SUBMARINER

Sustainable Uses of Baltic Marine Resources

A presentation of SUBMARINER

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Baltic Sea Region Programme 2007–2013

Part-financed by the European Union (European Regional Development Fund)

EU-Overall strategy

Bio-economy – An EU priority

EU 2020 Strategy:
Smart growth
Sustainable Growth
Inclusive Growth
(broad based growth)

Building a sustainable Bioeconomy for Europe

Innovation Union:
Turning innovative ideas into products and processes for growth and job creation.

Source: European Commission

New marine uses: an opportunity

BUT ... Novel technologies and growing scientific knowledge offer opportunities for new uses of the marine environment with commercial appeal and which may contribute to solving environmental problems!

- Micro- and macro-algae cultivation (and collection) for biofuel production, eutrophication reduction
- Innovative aquaculture solutions
- Mussel cultivation
- Blue biotechnology
- Wave energy
- Reed collection
- Combined uses of offshore wind farms

Results - Harvesting in Trelleborg

- 2 000-6 000 tonnes dwt

  (10-30 % of standing stock)

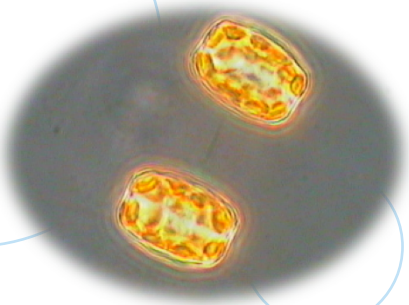
- 50-150 tonnes N reduction → 5-15 % of annual freshwater runoff

- 170-500 households can be heated annually

Potential of Large Scale Microalgae Cultivation in the Baltic Sea Region

General status

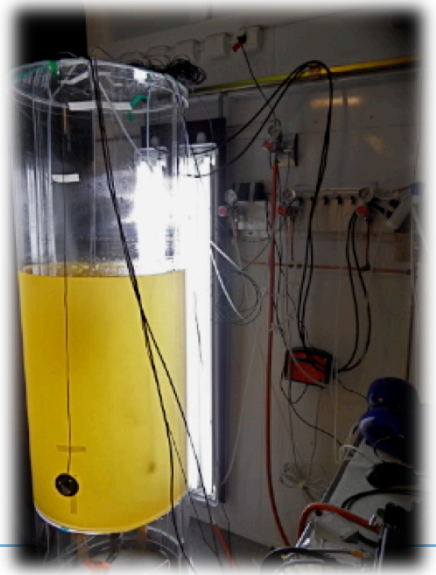
- Projected productivity of microalgae is very high
- Large scale cultivation does not yet exist
- New solutions required for cultivation, harvesting and processing of algae biomass



Potential of Large Scale Microalgae Cultivation in the Baltic Sea Region

Baltic Sea perspective

- ❑ Amount of sunlight limits the productive season
- ❑ Not globally ideal location for large scale cultivation
- ❑ Provides huge multidisciplinary research potential and technological competence for global developments



