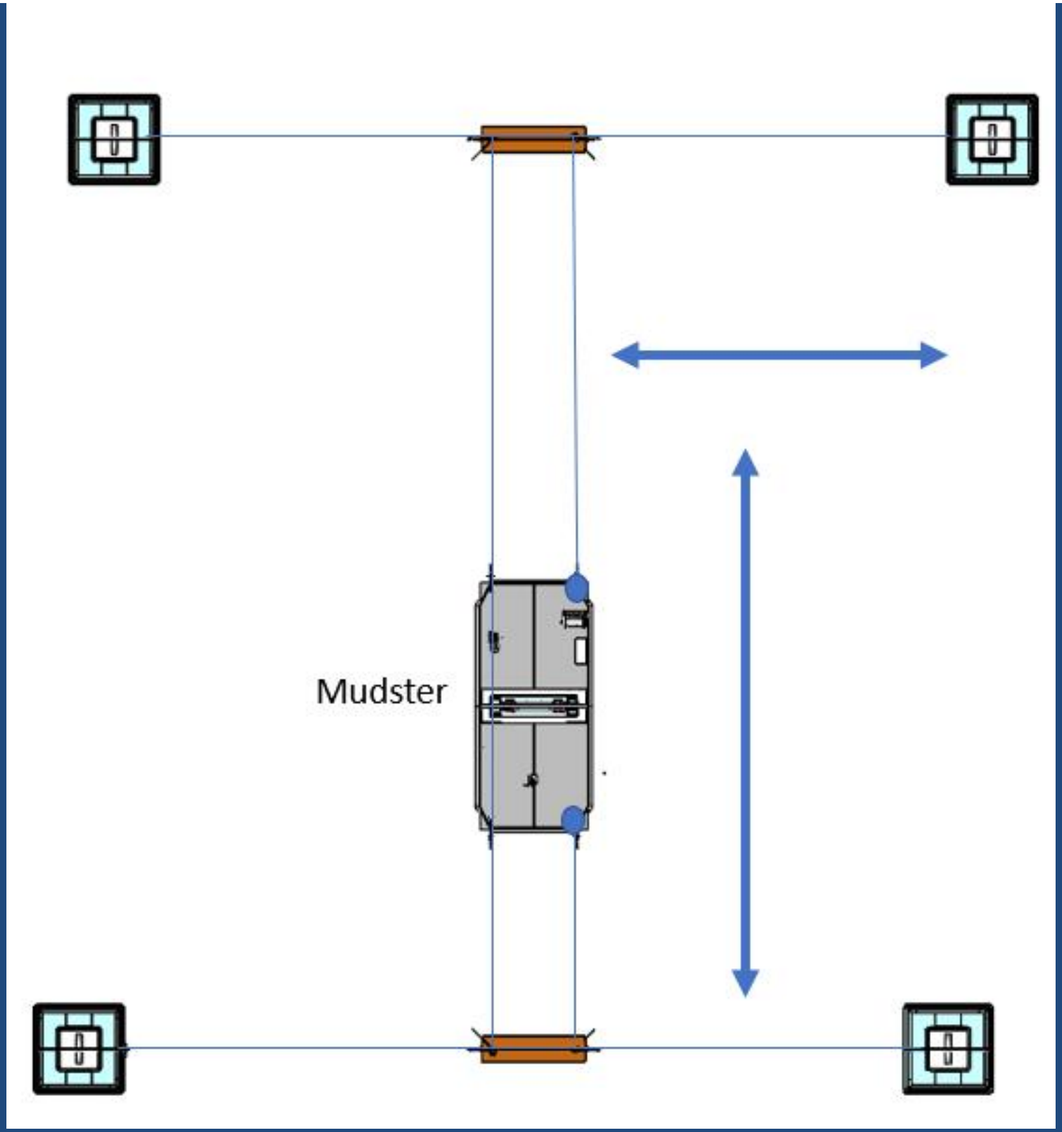
Kalmar kommun

2024-05-02

LIFE SURE – Mudster robots

Kalmar kommun

2024-05-02


Mudster

Possible benificial uses

Agriculture

- Fertilizer,
- Soil improver

Construction

- Sound barriers
- Building blocks
- Pavement/parking blocks
- Landscape architecture
- Restore habitats (wetlands)
- Flood protection

Fotos:
top left: Kalmar municipality
Others: Netics

One step closer to a circular economy

- Cleaner bays,
- Living ecosystems
- Minimize waste
- Cost- and energy-efficient

Dredged sediment in growth substrate for plant cultivation

- **Malmfjärden sediment characteristics**

Clay [%]	**70**	
Silt [%]	20	
LOI [%]	13.5 ± 1.0	
pH [-]	5,8	
P-tot [mg*kg^{-1}]	1159 ± 111	
N-tot [mg*kg^{-1}]	9488 ± 1339	
Cd [mg*kg^{-1}]	1.5 ± 0.4	0.5
Pb [mg*kg^{-1}]	58 ± 25	50
Zn [mg*kg^{-1}]	220 ± 14	250
As [mg*kg^{-1}]	10.8±1.8	10

reference values - ”känslig markanvändning”
(Swedish EPA ,2009)

Dredged sediment in growth media for plant cultivation

- **Substrate composition**

Photo: Laura Ferrans

Physical structure

- Pore size distribution
  - Hydraulic conductivity
  - Aeration
  - Water retention capacity

Materials

- Peat
- Bark compost
- Beach wrack
- **Biochar**

Dredged sediment in growth substrate for plant cultivation

- Cultivation trial: greenhouse and pilot study

Dredged sediment in growth media for plant cultivation

- **Cultivation trial: pilot study – plant species**

- Sunflower
- Strawberry
- Red beet
- Lettuce
- Rocket
- Wheat
- Rhy
- Indian cress
- Squash
- Carrot
- etc

Agriculture and land use: Growing experiments

Lavendel trial 2023

Kalmar kommun

LOVA
LOKALA VATTENVÅRDSPROJEKT
Havs och Vatten myndigheten
Länsstyrelserna

Linnéuniversitetet

2024-05-02

Some of our partners, networks and other projects.

Low-flow dredging network

https://www.pdjf.dk/en/program/circular-phosphorus-recovery-repair/

NETICS
THE SEDIMENT ENGINEERS

Linnéuniversitetet

LOVA
LOKALA VATTENVÅRDSPROJEKT
Havs och Vatten myndigheten
Länsstyrelserna

Kalmar kommun

https://www.richwaters.se/vara-projekt/lagflodesmuddring-oljaren/

2024-05-02

Want to learn more?
Feel free to contact us!

Watch our film about the project:
https://youtu.be/77a0u9iQS24

Please visit our website: www.life-sure.eu

Johan.persson2@kalmar.se

Kalmar kommun

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Länsstyrelserna

2024-05-02

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Workshop: Solutions for circulation of nutrients: Sea and Land Reducing nutrients in the Baltic Sea and inlands waters?

Subtitle: Low flow dredging-circulation of nutrients

THEME:

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Katrineholm

Low Flow dredging Lake Öljaren

LIFE IP Rich Waters

Jenny Herbertsson, Environmental strategist and water coordinator

Rich Waters

Tillsammans når vi längre!

Rich Waters

Havs och Vatten myndigheten

Hjälmarens Vattenvårdsförbund

MÄLARENS VATTENVÅRDSFÖRBUND

VATTENMYNDIGHETEN Norra Östersjön

Nyköpingsåarnas Vattenvårdsförbund

Jordbruks verket

Ecopelag

JHC JULMYRA HORSE CENTER

MälarEnergi

SE Smedjebacken Energi & Vatten

Bioremed

LANTBRUKARNAS RIKSFÖRBUND

LÄNSSTYRELSEN VÄSTRA GÖTALANDS LÄN

Länsstyrelsen Norrbotten

ÖREBRO

VÄSTERÅS STAD

STOCKHOLMS STAD

ÖSTHAMMARS KOMMUN – EN DEL AV ROSLAGEN

ivl SVENSKA MILJÖINSTITUTET

SLU

Uppsala KOMMUN

Upplands Väsby kommun

LÄNSSTYRELSEN UPPSALA LÄN

Länsstyrelsen Västernorrland

Länsstyrelsen Örebro län

Länsstyrelsen Stockholm

Länsstyrelsen Kalmar län

SOLLENTUNA KOMMUN

Älvkarleby kommun

LÄNSSTYRELSEN DALARNAS LÄN

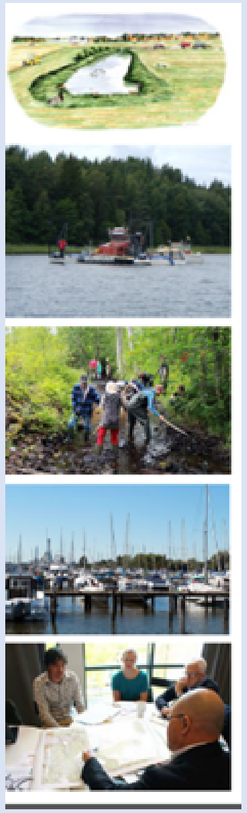
LÄNSSTYRELSEN Södermanlands län

Länsstyrelsen Västmanlands län

Katrineholms kommun

HEBY KOMMUN

Five thematic areas LIFE IP Rich Waters



External loading

- policyinstrument, horsefarms, stormwater

Internal loading

- Lake Öljaren, mussel farming, aluminiumtreatment

The natural connections of water

- Fish migration barriers (conductivity), hydroelectric power

Pollutants

- Coordinated measurements and measurement data, boat bottom cleaning

Waterplanning

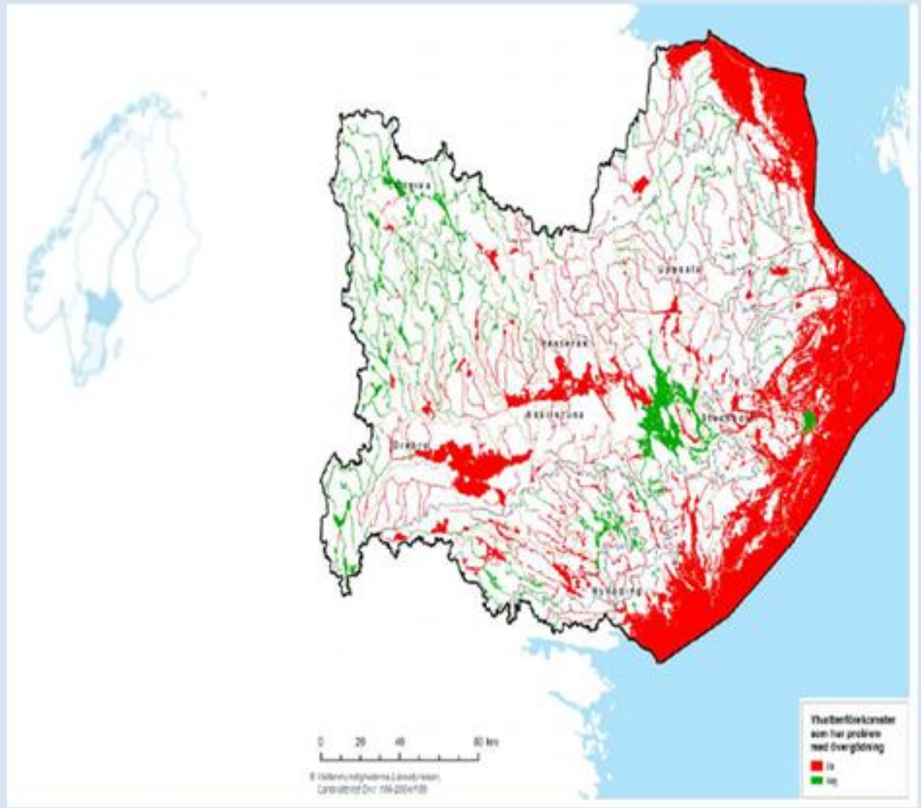
- Policies and guidelines for the water district

