Modelling mussel larval distribution for optimal site selections of mussel farming

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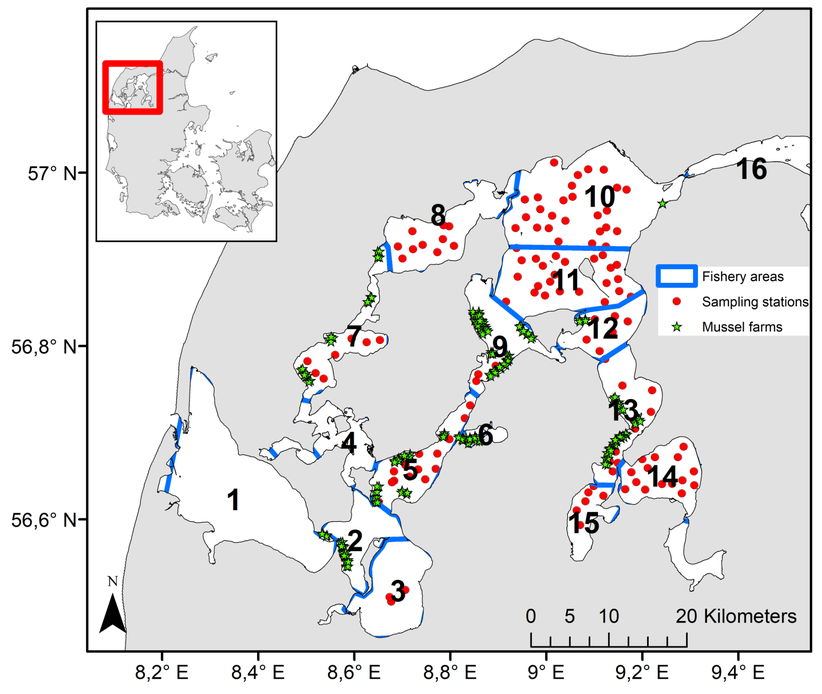
Background

Aquaculture of mussels has the largest potential in relation to production volume, economic potential and sustainability in eutrophic systems, contributing substantially to the blue growth in the Baltic. Spawning takes place in the natural mussel beds (see figure) during spring, and larvae are spread by the water currents to other areas before settling on the bottom or on the long-lines in the mussel farms. The farms should therefore be located in areas with a high and stable year-to-year recruitment of mussel larvae and be climate ready considering changes in future distributions.



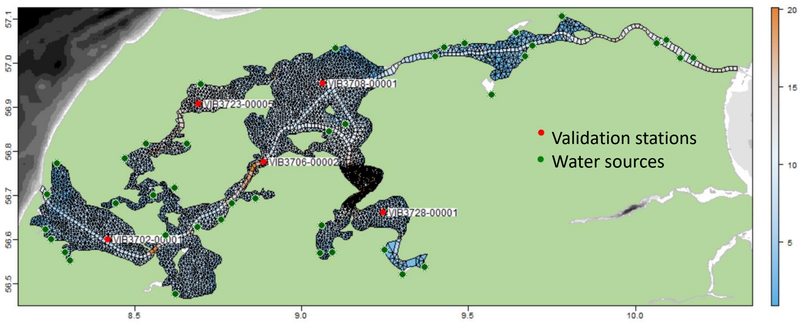
Scope

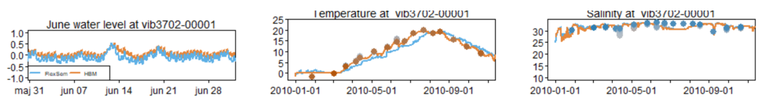
Estimate blue mussel (*Mytilus edulis*) larval distribution and connectivity within different subareas in the Limfjorden for its further use in site-selection processes of mussel farming.

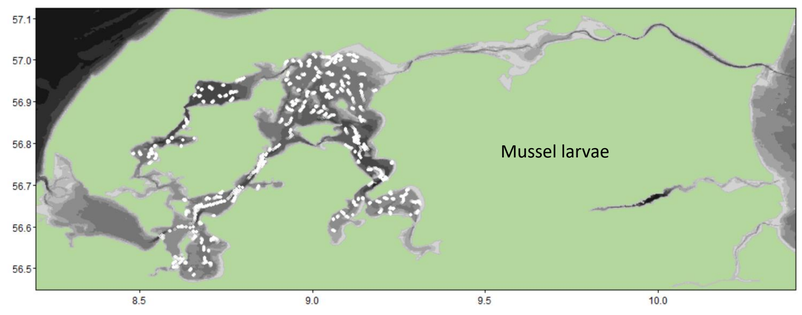
Method

Hydrodynamic model: Flexsem → **Biological parameters** → **Agent Based Model (ABM)**

- Pelagic larval duration (PLD)
- Spawning season
- Habitat preference
- Larval behavior

