Growth of blue mussels (*Mytilus edulis*) in a Norwegian and a French culture site: comparison of food proxies with Dynamic Energy Budgets (DEB)

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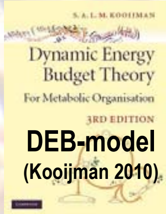
Introduction

✓ Worldwide culture of *Mytilus edulis* (≈ 391 000 tonnes in 2005, 93% from EU, different methods, *e.g.* poles, longlines), under contrasted environments, *e.g.* phytoplankton (1-12 µg·L^{-1}), seston (1-100 mg·L^{-1}), temperature (1-22°C)

⇨ **How to relate environmental variability and mussel growth?**
(*e.g.* in a context of carrying capacity studies at different scales, effects of global change on individuals and trophic interactions)

✓ By using a generic tool, the DEB-model, applied in shellfish culture, *e.g.* for coupling with ecosystem models and farm models



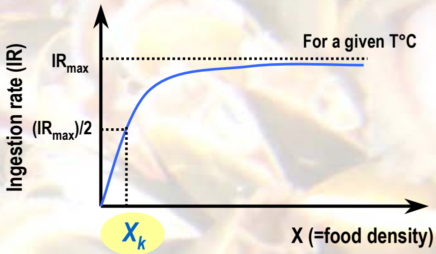
Methods

✓ **Two sites:** Flødevigen (Flø) 2007-2009 (Norway, 58N25'; 8E49')
Aiguillon Bay (Aig) 2000-2005 (France, 46N15';-1W13')

✓ One **fixed set of 15 DEB parameters** for *M. edulis* (Rosland *et al.* 2009)
except X_K (half-saturation coefficient) calibrated for each simulation (site, year)

✓ **Forcing variables**: water **temperature**, food density
⇨ **two food proxies** tested: chlorophyll *a* (chl-*a*), phytoplankton counts (phyt-N)

✓ Validation data (9 datasets): mussel growth (dry flesh mass)



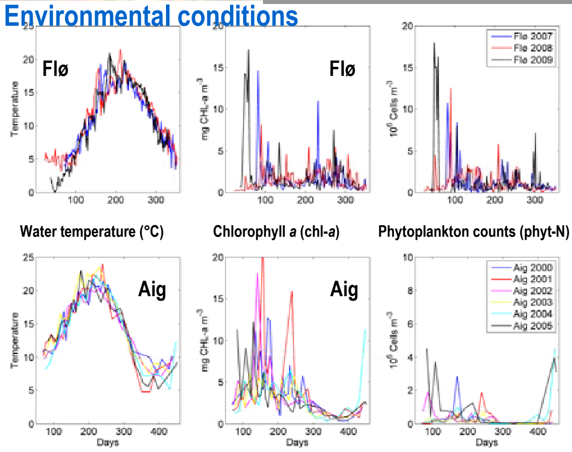
Results & discussion

✓ Water temperature: fairly similar among sites & years

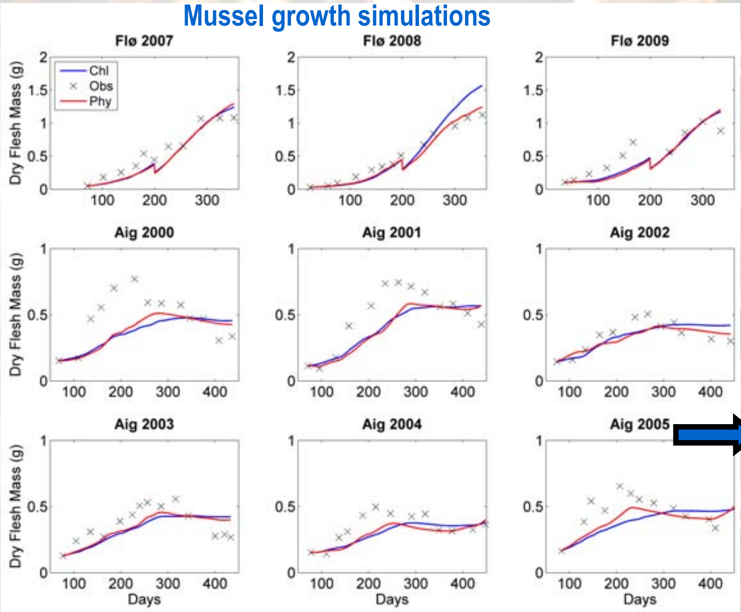
✓ Aiguillon Bay: chl-a_{mean} = 3.2 µg·L^{-1}; phyt-N$_{mean}$ = 3.5·10^5 cells·L^{-1}
≈ 86% diatoms, 9% dinoflagellates, 5% "other"

✓ Flødevigen: chl-a_{mean} = 1.8 µg·L^{-1}; phyt-N$_{mean}$ = 12.9·10^5 cells·L^{-1}
≈ 70% of flagellates, 25% diatoms, 3% dinoflagellates

Environmental conditions



Mussel growth simulations



✓ Mean half-saturation coefficient values:
* Aiguillon Bay: X_K = 4.11 µg·L^{-1}, 3.1·10^5 cells·L^{-1}
* Flødevigen: X_K = 0.34 µg·L^{-1}, 2.1·10^5 cells·L^{-1}

✓ Bad fit of dry flesh mass during 'lean' periods (fall, winter) in Aiguillon Bay; but no spawning & *Leptocylindrus minimus* ('disgusting' algae for mussels?) dominates

✓ No better simulations of mussel dry flesh mass using any of food proxy; but variations in X_k values among sites and years are less for phyt-N than for chl-*a*

✓ The DEB model: robust enough to simulate properly the mussel shell length (Alunno-Bruscia *et al.* in prep.), but still some discrepancies between sim. and obs. dry flesh mass

✓Next steps: *i)* using other food proxy (carbon) or factors (seston) to improve ingestion/filtration functions, *ii)* re-considering reproduction in DEB

Fundings & references

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✓ Kooijman, S.A.L.M. 2010. Dynamic Energy and Mass Budgets in Biological Systems. Cambridge University Press. 3rd ed. // Rosland R., Strand Ø., Alunno-Bruscia M., Bacher C., Strohmeier T. 2009. *J. Sea Res.*, 62: 49-61.