Katrineholm

Rich Waters

Status Lake Öljaren and catchment area

- Northern Baltic Sea
- Poor status
- Runn of to lake Hjälmaren



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Low flow dredging Lake Öljaren

- Subproject internal loading" Actions against internal phosphorus loading in lakes and coastal waters"

Rich Waters

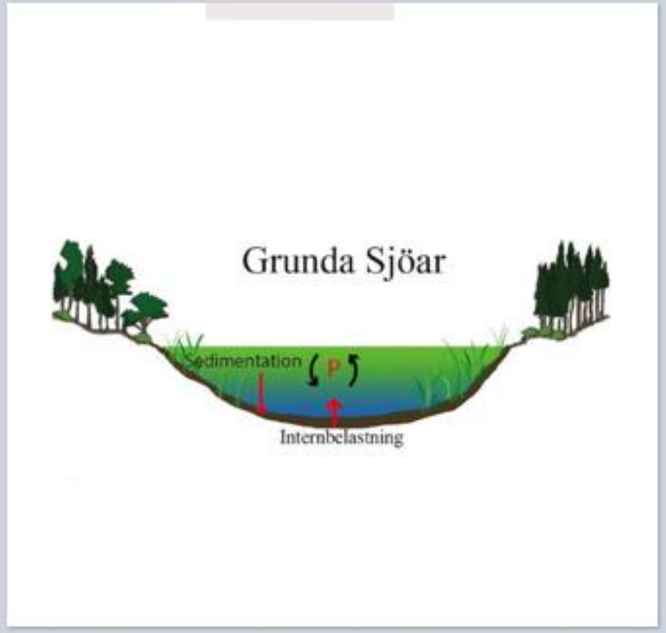
Life

Havs och Vattenmyndigheten

LOVA LOKALA VATTENVÅRDSPROJEKT

NEFCO

Katrineholm



Background

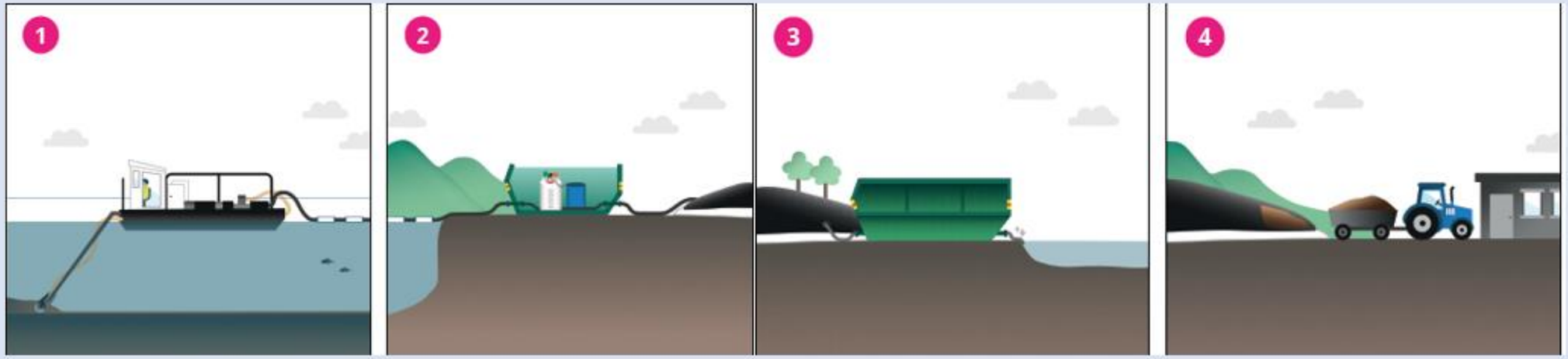
Katrineholm

Low Flow Dredging Öljaren

Foto: Johan Hammar

Katrineholm

Low Flow Dredging Öljaren



Rich Waters

Life

och Havs Vatten myndigheten

NEFCO

LOVA
LOKALA VATTENVÅRDSPROJEKT

Katrineholm

The dredging device

Foto: Johan Hammar

Dewatering geobag

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Reject water and sediments

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Emptying of the geobag

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Analysis of sediments

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►B

KOMMISSIONENS FÖRORDNING (EG) nr 889/2008

av den 5 september 2008

om tillämpningsföreskrifter för rådets förordning (EG) nr 834/2007 om ekologisk produktion och märkning av ekologiska produkter med avseende på ekologisk produktion, märkning och kontroll

(EUT L 250, 18.9.2008, s. 1)

Ändrad genom:

		Officiella tidningen		
		nr	sida	datum
►M1	Kommissionens förordning (EG) nr 1254/2008 av den 15 december 2008	L 337	80	16.12.2008
►M2	Kommissionens förordning (EG) nr 710/2009 av den 5 augusti 2009	L 204	15	6.8.2009
►M3	Kommissionens förordning (EU) nr 271/2010 av den 24 mars 2010	L 84	19	31.3.2010
►M4	Kommissionens genomförandeförordning (EU) nr 344/2011 av den 8 april 2011	L 96	15	9.4.2011
►M5	Kommissionens genomförandeförordning (EU) nr 426/2011 av den 2 maj 2011	L 113	1	3.5.2011
►M6	Kommissionens genomförandeförordning (EU) nr 126/2012 av den 14 februari 2012	L 41	5	15.2.2012
►M7	Kommissionens genomförandeförordning (EU) nr 203/2012 av den 8 mars 2012	L 71	42	9.3.2012
►M8	Kommissionens genomförandeförordning (EU) nr 505/2012 av den 14 juni 2012	L 154	12	15.6.2012
►M9	Kommissionens genomförandeförordning (EU) nr 392/2013 av den 29 april 2013	L 118	5	30.4.2013
►M10	Kommissionens förordning (EU) nr 519/2013 av den 21 februari 2013	L 158	74	10.6.2013
►M11	Kommissionens genomförandeförordning (EU) nr 1030/2013 av den 24 oktober 2013	L 283	15	25.10.2013
►M12	Kommissionens genomförandeförordning (EU) nr 1364/2013 av den 17 december 2013	L 343	29	19.12.2013
►M13	Kommissionens genomförandeförordning (EU) nr 354/2014 av den 8 april 2014	L 106	7	9.4.2014
►M14	Kommissionens genomförandeförordning (EU) nr 836/2014 av den 31 juli 2014	L 230	10	1.8.2014
►M15	Kommissionens genomförandeförordning (EU) nr 1358/2014 av den 18 december 2014	L 365	97	19.12.2014
►M16	Kommissionens genomförandeförordning (EU) 2016/673 av den 29 april 2016	L 116	8	30.4.2016
►M17	Kommissionens genomförandeförordning (EU) 2016/1842 av den 14 oktober 2016	L 282	19	19.10.2016
►M18	Kommissionens genomförandeförordning (EU) 2017/838 av den 17 maj 2017	L 125	5	18.5.2017

B	Organiskt rikt sediment från sötvatten som bildats under syrefria betingelser (t.ex. sapropel)	Endast organiska sediment som är utvunna som biprodukter från verksamhet i sötvatten eller utvunna från tidigare sötvattensområden. I tillämpliga fall bör utvinning ske på ett sätt som orsakar minsta möjliga påverkan på vattenmiljön. Endast sediment från källor som är fria från föroreningar av bekämpningsmedel, långlivade organiska föroreningar och bensinliknande ämnen. Högsta tillåtna koncentration i mg/kg torrvikt: Kadmium: 0,7, koppar: 70, nickel: 25, bly: 45, zink: 200, kvicksilver: 0,4, krom (totalt): 70, krom (VI): ej påvisbart.

Katrineholm

Sediment dispersion

Katrineholm

Funding of the project

- EU- contribution and municipality of Katrineholm ~ 4,8 millions sek
- LOVA contribution 765 000 sek + 3,3 millions sek
- Swedish Agency for Marine and Water Management, funding 5 millions sek
- BASAP Fund, foundation €200 000

Rich Waters
Life
Havs och Vattenmyndigheten
NEFCO
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Katrineholm

Katrineholm

Thank you for listening

Jenny Herbertsson

jenny.herbertsson@katrineholm.se

BLUE MISSION BANOS

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Workshop: Circulation of nutrients

Subtitle: Resource circulation of reed

THEME: Baltic Reed /Ulla Rosenström

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BalticReed

Baltic Sea Coastal Nutrient Management with Reed

Aim: To improve the state of the Baltic Sea coastal waters by developing sustainable reed-based production chains

Duration: 5/2023 – 4/2026
Budget: Approx. 3 MEUR (2.992)
Co-financing: EU Interreg Central Baltic Programm
Location: Finland, Sweden, Åland Islands

Interreg
Co-funded by the European Union
Central Baltic Programme

BalticReed

Interreg
Co-funded by the European Union
Central Baltic Programme
BalticReed

Background

- Reed retains significant amount of nutrients: One hectare of dense reed contains 5-10 kg of phosphorus(P) and 80-100 kg of nitrogen(N).
- Harvest, collection and re-use of reed results in two benefits: Uptake of nutrients and improving the coastal habitats which benefits the biodiversity.
- Reed is an excellent biomaterial that has also been used historically for several purposes

Nutrient removal by sustainable use of reed beds

WP Nutrient removal & coastal restoration

Pilot activities

- Nutrient reductions from coastal bays by harvesting (n=12)
- Improved coastal habitats

Awareness raising

- Increasing knowledge on the need of coastal water protection (guidelines for sustainable harvesting)

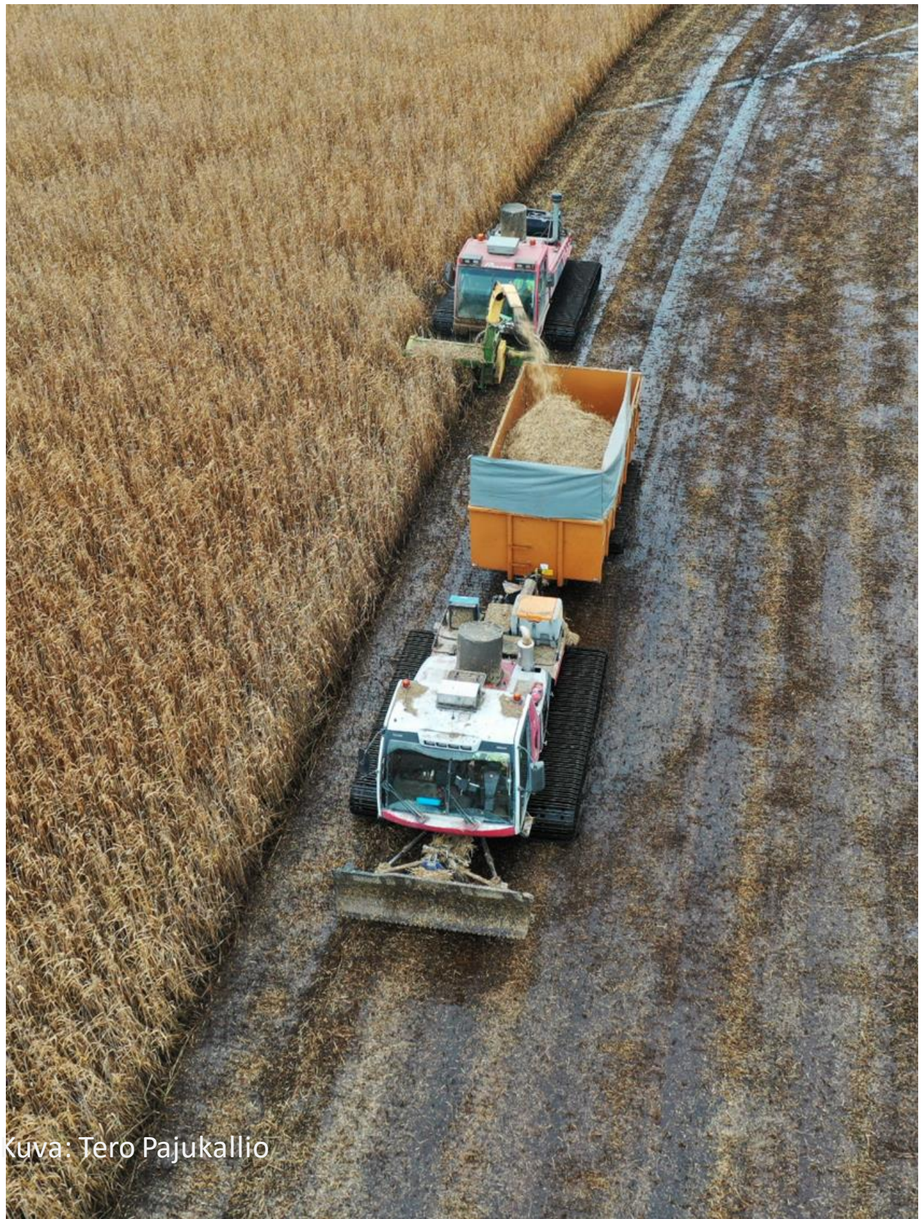
WP Sustainable solutions for reed-based value chains

