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## *Apherusa delicata* n. sp., a new suprabenthic amphipod (Crustacea, Eusiroidea, Calliopiidae) from the northern Bay of Biscay, with a discussion of the genus

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### Abstract

A new calliopiid amphipod, *Apherusa delicata* n. sp., is described from specimens sampled with a suprabenthic sled in the 'Grande Vasière' area (northern Bay of Biscay). The new species can be distinguished from its sympatric congeners, *A. bispinosa* and *A. ovalipes*, mainly by the posterodorsal tridentate armature of pleosomites 2 and 3 and by the smooth posterior margin of epimeral plate 3. Its geographical distribution seems to be restricted to muddy sand bottoms of the 'Grande Vasière' fishing grounds. A key to the 20 known species of *Apherusa* is provided, followed by a discussion on the morphological characters to be considered for a future cladistic analysis of species within this genus. © 2005 Gesellschaft für Biologische Systematik. Published by Elsevier GmbH. All rights reserved.

**Keywords:** Amphipoda; Eusiroidea; Calliopiidae; *Apherusa delicata* n. sp.; Bay of Biscay; Grande Vasière

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### Introduction

The 'Grande Vasière' is a well-known French fishing (mainly trawling) ground located south of Brittany in the northern Bay of Biscay. Following the pioneering bionomical synthesis of Le Danois (1948) on trawled epifaunal communities, the benthic communities from this area have been described by Glémarec (1969a–d, 1971, 1997) from the analysis of qualitative samples carried out with Rallier du Baty and Charcot-Picard

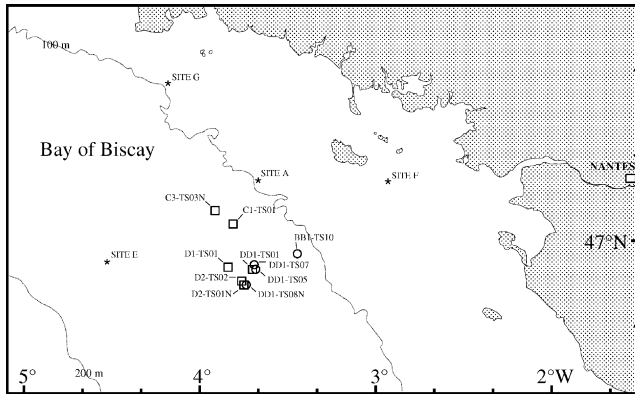
dredges (about 3000 sampling stations on the southern Brittany continental shelf, north of 46°N). Le Danois (1948) mentioned the presence of two eusirid species, *Eusirus longipes* Boeck, 1861 and *Apherusa bispinosa* (Bate, 1857), in the outer part of the 'Grande Vasière' area, but the subsequent inventory of the benthic fauna by Glémarec (1969d) did not mention any eusiroid species, probably because samplers were not adequate for the capture of small, motile near-bottom fauna.

During the course of a recent research programme on these fishing grounds (integrated study of demersal/benthic ecosystems of the northern Bay of Biscay), new original investigations were carried out on suprabenthic communities of the continental shelf (INTRIGAS cruise May/June 2001; TROPHAL cruise September 2002). A total of 38 suprabenthic samplings (28 daytime hauls; 10 nighttime hauls) was carried out with a multi-net sled at

*Abbreviations:* A1, 2, antenna 1, 2; art, article; Cx, coxa; Ep, epimeral plate; Gn1, 2, gnathopod 1, 2; *l/b*, ratio length to breadth; LL, lower lip (labium); Md, mandible; Mdp, mandible palp; Mx1, 2, maxilla 1, 2; Mxp, maxilliped; ov., ovigerous; P3–7, peraeopod 3–7; ped, peduncle; Pl, pleosome; pls, pleosomites; ps, peraeosome; T, telson; U1–3, uropod 1–3; UL, upper lip (labrum); Us, urosome.

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**Fig. 1.** Geographical distribution of *Apherusa delicata* n. sp. in the ‘Grande Vasière’ fishing grounds (southern Brittany) during INTRIGAS (squares) and TROPHAL (circles) sampling. Asterisks: sampling sites where no specimens were recorded.

seven sampling sites (see Fig. 1) located within the ‘Grande Vasière’ area (sites A–D: muddy fine to medium sands, 93–126 m depth), on the inner shelf (site G: mud, 80–92 m depth; site F in front of the Loire estuary: fine sands, 36–40 m depth), and on the outer shelf (site E: muddy medium sands, 130–145 m depth). Results on the structure of these suprabenthic communities will be published elsewhere. The present paper provides the description of a new *Apherusa* species discovered in the suprabenthic material collected during the two cruises. Ecological comments about this new finding from the northern Bay of Biscay are also given.

