Interannual variability of individual growth of the great scallop *Pecten maximus*.

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MASTER 2 training research project
Sciences Biologiques Marines

LEMAR
Institut Universitaire Européen de la Mer

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**Pecten maximus**

- mollusc, bivalve, Pectinidae
- benthic suspension feeders
  depth: 5 m ➔ 120 m
- temperate species
  Norway ➔ Maroco
- high economical value
- fishery in Bay of Brest

→ Studied by LEMAR
(Laboratory of Marine Environment Sciences)
The DEB model

- Standard DEB model (in energy)

- States variables:
  - Energy reserves (E)
  - Structure (V)
  - Maturity and reproduction (Er)

- Forcing variables:
  - Food
  - Temperature

Diagram:
- Food
- Temperature
- Faeces
- Pseudo-faeces
- Energy reserves E
  - Kappa
  - 1-Kappa
- Structure V
- Maturity Er
  - Somatique maintenance
  - Maturity maintenance
**The model parameters**

- Literature

- Calculated from literature

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Study site: Bay of Brest

Roscanvel = fisheries site
**Biological data**

- Monitoring of a *Pecten maximus* population (Roscanvel):
  - 8 years from 1996 to 2003 (LEMAR)
  - 2.5 to 3.5 years old individuals (age classe 3)
  - 25 individuals twice a month

**Variations of the shell length and the total flesh dry weight**
Biological data

- Monitoring of a *Pecten maximus* population (Bay of Brest):
  - 8 years from 1996 to 2003 (LEMAR)
  - 2.5 to 3.5 years old individuals (age classe 3)
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Variations of the shell length and the total flesh dry weight
**Forcing variables: temperature**

- **Temperature of the bottom water at Roscanvel:**
  - Linear interpolation to obtain daily data
  - No data since 2001 => average of the 5 previous years

![Temporal variations of the bottom water](image)
**Forcing variables: food**

- Phytoplankton data from REPHY survey (Ifremer) at Lanvéoc:
  density of phytoplankton species => Nb. of Cells L⁻¹

**Temporal variations of the specific phytoplankton blooms composition**

![Graph showing temporal variations of phytoplankton blooms composition]
**Environmental data: food**

- Phytoplankton data in Lanvéoc from REPHY survey (Ifremer):
  
density of phytoplankton species => Nb. of Cells L$^{-1}$

**Temporal variations of the specific phytoplankton bloom composition**

![Graph showing temporal variations of phytoplankton bloom composition](image-url)
Résults : dry weight growth

**1999**

- **Simulation (g)**
- **Observations (g ; +/- S.D.)**

**GROWTH (-)**

**2002**

- **Simulation (g)**
- **Observations (g ; +/- S.D.)**

**GROWTH (-)**

**2003**

- **Simulation (g)**
- **Observations (g ; +/- S.D.)**

**GROWTH (+)**
Résults : dry weight growth

... but :

1997

Time (Julian Days)

Total Flesh Dry Weight (g)

Simulation (g)

Observations (g ; +/- S.D.)

GROWTH (+)
Studies: Chauvaud & al. (1998; 2001) and Lorrain & al. (2000)

Bloom → massive sedimentation → clogging gills → disturbance

filtration = 0 → when [Phytoplankton] > 1.5 \times 10^6 \text{ cell. L}^{-1}
**Résults: stop in filtration activity => Dry weight**

Better fit

Stop in the dry weight growth

Model able to simulate the impact of bloom massive sedimentations
Résults: stop in filtration activity => Shell

Stop in the length growth (shell)  Model able to simulate length growth stop
Conclusions

• Good simulations (1999 to 2003):

  • trophic resource (+) => « high » growth
  • trophic resource (-) => « low » growth

• 2002 & 2003 => deviations

  ➔ contribution of other food sources?

  - microphytobenthos
  - detritic and terrestrial matter
  - size/species selection?
  - how consider « quality » of food sources?
Conclusion

Model behaviour in 1997:

food concentration: (+) (+) (+) => over estimation of the dry weight growth

simple way to model the Chauvaud & al. (1998; 2001) and Lorrain & al. (2000) hypothesis:

=> growth in weight and length OK
=> stop in weight and length growth

• another perspective

=> latitudinal gradient

Maroco ← Bay of Brest → Norway
... thank you!