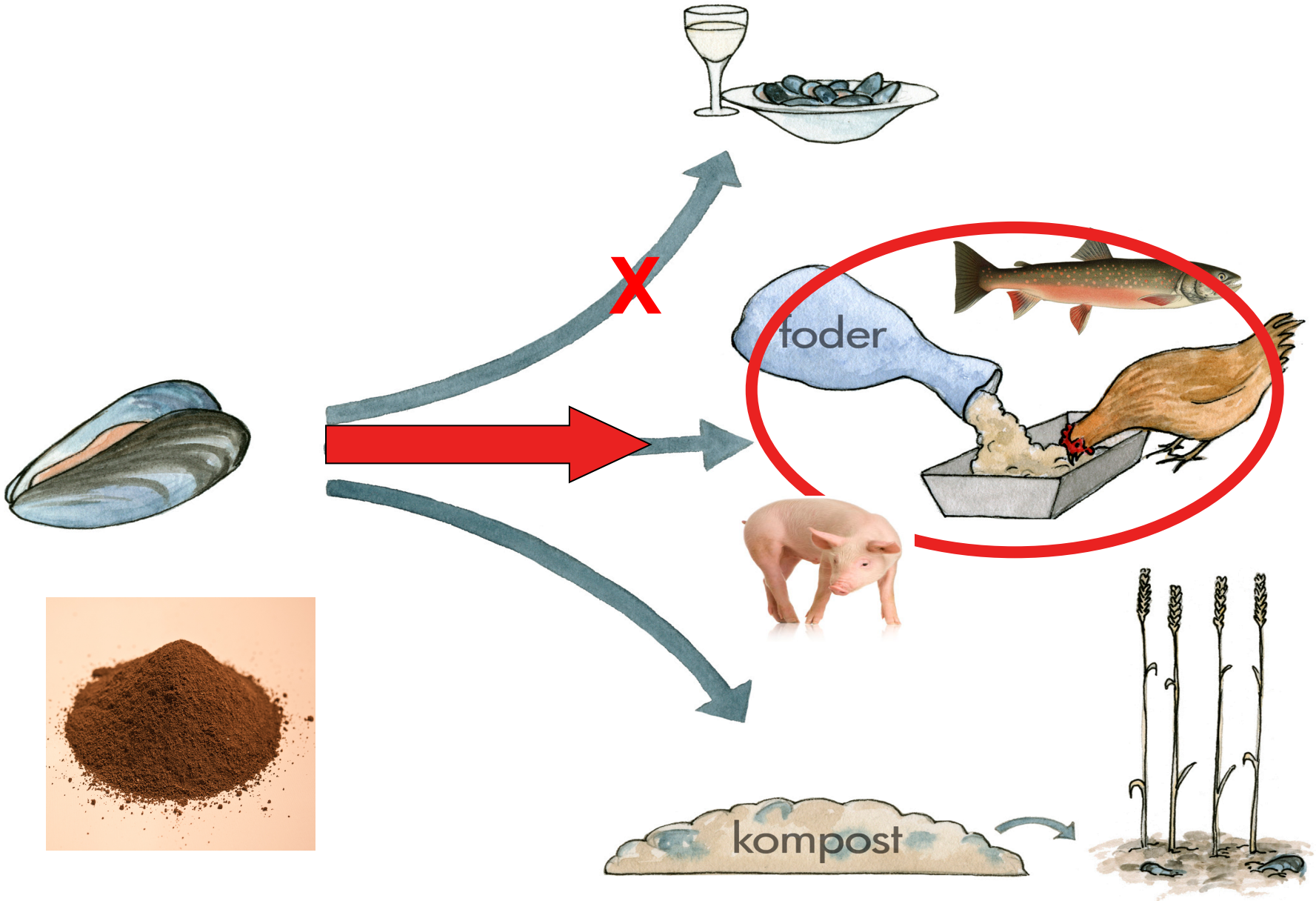