## Material and methods

During the INTRIGAS and TROPHAL cruises, the suprabenthic fauna (mainly peracarid crustaceans) was quantitatively sampled with a Roscoff multi-net sled (see full description in Dauvin et al. 1995) towed over the sea-floor at 1–2 knots. This sled is equipped with an opening–closing mechanism acting by contact with the sea-floor, and with four superimposed nets (mesh size: 0.5 mm) that simultaneously sample the 10–40 cm (N1), 45–75 cm (N2), 80–110 cm (N3), and 115–145 cm (N4) water layers above the bottom. Each net is provided with a TSK flowmeter that allows estimating the water volume filtered by the net or the bottom area swept by the sled during a haul. Therefore, taxa abundance values may be expressed as individuals (ind.)/100 m<sup>3</sup> (Dv) or as ind./100 m<sup>2</sup> (Ds). The material collected was preserved with a solution of formaldehyde in sea water (10%) before subsequent sorting at the laboratory. Fig. 1 shows the geographical locations of stations where the

new *Apherusa* species was sampled on the ‘Grande Vasière’ fishing grounds.

All *Apherusa* specimens collected with the suprabenthic sled were more or less damaged (mainly antennae and pereopods), probably due to recovery treatment of samples. The normal procedure in dealing with amphipods was used: direct observation under Reichert and Wild M5 dissecting microscopes with specimens in alcohol and glycerine; then drawing from preparations (dissected and stored in glycerine or Faure’s medium) under a Wild M20 microscope.

## Taxonomic section

Order AMPHIPODA Latreille, 1816  
Suborder GAMMARIDEA Latreille, 1803  
Superfamily EUSIROIDEA Stebbing, 1888  
Family CALLIOPIIDAE Sars, 1893

Genus *Apherusa* Walker, 1891.

## Diagnosis

Body compressed, dorsally smooth, weakly carinate or toothed. Head: rostrum small, lateral cephalic lobes rounded, with weak sinus, anteroventral margin produced or not. Eyes round or reniform. Antennae subequal or A1 < A2; article 3 of A1 peduncle produced or not. Acc. flagellum always lacking. Mouthparts: UL entire, about as long as wide; epistome not produced. Md molar triturative, columnar, Mdp art2 unlobed, art3 subequal to or shorter than art2. LL: inner lobes small. Mx1 inner plate with 3–14 medial setae, palp art1 short, art2 long. Mx2 inner plate narrower than outer, weak facial row of setae, some setae on inner margin. Mxp: basis as long as or shorter than ischium; palp art4 < art3, articles not spinose or lobed. Ep2,3 smooth or serrate. U1,2 outer ramus shortened or not, spines lateral and dorsal. U3 ordinary, not extended or especially large or with large process on ped, U3 rami lanceolate, nearly subequal. Telson elongate, entire, distally pointed, rounded or somewhat notched, without long setae.

*Main variables:* Cx1; ratio of length of Gn1,2 carpus to propodus; dorsal teeth on Pl and Us; Ep3 hind margin; shape of U3; telson ratio length to width, shape of distal end.

*Apherusa delicata* n.sp. (Figs. 2–4).

## Etymology

The specific epithet stresses the fragility of these animals.



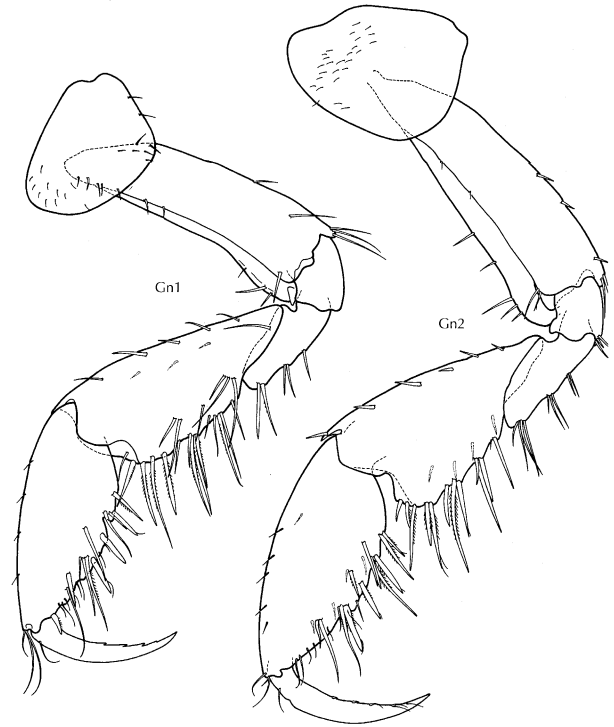
**Fig. 2.** *Apherusa delicata* n. sp., female 5 mm. Habitus to scale  $x = 1$  mm; A1 to scale  $x = 0.5$  mm; Md to scale  $y = 0.25$  mm, detail Md' to scale  $y = 0.125$  mm; LL to scale  $y = 0.5$  mm, UL to scale  $y = 0.125$  mm; Mxp to scale  $y = 0.5$  mm; Mx1, Mx2 to scale  $y = 0.25$  mm.