Sustainable use of reed beds:

- Solutions for developing legislation, permitting and multi-purpose planning

Viable value chains:

- Reed-based products, novel solutions and innovations
- Knowledge exchange and learning



Kuva: Tero Pajukallio

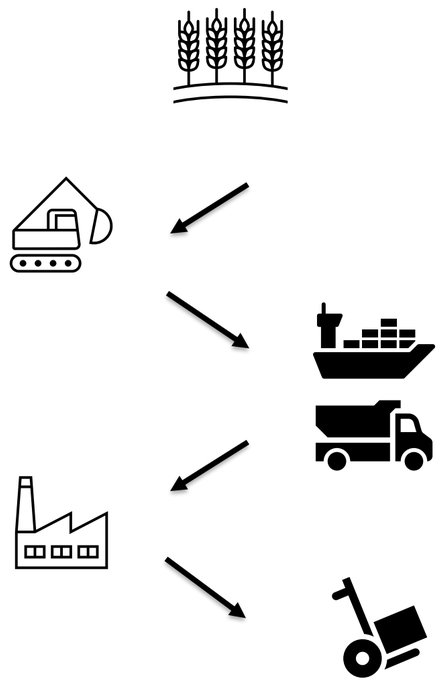
BalticReed

From shore to store

Interreg
Co-funded by the European Union
Central Baltic Programme
BalticReed

Bio

Value Chain development



Bottlenecks identified:

Harvest

- techniques & equipment ineffective →harvesting expensive
- several harvesting techniques required (land vs. water harvest; winter vs. summer harvest

Logistics

- reed grows in inaccessible areas and is scattered
- reed is bulky and often a “fresh produce”
- communication problematic as many players involved and weather dependent

Consistency

- limitations in harvest season (due to weather and wildlife) → affects availability

Willingness to pay

- cheap/free biomaterials are available (eg. for biogas, biochar, and soil)
- requires investments

Efficiency across all components of the chain should be optimized, with seamless communication among all parties

Interreg
Co-funded by the European Union
Central Baltic Programme
BalticReed

BLUE MISSION BANOS

BlueGreen Governance

Baltic MUPPETS

2nd MISSION ARENA
25-26 April 2024 | Riga, Latvia

Assessing the role of shellfish farming in nutrient and carbon capture

Jonne Kotta, University of Tartu

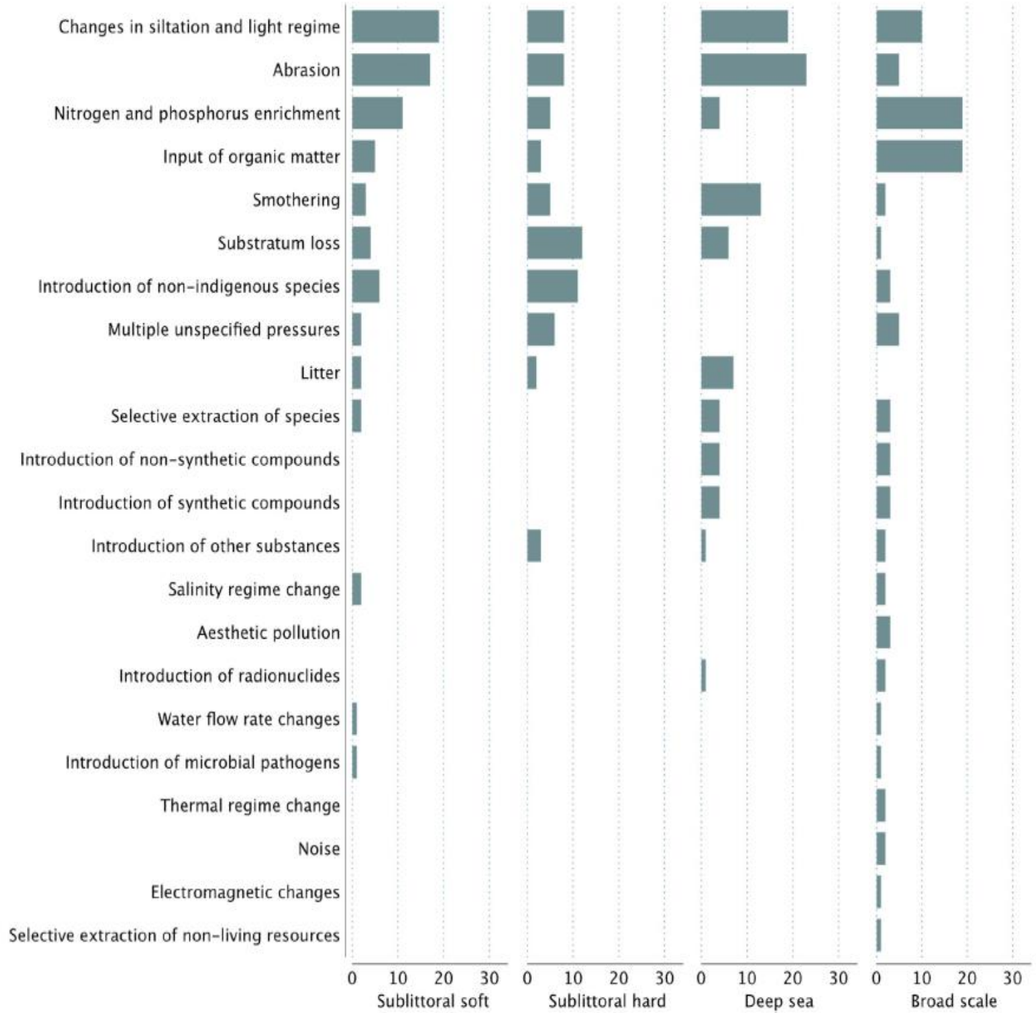
#Arena2

EU MISSIONS RESTORE OUR OCEAN & WATERS

Funded by the European Union

HUMAN ACTIVITIES HAVE IMPACTS

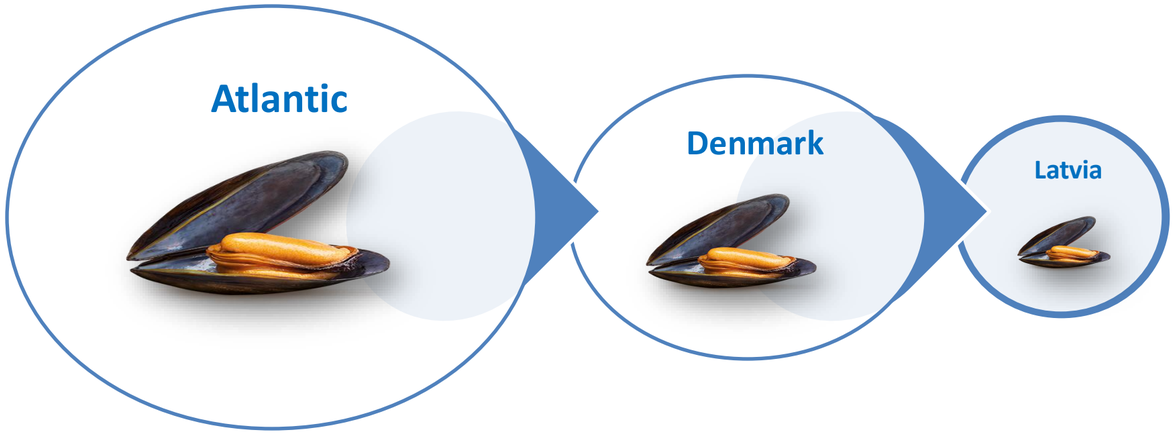
Human induced pressures become more intense and diverse and result in the loss of habitats



Low-trophic aquaculture

Economic benefit

Environmental healing (extracting legacy nutrients and capturing carbon)



Do the low salinity and cold water of the Baltic Sea favour shellfish farming?

How can it help counteract the negative effects of eutrophication and climate change?

Baltic MUPPETS

Modelling biomass growth

Baltic Blue Growth

- statistical models
- explore statistical associations
- predict biomass yield (dependent variable)

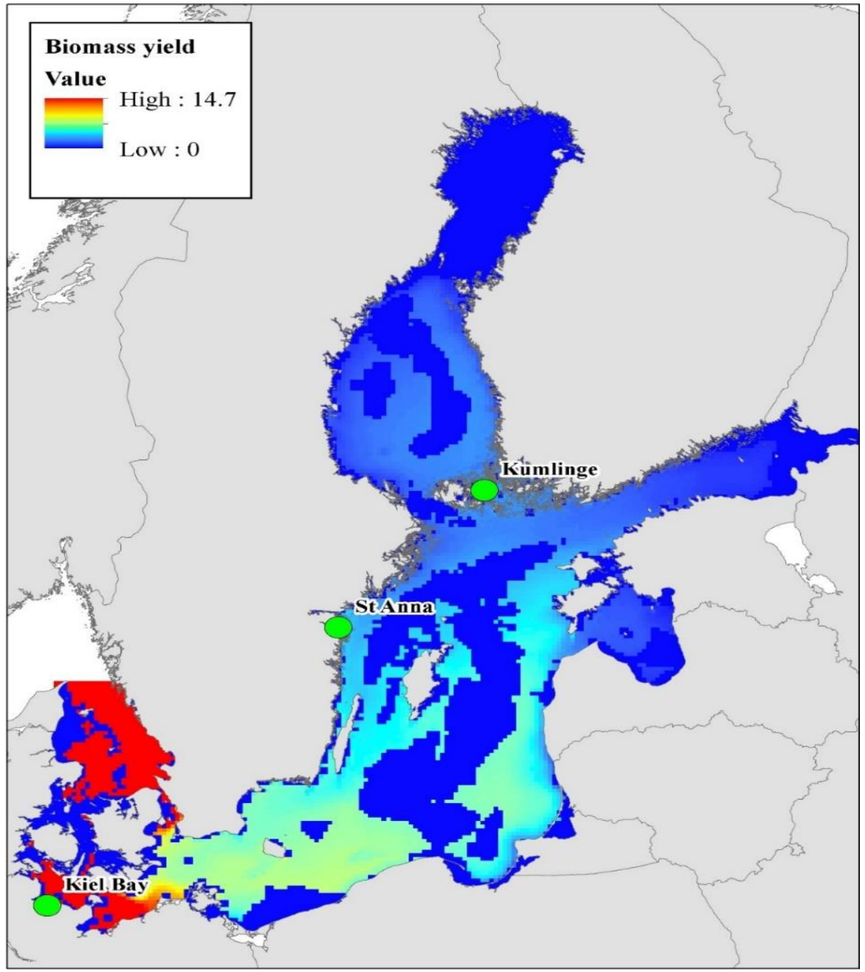
Baltic Muppets

- dynamic models
- explore processes
- predict multiple outcomes (biomass, NPC fluxes)

