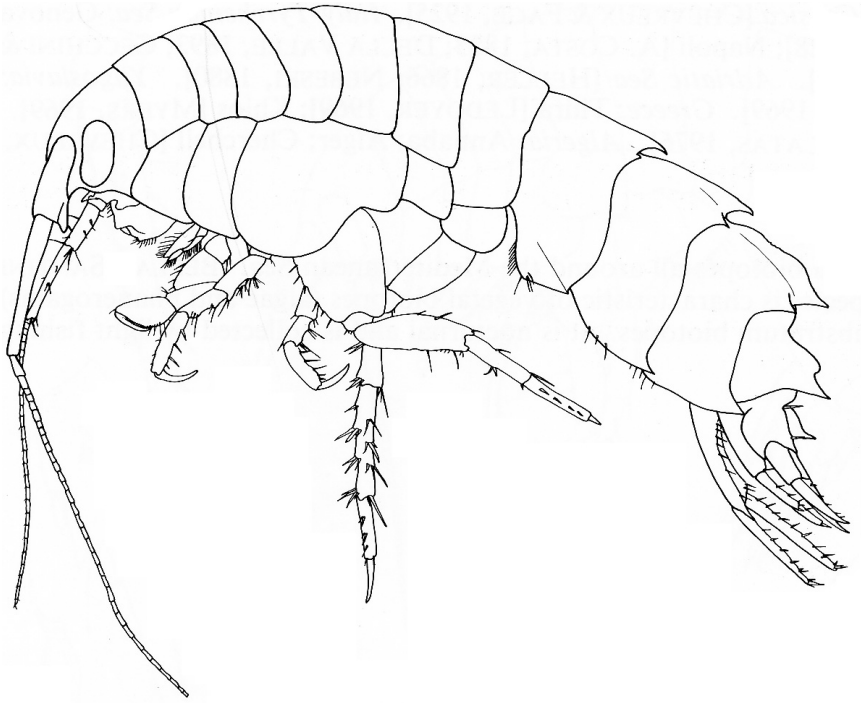
LSD Laboratoire de Systématique & Diversité animale ULg

Trophic diversity among amphipod crustaceans from *Posidonia oceanica* meadows : A stable isotope assessment.

L. Michel, G. Lepoint, S. Gobert & P. Dauby



15th Benelux Congress of Zoology (Liège, 30-31/10/08)

Université de Liège

Introduction

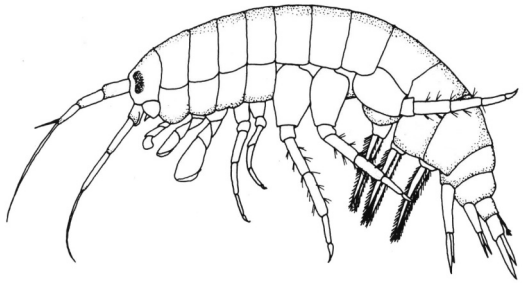
- *Posidonia oceanica* : Mediterranean endemic seagrass, able of forming meadows

- Important biomass and biodiversity of vagile invertebrates

Source : www.com.univ-mrs/fr/gisposi

After Picton & Borrow, 2005

Source : ceratium.ietc.wwu.edu

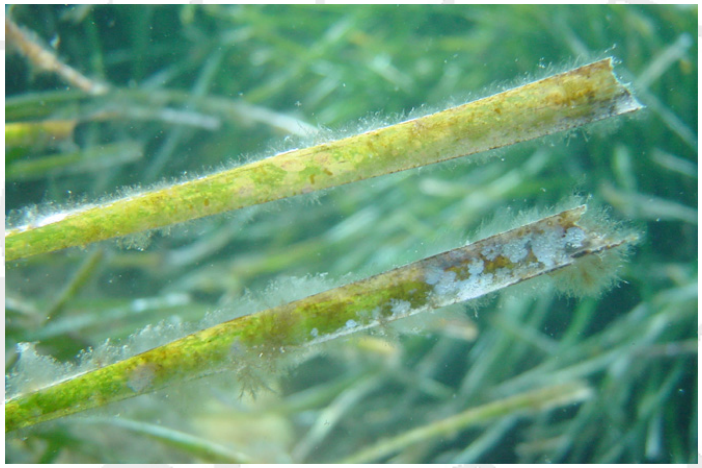


Source : www.crustacea.net

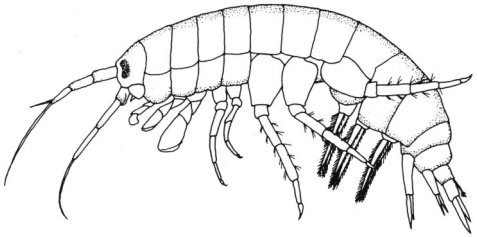
Importance of vagile invertebrates

- Key trophic position (base of food webs)

- Important part in the ecosystem functioning : "Seagrass - Epiphytes - Grazers" system

