Potential for line-mussel production in the Great Belt (Denmark)

Daniel Pleissner (danielp@biology.sdu.dk), Kim Lundgreen, Line Bøttiger & Hans Ulrik Riisgård

Marine Biological Research Centre (University of Southern Denmark), Hindsholmvej 11, 5300 Kerteminde, Denmark

Introduction

Bivalve aquaculture is of increasingly economic importance in Europe. In Limfjorden, Denmark, an extensive blue mussel (*Mytilus edulis*) fishery exploits the wild stocks, and during the last 10 years line-mussel farming has been introduced to increase the production. But eutrophication and seasonal oxygen depletion cause high mortality of mussels during late summer, especially in the central parts of Limfjorden. Within the MarBioShell project (2008-2012) we are evaluating the potential of the Great Belt region, between Kattegat and the Baltic Sea (Fig. 1) as a new cultivation site to cover the increasing demand for blue mussels.

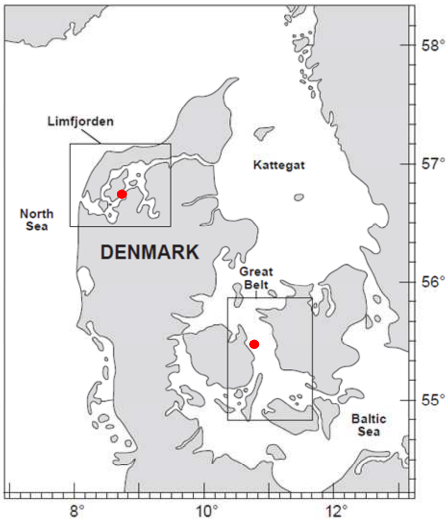

Figure 1: Map of Denmark showing the locations (red dots) in Limfjorden and Great Belt for field growth experiments with *Mytilus edulis* in net-bags.

In the present study, as a first step towards evaluation of the potential for line-mussel production, mussels were grown in suspended net-bags in Limfjorden and Great Belt, and special emphasis was laid on the importance of phytoplankton biomass (measured as chlorophyll *a*) for the specific growth rate of different size classes of mussels.

Table 1: Chlorophyll *a* concentration, temperature, and salinity in Limfjorden and Great Belt, and weight specific growth rate of 20 and 40 mm mussels grown in net-bags (Riisgård et al. in prep).

	Great Belt	Limfjorden
Chlorophyll *a* (µg l^{-1})	3.1±0.7	2.9±1.7
Temperature (°C)	16.0±3.5	19.0±1.9
Salinity (psu)	14.2±3.4	29.4±1.0
Length (mm)	Growth rate (% d^{-1})	
20	3.3	3.1
40	2.0	2.1

Results

In both, Limfjorden and Great Belt the mean chlorophyll *a* concentration was around 3 µg l^{-1} between July and October 2010. The mean salinity in the Great Belt was about 14 psu, which is approximately two times lower than the salinity in Limfjorden (Table 1). Laboratory feeding experiments have however revealed no influence of salinity on growth rate of *M. edulis* exposed to salinities between 15 and 25 psu (Bøttiger & Riisgård, submitted). In Limfjorden and Great Belt the average weight specific growth rates of 20 mm mussels were 3.1 and 3.3 % d^{-1} (Figs. 2A & D) and 2.1 and 2.0 % d^{-1} for 40 mm mussels (Table 1).

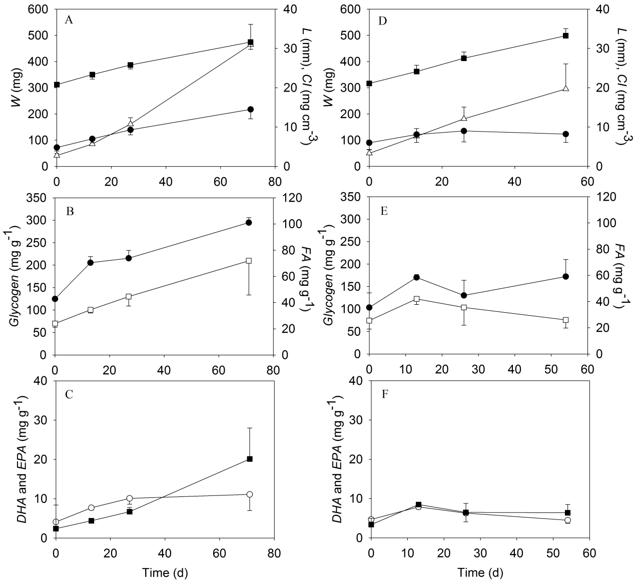

Figure 2: Growth of 20 mm mussels in net-bags in Great Belt (A-C) and Limfjorden (D-F). A & D: Dry weight of soft parts (*W*,△), condition index (*CI* = *W*/*L*^{3},●) shell length (*L*,■), B & E: glycogen (●), sum of fatty acids (*FA*,□), C & F: docosahexaenoic acid (*DHA*,○) and eicosapentaenoic acid (*EPA*,■).

Specific concentrations of glycogen and fatty acids tripled in mussels grown in Great Belt whereas only marginal increase in glycogen and no gain of fatty acids were found in mussels from Limfjorden (Figs. 2B & E). Concentrations of the polyunsaturated fatty acids docosahexaenoic and eicosapentaenoic acid were 10 and 20 mg g^{-1} in mussels grown in Great Belt (7 Oct.) whereas 6 and 5 mg g^{-1} were measured in mussels grown in Limfjorden (21 Sept.) (Figs. 2C & F).

Experiments revealed that mussel with a low condition index gain faster in body dry weight and accumulate more fatty acids than mussels with a higher condition index and the total fatty acids content (*TFA*) increased with increasing condition index (Fig. 3, Pleissner et al. in prep.).

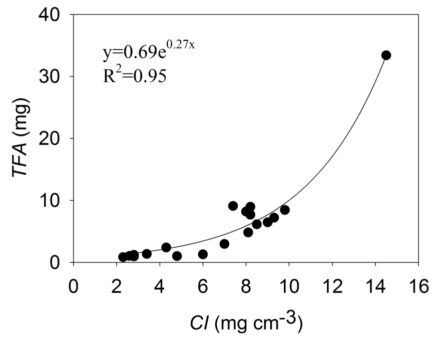

Figure 3: Total fatty acids content (*TFA*) of mussels as a function of condition index (*CI*).

Conclusion

Although the specific growth rates were near identical in Limfjorden and Great Belt higher concentrations of polyunsaturated fatty acids were found in mussels grown in the Great Belt. This indicates a promising potential for line-mussel cultivation in the Great Belt region where strong currents both provide a steady input of phytoplankton and eliminate the risk of oxygen depletion.

We suggest that small mussels with a high growth rate may be used as accumulators of fatty acids, and that small mussels grown for only one season in Great Belt may be used as human food, for production of fish oil, or as source for valuable fatty acids.

Acknowledgment

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References

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Pleissner D, Lundgreen K, Riisgård HU, Eriksen NT (in preparation) Feeding, growth and uptake of fatty acids in blue mussels (*Mytilus edulis*) fed different species of micro-algae.

Riisgård HU, Lundgreen K, Larsen PS (submitted) Growth model for relationship between mussel (*Mytilus edulis*) size, specific growth rate, and phytoplankton biomass.

Riisgård HU, Lundgreen K, Larsen PS (in preparation) Bioenergetic growth model for evaluation of potential for line-mussel (*Mytilus edulis*) farming in Danish waters.