### Type material

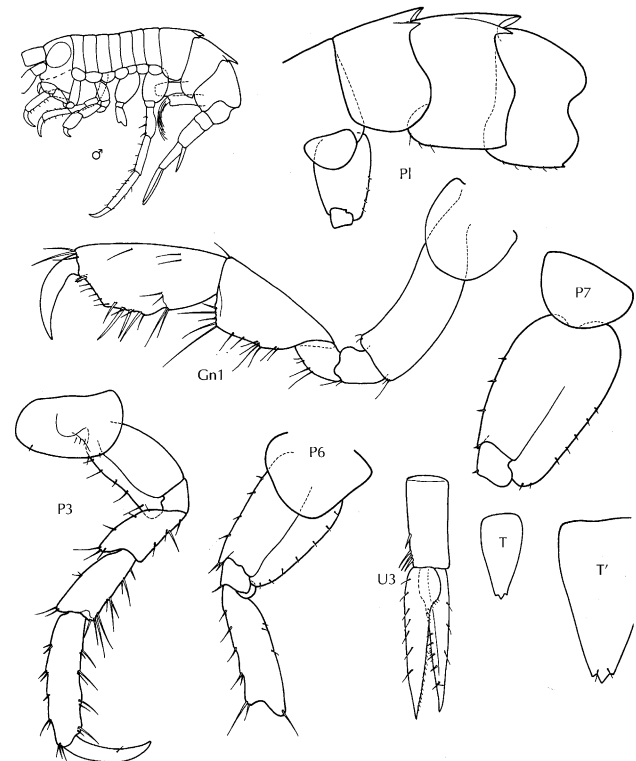
Holotype: mature female, total length 5.6 mm (deposited at the Muséum National d'Histoire Naturelle, Paris (MNHN-Am6676). INTRIGAS cruise, 30 May 2001, 08:41–09:00, RV “Côtes de la Manche”; Roscoff suprabenthic sled; sample reference D2-TS02-N1. ‘Grande Vasière’, haul coordinates: 46°50.38' N–3°45.84' W to 46°50.06' N–3°44.78' W, 120–121 m depth, 10–40 cm water layer above bottom, muddy fine sand (median: 161  $\mu$ m; silt and clay: 14.22%; sand: 84.84%; gravel: 0.94%; organic content: 1.93%); near-bottom water temperature: 12.1 °C, near-bottom water salinity: 35.5.

### Additional material

INTRIGAS cruise: D2-TS01N-(N1, N2, N3): 5 females, 1 male (slides). Haul coordinates: 46°49.41' N



**Fig. 3.** *Apherusa delicata* n. sp., female 5 mm. Gn1,  $2 \times 20$ ; to scale  $y$  (in Fig. 2) = 0.25 mm.



**Fig. 4.** *Apherusa delicata* n. sp., male 3 mm. Habitus to scale  $x = 1$  mm; Pl to scale  $x = 0.5$  mm; Gn1 to scale  $y = 0.25$  mm; P3, P6–7 to scale  $y = 0.5$  mm; U3, T to scale  $y = 0.5$  mm, detail T' to scale  $y = 0.25$  mm; for scales see Fig. 2.

3°44.99'W to 46°49.77'N 3°45.73'W; 125 m depth. Nighttime haul. D1-TS01-N1: 2 females (alcohol). Haul coordinates: 46°53.52'N 3°50.56'W to 46°53.43'N 3°49.77'W; 124 m depth. C3-TS03N-N1: 1 female (alcohol). Haul coordinates: 47°06.87'N 3°54.72'W to 47°06.79'N 3°53.92'W; 113 m depth. Nighttime haul.

**TROPHAL** cruise: BB1-TS10-N1: 7 females (alcohol); haul coordinates: 46°56.79'N 3°27.00'W to 46°56.79'N 3°26.08'W; 103–102 m depth. DD1-TS05-N1: 3 females (alcohol); haul coordinates: 46°53.57'N 3°42.13'W to 46°53.82'N 3°41.33'W; 113–112 m depth. DD1-TS08N-N1: 4 females (alcohol); haul coordinates: 46°49.43'N 3°45.07'W to 46°50.14'N 3°44.70'W; 120–121 m depth. Nighttime haul. DD1-TS07-N1: 6 specimens (alcohol); haul coordinates: 46°53.95'N 3°41.12'W to 46°54.46'N 3°40.24'W; 111–110 m depth.

