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## OPTIMIZING PRODUCTION OF MITIGATION MUSSELS

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Leveraging bivalve ecosystem services to counter eutrophication, and integration into water management plans, is a growing focus in many regions. Wild and cultivated bivalve assemblages assimilate nutrients bound in organic matter, can enhance nutrient cycling, and provide potential for net nutrient extraction through harvest. Intensive cultivation of mussels (*Mytilus edulis*) designed for maximizing nutrient extraction in eutrophic estuaries is developing in terms of technical and policy implementation. In Denmark, mussel mitigation culture is under consideration as a management tool within the third management cycle of the Water Framework Directive. Intensive research in optimization and further refinement in production outputs has been carried out by the Danish Shellfish Center (DTU Aqua) to document the mussel mitigation production volumes and nutrient removal for different production technologies and environmental conditions.

Over two growing seasons (2017-2019), six test-line sites and three full-scale mitigation mussel farms were monitored for production potential in Denmark. As principle factors, linear density of settling material, vertical coverage, cultivation substrate, and relative position within the culture unit were analyzed for yield in terms of total mussel biomass and condition. In the 2017 growth cycle, differing configurations of traditional long lines were tested, yielding ~1300 t per model farm (18.8 ha) in Limfjorden. In 2018, different technologies were tested; preliminary results demonstrate capacities for exceeding 3000 t per model farm (Figure 1). High resolution biomass sampling demonstrated significant clustering of mussel condition within farm units, indicating meso-scale carrying capacity limitations, however, larger farm-scale yields were not demonstrably different between sites or by substrate quantity; indicating mitigation farms within Limfjorden conditions can be appropriately applied to reduce nutrient loads within the marine environment. In other tested estuaries, settlement and growth of mussels have been positive, suggesting mitigation culture can be applied as a nutrient management tool for many coastal waters.

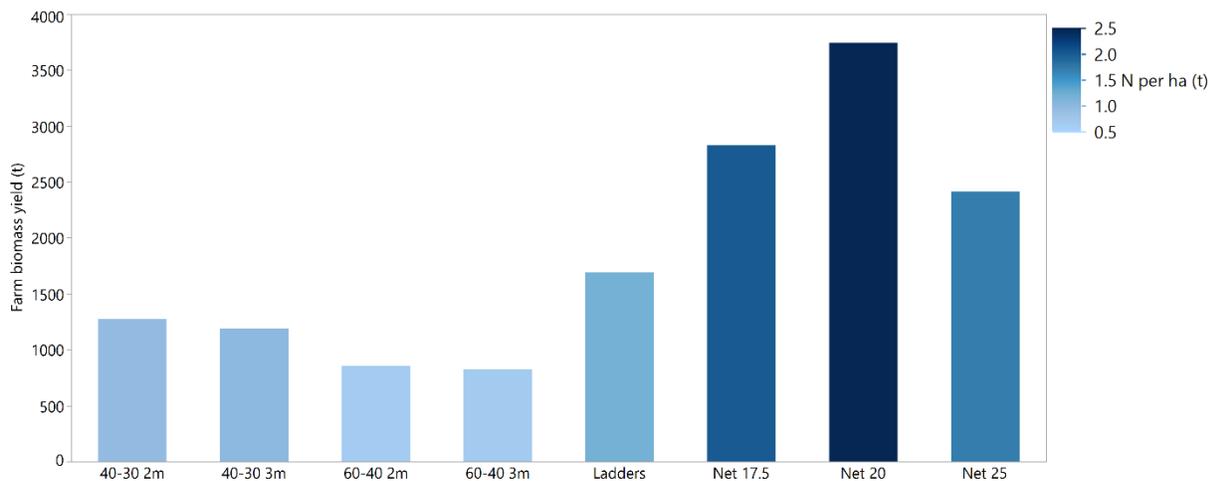


Figure 1. Potential farm (18.8 ha) mussel biomass yield and harvestable N-content per hectare by cultivation technology. 40-30 refers to 30cm spat collector spacing, 60-40 is 60cm spacing, 2 and 3m refer to spat collector depth. Ladders refer to a linear gridded collection system, and Net treatments refer to respective mesh size (cm) on 100m long, 3m deep nets.