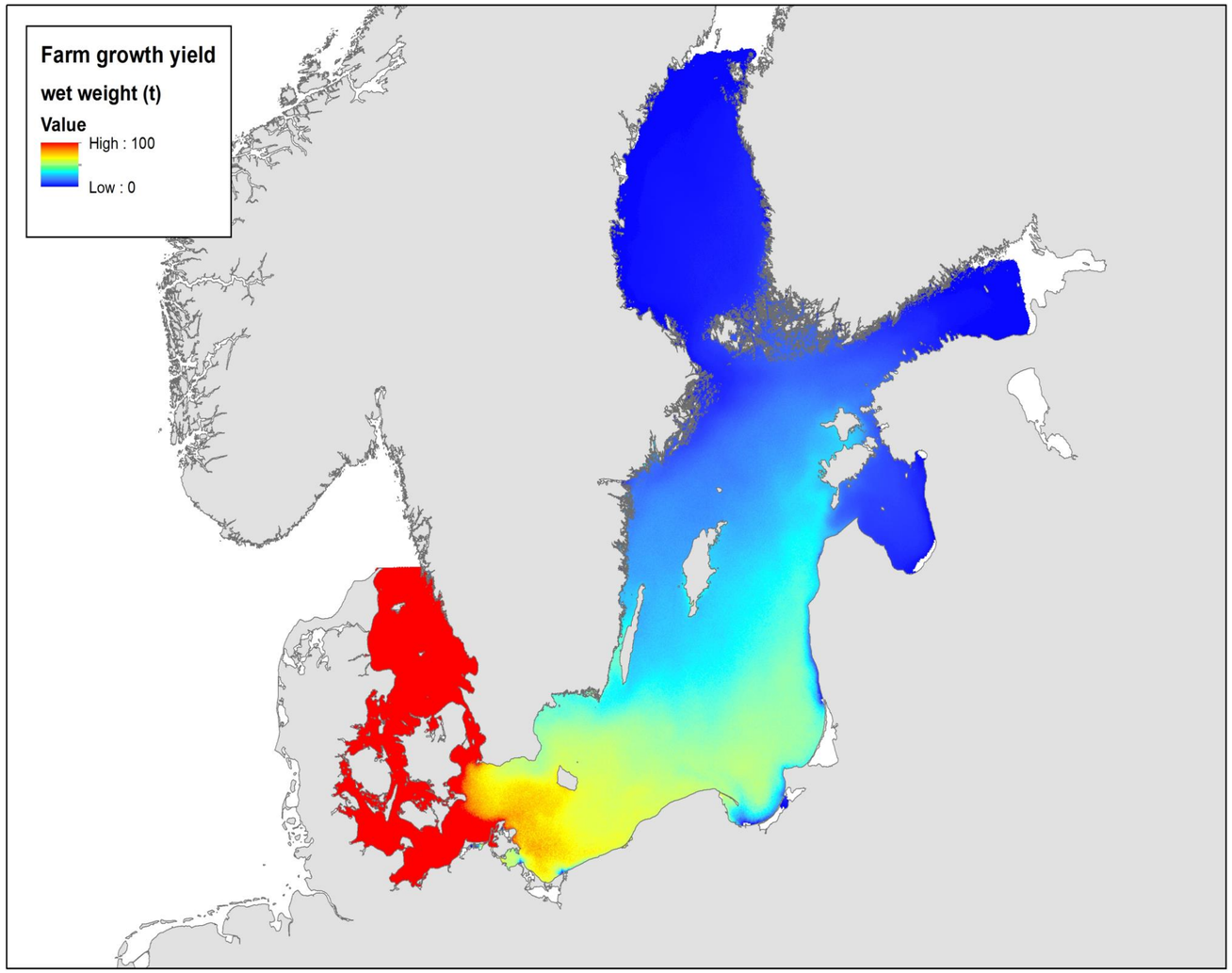
Baltic MUPPETS

Modelling biomass growth (regional)

Baltic Blue Growth

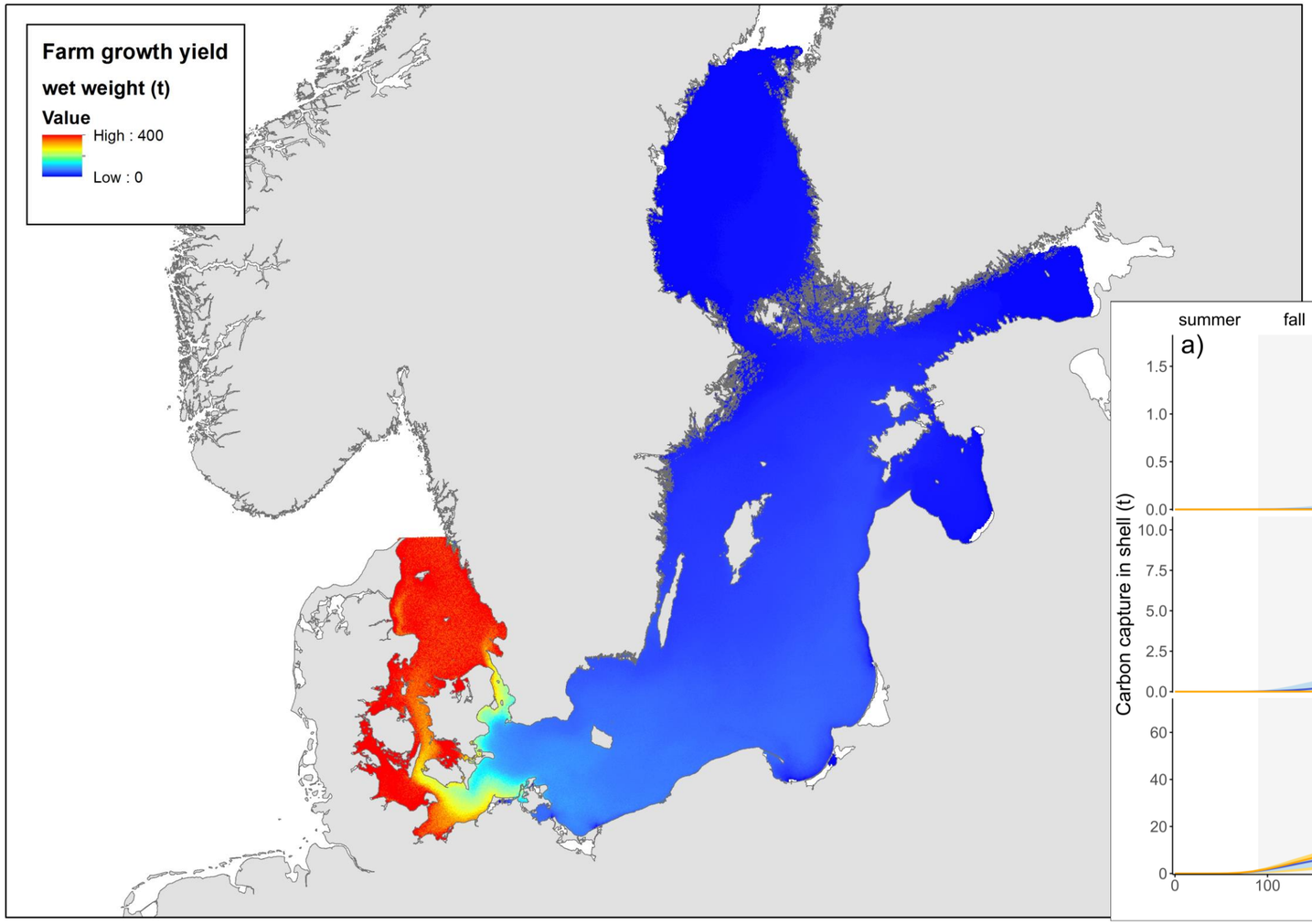


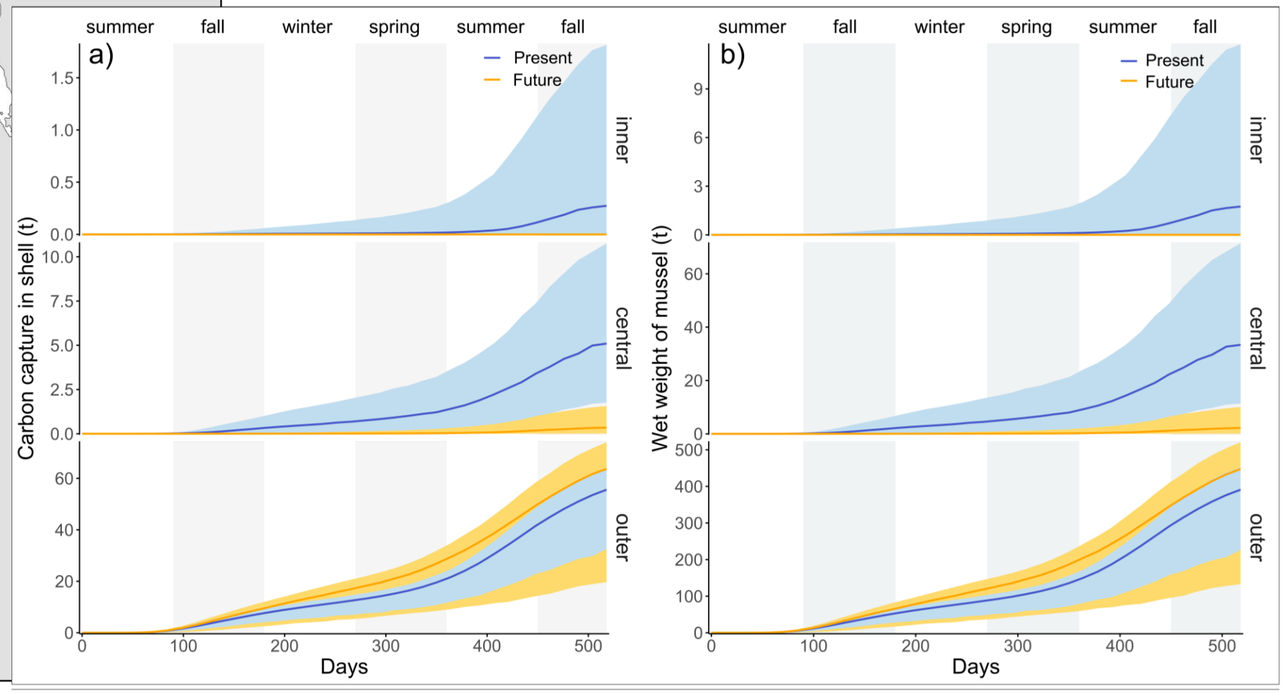
Baltic Muppets



Baltic MUPPETS

Modelling biomass growth + NPC capture (regional)