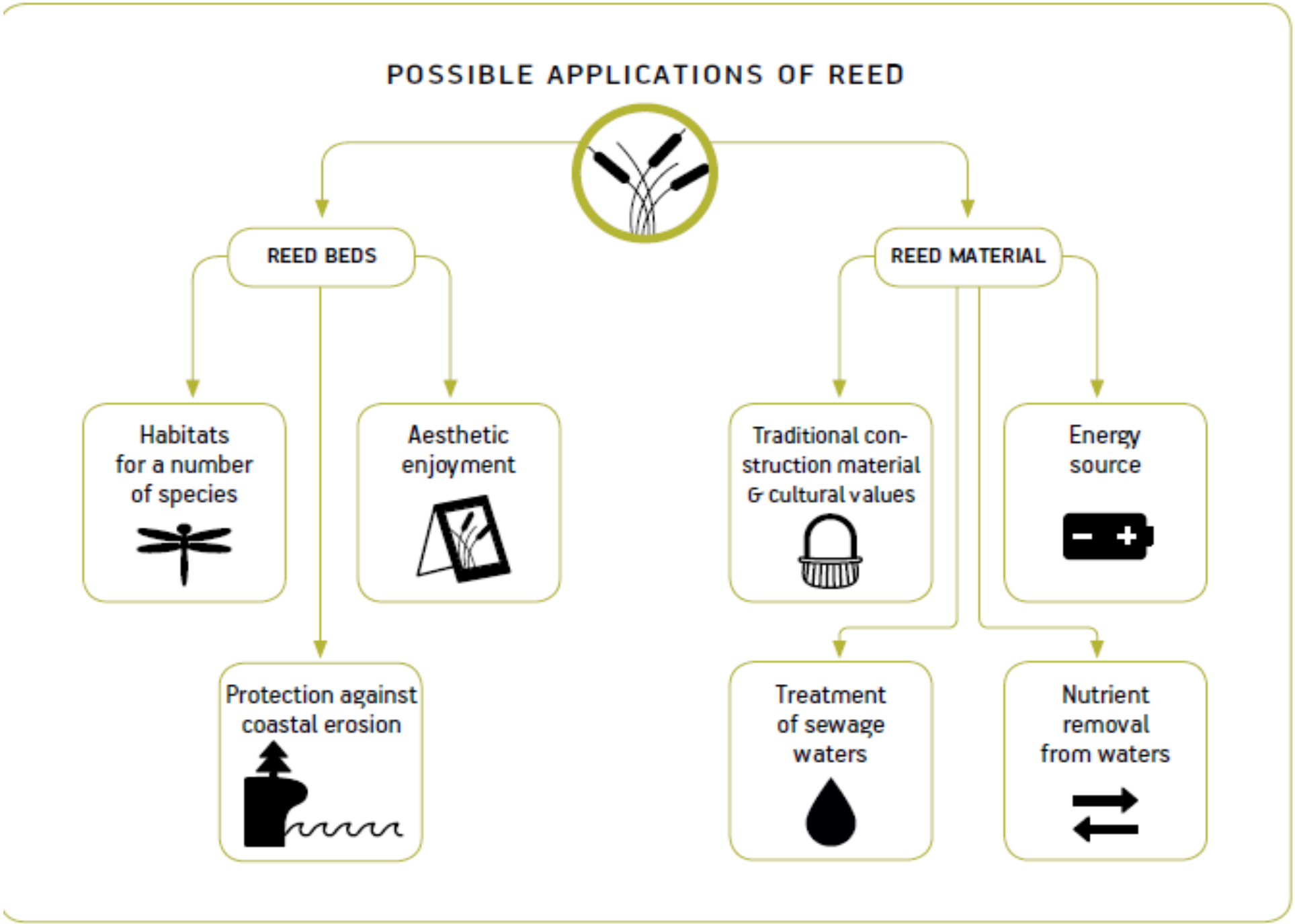


