

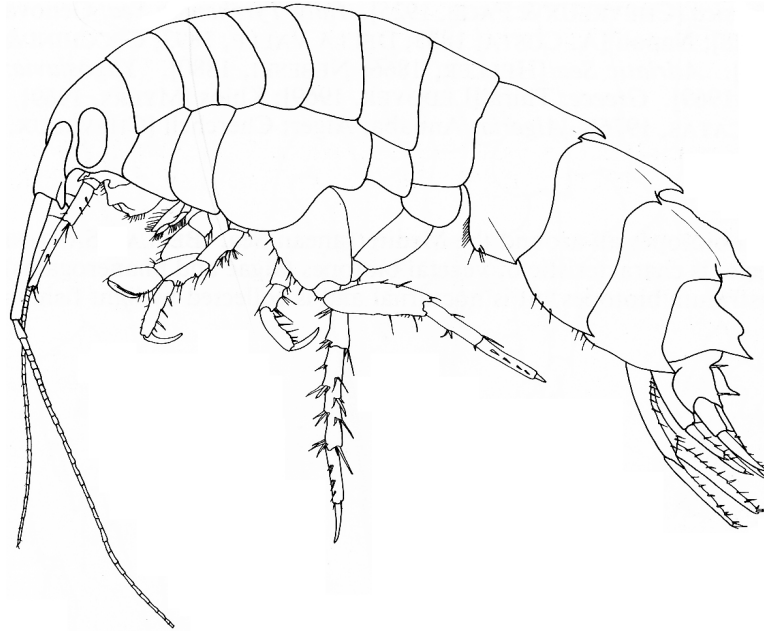


LSD

Laboratoire de  
Systématique  
& Diversité  
animale  
ULg



Impact of grazing by amphipods on the dynamics of the epiphytic cover of the *Posidonia oceanica* leaves : an *in vitro* experiment.



MICHEL Loïc, GOBERT Sylvie, DAUBY Patrick & LEPOINT Gilles

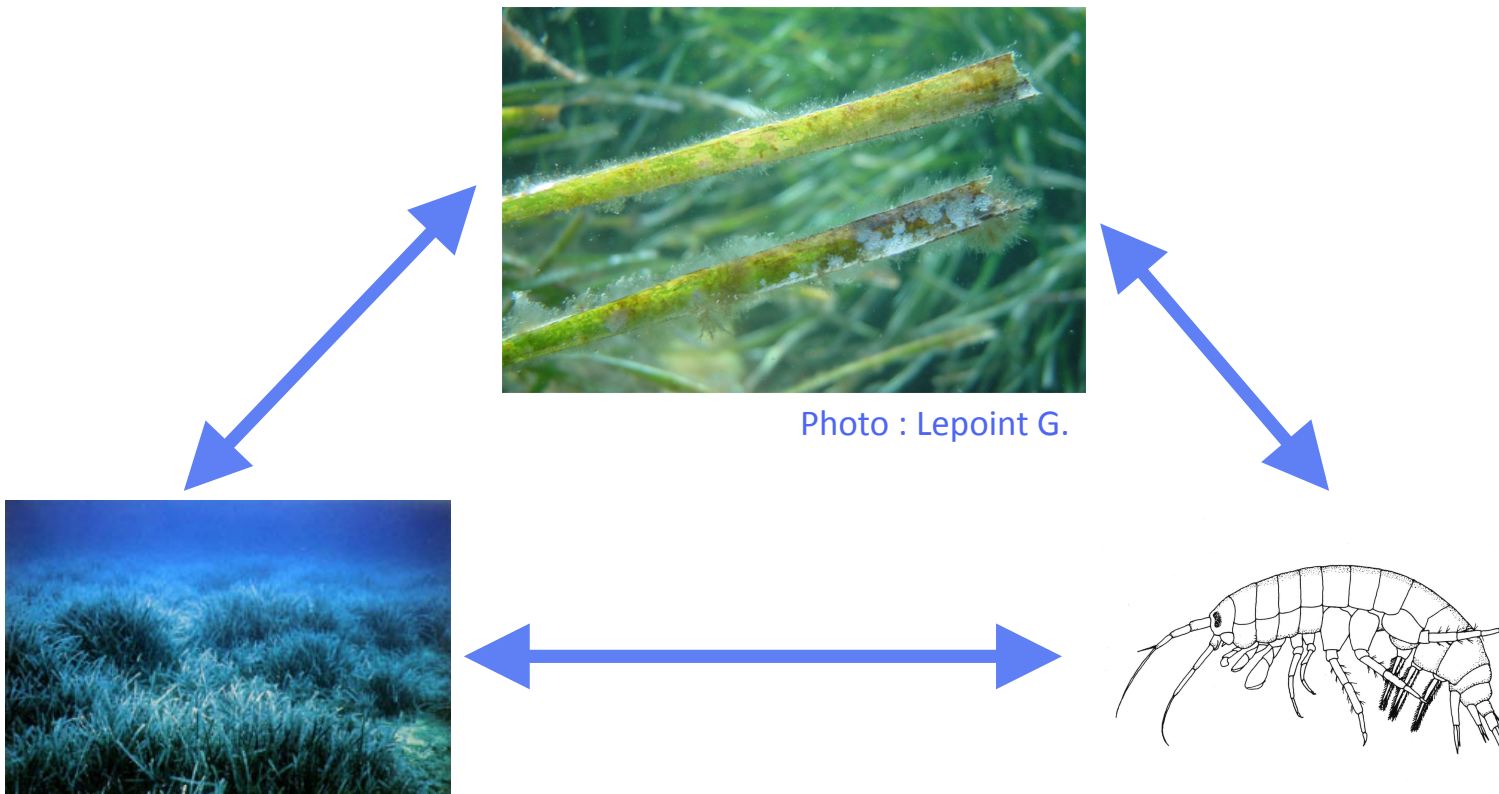
University of Liège (Belgium)

Université  
de Liège



# Context of the study

- Amphipods : one of the dominant taxa of the vagile fauna of many seagrass meadows
- Key trophic position (link between producers and upper rank consumers)
- In temperate meadows (e.g. *Zostera marina*) : important role in the meadow functioning, via the epiphyte - seagrass - grazer system



# *Posidonia oceanica* meadows

- Amphipods : one of the dominant taxa + epiphyte consumers
- How much epiphytes are consumed ? What's the influence of this trophic activity on the meadow functioning ?

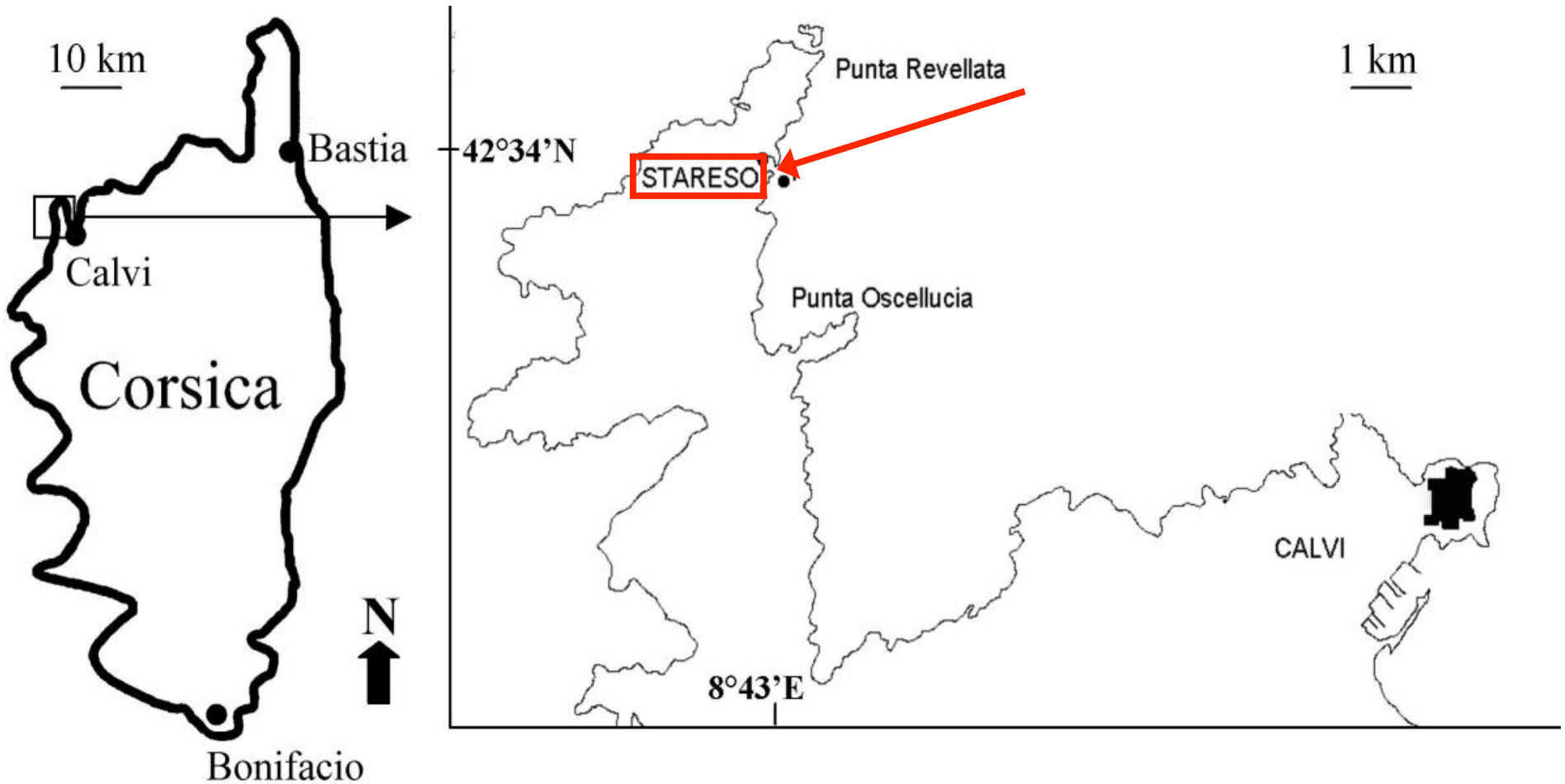
Photo : N. Luy



→ Quantify the impact of grazing on the dynamics of the leaves' epiphytic cover

# Study site

Calvi bay (NW Corsica) – STARESO Research station (University of Liège)