Specimens deposited at the Museo Civico di Storia Naturale, Verona, Italy.

## Diagnosis

Gn1,2 not sexually dimorphic,  $l/b$  carpus Gn1 female  $< 2.5$ . P7 basis posterodistally rounded. Ps7 ordinary. Pls1,2 dorsally with one long medium and on each side one shorter lateral tooth; pls3 dorsally smooth. Ep1 rounded, Ep2 with subrectangular posterodistal corner, Ep3 posterodistally with small tooth followed by rounded hind margin and deep excavation. U3 rami lanceolate. T  $l/b = 1.75$ , triangular, distomarginal pair of setae inserted in incisions.

## Description

**Length:** Incubant female 4.5–5 mm, male 3 mm.

**Head:** Lateral cephalic lobes normal for the genus. A1,2 ped with groups of aesthetascs, but no calceoli observed. One female A1 with 57 arts, all others broken.

## KEY to species of *Apherusa*

Barnard and Karaman (1991) cite Bate's species *A. antiqua* (Bate 1857; with thick antennar peduncles and a one-articulate accessory flagellum after Bate 1862, p. 120, pl. XXI) and *A. barretti* (Bate 1862; similar to *A. jurinei*), both with a smooth dorsum. However, these should remain species dubiae as the descriptions are too scanty. Barnard and Karaman (1991) place *Paramphithoe fragilis* Goes (as *Rozinante* in Stebbing 1906) in *Apherusa*, but this species has a partly cleft telson and thus is excluded from the genus here.

Therefore, 18 of the 21 species in Barnard and Karaman (1991) remain. In addition, one species has been revived since (*A. macrocephala* M. Sars, in Krapp-Schickel and Kulla 2002), and one is added as new to science here.

- |    |  |  |
|----|--|--|
| 1. | Body dorsally smooth . . . . .   | 2  |
| —  | Body dorsally with teeth . . . . .   | 7  |
| 2. | Ep3 hind margin triangular . . . . .   | 3  |
| —  | Ep3 hind margin convex . . . . .   | 4  |
| 3. | U3 with both peduncle and rami spinose; T tip rounded, smooth; (northern Atlantic, Baltic) . . . . . | <i>A. jurinei</i> Milne-Edwards, 1830 (6–9 mm) |

**Mouthparts:** Mdp art2 a little shorter than art3 which is beset with many strong setae along inner margin and with many short fine setae all over distal surface; with three robust setae distally. Ratio width art2/art3 = 1.66.

**Habitus dorsally:** Pls 1,2 each with three teeth.

**Coxae 1–7:** Short, broad, distal margin always regularly curved, on P5 without second lobe.

**Gnathopods:** Similar in shape and size, the only difference being that the distal and posterior margin of carpus is more prominent in Gn2 than in Gn1.

**Peraeopods:** As usual in this genus; most legs were mutilated. P3 similar to P4, with strong dactylus. P5–7 bases oval, hind margins smooth, no remarkable posterodistal lobe.

**Ep 1–3:** Ep1 rounded; Ep2 with acute corner; Ep3 posterodistal corner with minute tooth, hind margin sinusoid with deep excavation medially.

**U1–3:** U1,2 always broken (probably with equal rami?); U3 subequal rami lanceolate, spinose; ratio ped/rami = 0.6.

**T:** Triangular, pointed,  $l/b = 1.75$ , subdistally on each side an incision with seta.

## Ecology

On muddy sand, 101–126 m depth; see also the “Distribution and autecology” section below.

## Remarks

As shown also in the following key, the new species belongs to those *Apherusa* species with dorsal processes, and is especially similar to *A. vexatrix* by having lateral teeth on the metasome segments as well.

