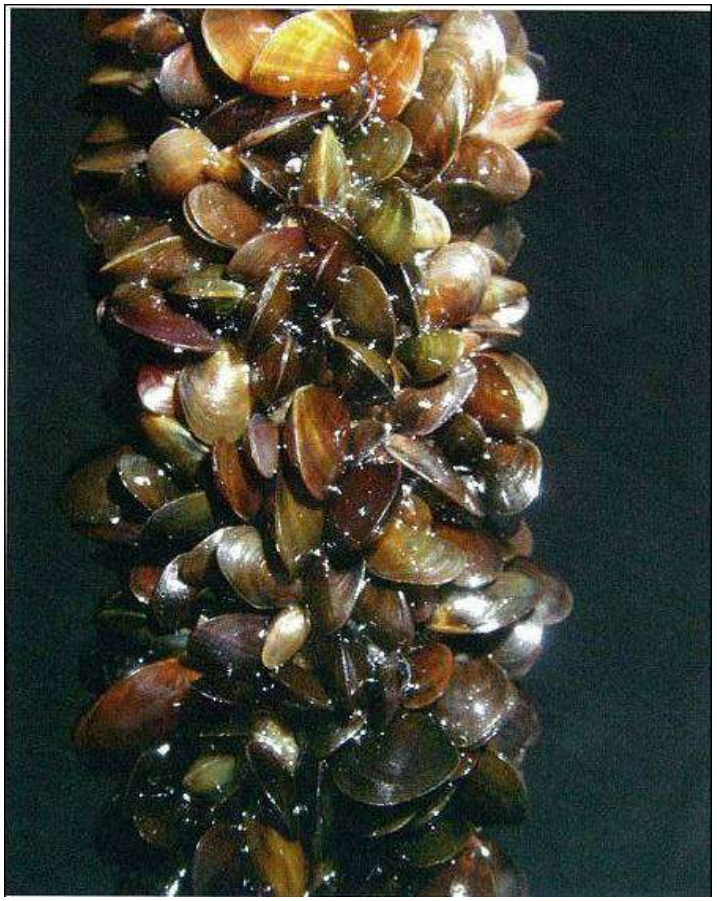
- Eutrophication – the most serious environmental problem of the Baltic Sea

- Action plan by the Helsinki Comission (HELCOM) for Sweden
  - 21 000 tonnes N, 290 tonnes P
  - Good ecological status 2021

# Macroalgaeharvesting in Baltic Sea


# Kalmarsund, 14 month



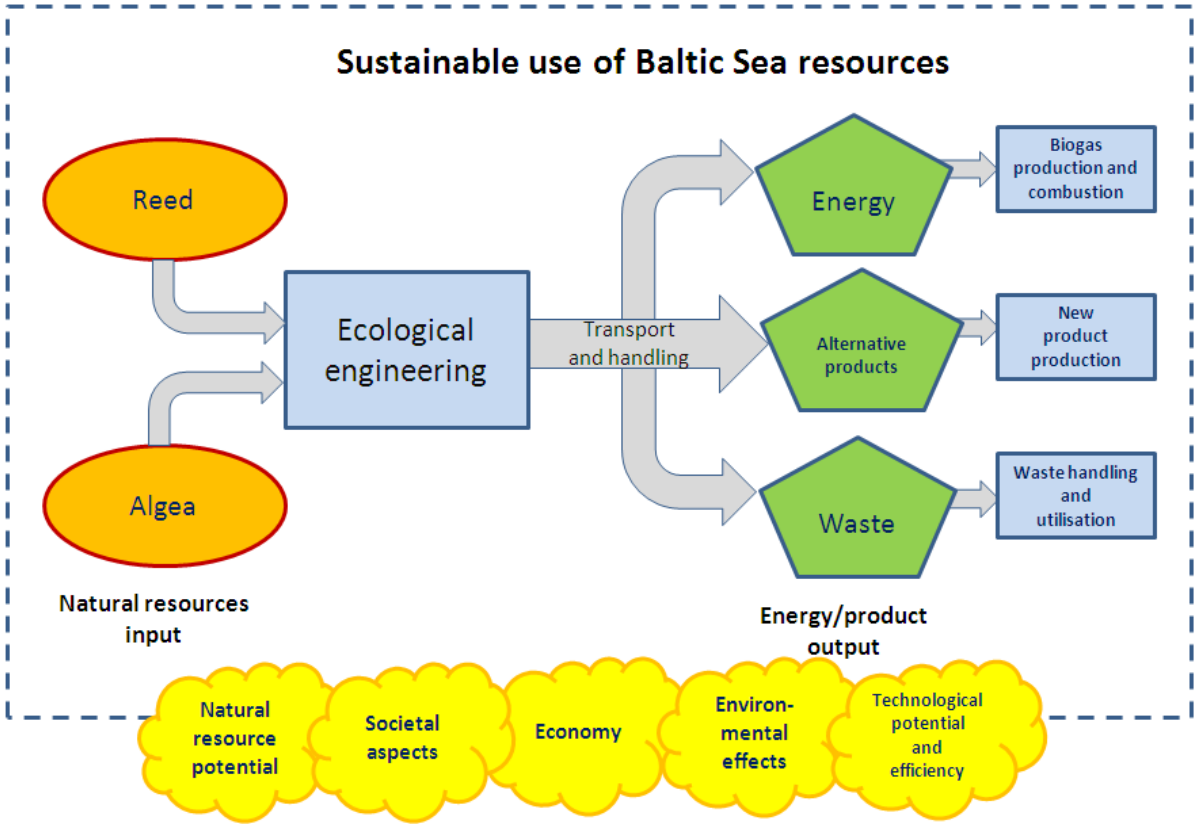
**The biomass after 1 year was 4 kg $m^{-1}$ or 16 kg for a long line.**