Modified after Lepoint, 1999

# Methodology

- *In vitro* experiments using microcosms

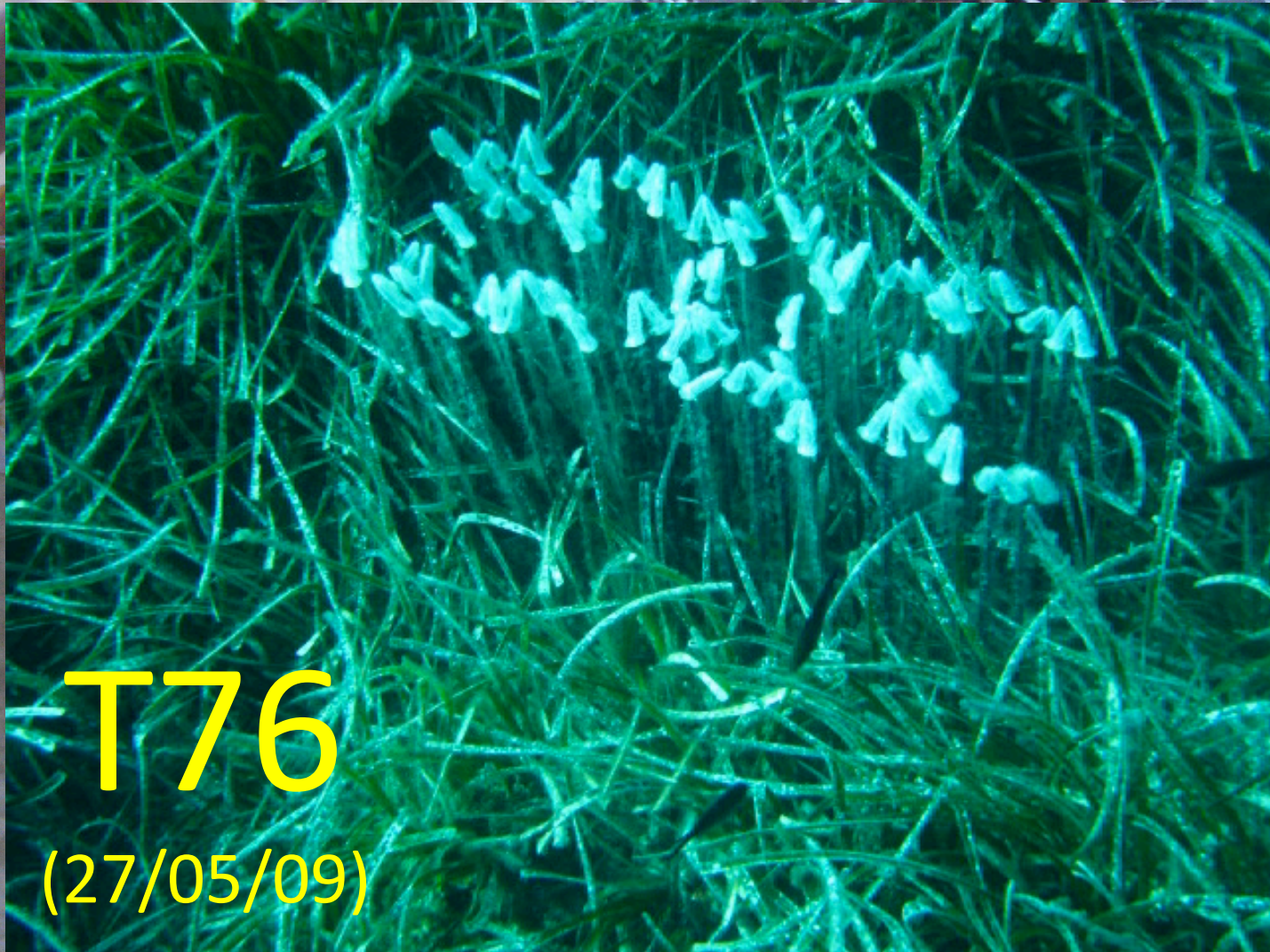
# Methodology



T0

12/03/09

# Methodology

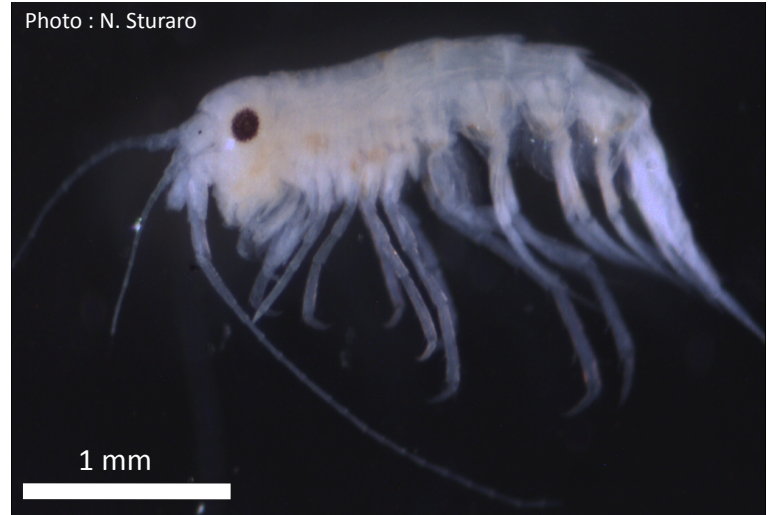


**T76**

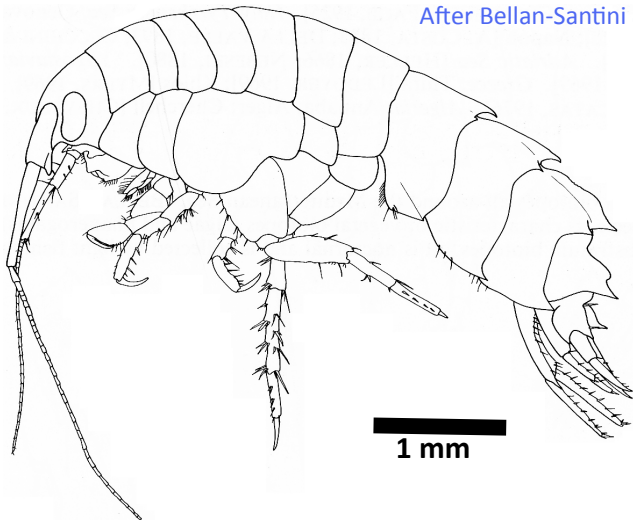
**(27/05/09)**

# Studied taxa

*Apherusa chiereghinii*

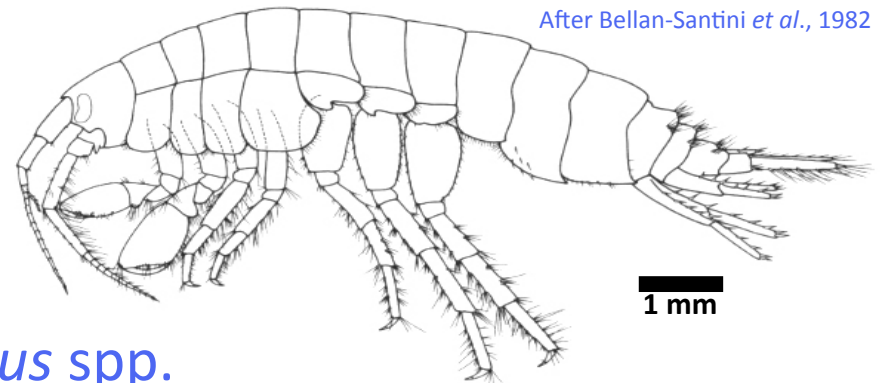


After Bellan-Santini *et al.*, 1982



*Dexamine spiniventris*

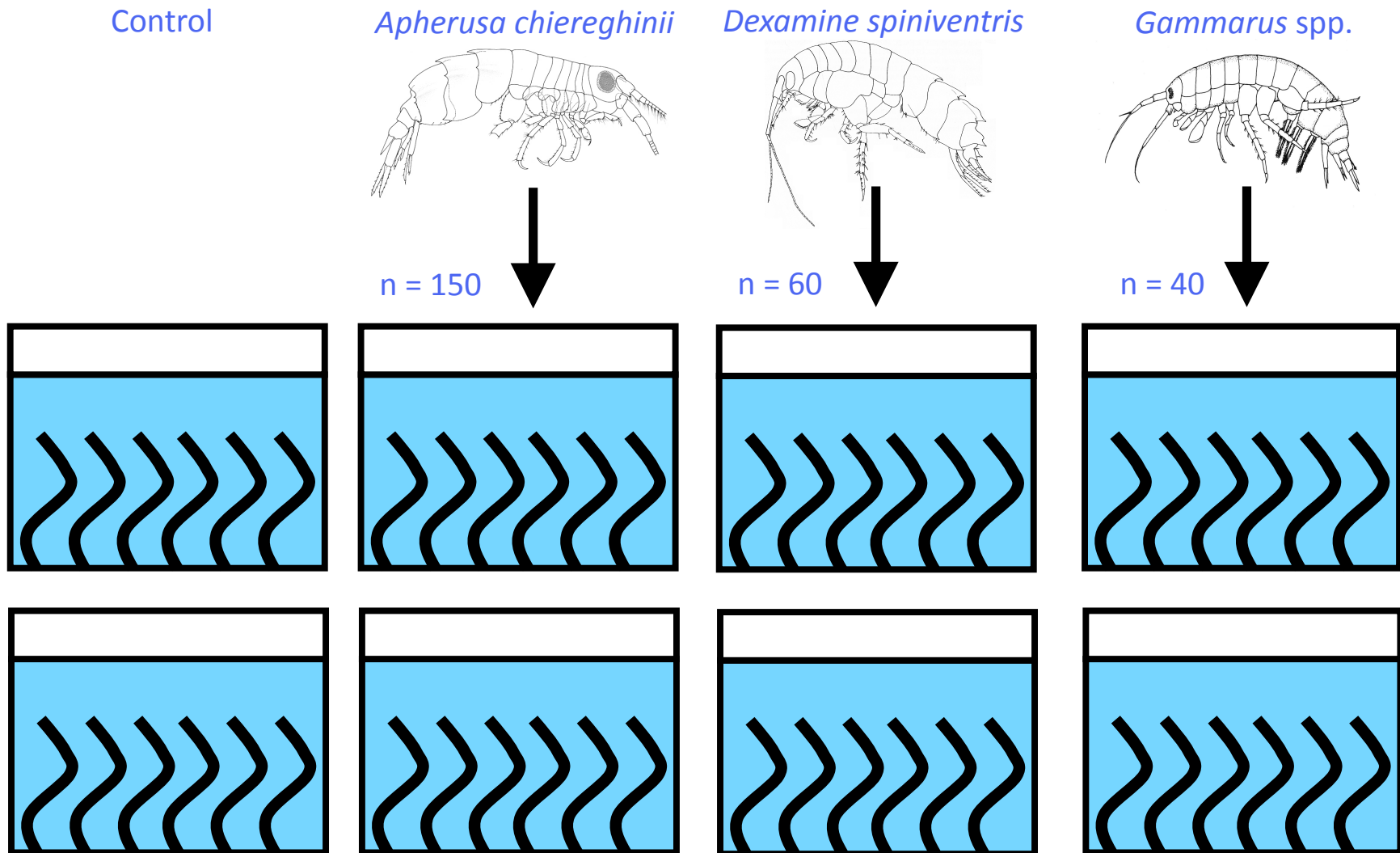
After Bellan-Santini *et al.*, 1982



*Gammarus* spp.

# Methodology

- In vitro* experiment using microcosms



# Objectives of the experiment

Characterize the trophic interaction between epiphytes and amphipods at 2 levels :

## I. Epiphytic cover modifications

- Quantitative : Biomass measurements
- Qualitative : Functional group contributions (erected/ encrusting epifauna/epiflora) to total biomass
- Elemental : Epiphytic C & N content

# Objectives of the experiment

Characterize the trophic interaction between epiphytes and amphipods at 2 levels :


- I. Epiphytic cover modifications
- II. Resource assimilation by the consumers
  - Assessed by measuring C & N stable isotope ratios of epiphytes and grazers at  $T_0$  and  $T_f$

# Epiphytic cover from seagrass mimics



- Presence of encrusting and erected algae typical of *P. oceanica* natural leaves
- Nearly no epifauna (< 1,5 % of biomass)
- Scarcity/absence of numerous taxa abundant on real leaves, and of community-structuring taxa