Illustration: Maj Persson


POSSIBLE APPLICATIONS OF REED
REED BEDS
REED MATERIAL
Habitats for a number of species
Aesthetic enjoyment
Protection against coastal erosion
Traditional construction material & cultural values
Energy source
Treatment of sewage waters
Nutrient removal from waters

Blue Biotechnology

Bacteria

Cyanobacteria

Microalgae

Fungi

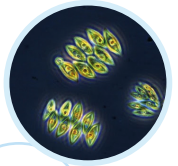
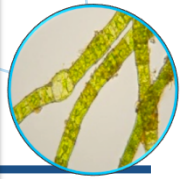
Macroalgae

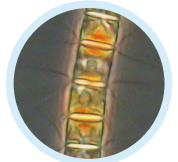
Sponges

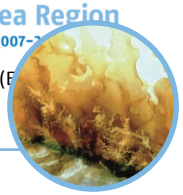
Mussels

The global market for marine biotechnology products was around 2.8 billion € in 2010 and will be around around 3.2 billion € in 2015.

- Oceans cover over 70% of the Earth's surface
- Ocean constitutes over 90% of the habitable space on the planet
- estimated 50-80% of all life on earth is found under the ocean surface
- 3.3 billion years of evolution
- All 36 known animal phyla can be found in the ocean (12 can be found on land)
- 0,01% of marine micro-organisms are discovered





Baltic Sea Region Programme 2007-2
Part-financed by the European Union (F
Regional Development Fund)