# Reed

- Grows as large monospecific stands along the Baltic coast of Sweden
- Swedish total reed area: 100 000 ha
- Biomass above ground in the middle, and south of Sweden in august: 1 kg dw/m2

Aquatic Plant Harvester RS2000 (RS-Planering AB).

Sustainable use of Baltic sea biomass resources based on ecological retrieval of biomass (reed and algae) for production of energy and new innovative products (including fertilizers) with an associated waste stream. Blue squares indicate technology dependent processes and the yellow clouds shows the sustainability and feasibility aspects. Gröndahl et. al. 2008



# Summary of projectobjectives

Investigate and report the feasibility and potential of ecologicalengineering and bio-manipulationmethods to balance the nutrientflows in the entire Baltic Sea.

Evaluate the technical, economical, social, and ecological potential of applyingalgae or reedharvesting and musselfarming, using a system analysis approach in specificcase studies.

Provide guidelines for placement of ecologicalengineeringfacilitieswithin the coastalzones.

# Objectives ofone initial study

- Compare the efficiency of reed and macro algae harvesting and mussel farming with respect to nutrient removal from the Baltic Sea.
- Provide and compare energy budgets for the full process chain from harvesting of biomass to biogas production for reed, macro algae and mussels.

# Nutrient removal efficiency

- Comparison of nutrient contents of the three biomasses, based on living weight
- Nitrogen content of mussels > 3 times higher
- Phosphorus content of mussels > 2 times higher
- Harvest of mussels is most efficient according to nutrient removal