# Epiphytic cover from seagrass mimics

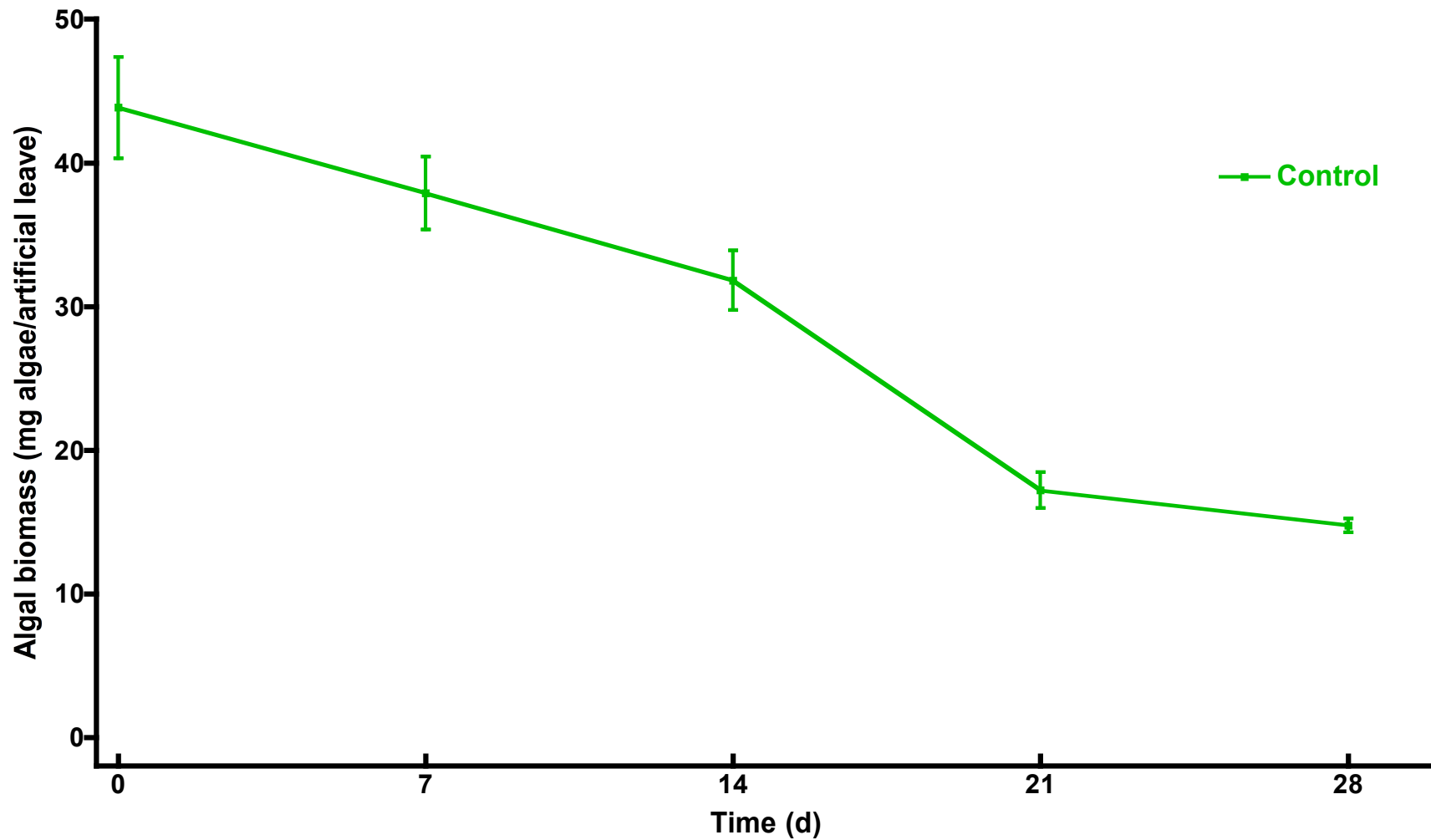


Simplified community,  
Shows resemblance with the natural one, but not  
truly representative...

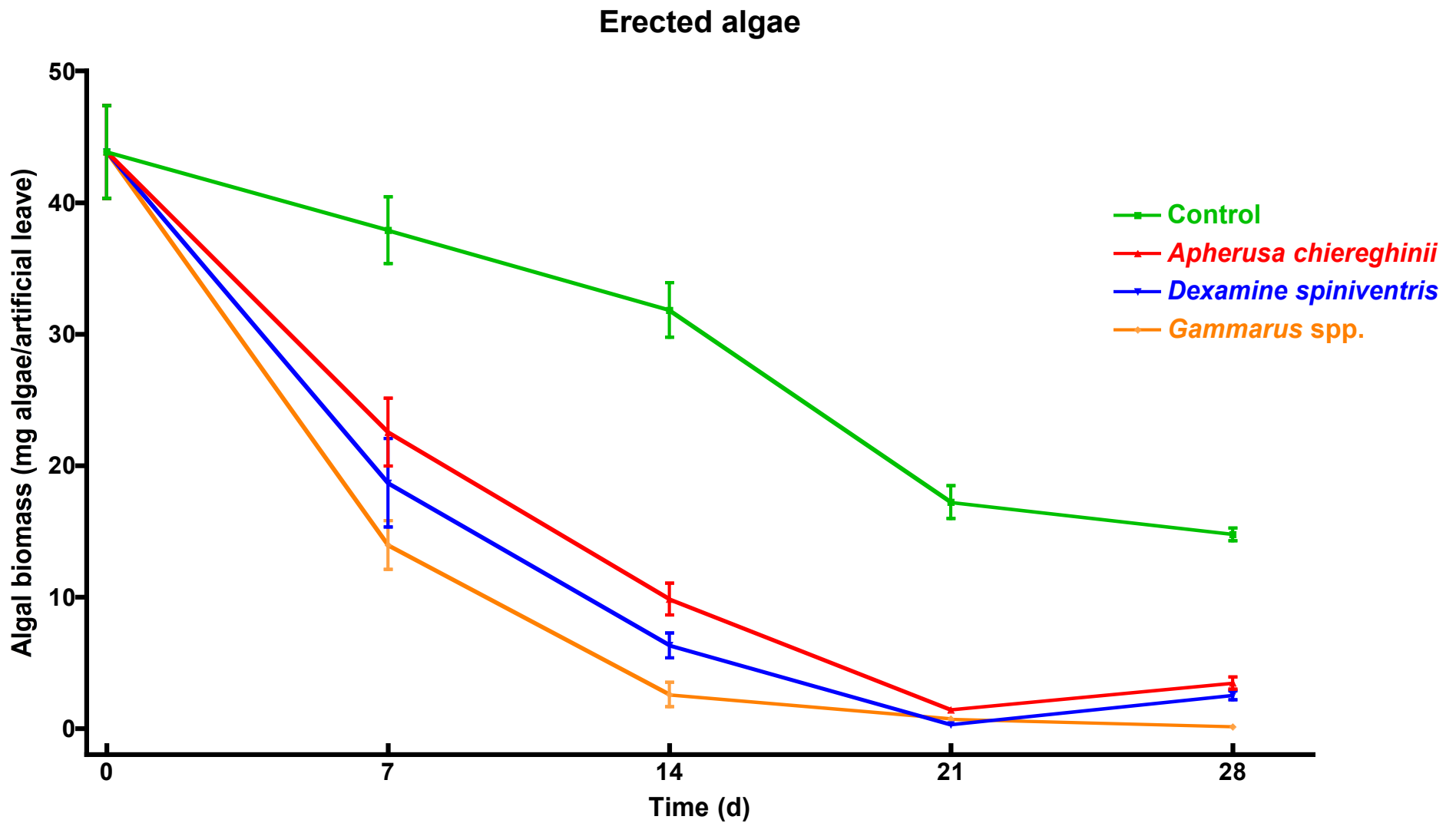
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# Epiphytic cover modification

