

CHAPTER 7

Hints for identification of selected mesozooplankton taxa

This chapter provides brief information on how to distinguish some most common and/or abundant mesozooplankton representatives in the zooplankton samples collected in the Baltic Sea. The following groups of organisms are described and illustrated:

1. Cladocera – genera: *Eubosmina* (*Bosmina*), *Podon*, *Pleopsis*, *Evadne*
2. Copepoda – genera: *Acartia*, *Centropages*, *Pseudocalanus*, *Temora*, *Eurytemora*, *Oithona*
3. Rotifera – genera: *Keratella*, *Brachionus*, *Synchaeta*
4. Meroplanktonic larvae – Cirripedia, Polychaeta, Mollusca

Brief descriptions of the selected genera and species of zooplankton in this chapter are supported by schematic drawings and original photographs made using the zooplankton samples from the Baltic Sea. More information on morphology and biology of these organisms can be found in the previous chapters of this edition as well as in the books and research papers listed in the References.

7.1 Cladocera

Cladocera are lower crustaceans that form significant part of mesozooplankton. These organisms are very diverse in body shape, which varies from spherical, oval and triangular to somewhat abstract elongated forms. The body is covered with carapace and therefore its segmentation is not visible. The shape of carapace is an important feature for the species identification. The body size of cladocerans generally ranges from 0.2 to 3.0 mm, with the exception of certain species (e.g., *Cercopagis pengoi*). Many cladocerans have rather big, black eyes that are clearly seen. In comparison with the Copepoda, most Cladocera have relatively short antennules. Examples of body shapes of Cladocera species are given in Figures 6.7, 6.8, and 6.9 (see Chapter 6).

7.1.1 Genus *Eubosmina* (*Bosmina*), Family Bosminidae (Figures 2.10, 7.1, 7.2)

There are a few species of the genus *Eubosmina* (*Bosmina*) that belong to the family Bosminidae, and they are widely distributed around the Baltic Sea. Taxonomy of this genus is a field in need of revision, but most of its representatives can be easily

identified to the species level due to the species-specific shape of carapace. To identify these organisms to the genus level, it is important to know and distinguish the following features:

- variable shape of carapace: from roundish to elongated, oval or irregular-shaped
- post-abdomen usually more or less rectangular
- often with two small (or sometimes relatively long) carapace spines at distal end
- two relatively long antennules (each looks like a “trunk”)
- medium-sized but well seen black eyes (compound eye)

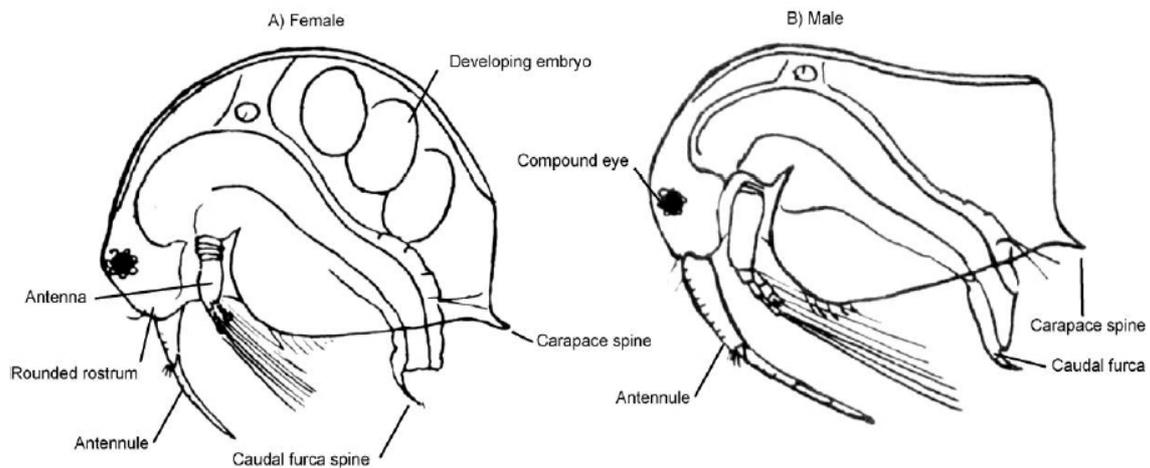


Figure 7.1: *Eubosmina* sp.: female (left), male (right) (after Telesh & Heerkloss, 2004).