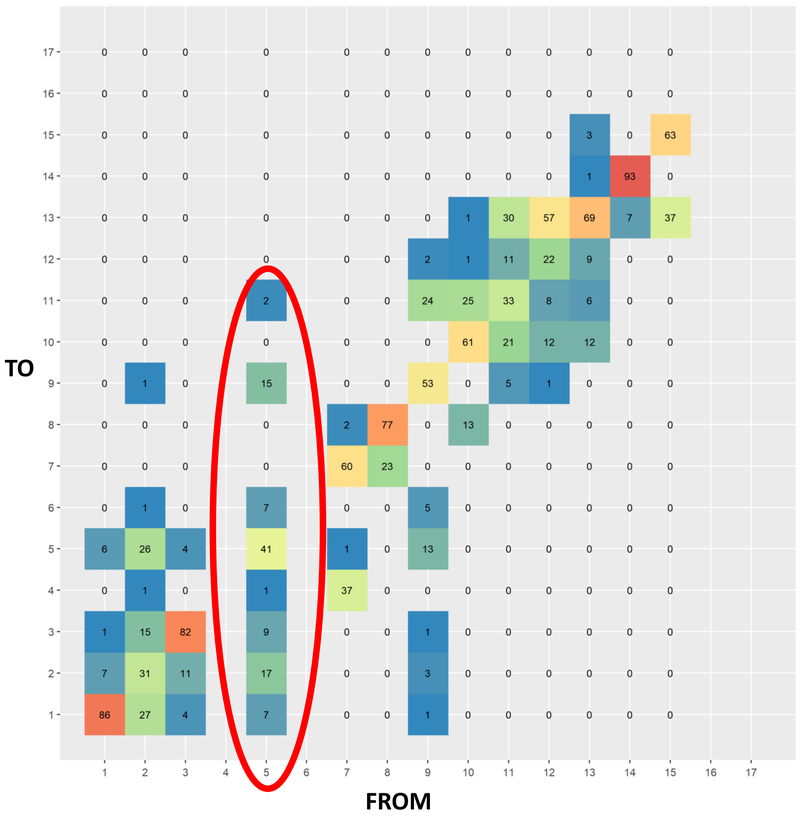


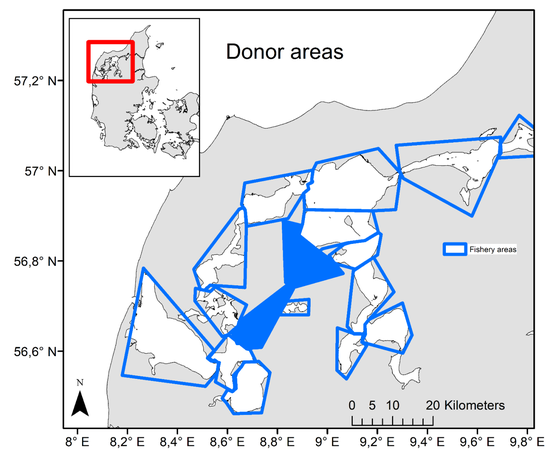




Connectivity Results

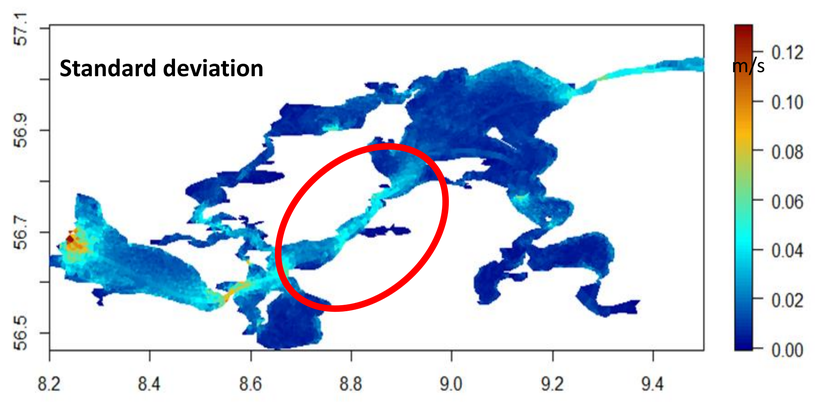
The connectivity matrix below shows the downstream connectivity, this is, the probability of the larvae ending up in a specific area. There is an overall high self-recruitment in the system (diagonal values in the matrix). Main donor areas are 5 and 9, main receiver areas 11 and 13 and isolated areas 14, 15, 16 and 17 (see figures).





Limfjorden hydrodynamics

Connectivity results can be explained by the circulation of current patterns in the area. The standard deviation of the current speeds within the simulation period (May-June) in the surface layer is shown below.



Conclusion

We are able to identify donor, receiver, and isolated areas of mussel larvae in the Limfjorden. These results highlight the importance of ABMs as powerful management and site selection tools. They also enable us to make predictions for future climate change scenarios that will affect the locations for placement of mussel farms.

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