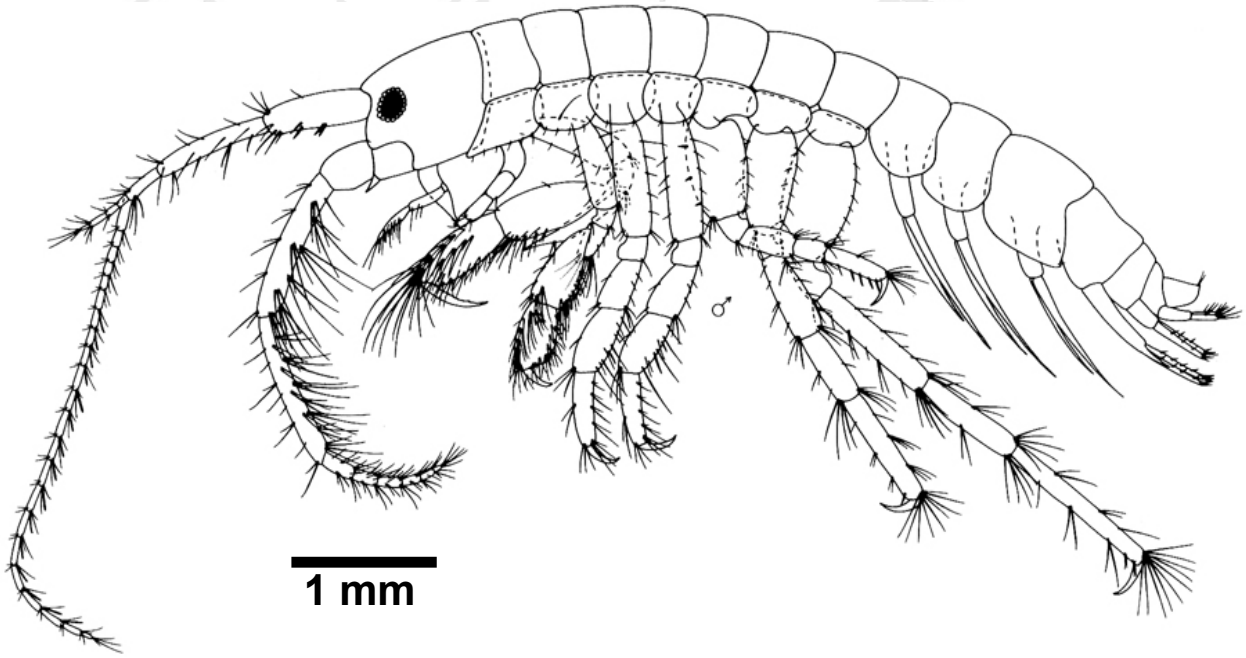


Photograph : Lepoint G.



Context of the study

- Few studies about these amphipods
- Diet poorly known
- Some species are suspected to be generalist vegetal epiphytes grazers, others to be deposit feeding detritivores



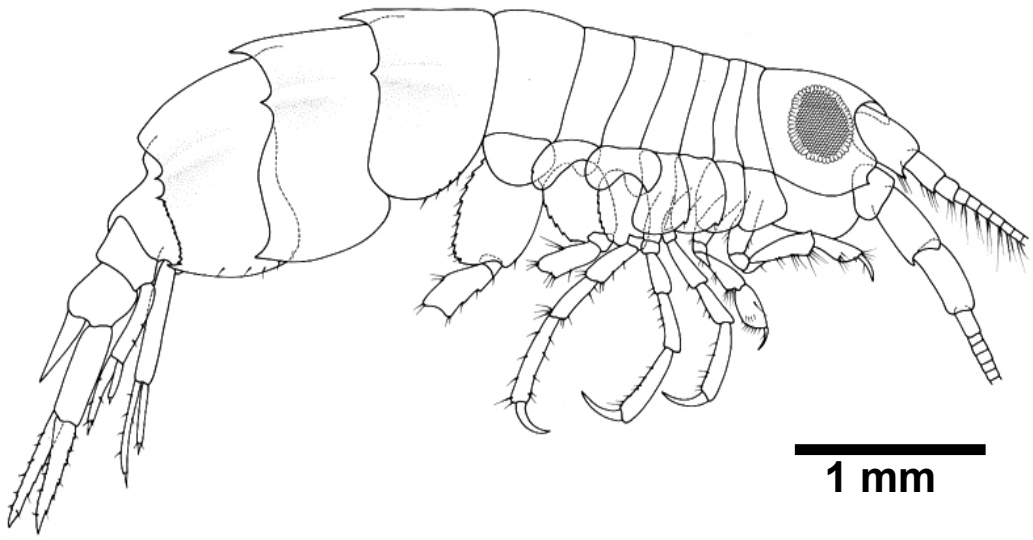
Aora spinicornis (After Bellan-Santini *et al.*, 1982)