Blue Biotechnology
First Achievements

SUB MARINER
Sustainable Uses of Baltic Marine Resources

Yondelis®
Anti-Cancer drug
PharmaMar
Tunicate

Collagen wound gel
CRM
Jellyfish
R&D stage

New antibiotics for treatment
R&D stage

NIVEA® Q10 plus
Face cream
Beiersdorf
Macroalgae

Magnum
Ice cream
Unilever
Fish

Pharma-ceutical

Medical

Animal health

Cosmetics

Nutraceuticals
Food

High Potential in the BSR

Feed for aquaculture

Bioremediation

Biofuels

Anti-fouling systems

Marine technologies

Concentrate
Feeding stuff
Blue Biotech GmbH
Microalgae

New microbial strains for degradation of pollutants
R&D stage

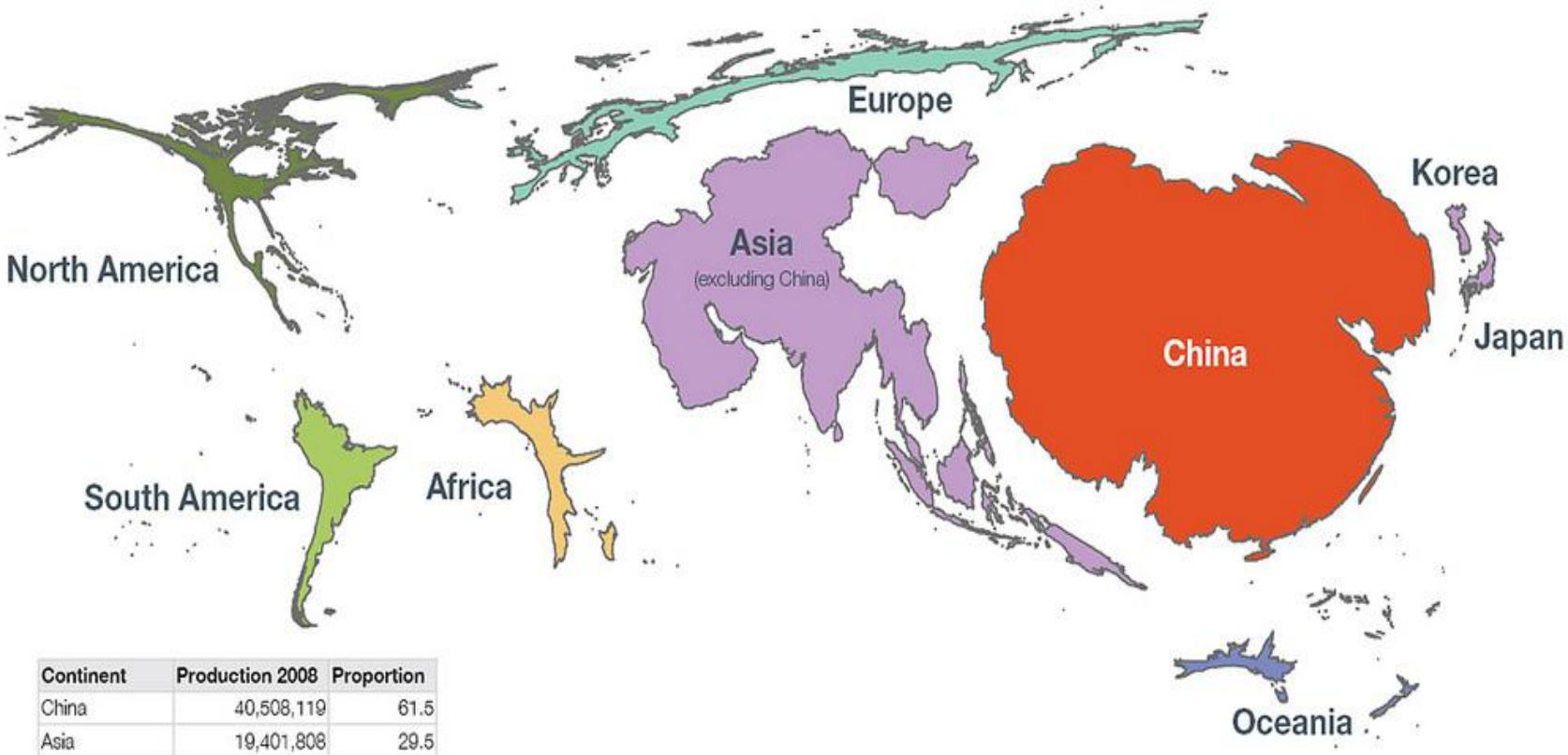
Bio-kerosine
Airbus
Microalgae
R&D stage

Anti-fouling substance
LimnoMar
R&D stage

New techniques and methods sufficient for the exploitation of marine organisms
R&D stage

Part-financed by the European Union (European Regional Development Fund).

