DHI SOLUTION

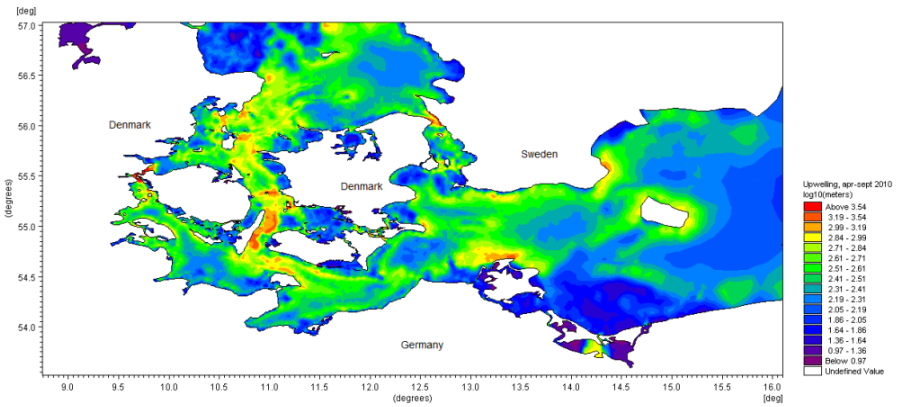
AQUACULTURE – SITES FOR OPTIMAL PRODUCTION

Helping you select the best sites for growing mussels, seaweed and fish

The selection of suitable sites for marine aquaculture is essential for economically viable production. Different environmental requirements, such as light, nutrients, oxygen and water column stratification, must be taken into account, during such site selections. As such, it is crucial to find the right combination of physical, chemical and biological conditions that best support cost-efficient production, while at the same time ensuring a low environmental footprint. We combine our advanced modelling techniques and our environmental and hydrodynamic expertise to identify optimal sites for aquaculture production. Our innovative solution combines our knowledge of chemical and biological conditions with the three-dimensional (3D) hydrodynamic modelling of our MIKE by DHI software.

SELECTION OF AREAS SUITABLE FOR THE PRODUCTION OF SEAWEED AND MUSSELS

The growth of dense seaweed populations requires an abundant and steady supply of nutrients over large areas. However, light and nutrient conditions can vary considerably in some areas, sometimes from season to season. Our site selection tools can help you identify the best areas for optimal aquaculture production throughout the year.



Upwelling (log (m)) across pycnocline in the summer when nutrient concentrations are low in the surface water.

SUMMARY

CLIENT

- Aquaculture farmers
- Regulatory bodies

CHALLENGE

Need to:

- identify sites with water quality conditions that are optimal for production
- ensure minimal environmental impacts
- prevent disease transmission between aquaculture productions
- identify areas with the best conditions for cost-efficient aquaculture production

SOLUTION

MIKE by DHI three-dimensional (3D) modelling of physical, chemical and biological conditions, combined with our extensive knowledge of conditions to identify appropriate sites

VALUE

- Cost-efficient production
- Low environmental footprint
- Helps with obtaining environmental clearance/licenses

Off the coast of Denmark, for example, stratification of the water column by a pycnocline during large parts of the year separates salty nutrient-rich water in the bottom from the less salty nutrient-poor surface water. The light in this layer is sufficient for seaweed production, but the low nutrient levels in the summer will limit growth. However, we can help you identify areas where and time periods when:

- the pycnocline is low in the water column, allowing the algae to benefit from both good nutrient conditions and sufficient light
- upwelling feeds nutrients to the surface from the nutrient-rich bottom water

Mussels are a valuable source of food for humans and an important ingredient in fish feed. In addition, harvested mussels may also help capture nutrients in the water – especially nitrogen in areas with eutrophication. We can help you identify areas where currents and phytoplankton concentrations are optimal for mussel production.

Blue mussels are widely distributed in European waters. The potential of farmed blue mussels is still highly under exploited.
© Mads van Deurs

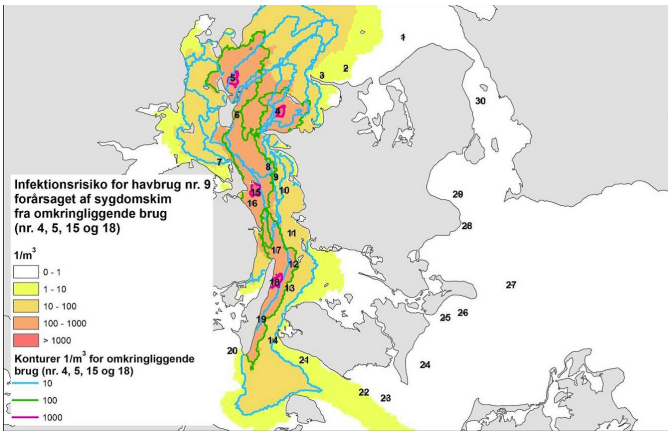
REDUCING DISEASE TRANSMISSION RISKS BETWEEN AQUACULTURES

Waterborne diseases affect marine fish farming, especially during the hot days of summer. Infections can:

- occur when transporting fish between fish farms
- be transmitted by infected fish within or between fish farm areas

Water currents spread the diseases between fish farms in the sea. As such, there is a greater risk of infection if fish farms are densely located or situated along the same main current direction.

When planning new aquacultures, the probability of transferring infections between fish farms can be reduced by placing fish farms in such a way that the exchange of water between sites is low. We can calculate and quantify potential disease dispersal, helping you identify more safe places for future aquacultures location.



Disease dispersal and potential infection risk for aquaculture #9.

In the image above, it is assumed that farms #4, #5, #18 and #15 have fish that emit infections, which decay by 50% per day. We have shown contours around aquacultures with sick fish and areas with maximum bacterial concentration per m^3.

At fish farm #9, the maximum concentration of bacteria in the surface layer is between 10 and 100/m^3. Aquacultures #18 and #15, in particular, are contributing to the infection risk to fish farm #9. The fish farms to the north do not increase the infection risk for fish farm #9. Information such as this can aid you in identifying locations that have a low risk of being infected by other fish farms.

ENSURING COMPLIANCE WITH SPECIFIC WATER QUALITY CRITERIA

When planning new fish farms, locations should be chosen where there is high dilution capacity in order to meet specific water quality criteria. Medicines and copper, for example, are used in aquacultures for the treatment of sick fish and as fouling inhibitors on nets and ropes. However, they can have toxic effects on marine life.

As such, they are administered on the basis of the water quality criteria – the highest concentrations of these substances allowed in the water that are considered harmless to the environment. We can help you select sites with high dilution capacities to ensure that medical products and copper do not exceed the maximum allowable concentration.

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For more information visit: www.dhigroup.com