Objectives of our study

➔ Enhance the comprehension of these amphipods' feeding ecology

I. Assessment of potential interspecific trophic diversity

II. Relative importance of potential food sources (*Posidonia* leaves & litter, epiphytes, SPOM, benthic POM)

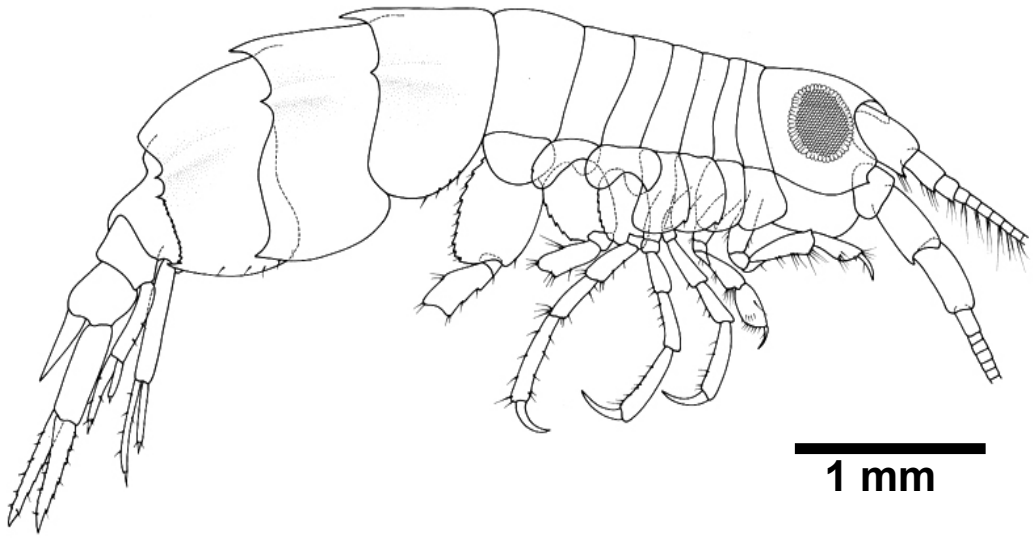


Apherusa chiereghinii (After Bellan-Santini *et al.*, 1982)

Objectives of our study

➔ Enhance the comprehension of these amphipods' feeding ecology

Use of C and N Stable isotopes as trophic markers



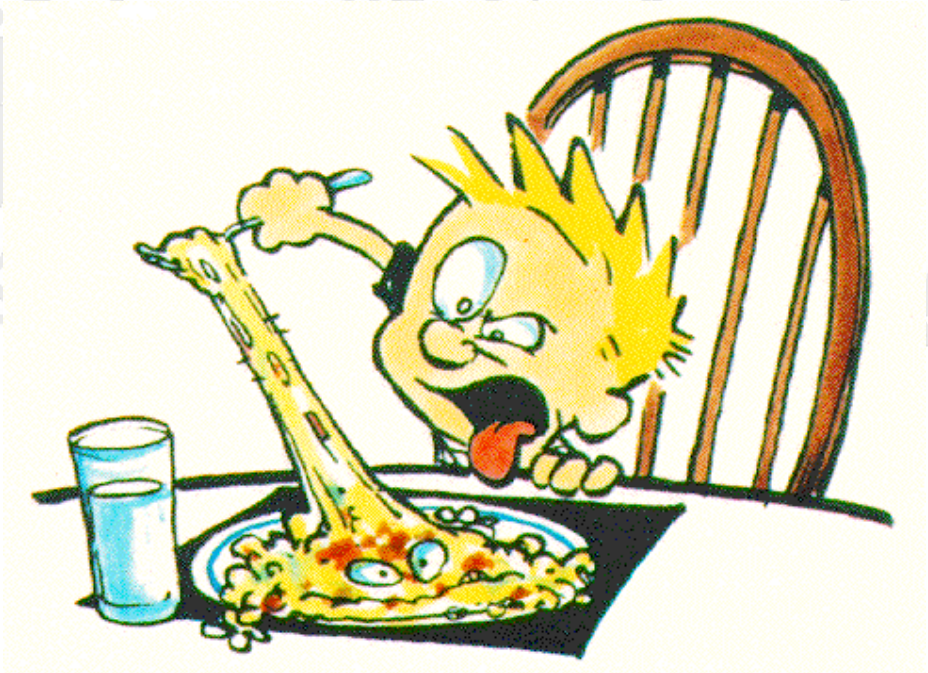
Apherusa chiereghinii (After Bellan-Santini *et al.*, 1982)