- U3 with peduncle naked, 2–3 robust setae on rami; T tip crenulated; (Svalbard, Arctic) . . . . . *A. corbeli* Lagardère, 1968 (6 mm)
4. T with shape of equilateral triangle; (Ep2,3 smooth; Bering Sea) . . . . . *A. stuxbergi* Oldevig, 1959 (9 mm)
- T longer than wide . . . . . 5
5. T tongue-shaped, triangular, but distally rounded . . . . . *A. mediterranea* Chevreux, 1911 (3–4 mm)
- T trapezium-shaped . . . . . 6
6. T distal width less than one-third of proximal one, distally emarginate, with two setae inserted in incisions. Gn1,2 with oblique and long palms, dactyls long; (Circumarctic) . . . . . *A. megalops* (Buchholz, 1874)
- T distal width about half of proximal one, crenulate but not emarginate, two setae sitting on the margin. Gn1, 2 with very short dactyls, palm scarcely visible; (Circumarctic) . . . . . *A. glacialis* (Hansen, 1888) (10–13 mm)
7. Metasome dorsally with 0–1 medial tooth and 1–2 lateral teeth on each side. . . . . 8
- Metasome dorsally with only one medial tooth . . . . . 9
8. Cx 1,2  $l > b$ ; Ep3 hind margin serrated and semicircularly emarginate; (Mediterranean) . . . . . *A. vexatrix* Krapp-Schickel, 1979 (3–6 mm)
- Cx 1, 2  $l < b$ , Ep3 hind margin smooth, not emarginate; (northern Bay of Biscay) . . . . . *A. delicata* n. sp. (3–5 mm)
9. Peraeon segment 7 dorsally (sometimes only in adult males) with tooth in addition to pleonal teeth . . . . . 10
- Peraeon segment 7 dorsally smooth . . . . . 13
10. T distally pointed, triangular (P7 basis with posterodistal corner lengthened and serrated) . . . . . 11
- T trapezium-shaped . . . . . 12
11. Ep3 hind margin medially with deep semicircular excavation; Cx 1,2 clearly longer than wide (central Atlantic) . . . . . *A. henneguyi* Chevreux and Fage, 1925 (3–5 mm)
- Ep3 hind margin medially with shallow excavation; Cx 1,2 broader than long (Mediterranean) . . . . . *A. alacris* Krapp-Schickel, 1969 (3.5–7 mm)
12. Ep1–3 hind margin serrate; T distally emarginate (Arctic) . . . . . *A. retovskii* Gurjanova, 1934 (14 mm)
- Ep1,2 hind margin smooth; T distally not emarginate, serrated (northern Atlantic) . . . . . *A. tridentata* (Bruzelius, 1859) (13.5–14 mm)
13. T trapezium-shaped with two distal pointed corners; (northern Atlantic) . . . . . *A. sarsi* Shoemaker, 1930 (11 mm)
- T triangular or tongue-shaped . . . . . 14
14. Ep3 hind margin smooth or weakly crenulate . . . . . 15
- Ep3 hind margin serrate . . . . . 16
15. Ep3 hind margin smooth, regularly convex; eyes small (less than 1/3 of depth of head); (NE Atlantic) . . . . . *A. cirrus* (Bate, 1862) (8 mm)
- Ep3 hind margin crenulate, angular; eyes moderately large (about 1/3 of depth of head); (central Atlantic) . . . . . *A. clevei* Sars, 1904 (3 mm)
16. Gn1 female carpus < propodus; (central Atlantic) . . . . . *A. ovalipes* Norman and Scott, 1906 (6 mm)
- Gn1 female carpus > propodus . . . . . 17
17. Gn1 male carpus > propodus . . . . . 18
- Gn1 male carpus < propodus . . . . . 19
18. Ep3 hind margin medially semicircularly incised; T tongue-shaped (northern Atlantic) . . . . . *A. macrocephala* (M. Sars, 1858) (6 mm)
- Ep3 hind margin with shallow excavation; T triangular; (Mediterranean) . . . . . *A. ruffoi* (Krapp-Schickel, 1969) (5–7.5 mm)
19. Gn1 female carpus about 3 × as long as broad, basis 5 × as long as broad; (Atlantic, Mediterranean) . . . . . *A. bispinosa* (Bate, 1857) (5–6 mm)
- Gn1 female carpus about 2 × as long as broad, basis about 3 × as long as broad; (Mediterranean) . . . . . *A. chiereghinii* (Giordani-Soika, 1950) (3–7 mm)

### Crucial characters and their states (where known) within *Apherusa*

Knowledge of the fragile calliopiid species, their distinguishing characters and character states is extremely patchy. For example, ratios of A1/A2 or U1/U2 are nearly always unknown, as these parts are regularly broken or lost. There are also many gaps in the knowledge of mouthpart morphology.