## Erected algae



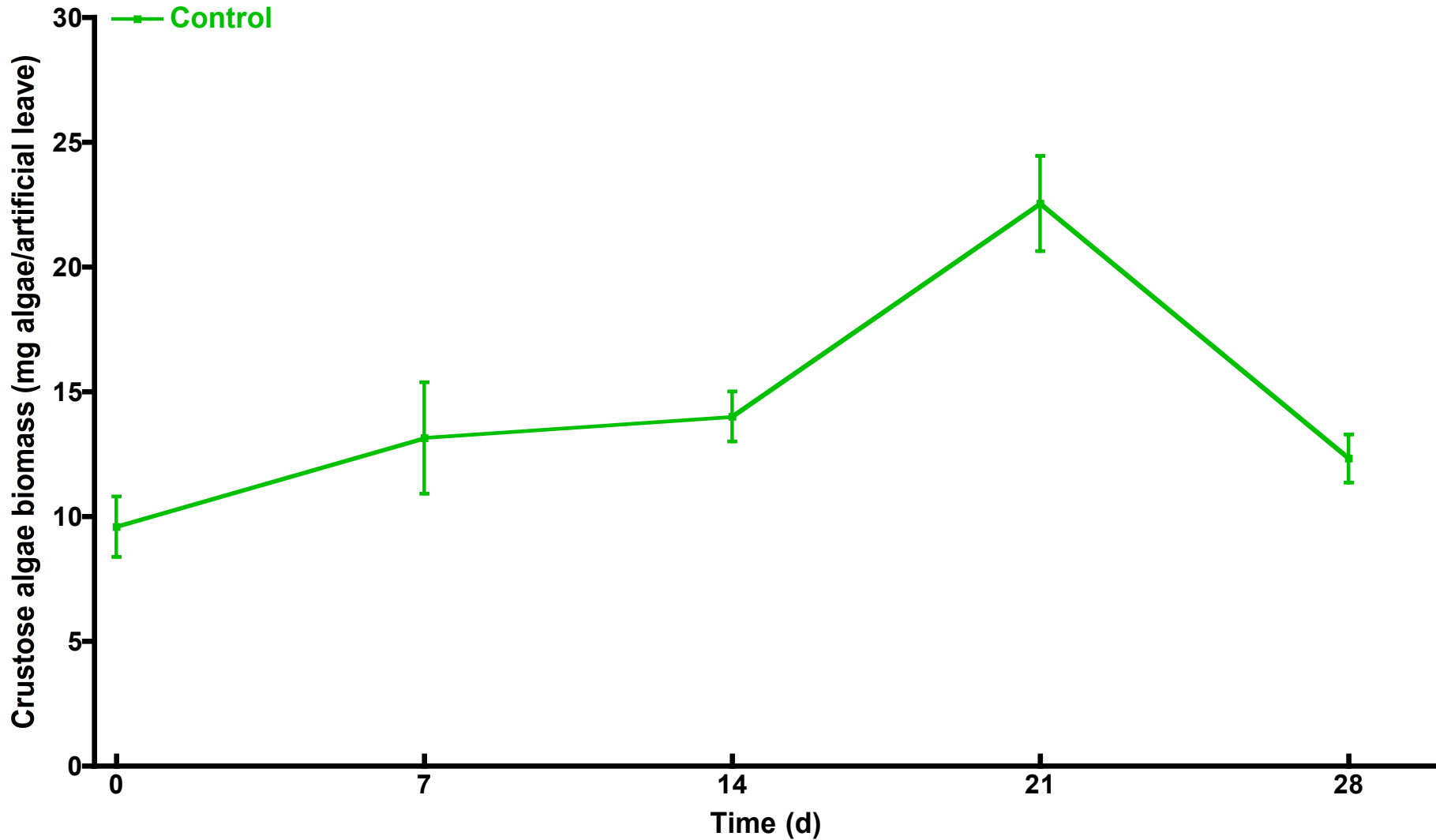
# Epiphytic cover modification



Significant depletion in all "grazer" treatments, no species-specific effect

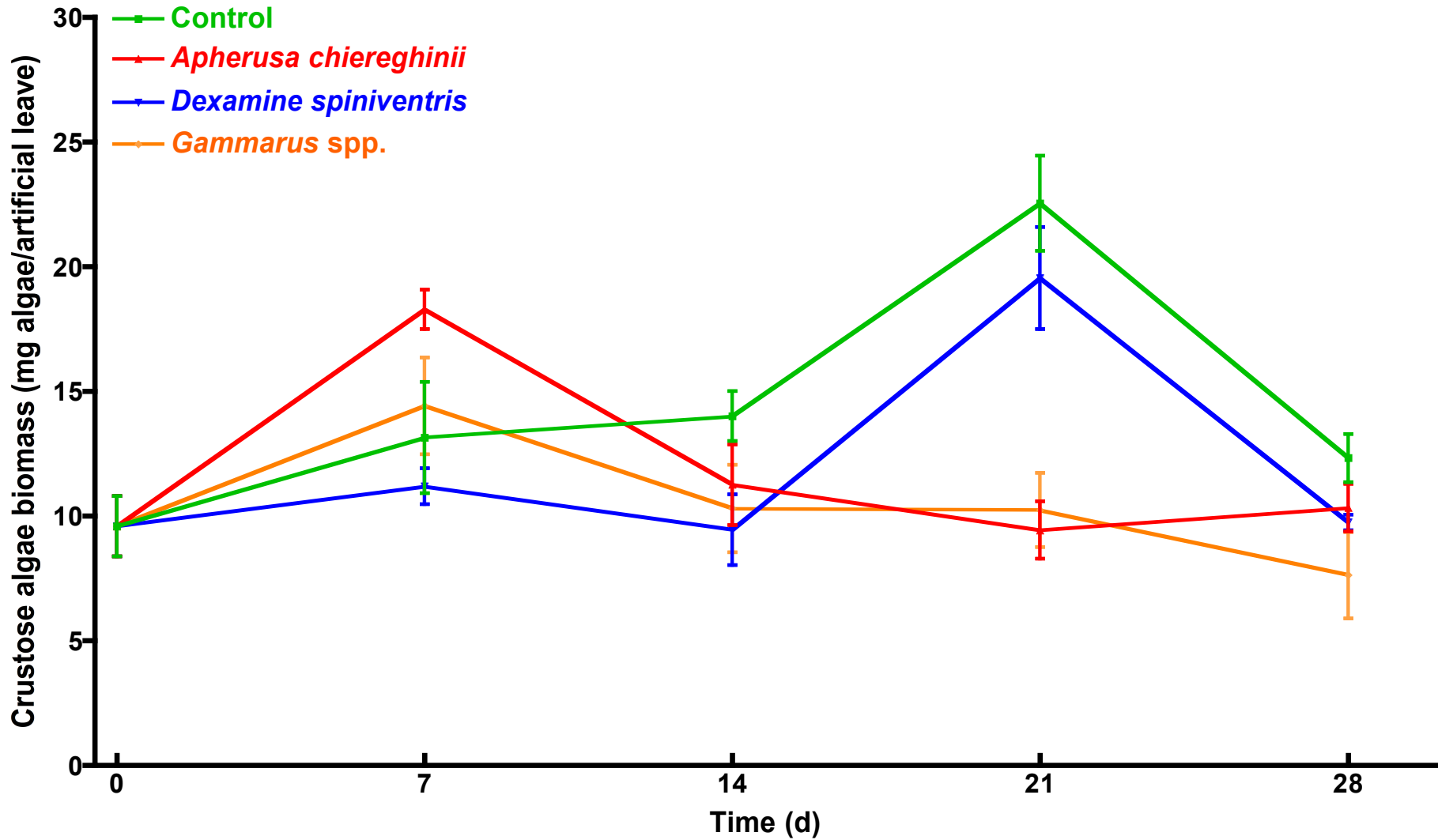
# Epiphytic cover modification

## Crustose Algae



# Epiphytic cover modification

## Crustose algae



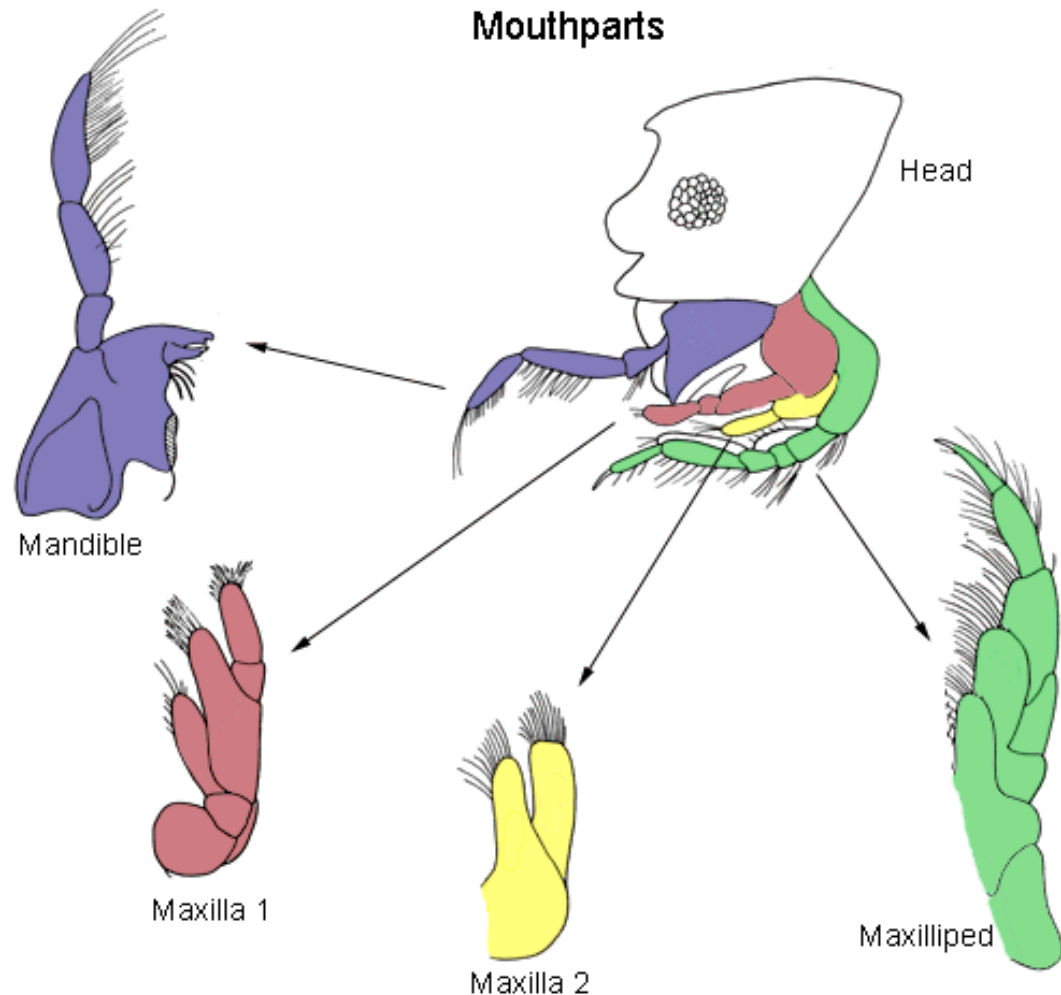
➔ No consumption of crustose algae by any of the considered taxa

# Resource depletion

- Amphipod grazing has a negative effect on algal epiphytic biomass, under controlled conditions

- Only erected algae seem to be consumed : consistent with amphipod mouthpart morphology and feeding mechanism

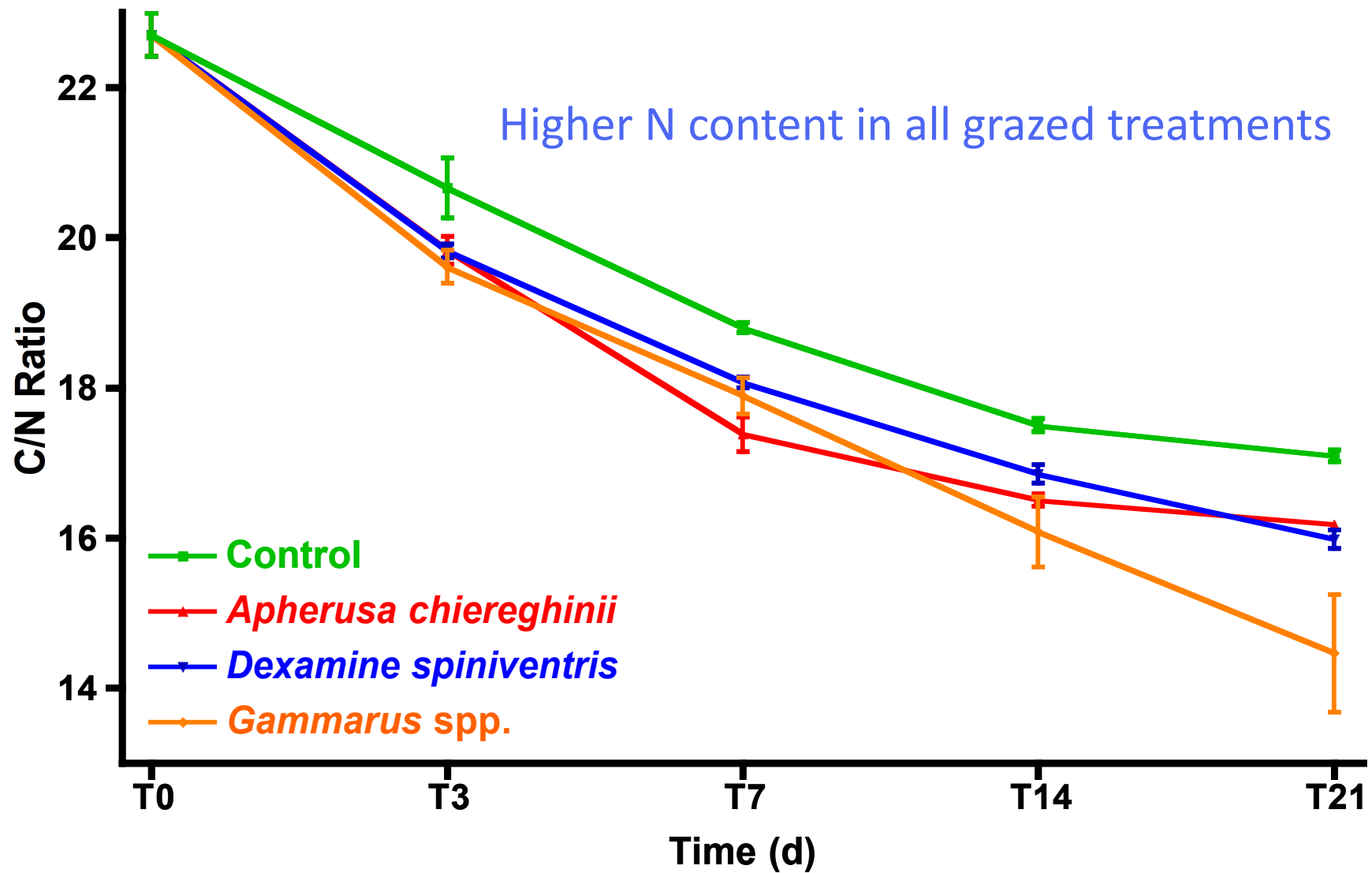
- No species-specific effect → Ecological redundancy ?



After: Barnard and Karaman, 1991

# Epiphytic cover modifications

## C/N ratios of erected algae



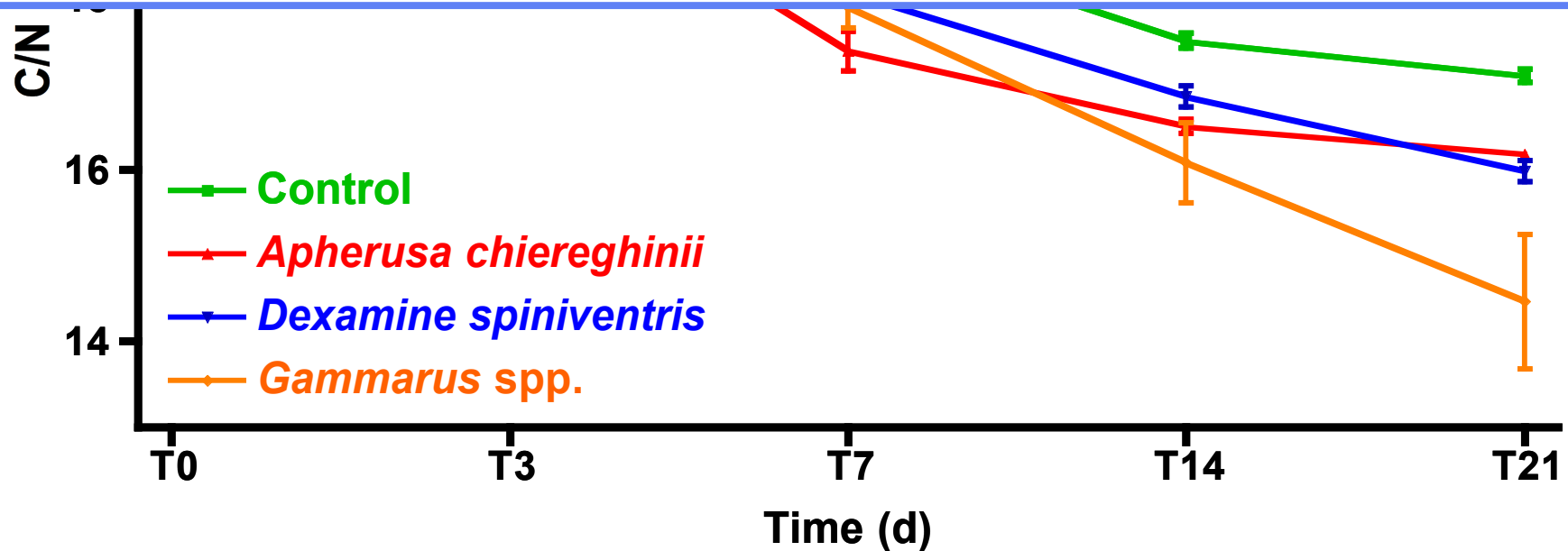
# Epiphytic cover modifications

## C/N ratios of erected algae

Grazing enhances N availability (sloppy feeding, excretion)



↗ N uptake by epiphytes



# Epiphytic cover modifications

## C/N ratios of erected algae

Grazing enhances N availability (sloppy feeding, excretion)



↗ N uptake by epiphytes

C/N

Grazing may not be a unilateral negative interaction !