Global dimension of Aquaculture

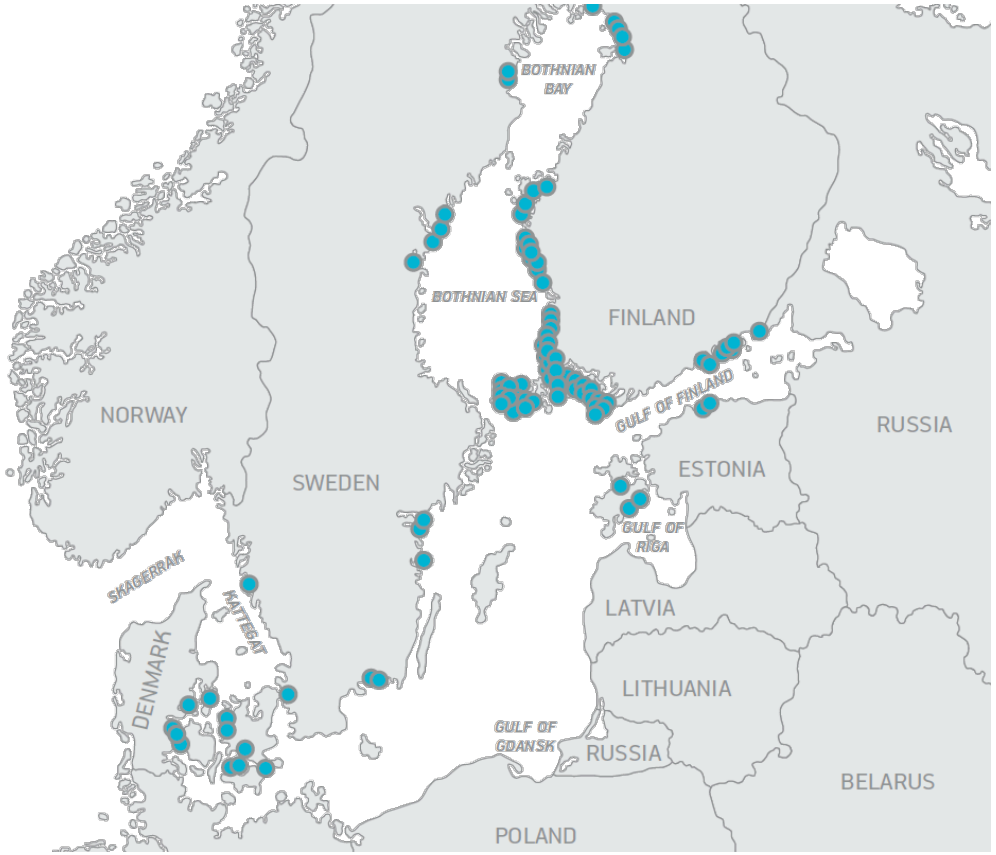


Continent	Production 2008	Proportion
China	40,508,119	61.5
Asia	19,401,808	29.5
Europe	2,341,646	3.6
South America	1,461,061	2.2
North America	965,792	1.5
Africa	952,133	1.4
Oceania	176,181	0.3

Source : WorldFish Center / Conservation International

Sustainable Fish Aquaculture

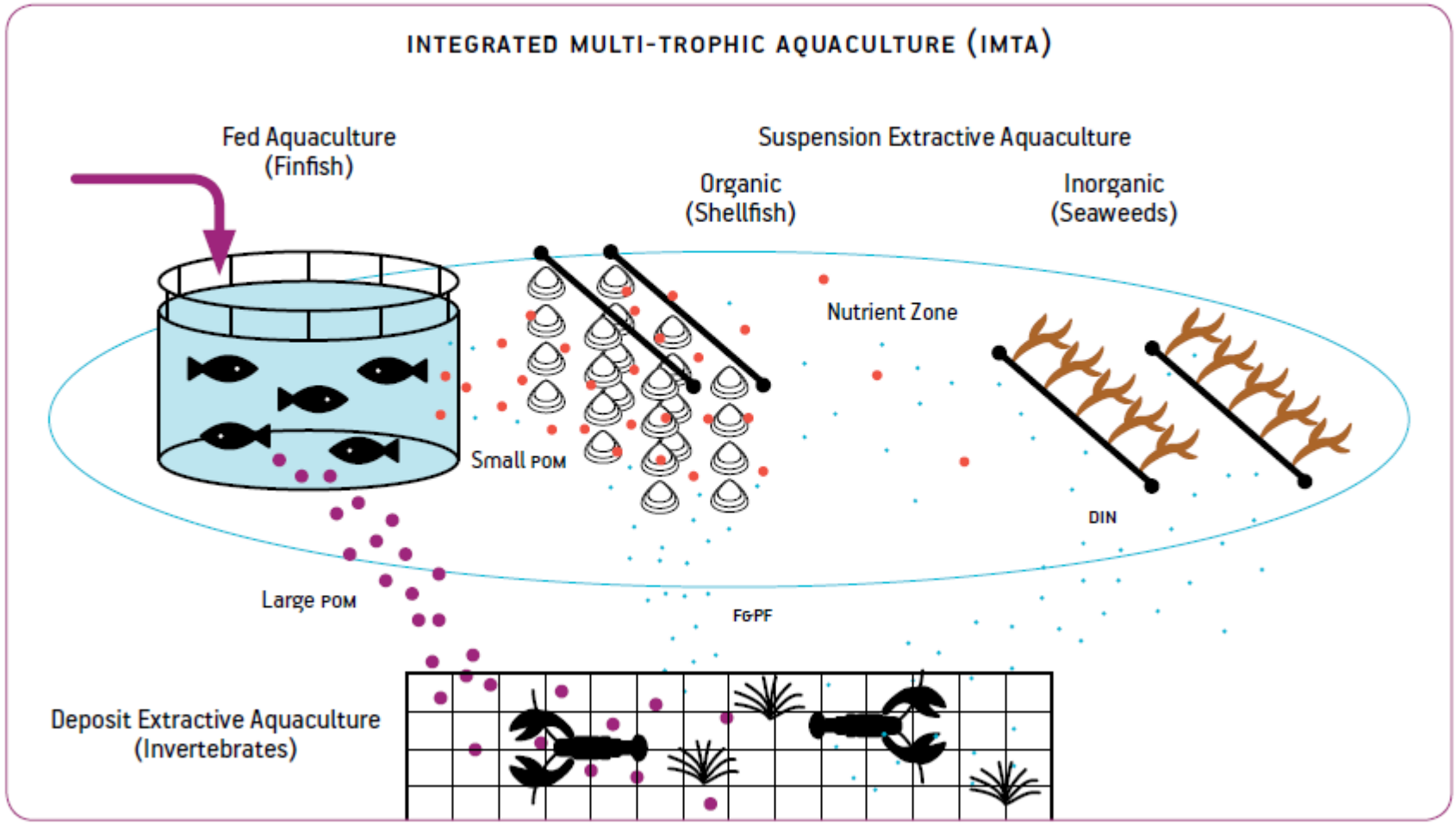
- Currently no possibility to expand open net cage fish aquaculture in the Baltic Sea:
  - lack of suitable sites
  - negative impact on water quality
- Innovative technologies bring opportunities:
  - land-based recirculating aquaculture systems (RAS)
  - adding integrated multi-trophic aquaculture (IMTA) to existing cages