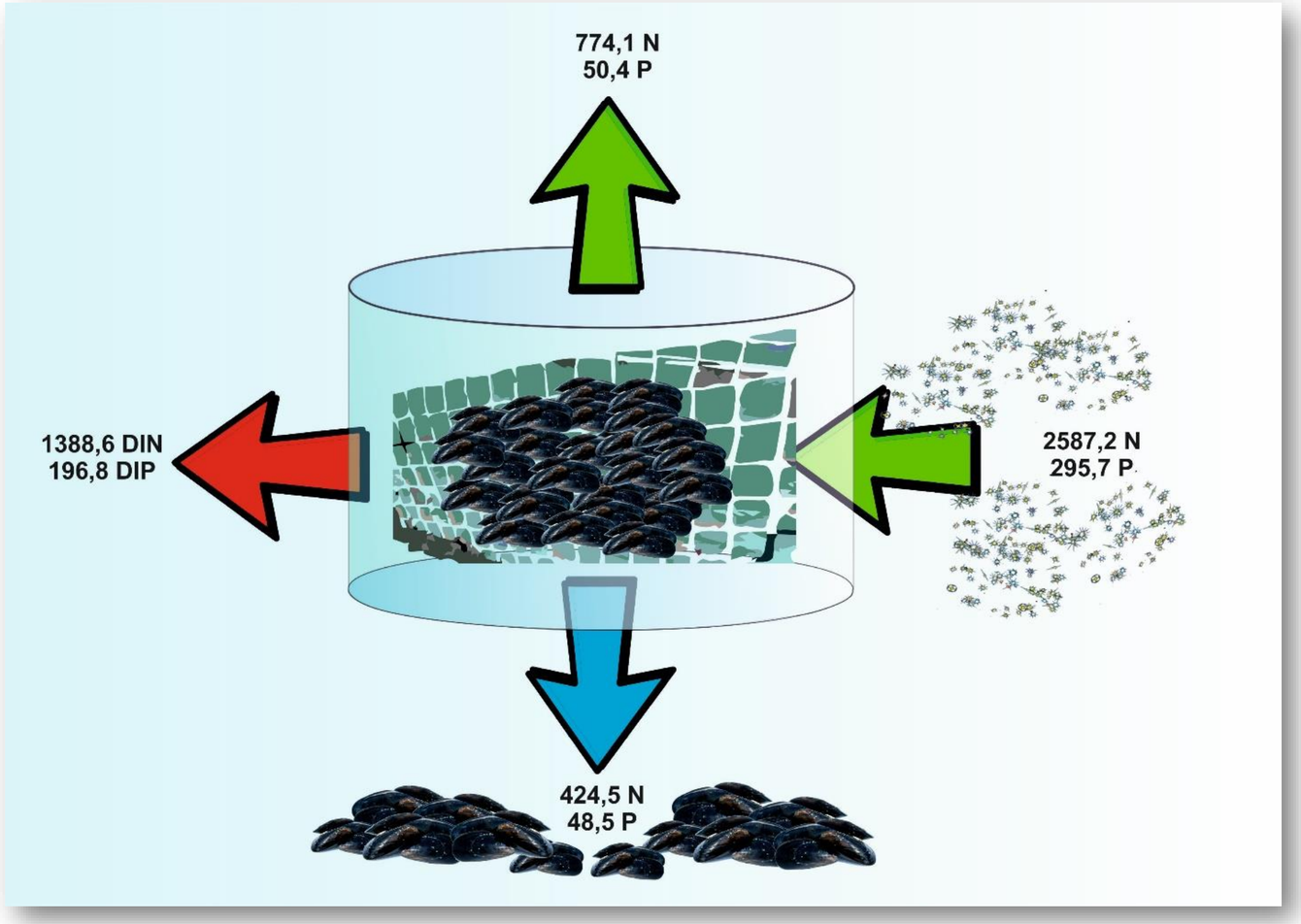


Baltic MUPPETS

Modelling biomass growth + NPC capture (farm)

0.5 ha low salinity farm

Nutrient flows (kg) in one harvest cycle

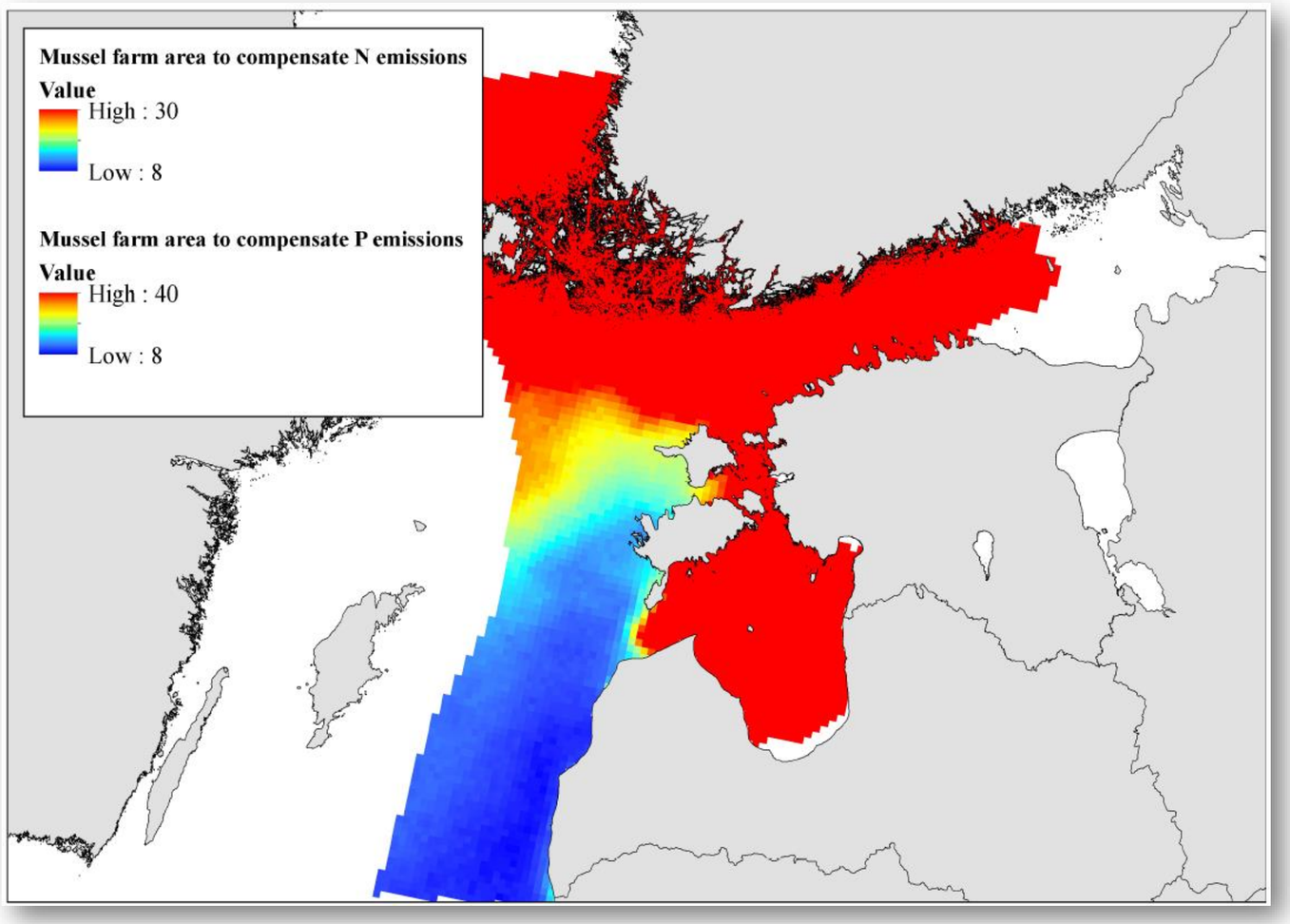


Baltic MUPPETS

Assessing the effectiveness of mussel farms in capturing nutrients from fish farms

1 ha low salinity mussel farm

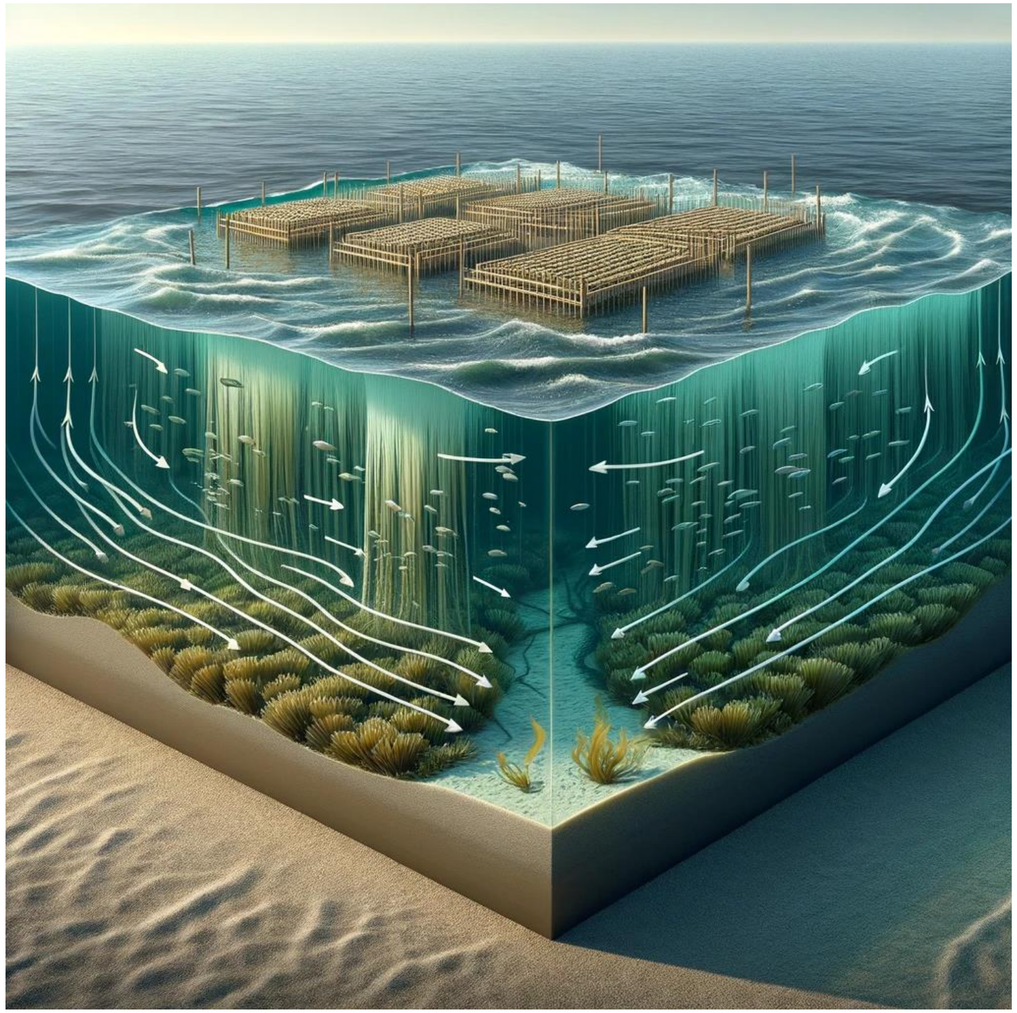
Fish farm with an annual production capacity of 200 tons.