#### Characters selected

- (1) Md ratio art2/art3: **0** = subequal; **1** = art2 > art3.
- (2) Mxp outer plate reaching half-carpus length: **0** = no; **1** = yes.
- (3) Lateral cephalic lobe anterodistally: **0** = rounded or rectangular; **1** = acutely lengthened.
- (4) Eyes: **0** = round; **1** = reniform.
- (5) Cx1 distally widened: **0** = not or scarcely; **1** = strongly.
- (6) Gn1 male ratio propodus/Cx1: **0** =  $\leq 1$ ; **1** = 1–1.5; **2** =  $\geq 1.5$ .
- (7) Gn1 female ratio propodus/Cx1: **0** =  $\leq 1$ ; **1** = 1–2; **2** =  $\geq 2$ .
- (8) Gn1 male propodus ratio length/width: **0** =  $\leq 2$ ; **1** = 2–4; **2** =  $\geq 4$ .
- (9) Gn1 female propodus ratio length/width: **0** =  $\leq 2$ ; **1** = 2–2.5; **2** =  $\geq 2.5$ .
- (10) Gn1 male carpus ratio length/width: **0** =  $\leq 2$ ; **1** = 2–2.5; **2** =  $\geq 2.5$ .
- (11) Gn1 female carpus ratio length/width: **0** =  $\leq 2$ ; **1** = 2–2.5; **2** =  $\geq 2.5$ .
- (12) Gn1 male ratio dactylus/propodus: **0** =  $\leq 0.3$ ; **1** = 0.3–0.5; **2** =  $\geq 0.5$ .
- (13) Gn1 female ratio dactylus/propodus: **0** =  $\leq 0.5$ ; **1** =  $\geq 0.5$ .
- (14) Gn1 male ratio propodus/carpus: **0** =  $\leq 1$ ; **1** = 1–1.5; **2** =  $\geq 1.5$ .
- (15) Gn1 female ratio propodus/carpus: **0** =  $\leq 1$ ; **1** = 1–1.4; **2** =  $\geq 1.4$ .
- (16) Gn1 male ratio propodus/basis: **0** =  $\leq 0.75$ ; **1** = 0.75–1; **2** =  $\geq 1$ .
- (17) Gn1 female ratio propodus/basis: **0** =  $\leq 0.75$ ; **1** = 0.75–1; **2** =  $\geq 1$ .
- (18) Gn2 male propodus ratio length/width: **0** =  $\leq 2$ ; **1** = 2–2.5; **2** =  $\geq 2.5$ .
- (19) Gn2 female propodus ratio length/width: **0** =  $\leq 2$ ; **1** = 2–2.5; **2** =  $\geq 2.5$ .
- (20) Gn2 male carpus ratio length/width: **0** =  $\leq 2$ ; **1** = 2–2.5; **2** =  $\geq 2.5$ .
- (21) Gn2 female carpus ratio length/width: **0** =  $\leq 2$ ; **1** = 2–2.5; **2** =  $\geq 2.5$ .
- (22) Gn2 male ratio propodus/Cx2: **0** =  $\leq 1$ ; **1** = 1–1.5; **2** =  $\geq 1.5$ .
- (23) Gn2 female ratio propodus/Cx2: **0** =  $\leq 0.75$ ; **1** = 0.75–1; **2** =  $\geq 1$ .
- (24) Gn2 male ratio dactylus/propodus: **0** =  $\leq 0.4$ ; **1** = 0.4–0.5; **2** =  $\geq 0.5$ .
- (25) Gn2 female ratio dactylus/propodus: **0** =  $\leq 0.4$ ; **1** = 0.4–0.6; **2** =  $\geq 0.6$ .
- (26) Gn2 male ratio propodus/carpus: **0** =  $\leq 0.75$ ; **1** = 0.75–1; **2** =  $\geq 1$ .
- (27) Gn2 female ratio propodus/carpus: **0** =  $\leq 1$ ; **1** = 1–1.5; **2** =  $\geq 1.5$ .
- (28) Gn2 male ratio propodus/basis: **0** =  $\leq 0.75$ ; **1** = 0.75–1; **2** =  $\geq 1$ .
- (29) Gn2 female ratio propodus/basis: **0** =  $\leq 0.75$ ; **1** = 0.75–1; **2** =  $\geq 1$ .
- (30) Cx4: **0** = longer than wide; **1** = subequal; **2** = wider than long.
- (31) P5 basis ratio length/width: **0** =  $\leq 1.25$ ; **1** = 1.25–1.5; **2** =  $\geq 1.5$ .
- (32) P5–7 ratio dactylus/propodus: **0** =  $\leq 0.33$ ; **1** =  $> 0.33$ .
- (33) P7 basis ratio length/width: **0** =  $\leq 1.25$ ; **1** = 1.25–1.5; **2** =  $\geq 1.5$ .
- (34) P7 basis posterior margin: **0** = smooth; **1** = serrate-crenulate.
- (35) Peraeon segment 7 dorsally: **0** = ordinary; **1** = lengthened with tooth.
- (36) Pleon segment 1 dorsally: **0** = ordinary; **1** = round lobe; **2** = medial tooth; **3** = 1 medial tooth + 1 lateral on each side.
- (37) Pleon segment 2 dorsally: **0** = ordinary; **1** = round lobe; **2** = medial tooth; **3** = 1 medial tooth + 1 lateral on each side.
- (38) Ep1 hind margin: **0** = smooth; **1** = serrate.
- (39) Ep2 hind margin: **0** = smooth; **1** = serrate.
- (40) Ep3 hind margin: **0** = smooth; **1** = serrate.
- (41) Ep3 hind margin: **0** = rounded; **1** = one strong peak medially.
- (42) U3 ratio ped/longer ramus: **0** =  $\leq 0.75$ ; **1** =  $> 0.75$ .
- (43) T ratio length/width: **0** =  $\leq 1.5$ ; **1** = 1.5–1.75; **2** =  $\geq 1.75$ .
- (44) T distal setae: **0** = no; **1** = yes.
- (45) T shape: **0** = triangular, distally acute; **1** = tongue-shaped; **2** = distally truncate; **3** = distally emarginate.