C & N stable isotopes

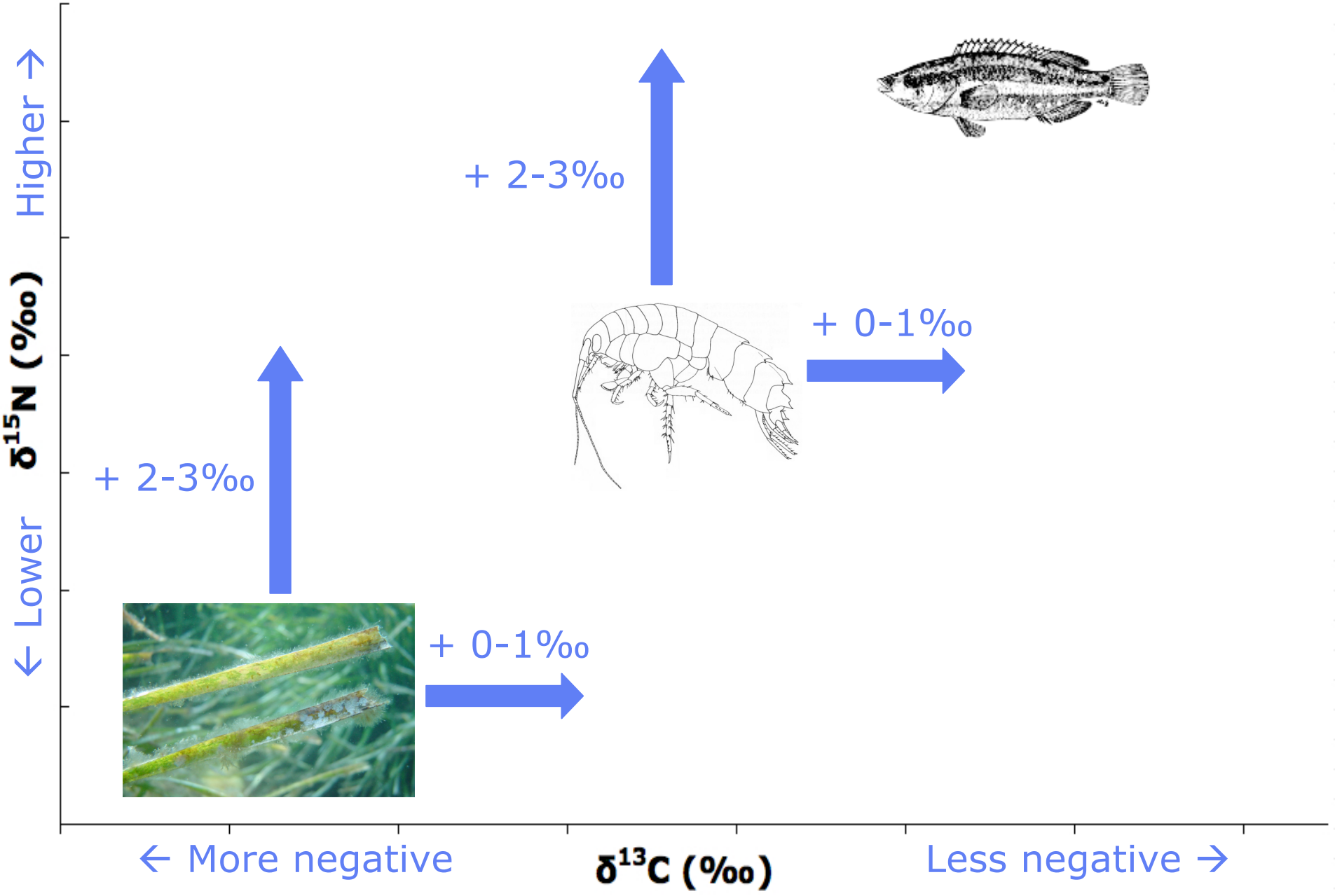
"You are what you eat"

(DeNiro & Epstein, 1978, 1981)

➔ A consumer's isotopic signature (*i.e.*, $^{13}C/^{12}C$ and $^{15}N/^{14}N$) is a proportional mixture of its food sources' signatures

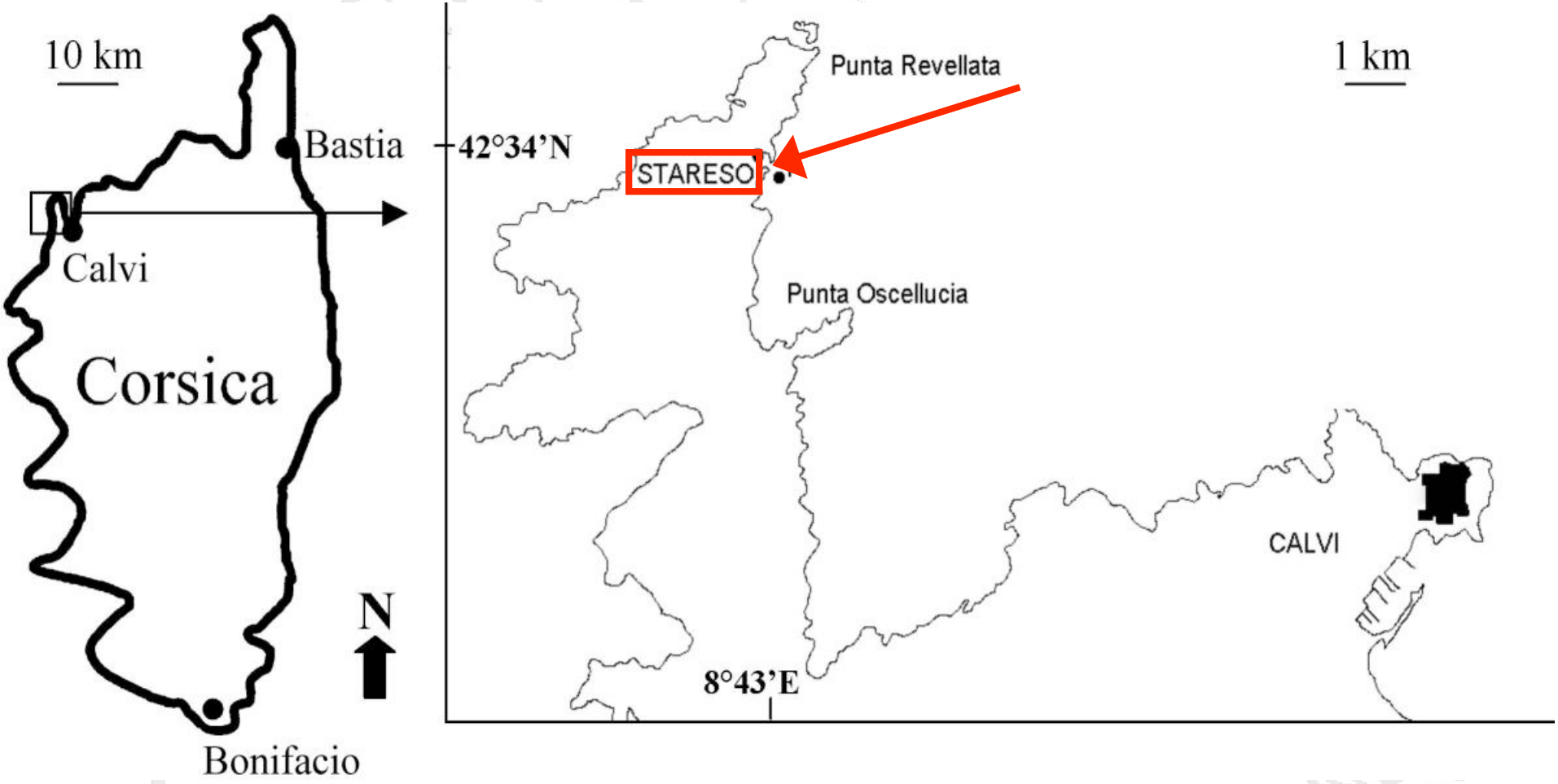


General theoretical case



Materials & Methods

- Study site : Calvi Bay (NW of Corsica, France)