— *Gammarus* spp.

T0

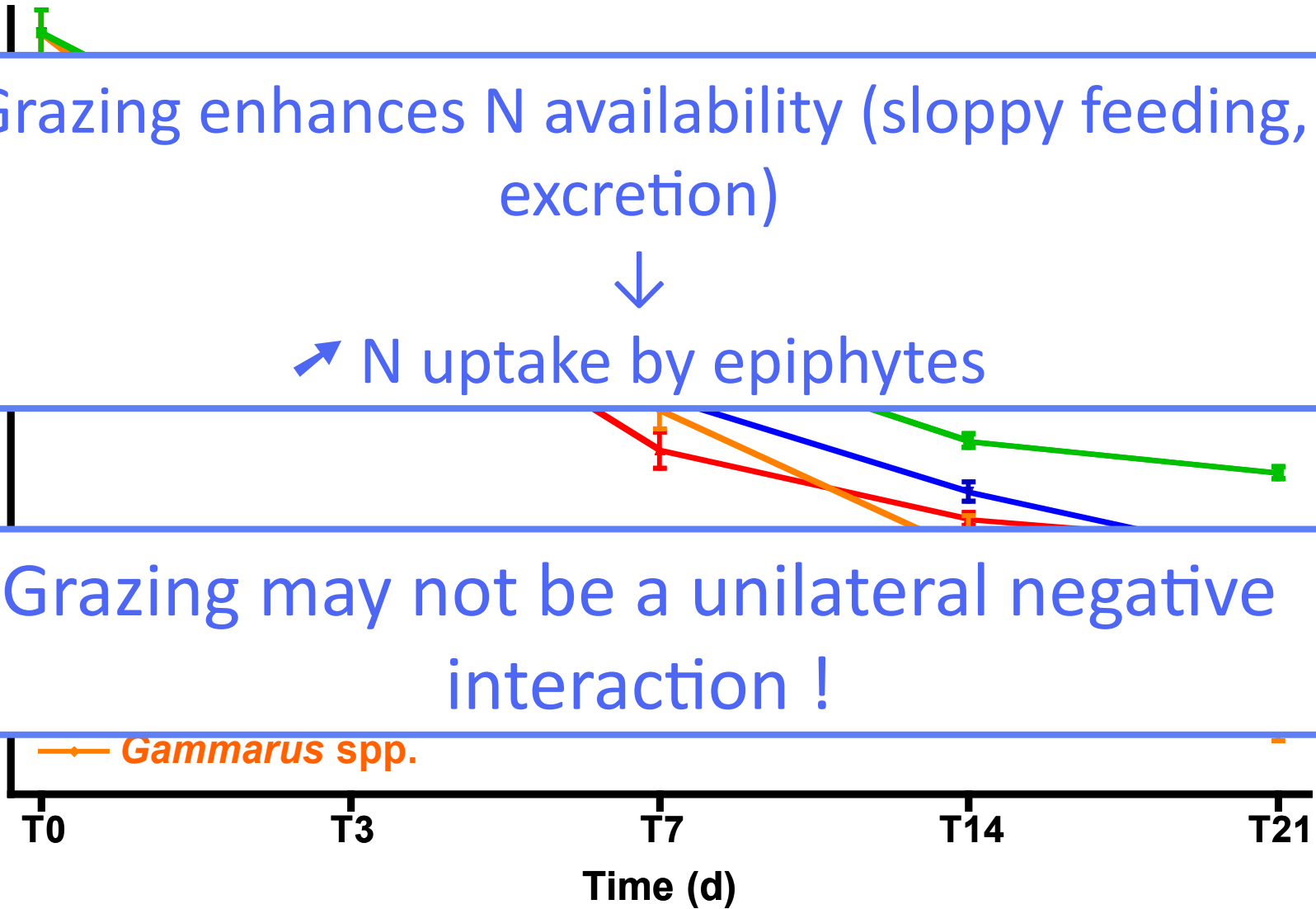
T3

T7

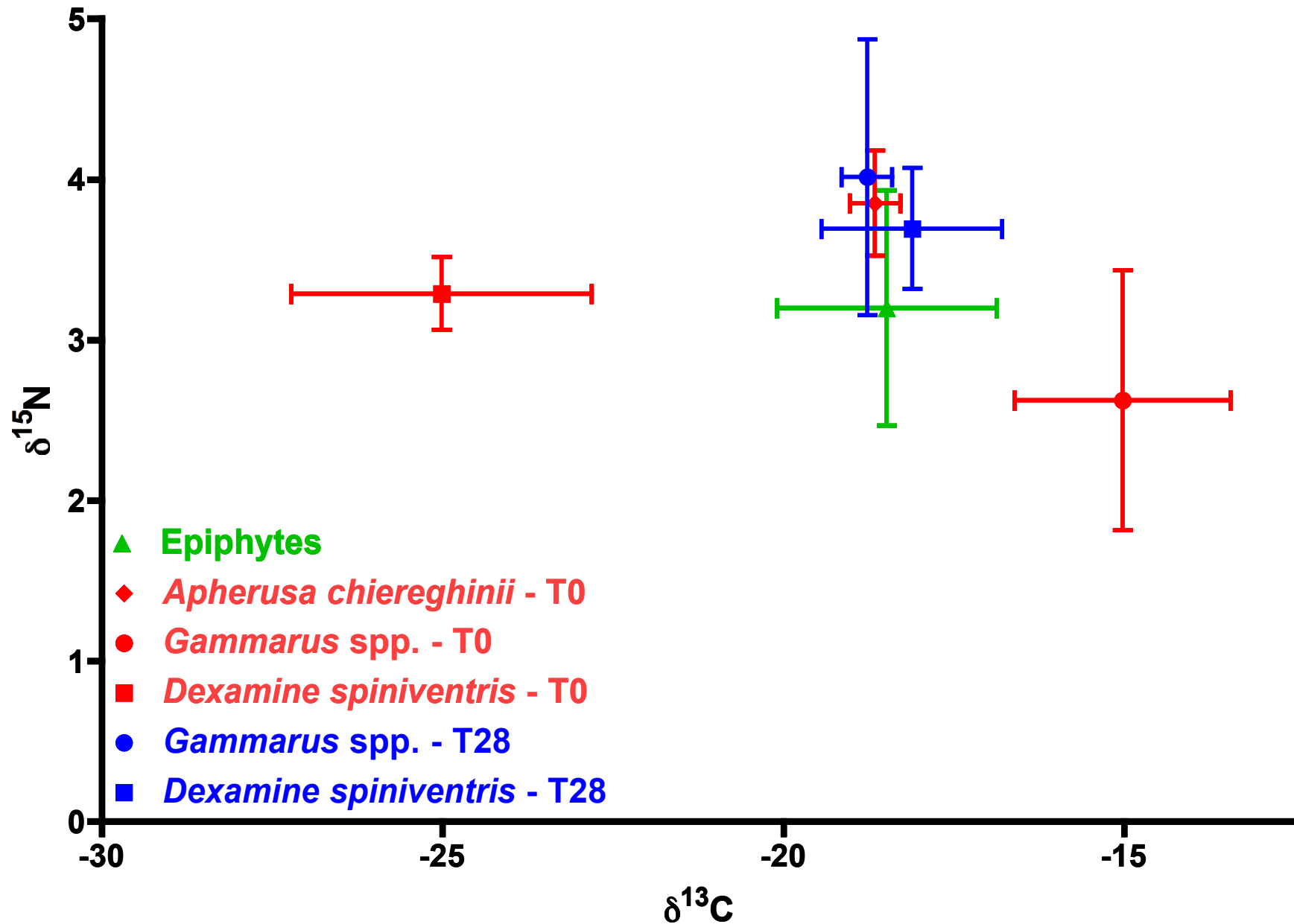
T14

T21

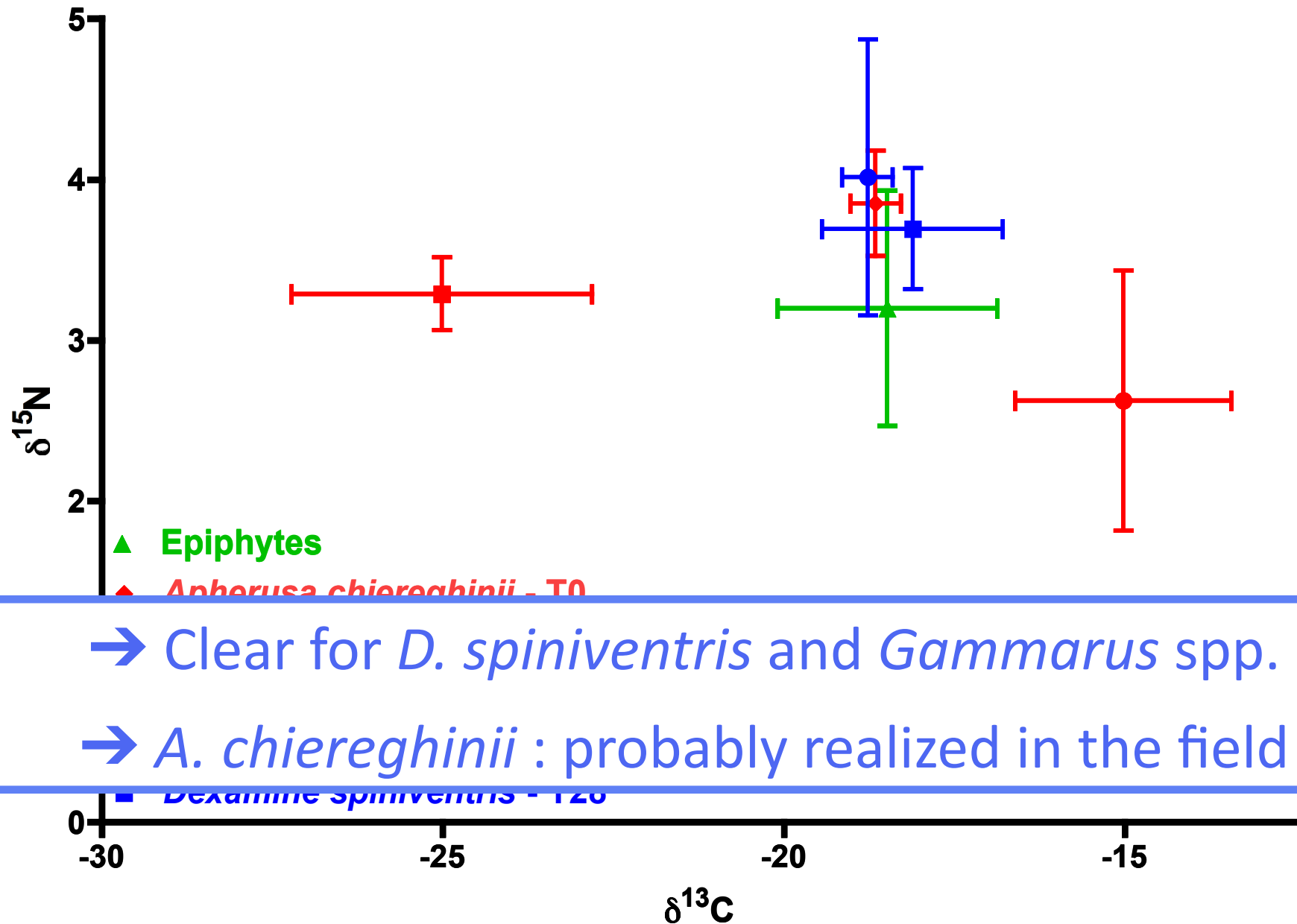
Time (d)



# Assimilation of grazed epiphytes



# Assimilation of grazed epiphytes



→ Clear for *D. spiniventris* and *Gammarus* spp.