A cladistic analysis can be successful only if the matrix contains relatively few question marks. In the future, patiently repeated sampling yielding series of scarcely damaged specimens should reduce the currently high number of question marks.

The following list of characters is meant as a stimulus to examine and describe new as well as long-known species in more detail.

## Distribution and autecology

As shown in Fig. 1, *Apherusa delicata* n. sp. was collected exclusively within the limits of the ‘Grande Vasière’ area as defined in Glémarec (1969c, d), i.e. at sites B, C and D (101–126 m depth, muddy sand bottoms) sampled during the INTRIGAS/TROPHAL cruises. The species was not recorded at the other sites A (muddy sands), E (medium sands), F (fine sands with low pelitic content) and G (coastal mud patch). Similarly, it was apparently absent in other recently studied coastal areas in the Bay of Biscay (Montaudouin and Sauriau 2000; Dauvin and Bellan-Santini 2002; Bachelet et al. 2003) as well as from the adjacent English Channel (Dauvin 1999) and the Portuguese continental shelf (Marques and Bellan-Santini 1991). Therefore, due to its restricted distribution to the northern Bay of Biscay, it is concluded that *A. delicata* is closely adapted to the ‘Grande Vasière’ environment, with a substrate preference for muddy, fine to medium sands (gravel: <0.1–1.2%, sand: 84.8–88.8%, silt and clay: 9.9–14.5%; median particle size: 161–201 µm; organic content of surface sediments: 1.33–2.66%). Furthermore, this limited distribution could be related also to the existence of the so-called ‘cloche thermique’ (Glémarec 1969d; Vincent and Kurc 1969), a cold (<11.5 °C) bottom water mass centred along the mid-continental shelf (including the ‘Grande Vasière’) that maintains low and constant temperature conditions above the benthic communities all year round. Thus, *A. delicata* must be considered as a cold stenothermic species.

According to unpublished data from the INTRIGAS/TROPHAL samples, *A. delicata* is much more rare than other sympatric eusiroid species simultaneously taken with the same sled, namely *Apherusa bispinosa* (Bate, 1857), *A. ovalipes* Norman and Scott, 1906, and *Eusirus longipes* Boeck, 1861. In terms of overall daytime abundance in the 10–145 cm water layer (Table 1), the mean value estimated for *A. delicata* was  $2.9 \pm 2.6$  ind./100 m<sup>2</sup> ( $x \pm s$ ; pooled data from the two cruises). The maximum value was 8.2 ind./100 m<sup>2</sup> at site B (September 2002), clearly lower than maximum values observed for *A. bispinosa* (135.1 ind./100 m<sup>2</sup>; site D, May 2001), *A. ovalipes* (26.5 ind./100 m<sup>2</sup>; site D, September 2002), and even *E. longipes* (10.8 ind./100 m<sup>2</sup>; site D, May 2001). The mean nighttime abundance of *A. delicata* ( $1.4 \pm 1.1$  ind./100 m<sup>2</sup>;  $x \pm s$ ; pooled data from the two cruises) was not significantly different from the corresponding daytime value (*t*-test;  $p > 0.05$ ).