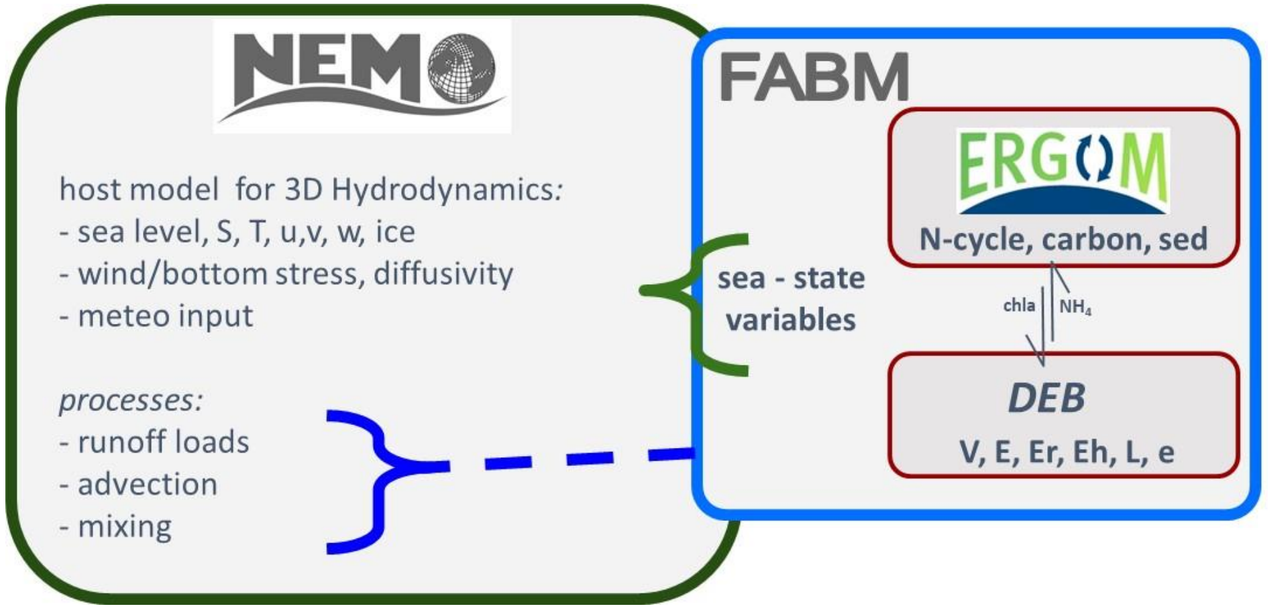
Baltic MUPPETS

Modelling carrying capacity

Maximising space: The optimal number of mussel farms per square kilometre



Linking 3D hydrodynamics with biological process modelling (e.g. dynamic energy budget models)



BLUE BIO SITES

Where cumulative impact analyses meet the future of low-trophic aquaculture

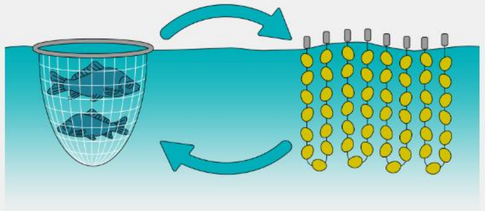
ODSS
Operational Decision Support System

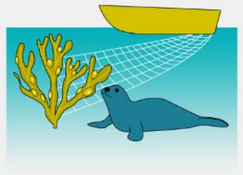
PlanWise4Blue

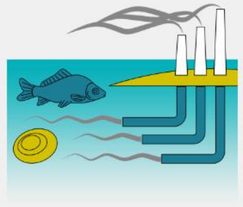
PlanWise4Blue **Estonia**

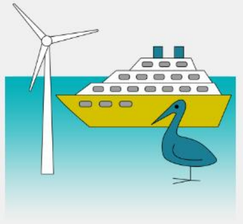
PlanWise4Blue **NorthEastern Baltic Sea**

PlanWise4Blue **Baltic Sea**









GUIDES

GUIDES

GUIDES

GUIDES

The blue mussel and macroalgae farming application - a platform for uploading, analysing and sharing information

Your science-based compass for managing multiple pressures on marine assets

About us, our partners and projects

Sign Up to start using our applications

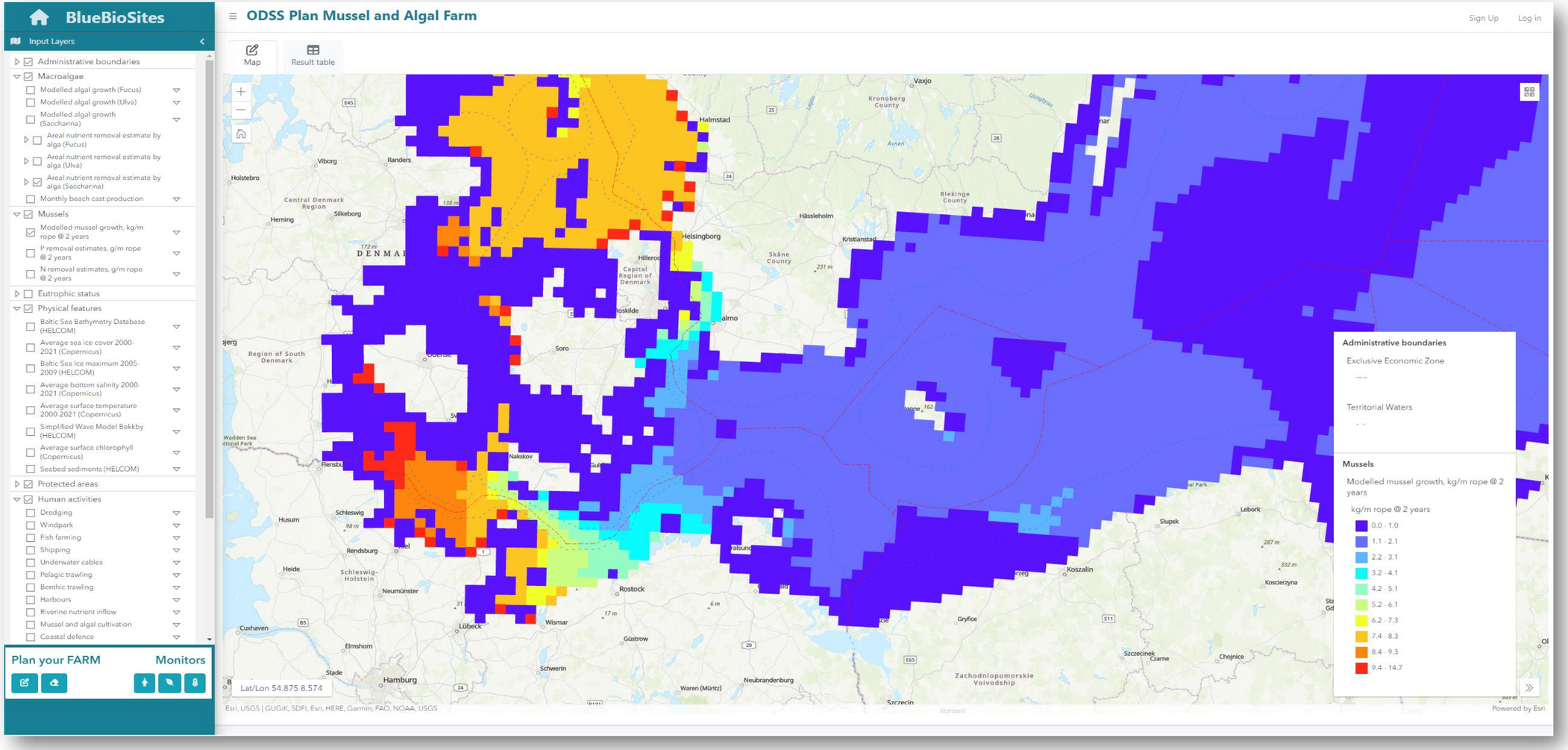
Open feedback form

Contact us:
bluebiosites@ut.ee

Baltic MUPPETS

Operational Decision Support System (ODSS) in action

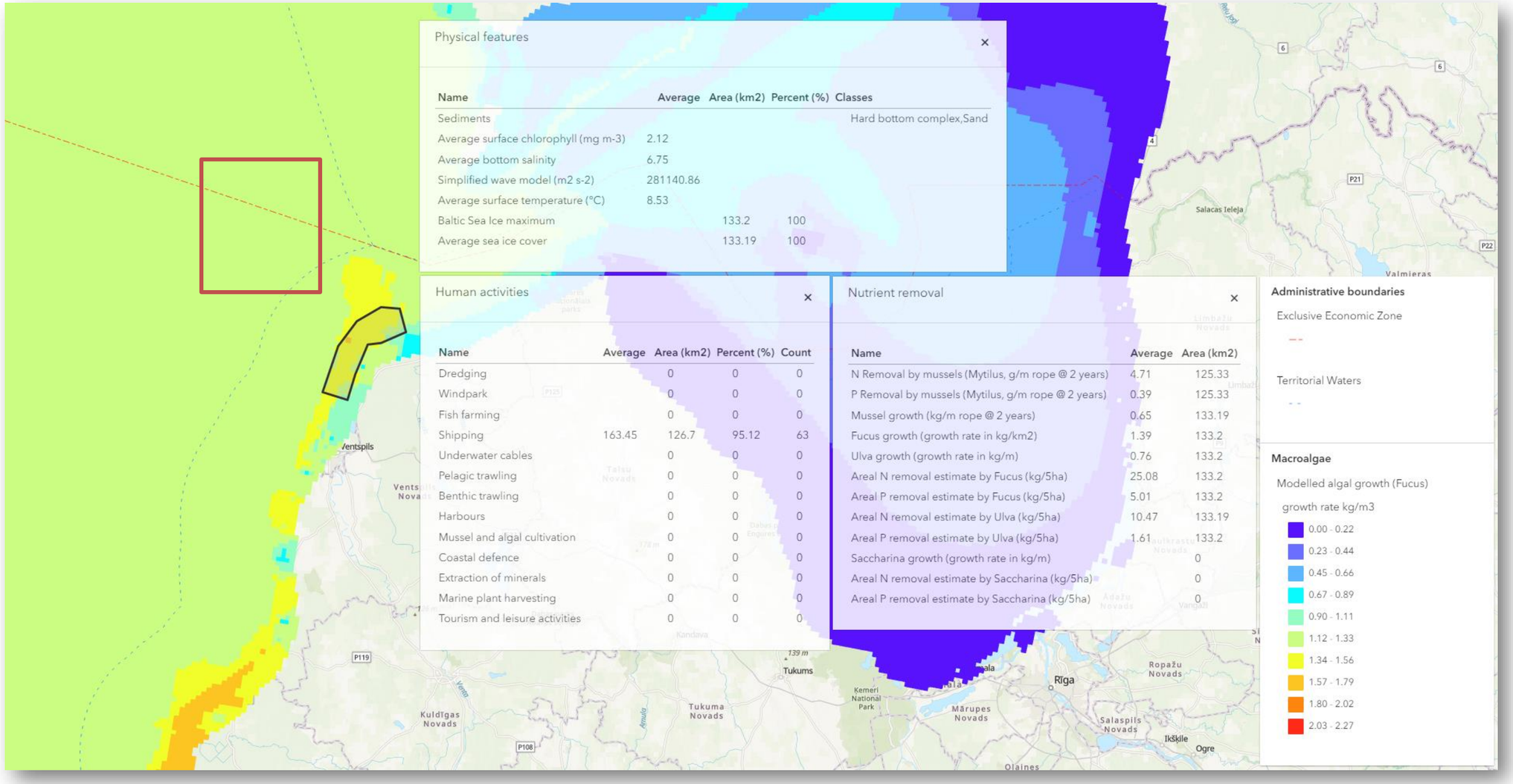
Display and analysis of different map layers



Baltic MUPPETS

Operational Decision Support System (ODSS) in action

Calculation of farm yields and associated ecosystem services



Baltic MUPPETS

Baltic Muppet tool for farm upscaling

Input
- Farm configuration (rope density)
- Optimum production yield expectation

Processing
- DEB model (mussel growth)
- 3D hydrodynamics

Output
- Maximum farm area to be within carrying capacity

Baltic MUPPETS

Baltic Muppet tool for ecosystem services mapping

Environmental conditions

DEB + 3D hydrodynamics

Nutrient and carbon flows

BLUE MISSION BANOS

2nd MISSION ARENA
25-26 April 2024 | Riga, Latvia

Workshop: Solutions for circulation of nutrients

Subtitle: Resource circualtion – algae and cyanobacteria: the case of the EU project „AlgaeService for LIFE“

Jūratė Karosienė, Judita Koreivienė, Nature Research Center, Vilnius, Lithuania

THEME: Resource Circulation

#Arena2

EU MISSIONS RESTORE OUR OCEAN & WATERS

Funded by the European Union

Resource circulation – algae and cyanobacteria

The EU project „Algae – economy based ecological service of aquatic ecosystems“

Acronym: AlgaeService for LIFE

Project No: LIFE17 ENV/LT/000407

Project duration: 01/08/2018 – 30/11/2023

Coordinating Beneficiary:

Associated Beneficiaries:

Co-Financed by:

Algae Service for Life

AlgaeService for LIFE

The project aimed to promote best practices in ecological services and the circular economy approach by implementing an innovative complex system.