→ *A. chieraghinii* : probably realized in the field

# Conclusions & perspectives

- Grazing by all three taxa of amphipods modified the epiphytic cover of seagrass mimics both quantitatively and qualitatively
- All behaved as generalist erected algae grazers, showing no species-specific differences (ecological redundancy ?)
  - Positive effect of grazing on epiphyte N content
  - Assimilation of grazed algae proven for 2 taxa

# Conclusions & perspectives

Under controlled *in vitro* conditions, amphipods from *Posidonia oceanica* meadows seem to be bound to seagrass epiphytes by a strong and complex interaction

# Conclusions & perspectives

Under controlled *in vitro* conditions, amphipods from *Posidonia oceanica* meadows seem to be bound to seagrass epiphytes by a strong and complex interaction



Is this interaction realized in the field ?  
Can the studied taxa exert top-down control on epiphytes ?

→ *In situ* grazing experiments

## Conclusions & perspectives

Under controlled *in vitro* conditions, amphipods from *Posidonia oceanica* meadows seem to be bound to seagrass epiphytes by a strong and complex interaction



**TO BE CONTINUED.....**

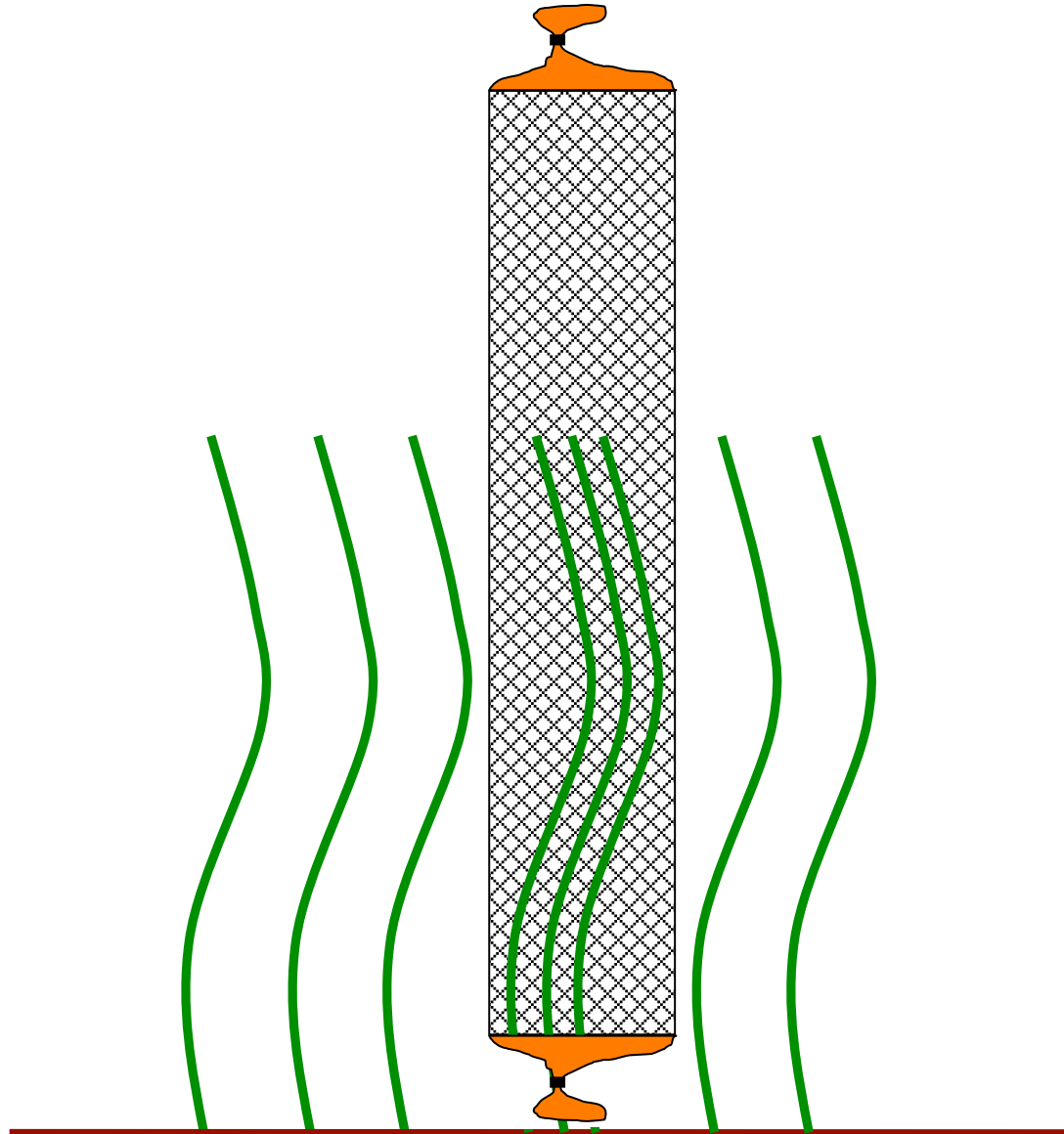
Is this interaction...  
Can the study...  
...experiments

Thanks for your attention...



# *In situ* grazing experiment

- *In situ* experiment using cylindrical ( $\varnothing$  15 cm) exclusion microcosms (400  $\mu$ m mesh)

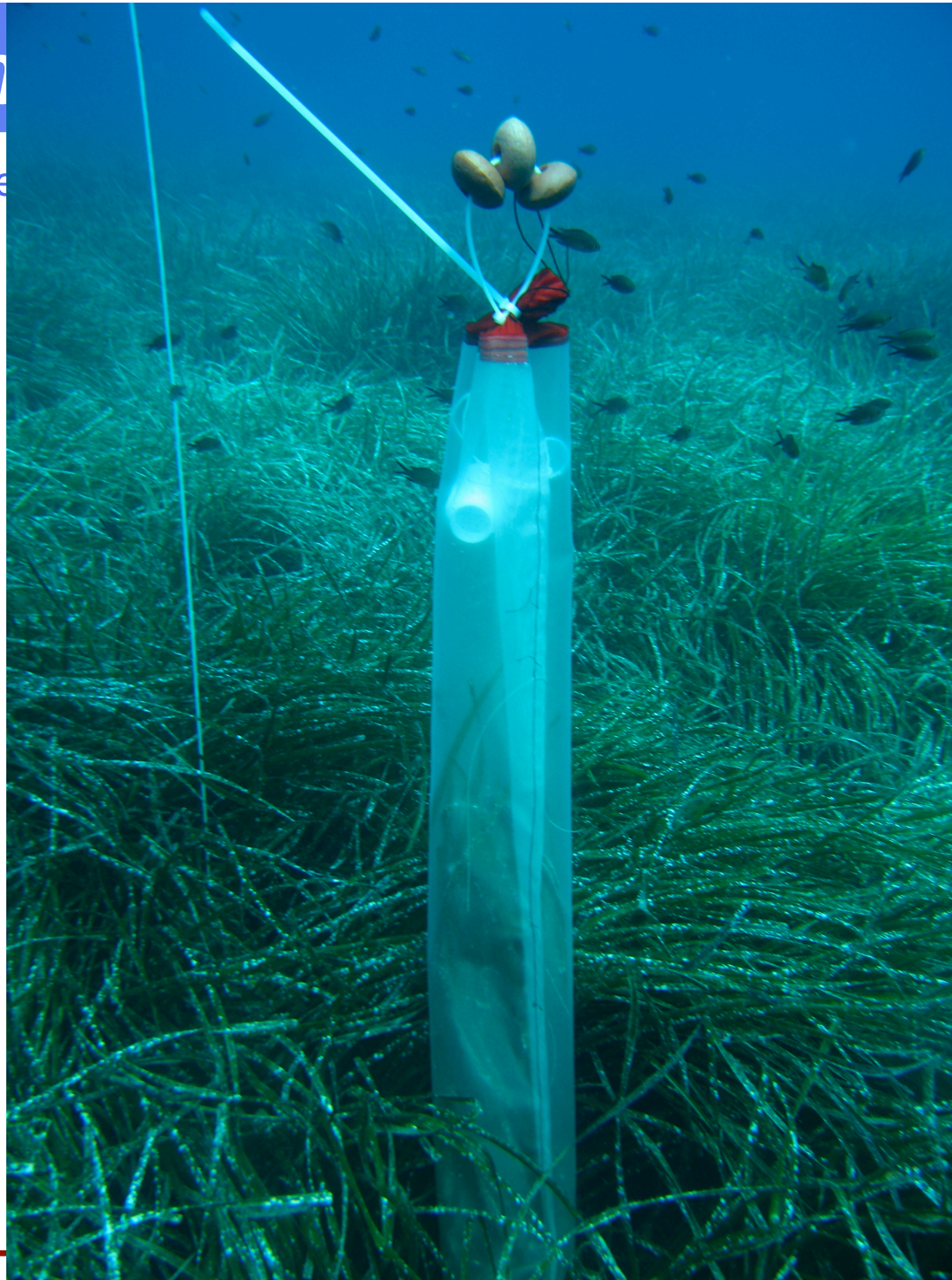


*In*

- *In situ* experime

nt

ns (400  $\mu$ m mesh)



"Natural" conditions (real epiphytic communities, habitat complexity ,  
DOM/FPOM fluxes)

→ Better survival rates ?

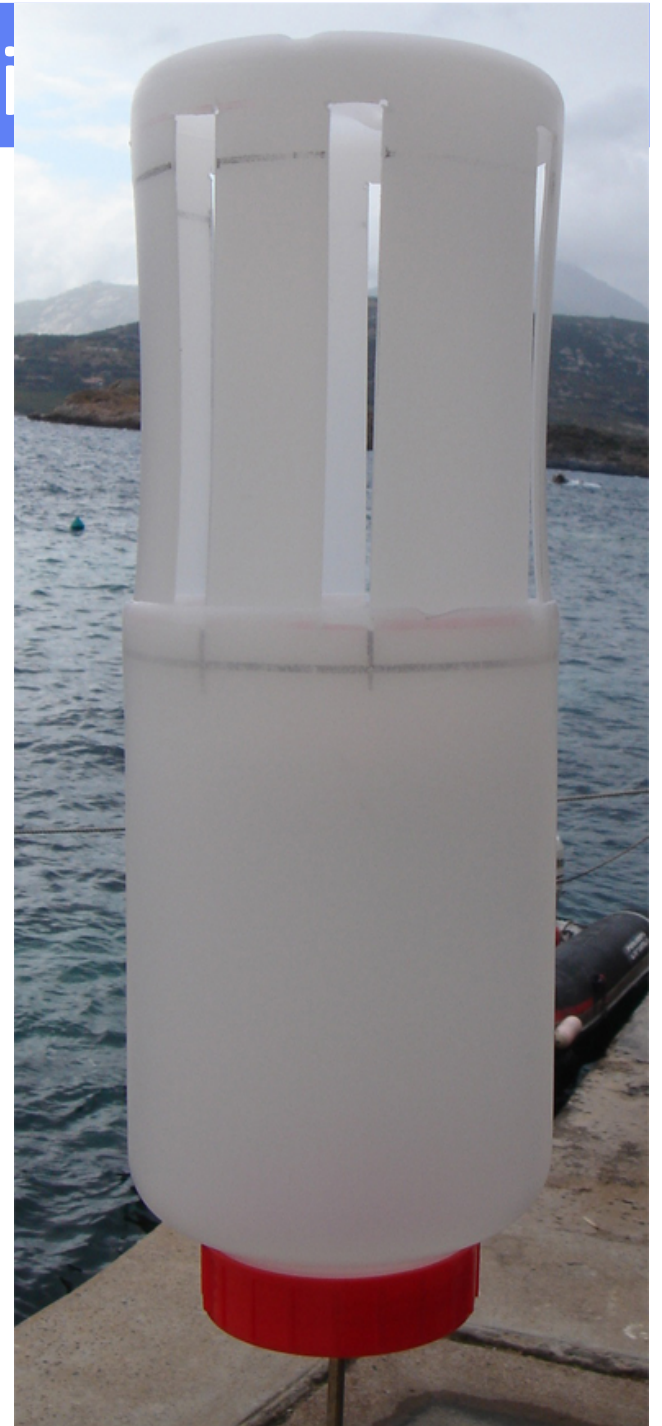
→ Reproducibility of *in vitro* results ?