(Modified after Lepoint, 2001)

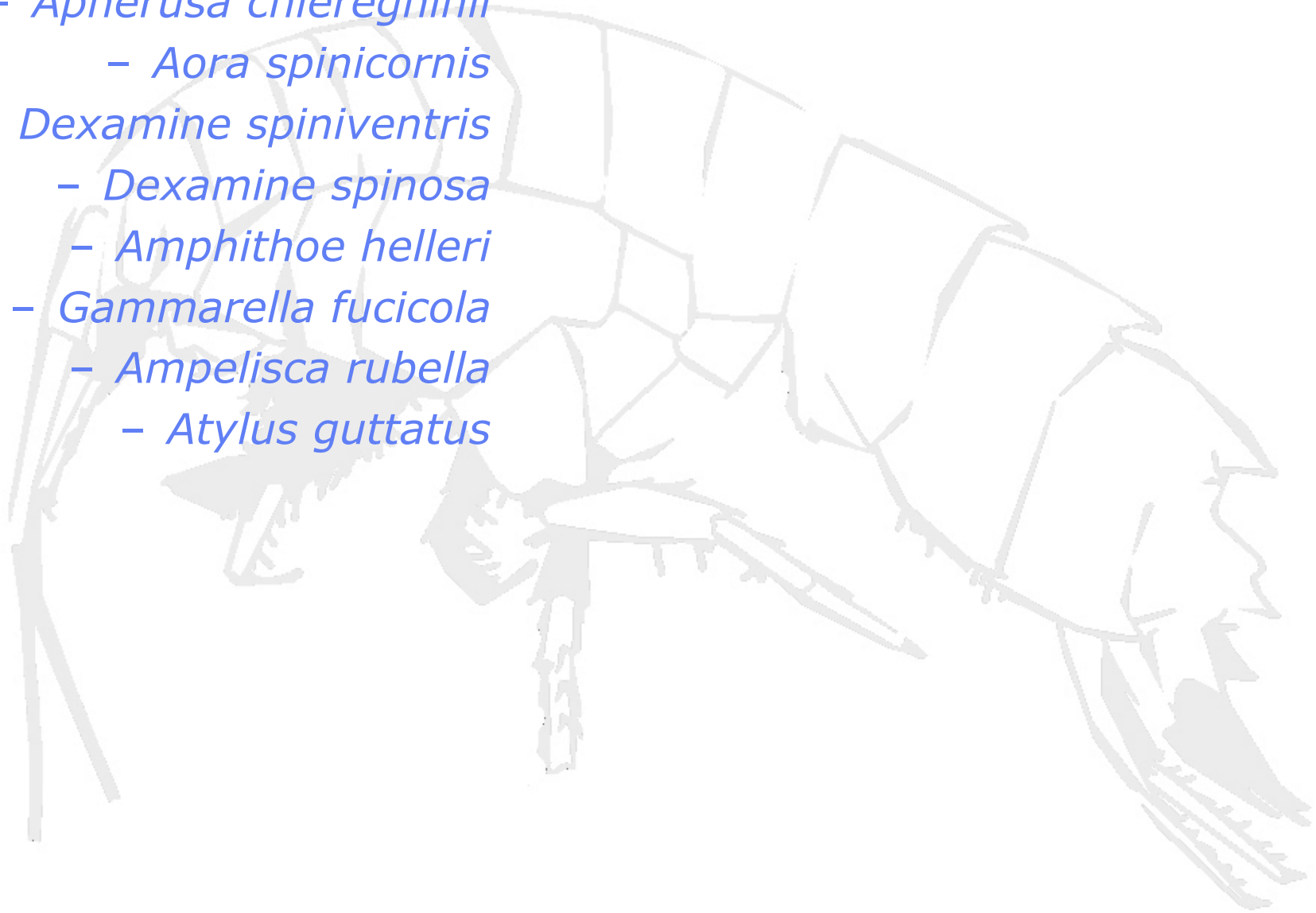
Collection of samples

- Amphipods : night collection using a hand-towed net

Photo : Lepoint G.