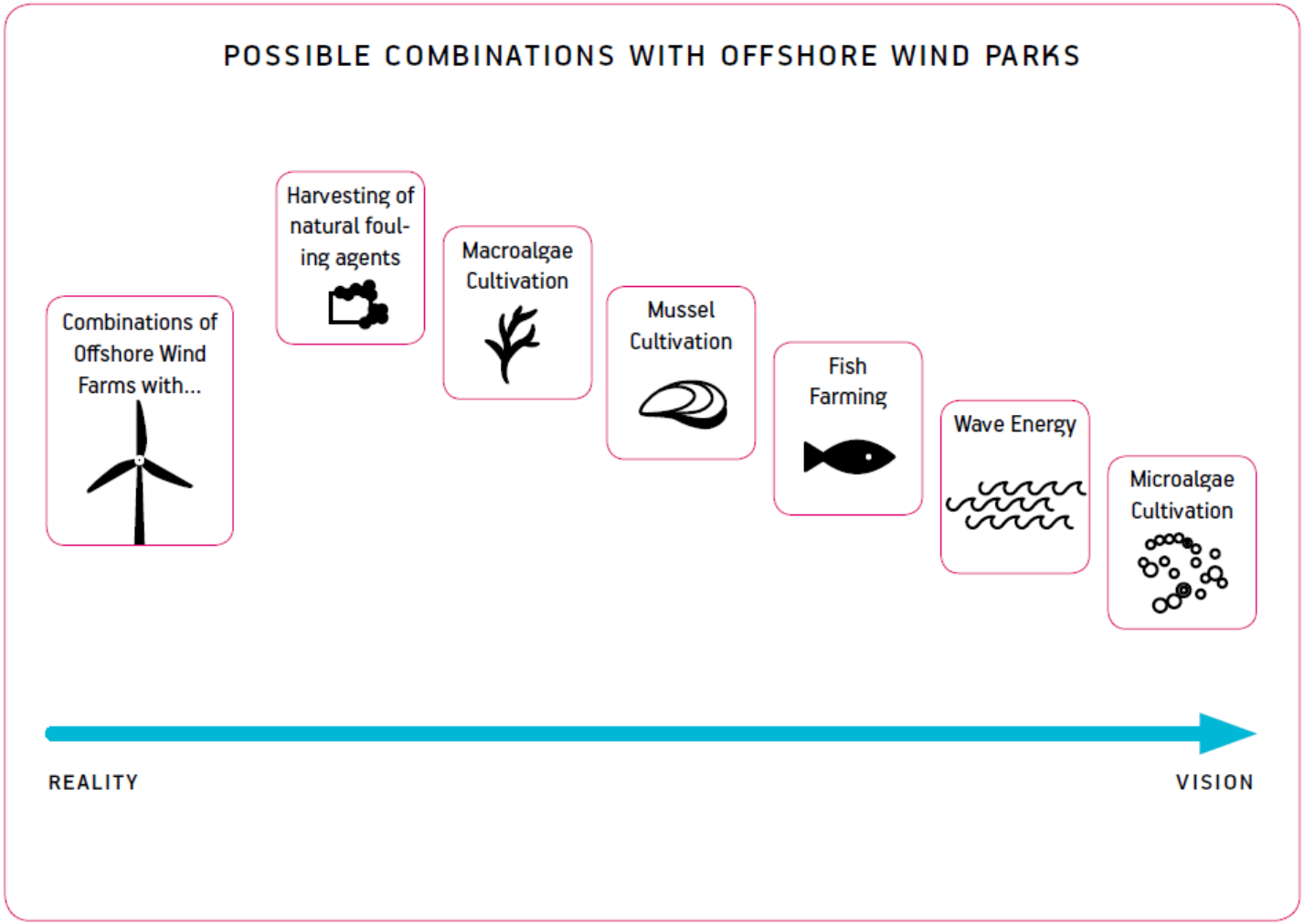


Marine and costal fish aquaculture operations in the Baltic Sea Region. Data from WWF.

IMTA

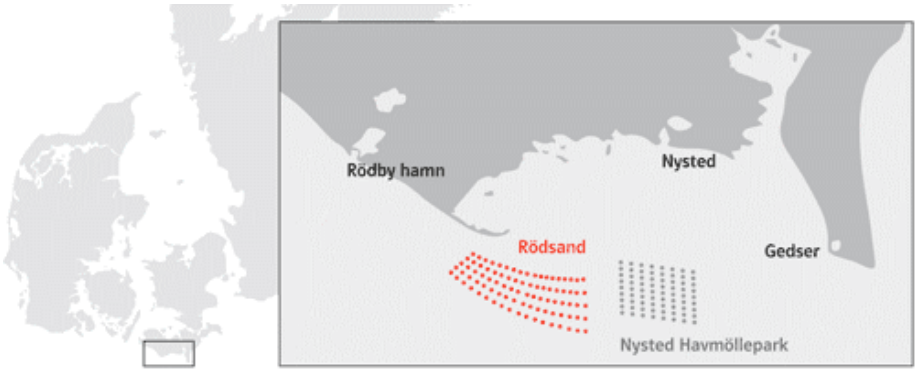
Figure 10: Conceptual diagram of an Integrated Multi-Trophic Aquaculture (IMTA) system (based on Chopin, 2011[5]) (POM: particulate organic matter; DIN: dissolved inorganic nutrients; F&PF: faeces & pseudo faeces).




POSSIBLE COMBINATIONS WITH OFFSHORE WIND PARKS
Combinations of Offshore Wind Farms with...
Harvesting of natural foul-ing agents
Macroalgae Cultivation
Mussel Cultivation
Fish Farming
Wave Energy
Microalgae Cultivation
REALITY
VISION

Results: biomass and sequestration

Preliminary results – biomass production site Lolland



- Yearly production > 3.4 kg/m2 dry matter (This corresponds to 0.81 ton N pr ha).
- Small-scale trials and experience from Swedish West coast suggest a nutrient harvest of 1.5 ton N pr. ha.
- Rødsand 2 covers an area of 34 km2.
- At least 690 t N per year can be sequestrated using 25 % of the wind park area.
- Or 4% of the nitrogen reduction of 17,210 tonnes of Denmark has committed itself to by 2021 according to HELCOM Baltic Sea Action Plan.