Photo : N. Luy

# Amphipod sampling

- Use of light traps (Michel *et al.*, 10)
- "Active" penetration of the grazers in the trap avoids mechanical damage and allows a better survival percentage
- Identification of live animals using snapshots



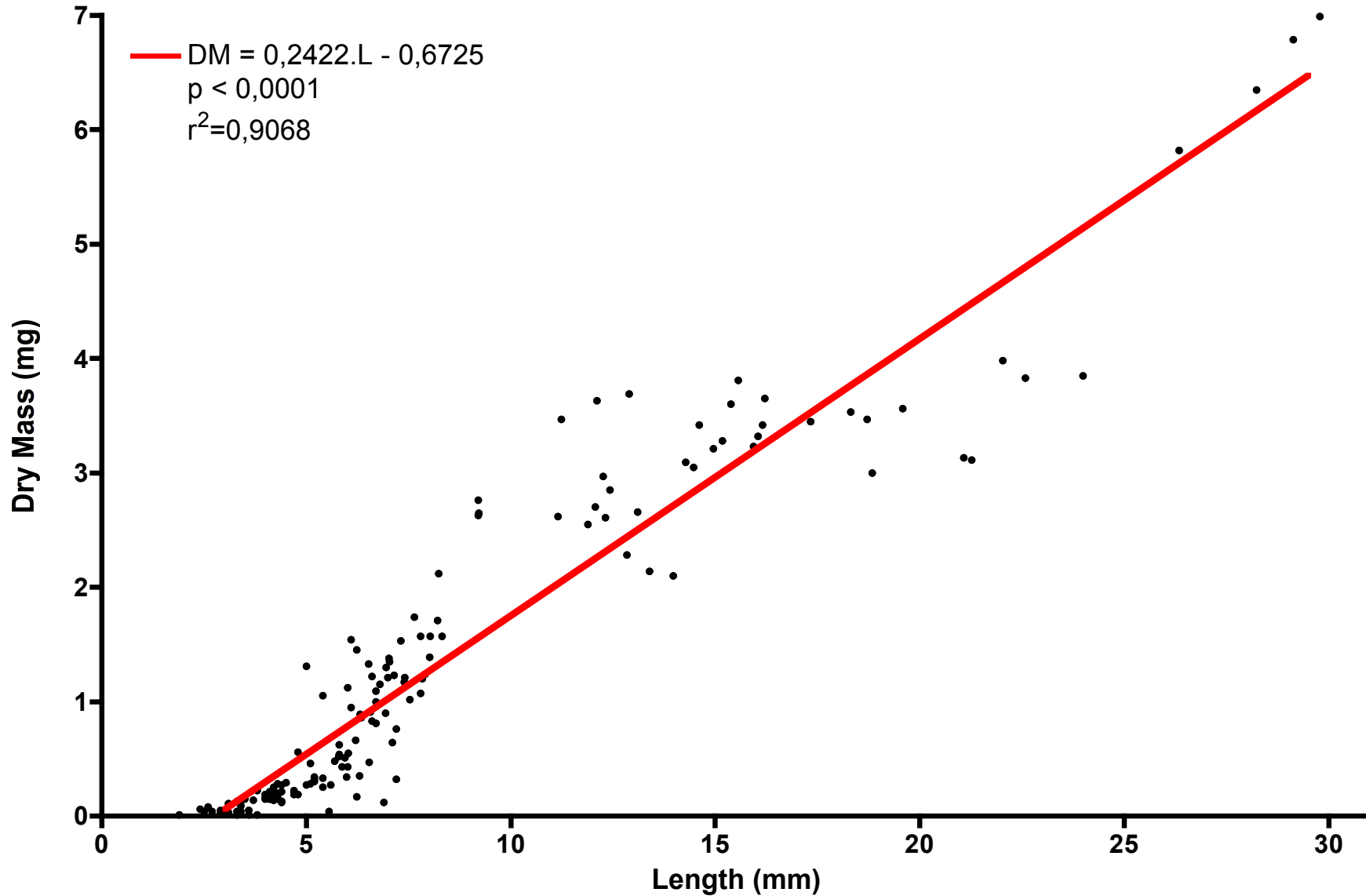
# Objectives of the experiment

Characterize the trophic interaction between epiphytes and amphipods at 3 levels :

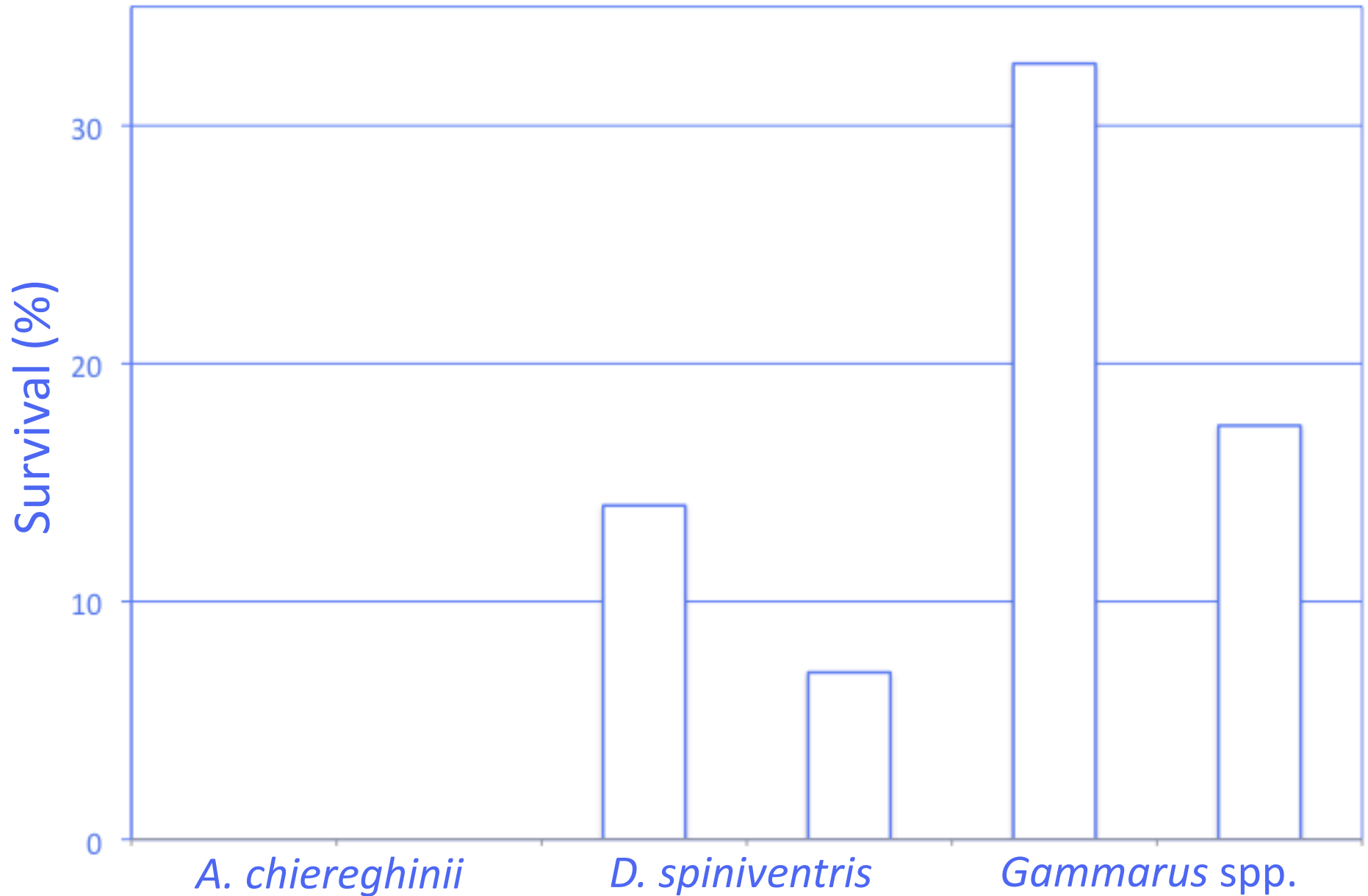
- I. Epiphytic cover modifications
- II. Resource assimilation by the consumers
- III. Exploitation of the assimilated biomass (secondary production)
  - Grazer biomass estimation at  $T_0$  and  $T_f$
  - Use of snapshot photographs : measurement of total body length, and biomass calculation using linear regression