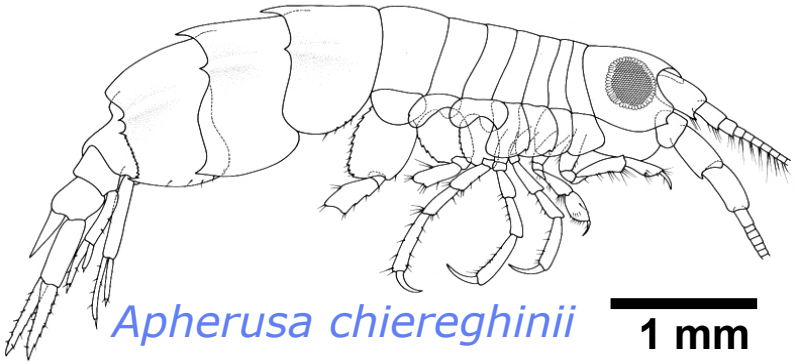
Collection of samples

- 8 species retained (n>5)
  - *Apherusa chiereghinii*
  - *Aora spinicornis*
  - *Dexamine spiniventris*
  - *Dexamine spinosa*
  - *Amphithoe helleri*
  - *Gammarella fucicola*
  - *Ampelisca rubella*
  - *Atylus guttatus*

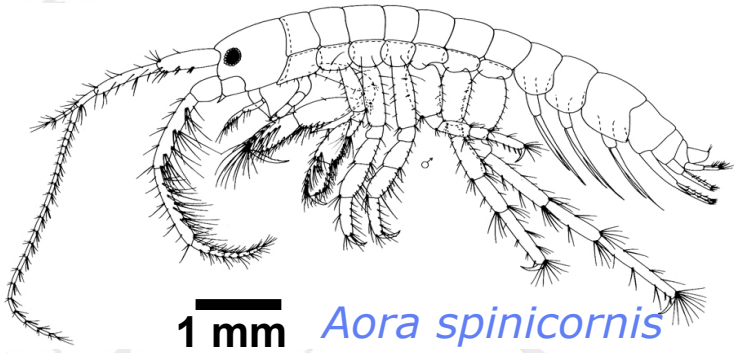


Collection of s

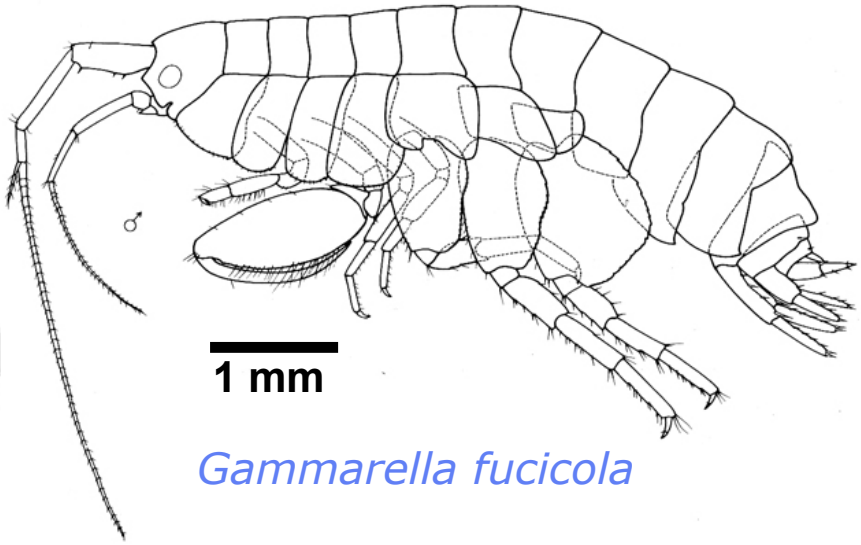
- 8 species retained (n>5)
  - *Apherusa chiereghinii*
  - *Aora spinicornis*
  - *Dexamine spiniventris*
  - *Dexamine spinosa*
  - *Amphithoe helleri*
  - *Gammarella fucicola*
  - *Ampelisca rubella*
  - *Atylus guttatus*