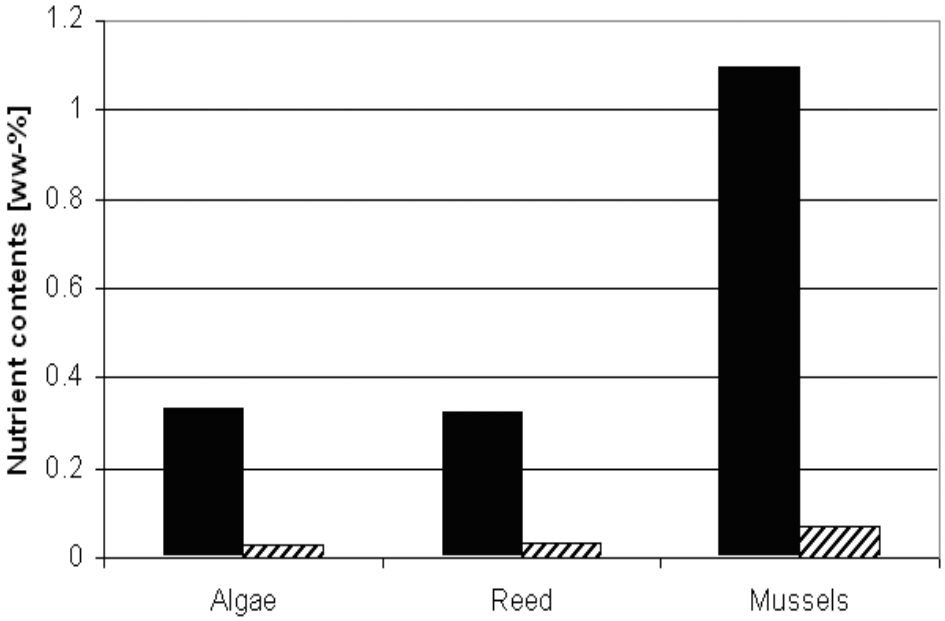
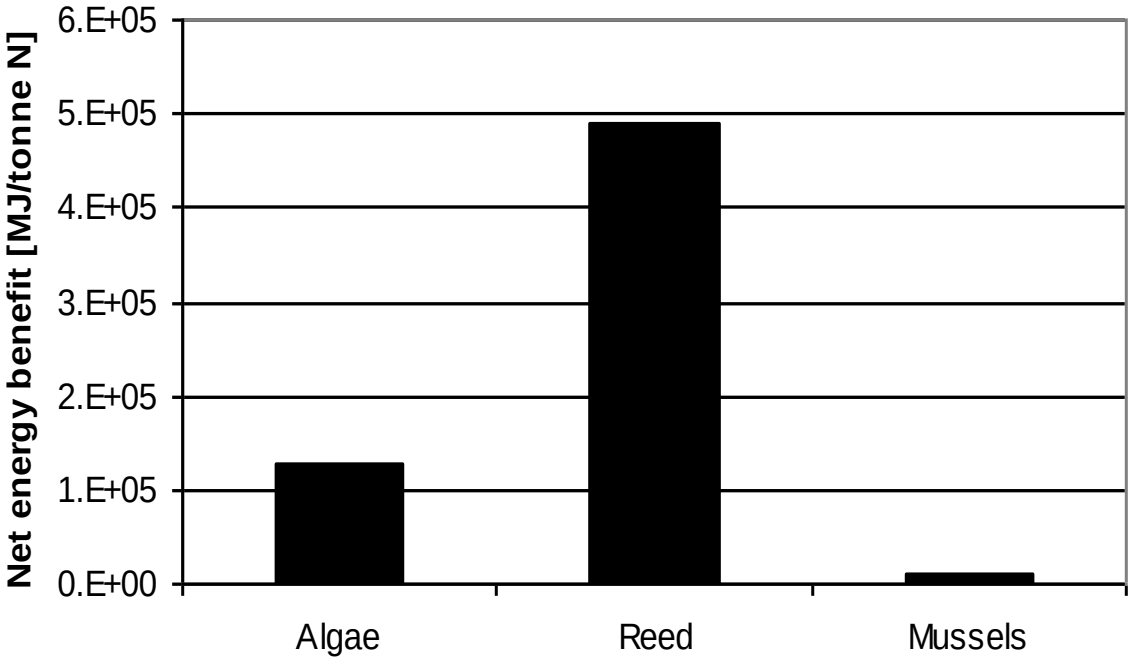



Figure 1. Wet weight nutrient contents [%] of algae, reed, and mussels where the bar to the left (black) represents nitrogen and the bar to the right (striped) represents phosphorus.

# Energy balance



# Conclusions

- Reed has the highestnetenergybenefit, followed by macroalgae.
- Blue mussels are not suitable for biogas production, but are betterthanreed or algaewhen the ambition is to remove nitrogen or phosphorus from the Baltic Sea.
- Biogas production from reed and macroalgaemay be important in the futurebutneedfurtherinvestigations.

# Advantage with Biomanupulation and the production of Biogas

- Biogas means less CO2 and is thus an important contributor to decreasing climate change.
- The establishment of wetlands will stimulate biological diversity in the region and will deal with the nutrient load from surrounding farm land.
- Harvesting of the reed belt will remove the nutrients from the wetland area.
- Harvesting of macro algae will remove nutrients and heavy metals from the Baltic Sea and improve local beaches for recreation purposes.
- The removal of Cyanobacteria will remove nutrients from the Baltic Sea, but perhaps the most important contribution is that it will improve recreational value in the region.
- When the shallow coastal waters are cleansed from oxygen-depleting, decaying accumulated macro algae, large areas will again become available to sustain the growth of juvenile fish.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