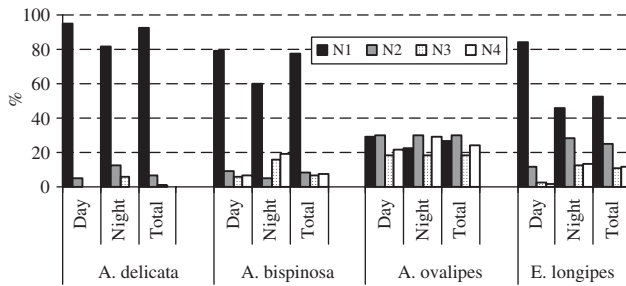
According to Lowry and Stoddart (1998), eusirids are mainly free-living amphipods of the near-bottom environment (suprabenthic species). They are also known to perform nocturnal migrations into the water column, the amplitude, intensity and regularity of which vary among species (Macquart-Moulin 1984). *Eusirus longipes* is classified as a ‘deep planktonic form’ due to nocturnal vertical migrations of only limited extent (Macquart-Moulin 1984). During the night, *Apherusa ovalipes* and *A. bispinosa* may be found swimming throughout the entire water column, with a maximum abundance in surface shelf waters around midnight (Russell 1925; Fage 1933). Such a nocturnal presence in

**Table 1.** Abundance ( $n$  = number of individuals; Dv = ind./100 m<sup>3</sup>; Ds = ind./100 m<sup>2</sup>) of the amphipod *Apherusa delicata* n. sp. in the near-bottom water layers (N1: 10–40 cm; N2: 45–75 cm; N3: 80–110 cm; N4: 115–145 cm; N1–4: 10–145 cm) sampled with a suprabenthic sled in the ‘Grande Vasière’ area during the INTRIGAS (May/June 2001) and TROPHAL (September 2002) cruises

	N1		N2		N3		N4		N1–4	
	<i>n</i>	Dv	<i>n</i>	Dv	<i>n</i>	Dv	<i>n</i>	Dv	<i>n</i>	Ds
INTRIGAS										
C1-TS01	0	—	2	3.7	0	—	0	—	2	1.1
C3-TS03N <sup>a</sup>	1	1.4	0	—	0	—	0	—	1	0.4
D1-TS01	4	6.6	0	—	0	—	0	—	4	2.0
D2-TS02	4	5.5	0	—	0	—	0	—	4	1.6
D2-TS01N <sup>a</sup>	5	5.5	2	2.2	1	1.1	0	—	8	2.6
DD1-TS01	12	14.5	0	—	0	—	0	—	12	4.4
Subtotals	26		4		1		0		31	
TROPHAL										
BB1-TS10	23	26.1	1	1.1	0	—	0	—	24	8.2
DD1-TS05	9	5.7	0	—	0	—	0	—	9	1.7
DD1-TS07	9	4.7	0	—	0	—	0	—	9	1.4
DD1-TS08N <sup>a</sup>	7	4.2	0	—	0	—	0	—	7	1.2
Subtotals	48		1		0		0		49	
Totals	74		5		1		0		80	

Far left column = haul codes.

<sup>a</sup>Nighttime hauls.



**Fig. 5.** Near-bottom vertical distribution (relative abundance) of four eusirid amphipods simultaneously sampled with a suprabenthic sled at sites B, C and D of the ‘Grande Vasière’ fishing grounds during INTRIGAS (May/June 2001) and TROPHAL (September 2002) cruises. Day = daytime distribution, Night = nighttime distribution; N1–N4 = near-bottom water layers 10–40, 45–75, 80–110, 115–145 cm, respectively.

surface waters of the southern Bay of Biscay was also repeatedly observed for *A. ovalipes*, but not in the case of *A. bispinoso*. Furthermore, both species were never sampled in surface waters during the night (Sorbe 1984). According to Vallet et al. (1995), Vallet and Dauvin (1995), and Dauvin and Zouhiri (1996), the nocturnal migration of *Apherusa* species in the near-bottom environment clearly starts at dusk, but the upward or downward direction of such movements remains to be ascertained. Like its sympatric relatives, *E. longipes*, *A. bispinoso* and *A. ovalipes*, *A. delicata* clearly is a near-bottom swimming component of the ‘Grande Vasière’ ecosystem. Its near-bottom distribution (Table 1 and Fig. 5) shows the same pattern as in *A. bispinoso* and *E. longipes* but contrasts with that of *A. ovalipes* (homogeneous near-bottom distribution) which must be considered a more pelagic than benthic species. Overall, during the daytime more than 95% of *A. delicata* specimens were taken in the lower 10–40 cm water layer, whereas no specimens were collected in the two uppermost levels (80–110 and 115–145 cm) sampled by the sled. During the night (first period before midnight), a small part of the population migrated upwards, one specimen up to the 80–110 cm water layer (haul D2-TS01N). However, this vertical migration was of weak amplitude, probably limited to the near-bottom environment, as demonstrated by the nocturnal absence of individuals from the 115 to 145 cm layer, the highest one sampled above the bottom (no abundance data available for the uppermost water column).

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