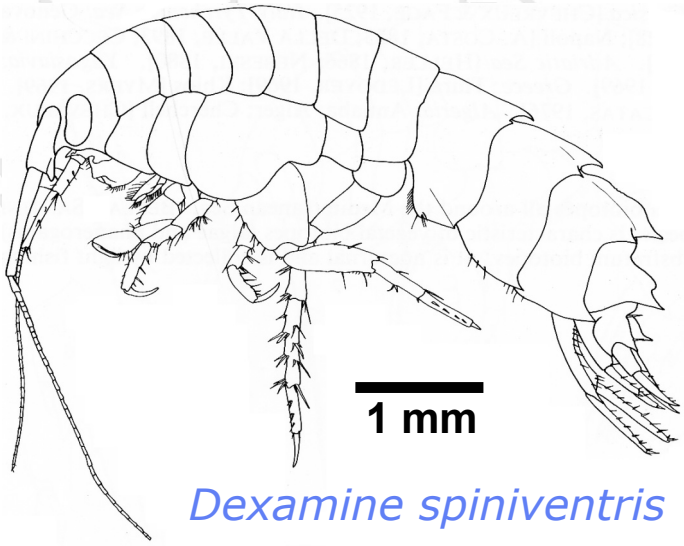
Apherusa chiereghinii



Aora spinicornis



Gammarella fucicola



Dexamine spiniventris

After Bellan-Santini *et al.*, 1982

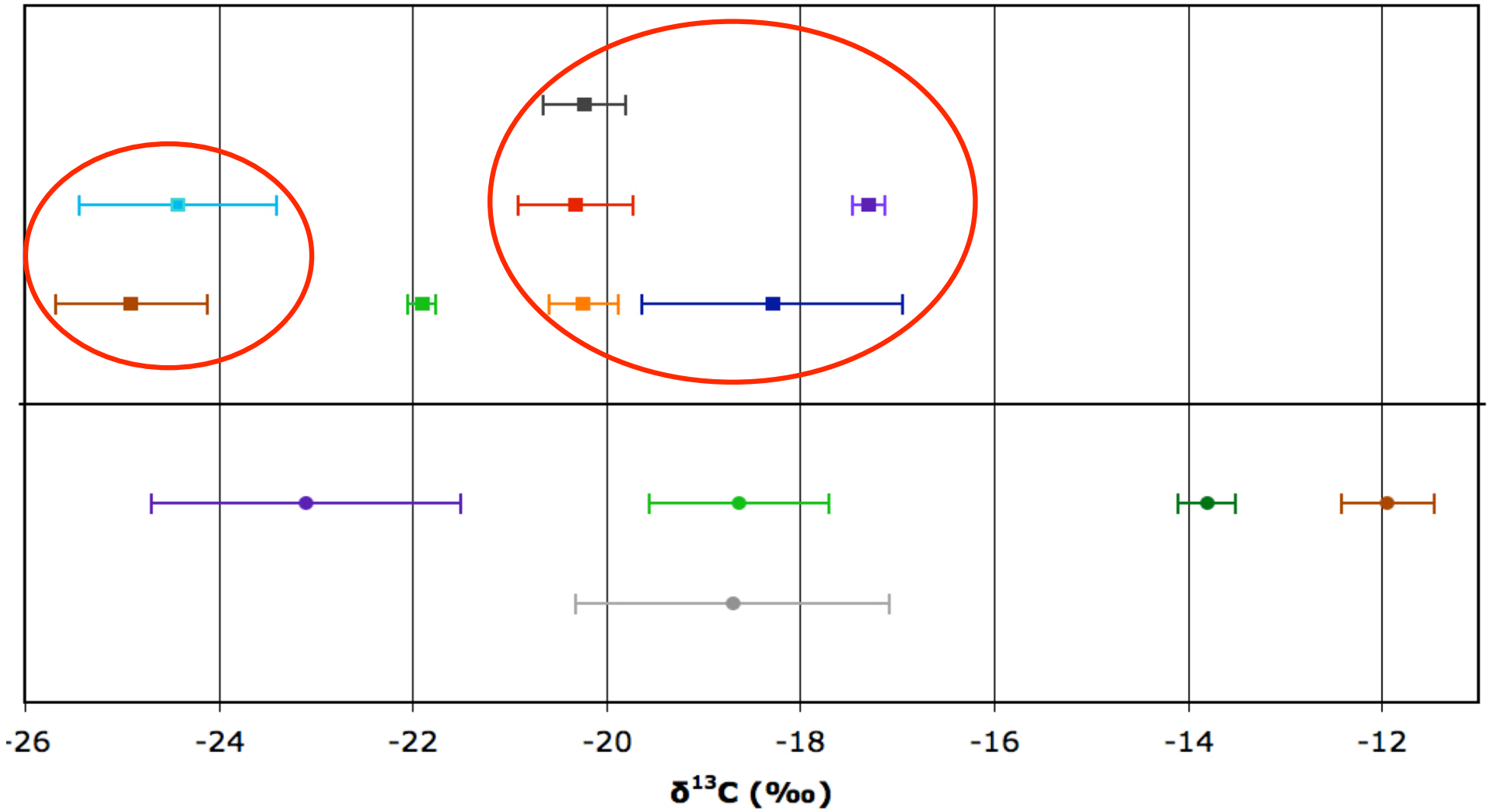
Collection of samples

- *Posidonia oceanica* leaves : Direct sampling of shoots, scraping of epiphytes
- *P. oceanica* litter : hand collecting, scraping of epiphytes
- SPOM : Water sampling inside the meadow using Niskin bottles, pre-filtration on a 500 µm sieve, filtration on Whatman GF/F Filters (0,7 µm)
- Benthic POM : Dredging of surface layers of sediment (~ 1 cm) and sieving to select ≤1 mm particles
- Epiflora : Scraping of *Posidonia* leaves & litter
- Epifauna : Negligible

Isotopic ratios measurements

- Automated analysis : Combustion of samples in a C-N-S elemental analyzer
- Measurement of $^{13}C/^{12}C$ and $^{15}N/^{14}N$ ratios by IR-MS
- Amphipods :
  - Individual measurements for C
  - Pooled measurements for N :
    - 15-20 individuals for *Apherusa chiereghinii* & *Aora spinicornis*
    - ~ 5 individuals for *Dexamine spiniventris* & *Ampelisca rubella*

Results : $\delta^{13}C$ values



- *Apherusa chiereghinii*
- *Aora spinicornis*
- *Dexamine spiniventris*
- *Ampelisca rubella*
- *Dexamine spinosa*
- *Gammarella fucicola*
- *Atylus guttatus*
- *Amphithoe helleri*
- *Posidonia* litter
- *Posidonia* leaves
- Benthic POM
- Epiflora
- SPOM