Environmental Assessment

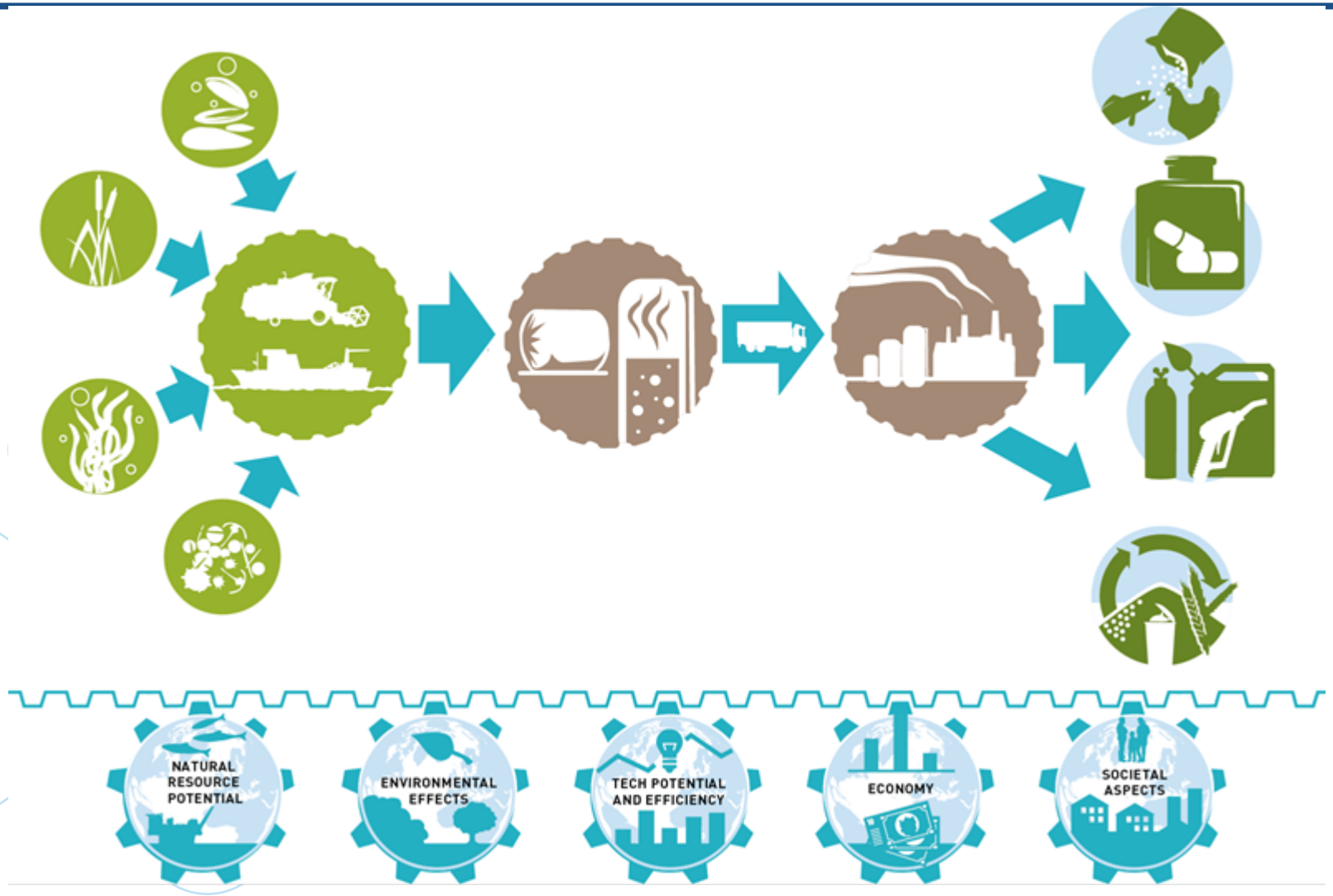
Objective	Priority	Benefit
Water Quality	Bathing Quality	Improve bathing water quality
	Water Transparency	Improve water transparency
	Eutrophication	Decrease eutrophication
	Biogeochemical Cycling	Stable biogeochemical cycling
Habitat / Species Protection	Food Web Dynamics	Maintain food web dynamics
	Biodiversity	Promote biodiversity
	Benthic Habitats	Protect benthic habitats
	Bird Habitats	Protect bird habitats
	Fisheries	Protect fish populations
	Marine Mammals	Protect marine mammal
	Marine Noise	Minimise marine noise
Coastal Protection	Coastal Morphology	Protect coastal morphology
	Scenery	Preserve scenery
Climate Protection	CO_2 Emissions	Reduce CO_2 emissions

Environmental Assessment

Objective	Priority	Macroalgae Harvesting (Beachcast)				
Water Quality	Bathing Quality	■				
	Water Transparency	■				
	Eutrophication	■				
	Biogeochemical Cycling		■			?
Habitat / Species Protection	Food Web Dynamics			■		?
	Biodiversity			■		?
	Benthic Habitats					
	Bird Habitats			■		?
	Fisheries					
	Marine Mammals					
	Marine Noise					
Coastal Protection	Coastal Morphology				■	
	Scenery	■				
Climate Protection	CO_2 Emissions		■		■	

Strongly supportive ■ ; Moderately supportive ■; Strongly NOT supportive ■; Moderately NOT supportive ■
Information gaps/further research needed ?

SEAFARM


NATURAL RESOURCE POTENTIAL
ENVIRONMENTAL EFFECTS
TECH POTENTIAL AND EFFICIENCY
ECONOMY
SOCIETAL ASPECTS

SUBMARINER

Sustainable Uses of Baltic Marine Resources

Thank You all in the Submariner team

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