# Secondary production : grazer biomass

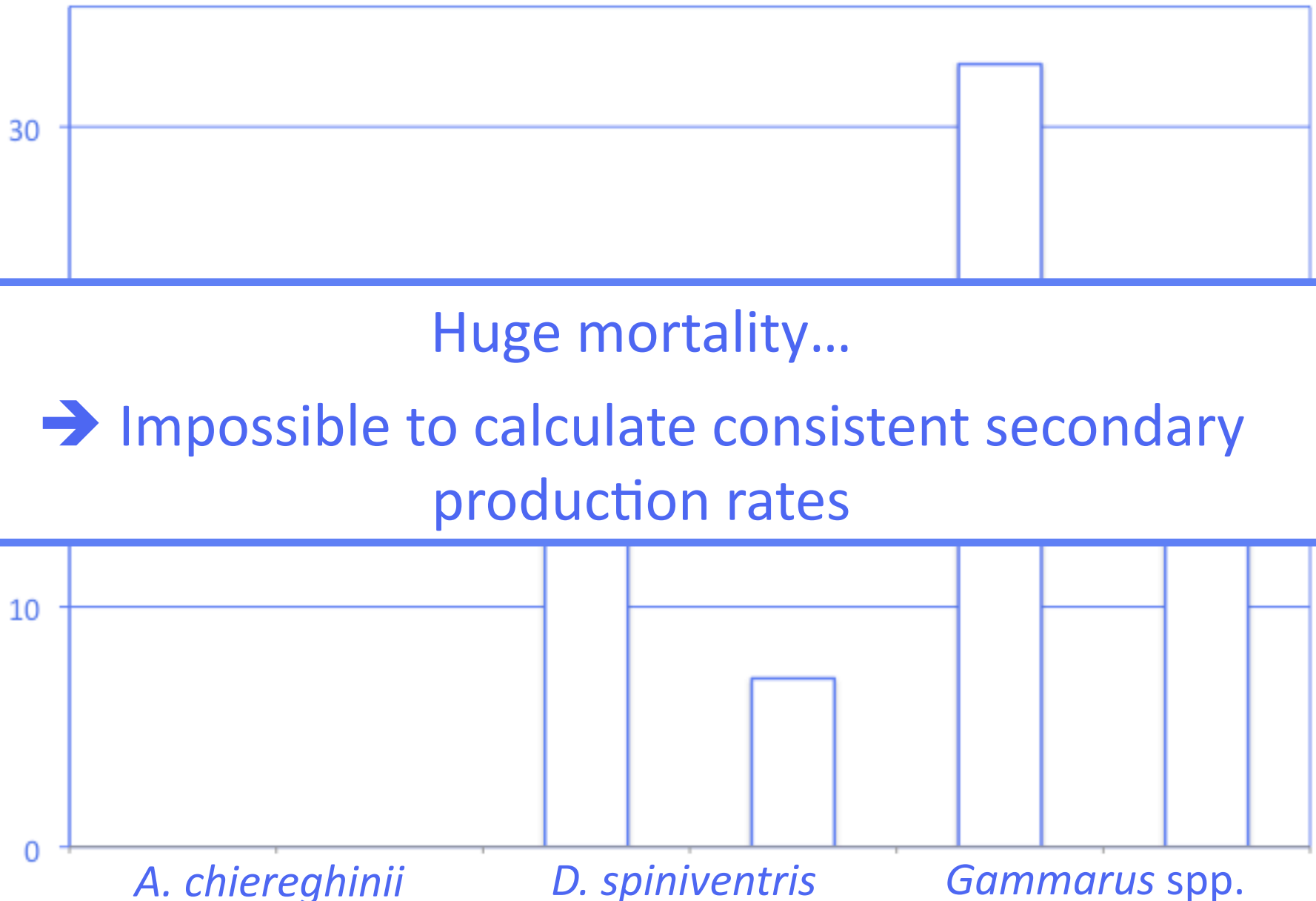
Length vs. Dry Mass



# Secondary production measurements



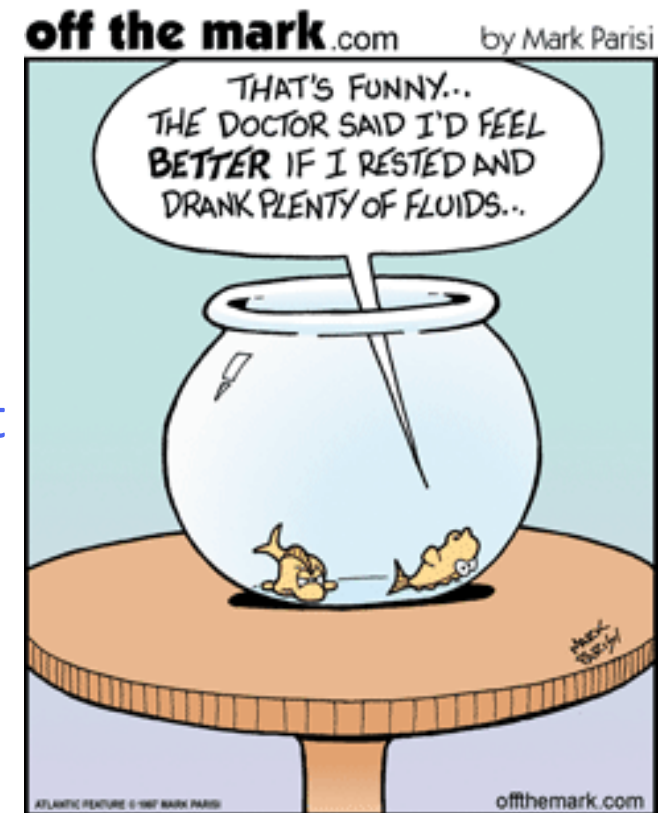
# Secondary production measurements



# Secondary production and mortality

What could explain the high losses ?

- (Bacterial infestation / hypoxia)
- Cannibalism
- Food scarcity / low nutritional content
- Unsuitable habitat
- Stress and/or damage during collection and picture taking
- ...



- Mortality obviously overrated due to artificial experimental conditions

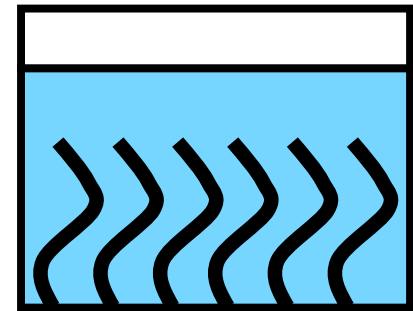
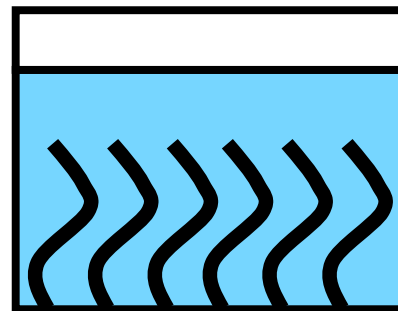
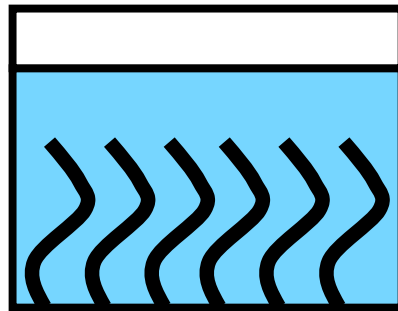
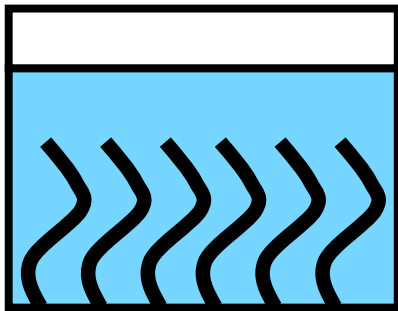
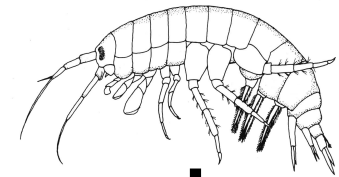
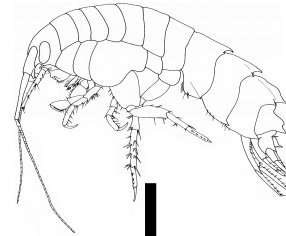
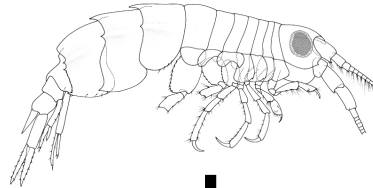
# Grazers : Isotopic ratios

Control

*Apherusa chierghinii*

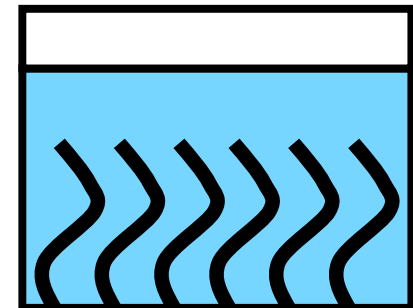
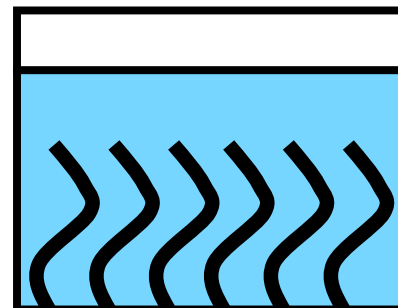
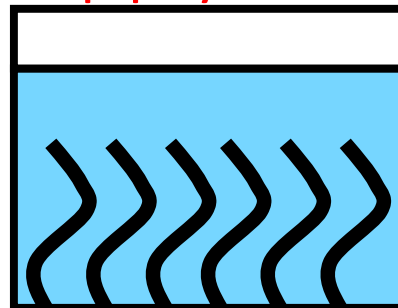
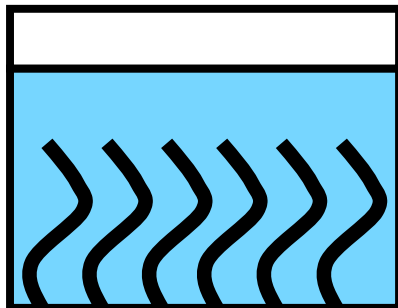
*Dexamine spiniventris*

*Gammarus* spp.



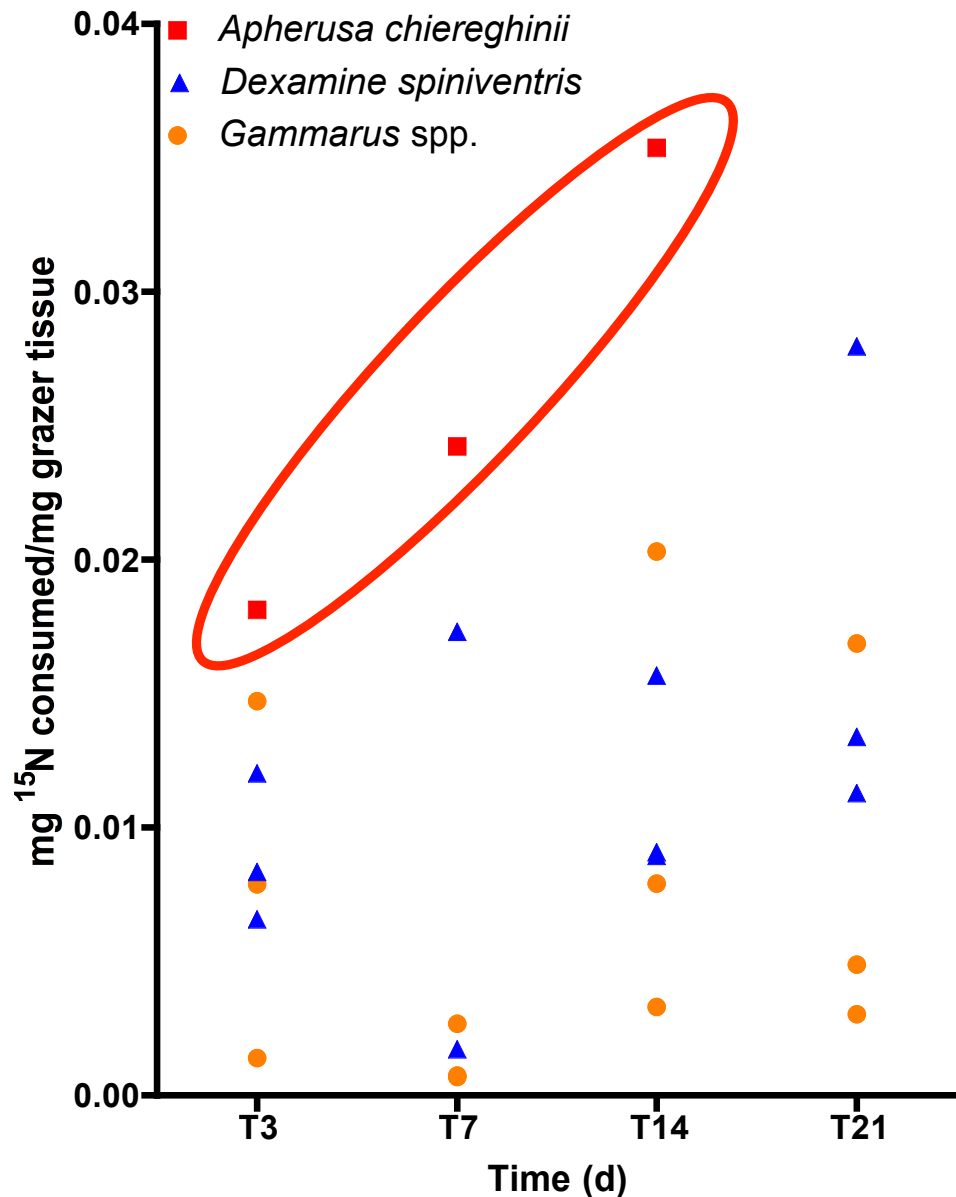
Unmodified epiphytes

$^{13}\text{C}$  &  $^{15}\text{N}$ -labelled epiphytes



# Assimilation of consumed algae

## $^{15}\text{N}$ incorporation in grazers



- Important dispersion  
→ High intra-population variability
- Unclear assimilation kinetics
- Trend to higher assimilation rates in *A. chiereghinii*

# Assimilation of consumed algae

- Important dispersion
- Unclear assimilation kinetics
- No particular trends