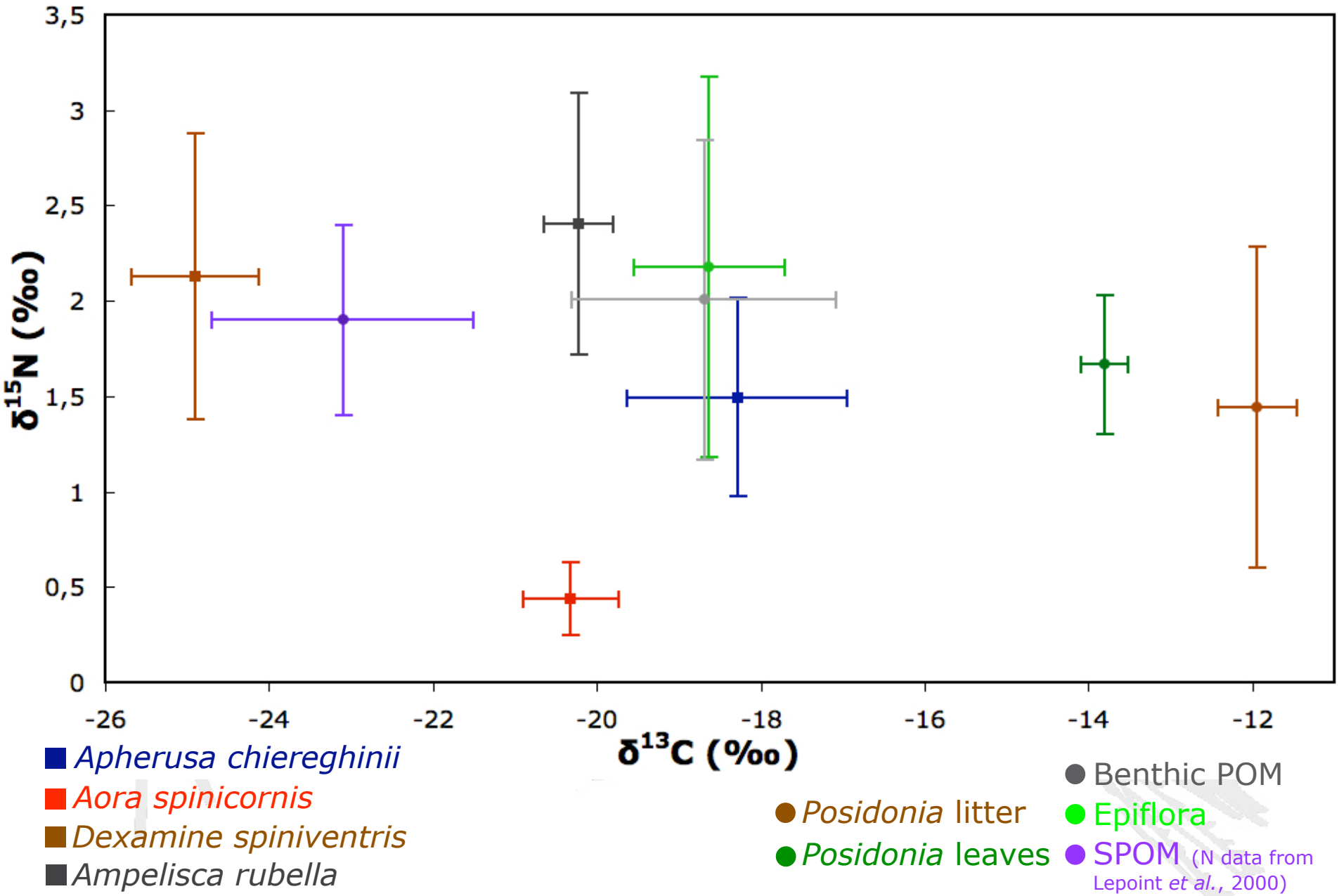
Insights from $\delta^{13}C$ values

- Exploitation of SPOM as a food source
  - Probable in *D. Spinosa* and *D. Spiniventris*, suspected to be deposit feeding detritivores (Gambi *et al.*, 1992)
  - Possible in *Amphithoe helleri*, tubicolous species suspected to be a filter feeder (Gambi *et al.*, 1992)

- Seagrass : - Little or no direct consumption... (Low N content, C mainly under refractory form)
  - Importance as a substrate for epiphyte growth
  - Cover lowers hydrodynamic perturbations

  ➔ Influence on the structure and availability of SPOM and benthic POM ?

Results : $\delta^{13}C$ vs. $\delta^{15}N$



Interpretation of $\delta^{15}N$ data

- Low to nil ^{15}N trophic enrichment
  - Previously recorded in marine detritivore and herbivore crustaceans
  - Composition differences between food sources and consumers

- Here : food sources with high C/N ratios (Epiflora : 9,78 ± 2,25 ; Benthic POM : 9,87 ± 1,54)

- "Trophic depletion" in *Aora spinicornis* : Extreme case ?

Gelidium sp.
(Source :www.algaebase.org)

$\Delta\ ^{15}N = -0,7$ ‰ !

Macko *et al.*, 1982

Amphithoe valida
(Source :www.dnr.sc.gov)

Interpretation of $\delta^{15}N$ data

Inadequacy of mean trophic fractionation factors !

- "Trophic depletion" in *Aora spinicornis* : Extreme case ?

Gelidium sp.
(Source :www.algaebase.org)

$\Delta\ ^{15}N = -0,7$ ‰ !

Macko *et al.*, 1982

Amphithoe valida
(Source :www.dnr.sc.gov)

Conclusions & perspectives

- Interspecific trophic diversity seems considerable, but has to be confirmed
- Influence of seasonal variations on food sources signatures ? *e.g.* changes in epiphytes' community structure
- Discrimination between overlapping sources (*e.g.* epiflora and benthic POM) ?

➔ Gut content analysis
➔Use of other trophic markers

➔ Interest of a multidisciplinary assessment !

Thanks for your attention...