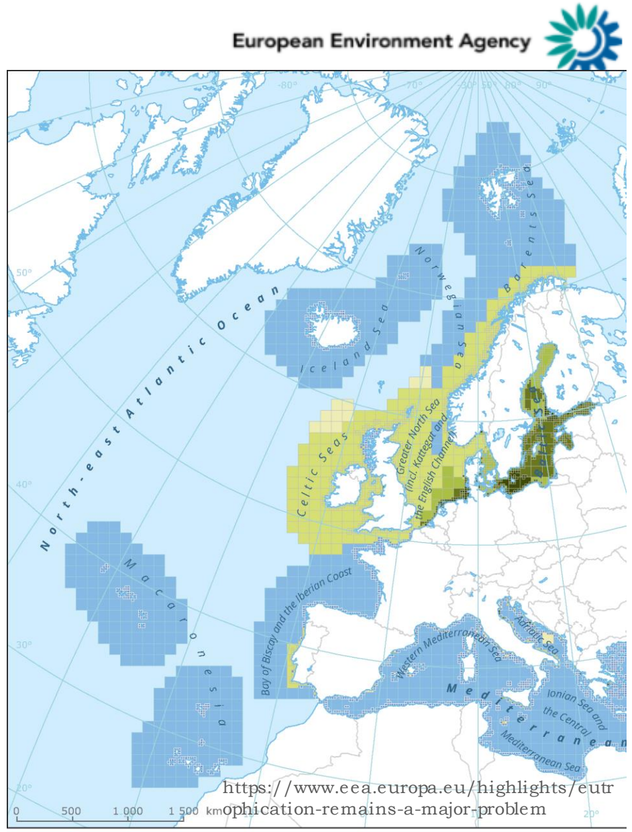
Objectives

- To demonstrate integrated **management** of nutrients and **algal blooms** through the harvesting of macroalgae mats and cyanobacteria scums
- To test and demonstrate the **redesigning** of harvested **biomass into** potentially valuable **products**
- To raise **awareness** to environmental, water quality and health hazard issues

Eutrophication

- The main problem of the Baltic Sea in the whole region is eutrophication with all its consequences.

Eutrophication has affected about 97% of the Baltic sea area.

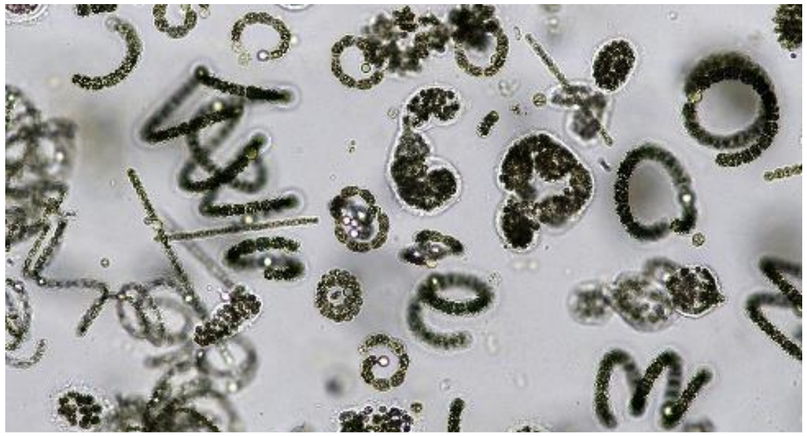


Cyanobacteria bloom in the Baltic Sea, 2005.

Satellite image from NASA' s Terra satellite, MODIS instrument.

Cyanobacteria and algae as biological filters

Cyanobacteria blooms



Kaunas Reservoir, September 2020

Macroalgae agglomerations

River Jūra, August 2019

Prototypes

for algae and cyanobacteria biomass harvesting

Baltic Environment

Characteristics	AS-S	AS-L
Target biomass	Macroalgae, cyanobacteria	Cyanobacteria
Type of water	Rivers, lakes and ponds	Large lakes, reservoirs, lagoons
Mobility	Towing a car (SUV) on a trailer	Special trailer with manipulator
Size and other specifities	Length - 4 m, width - 2.45 m, height - 2.2 m, weight - 1.5 t	Length - 9 m, max width - 4.8 m, height - 3.8 m, weight - 4 t
Area of filtration mesh	For cyanobacteria - 3.38 m²	13.52 m²
Filtration rate of water	For cyanobacteria - 1.07 m³/h	4.27 m³/h
Efficiency	Up to 2000 kg/h wet macroalgae biomass 30-80 l/h wet weight of cyanobacteria	120-350 l/h wet weight
Biomass density	Up to 4% dry weight of cyanobacteria	Up to 4% dry weight
Collected amount of wet biomass	60 t wet weight of macroalgae 1 t wet weight of cyanobacteria	8 t wet weight

Prototypes

for algae and cyanobacteria biomass harvesting

Baltic Environment

Algae Service for Life

Life

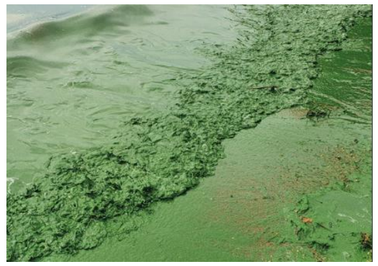
GAMTOS TYRIMU CENTRAS

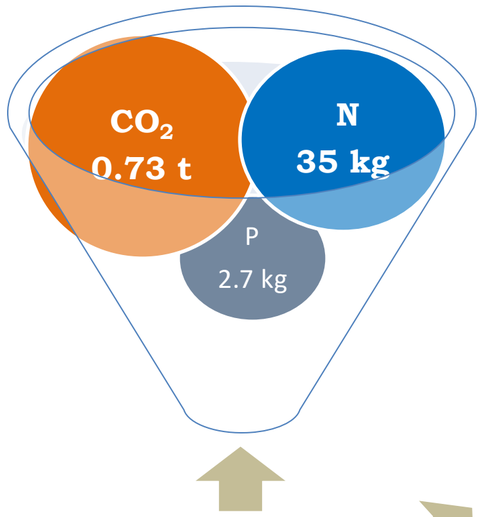
Characteristics	AS-S	AS-L	AS-LAND
Target biomass	Macroalgae, cyanobacteria	Cyanobacteria	Cyanobacterial scums near shore
Type of water	Rivers, lakes and ponds	Large lakes, reservoirs, lagoons	Lakes, ponds, littoral zone
Mobility	Towing a car (SUV) on a trailer	Special trailer with manipulator	Easily transportable on trailer
Size and other specifities	Length - 4 m, width - 2.45 m, height - 2.2 m, weight - 1.5 t	Length - 9 m, max width - 4.8 m, height - 3.8 m, weight - 4 t	Two parts: Floating collecting device: 1.3×1.7 m Concentrating on-land device: 4.6×1 m²
Area of filtration mesh	For cyanobacteria - 3.38 m²	13.52 m²	4 m²
Filtration rate of water	For cyanobacteria - 1.07 m³/h	4.27 m³/h	1.2-10.9 m³/h (depends on the concentration in water body)
Efficiency	Up to 2000 kg/h wet macroalgae biomass 30-80 l/h wet weight of cyanobacteria	120-350 l/h wet weight	Up to 136 kg/h wet weight
Biomass density	Up to 4% dry weight of cyanobacteria	Up to 4% dry weight	Up to 5.8 (average 4.8) % of dry weight
Collected amount of wet biomass	60 t wet weight of macroalgae 1 t wet weight of cyanobacteria	8 t wet weight	4.14 t wet weight

Biomass collected

Algae Service for Life

Cyanobacteria harvesting



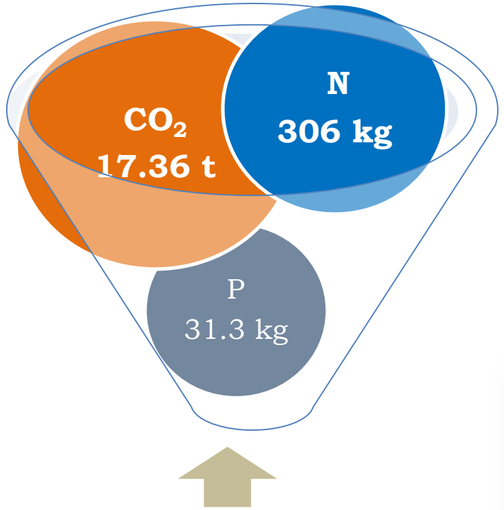


Cyanobacteria
13.32 tons

Eliminating biomass removes

Cyanotoxins
(mainly hepatotoxic microsystins)
372 g

Macroalgae harvesting



Macroalgae
95.44 tons

Algae Service for Life

Low value products

Corg. 13.1-72.8%

K 1.2-8.3%

N 1.5-4.5%

P 0.1-0.5%

Chemical composition of *Cladophora glomerata* (% in dry biomass).

Fertilizers

Macroalgal biomass as an organic slow-release fertilizers was tested.

Laboratory

Macroalgal aqueous extracts (5% and 25% concentration) had a positive effect on germination of tomatoes, basil, spring wheat and cucumber seeds. The extracts have no effect or even negative for peas seeds.

Experimental fields

Variously prepared macroalgal biomass, applicated into light-textured soil as a fertilizer, increased the yield of cereals and storage plants by 47-104%. The application of biomass for fertilization in spring was 50% more effective.

Agricultural fields

Fertilizer obtained by adding macroalgae biomass to manure was highly successful in enhancing potatoe crops yields, up to around 80% compared to control.

Biogas

- 35.6 t of macroalgae and 9 t of cyanobacteria wet biomass were used for biogas production.
- 832 m³ of biogas was produced.
- 4 925 kWh of energy was produced with a methane concentration of 65-75% and a yield of 0.58-0.80 m³/d/m³ of substrate.

The installed photobiofilter for biogas upgrading:

- increase of methane concentration by 5-8%
- reduse CO_2 by 8-15% and H_2S by 12-40%.

Algae Service for Life

Low value products

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Innovative feed products

- for rabits

LITHUANIAN UNIVERSITY OF HEALTH SCIENCES

- for fishes

eureka

ECO-AQUA-RECYCLE

2021-2023 (applied for EU patent)

High value products

Algae Service for Life

Life

CAMTOS TYRIMU CENTRAS

Cyanobacteria non-toxic biomass for blue-coloured pigment

Phycocyanin

Was extracted and purified from wild non-toxic cyanobacteria biomass collected from the Kaunas reservoir.

Phycocianin extraction from cyanobacteria

Precipitation with amonium sulfate

Ultrafiltration and purification using gel filtration or ion exchange chromatography

Freeze drying (lyophylization)

Freeze-dryed phycocyanin powder

The method for extraction and purification of phyco-cyanin was optimised. Phycocyanin purity varied from food grade used for food and cosmetic to analytic grade.

Macroalgae *Cladophora glomerata* biomass for cosmetic

Extracts for cosmetic

STEP BY STEP | From raw macroalgae to high value cosmetic products:

Macroalgae raw material is first cleaned, de-encrusted and crushed before extraction

Solvent extraction, followed by low-pressure evapora-tion isolates the active compounds

A suitable emulsion base is developed, which will complement the macroal-gae extract

The final cosmetic product undergoes stability, purity and consumer-based testing

Algae Service for Life

Macroalgae value chain

Detection hot spots of agglomerations & evaluation of the biomass using UAV

Harvesting of biomass using AS-S

PRODUCTS

- Biogas
  - Digestate as fertilizers
  - Biomass as fertilizers
- Extracts for natural cosmetics
- Feed additives
- Cellulose production

STAKEHOLDERS

Small ecological farms get energy and fertilizers to increase sustainability: save money by producing self energy, improve the soil quality and crop yield.

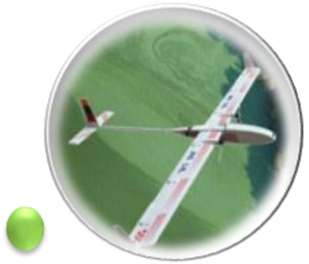
Companies seeking replacing chemical compounds by natural products in cosmetics.

Companies producing feed for various types of animals to obtain better quality product and keep animals healthy from diseases.

Algae Service for Life

Cyanobacteria value chain

Monitoring water bodies using UAV



Biomass harvestin by AS-LAND

Biomass application

! Cyanobacteria biomass has strict regulation of biomass utilisation in the European Union

Biomass

Toxic biomass: ⇢

⇢ Fertilizers for energetic plants

Project: NutriBiomass 4LiFE

Phycocyanin

Non-toxic biomass: ⇢

⇢ Anti-skin cancer gel

LITHUANIAN UNIVERSITY OF HEALTH SCIENCES
Medical Academy

Algae Service for Life

Thank you for the attention!

BLUE MISSION BANOS

2nd MISSION ARENA
25-26 April 2024 | Riga, Latvia

Workshop: Resource circulation - seawheat

Karina Balina/ Researcher at Circularity Transitions Research Group or Scientific Communication Coordinator at SeaWheat COST Action.

#Arena2

EU MISSIONS RESTORE OUR OCEAN & WATERS

Funded by the European Union

SeaWheat

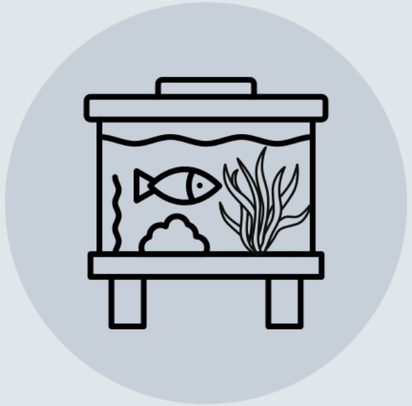
COST Action CA20106

ULVA: TOMORROW'S "WHEAT OF THE SEA", A MODEL FOR AN INNOVATIVE MARICULTURE

PhD Karina Balina
Scientific Communication Coordinator

Funded by the European Union
cost EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

BIOLOGY
Dr. Ronan Sulpice



AQUACULTURE
Dr. Rui Pereira

FOOD, FEED AND BIOMATERIALS
Dr. Sylvia Strauss

BIOACTIVE PRODUCTS
Dr. Thomas Wichard

ECOSYSTEM SERVICES
Dr. Annette Bruhn

SOCIAL, LEGAL AND REGULATORY ASPECTS
Dr. Celine Rebours

The main goals SEAWHEAT of the COST Action

- make a step-change towards a green economy based on **Ulva mass production and utilization** within the European community and beyond,
- development of **Ulva-based blue-biotech industries** and utilization of Ulva as a **model organism in European algaculture**,
- introducing the traditional European diet and taste with **Ulva, as a new, sustainable and safe food item**.

Progress of SEAWHEAT

- Involved over 300 participants, 30 countries
- More than 20 SMEs
- Ongoing work on several reviews
- Starting EU level Ulva sampling and analysing

  (genome, compositition, microbiome)
- SME survey
- Policy analyses both national and EU level
- Training Schools, Conferences, WorkShops, STSMs

Lunch with Ulva 2024

25th April - **Erik Malta**

30th May - **Anna Fricke**

27th June - **Olivier De Clerck**

25th July - **Ronan Sulpice**

26th September - **Annette Bruhn**

24th October - **Stefan Kraan**

Register Now!

BLUE MISSION BANOS

2nd MISSION ARENA
25-26 April 2024| Riga, Latvia

EU MISSIONS RESTORE OUR OCEAN & WATERS

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WORKSHOP

"BIOACTIVES IN ULVA"

24TH - 25TH JUNE, 2024

START AT 9.30 AM

UNIVERSITY OF AVEIRO, PORTUGAL

APPLICATION DEADLINE 28TH APRIL

Register Now

Funded by the European Union

SeaWheat
COST Action CA20106

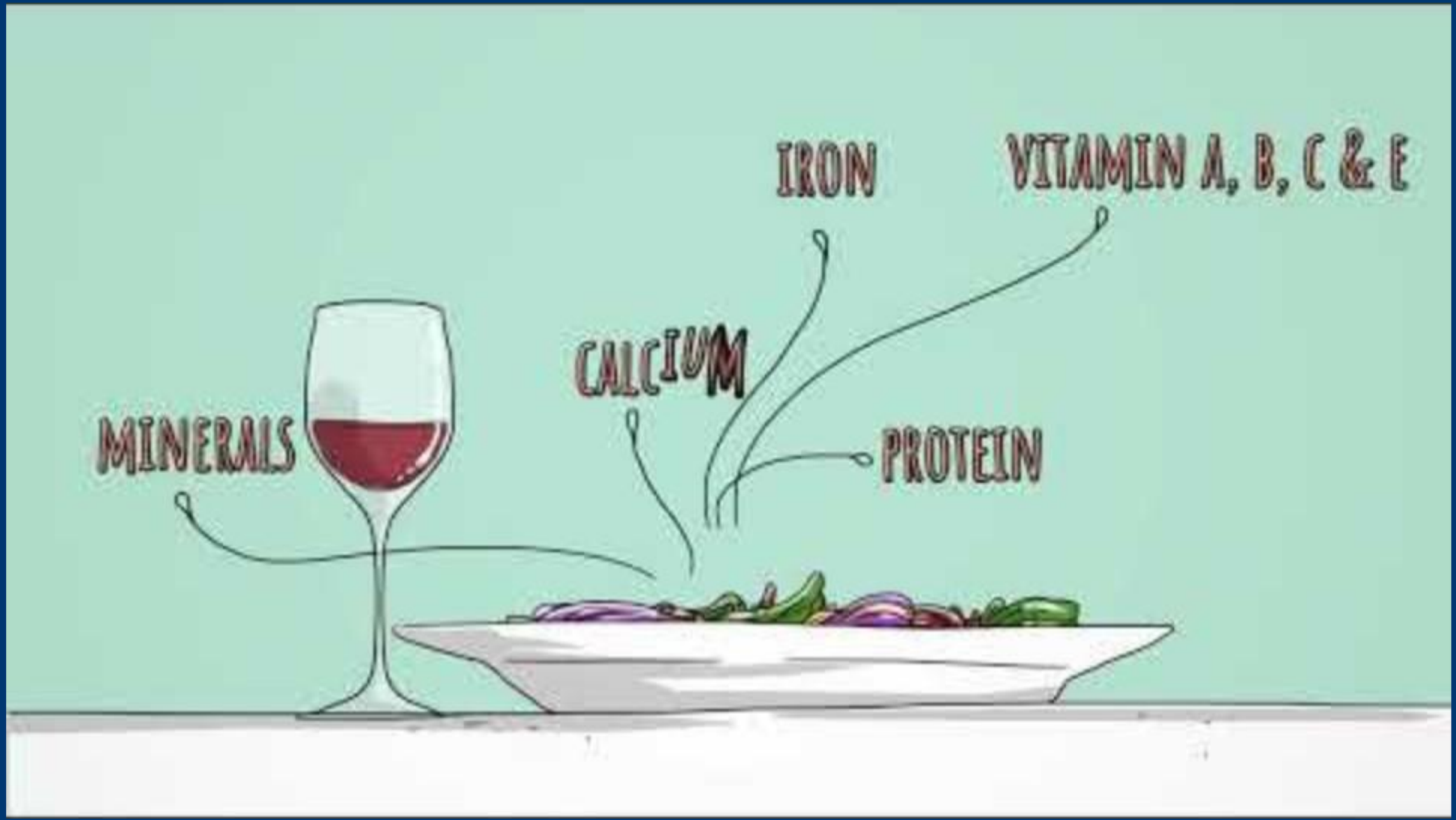
אוניברסיטת חיפה
University of Haifa
جامعة حيفا

universidade de aveiro

cost
EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

FRIEDRICH-SCHILLER-UNIVERSITÄT JENA

ALGA+


IRON
VITAMIN A, B, C & E
CALCIUM
MINERALS
PROTEIN

SeaWheat

COST Action CA20106

TOMORROW'S 'WHEAT OF THE SEA': ULVA, A MODEL FOR AN INNOVATIVE MARICULTURE

seawheat@univ.haifa.ac.il

Karīna Bāliņa karina.balina@lu.lv

BLUE MISSION BANOS

2nd MISSION ARENA
25-26 April 2024 | Riga, Latvia

Thanks for listening
Now time for discussions

#Arena2

EU MISSIONS RESTORE OUR OCEAN & WATERS

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Solutions for circulation of nutrients

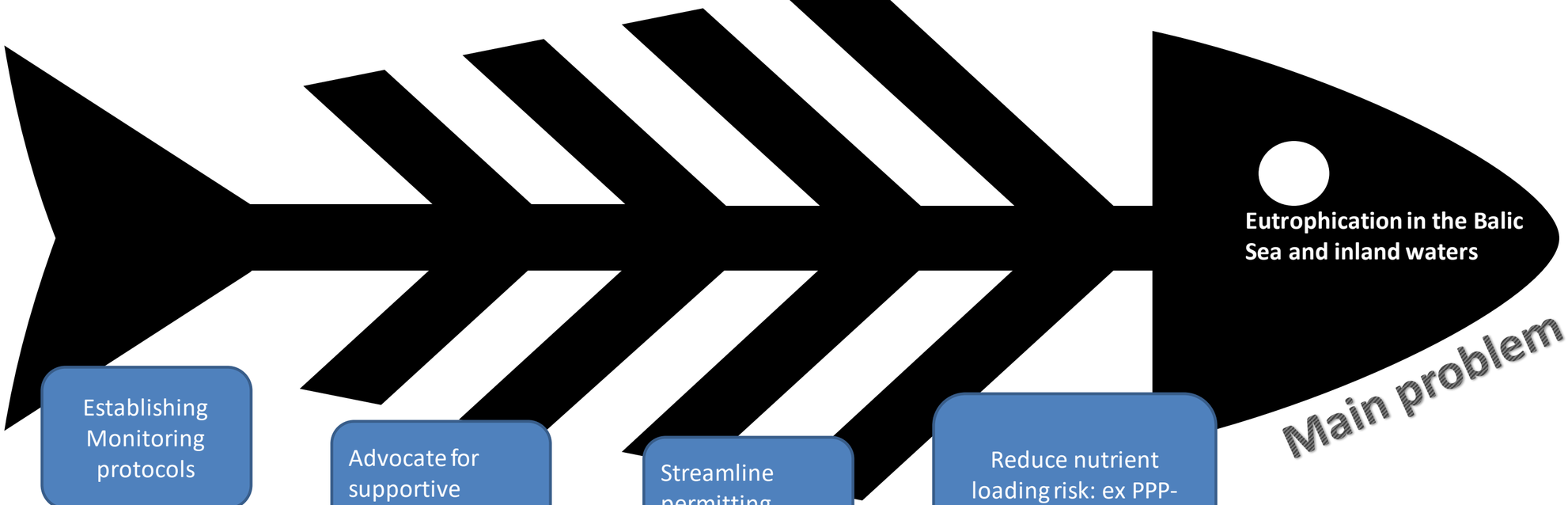
Actions needed

Dominate the narrative

Devolve Management:
-include more stakeholders

Create better environment for advanced research:
-testbed
-local labs for review

Improve harvesting practices



Establishing Monitoring protocols

Advocate for supportive policies

Streamline permitting practices

Reduce nutrient loading risk: ex PPP-Polluter Pays Principle

Slide Title

Slide Content