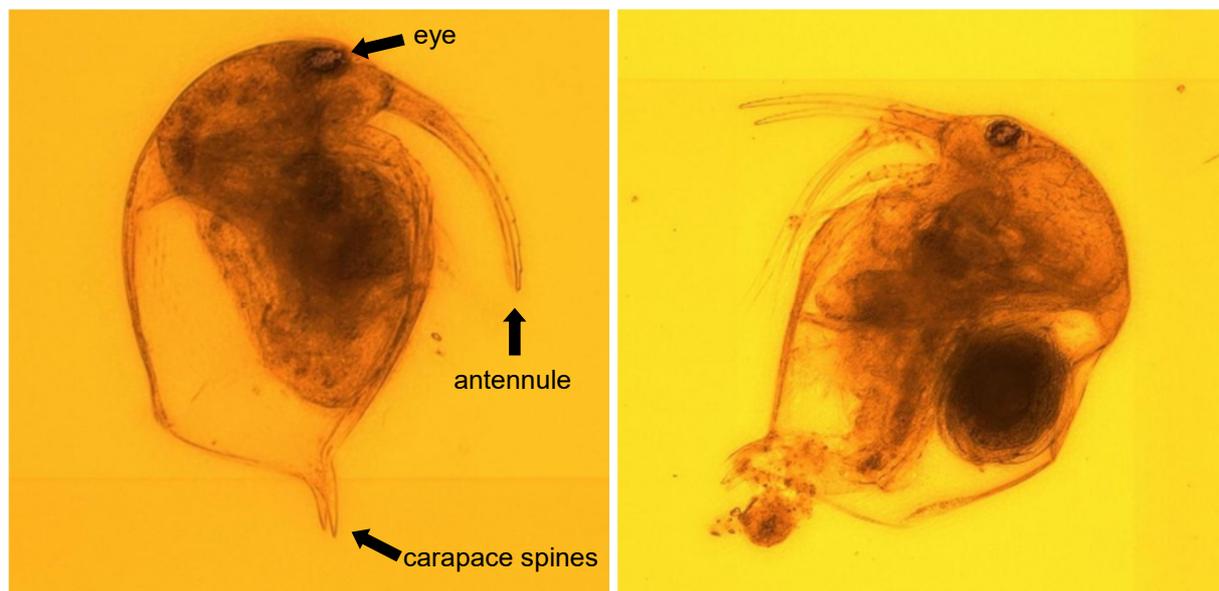


Figure 7.2: *Eubosmina* sp.: antennule, carapace spines and eye shown by arrows. Left – female with an empty brood pouch; right – female with a resting egg in the brood pouch (photos: C. Volkmann).

7.1.2 Genera: *Podon*, *Pleopsis* and *Evadne*, Family Podonidae (Figures 2.5, 7.3, 7.4)

Four species from the family Podonidae that occur in the Baltic Sea zooplankton are described here: *Podon leuckarti*, *Podon intermedius*, *Pleopsis polyphemoides* and *Evadne nordmanni*. It is important to know the morphological differences between these species. The brief species descriptions of *P. leuckarti*, *P. intermedius* and *P. polyphemoides* are given below.

Podon leuckarti
(Figures 2.5, 7.3, 7.4)

- large body (average size of males and females ca. 1.0 mm)
- round-shaped head with relatively big black eyes
- head and body are offset from each other
- hemispherical brood pouch (looks a bit like a backpack)
- with ONE long seta (kemp) located at the joint of the first thoracic limb:
 - actually, this is the only real though not easily seen identification characteristic.

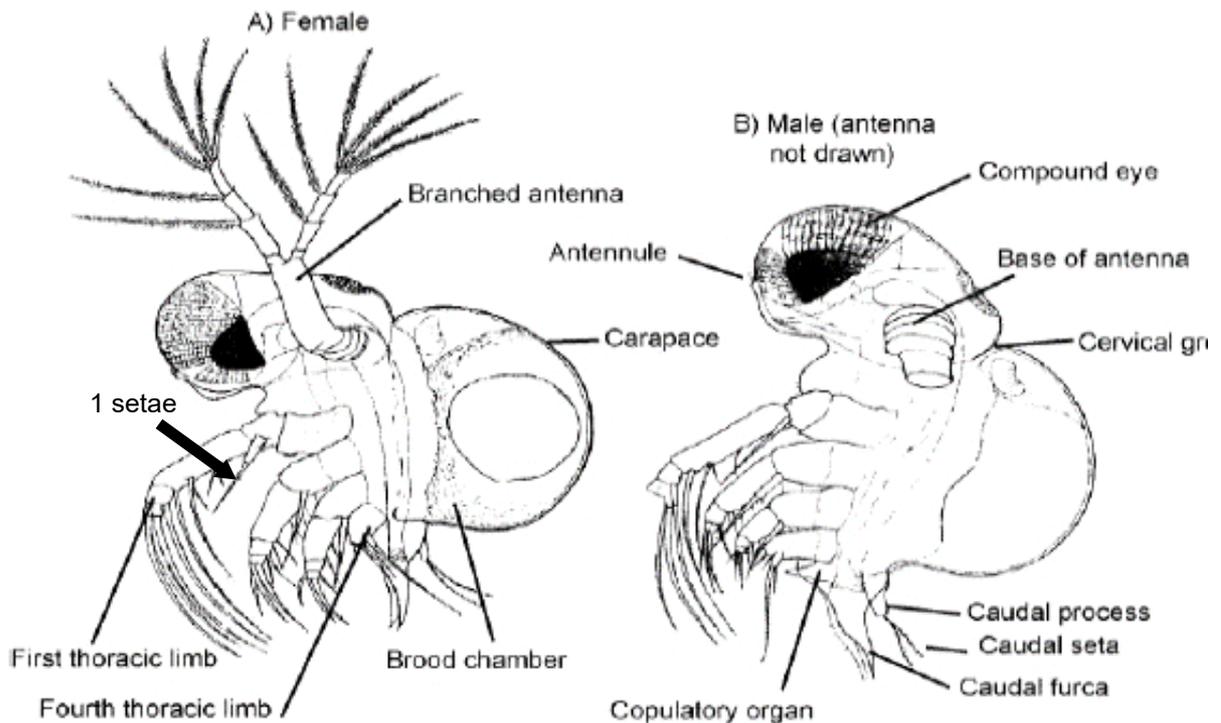


Figure 7.3: *Podon leuckarti*, female (left), male (right) (from Lilljeborg, 1901, as *P. leuckarti*).

Podon intermedius

- large body (average size of males ca. 0.9 mm, females 1.0–1.2 mm)
- round-shaped head with big black eyes
- head and body are offset from each other
- oval to hemispherical brood pouch (brood chamber), which looks a bit like a backpack
- TWO setae at the joint of the first thoracic limb:
 - actually, this is the only real identification characteristic but also not easy to see

Podon leuckarti and *P. intermedius* look quite similar and differ only by the number of setae (one or two, respectively) at the joint of the first thoracic limb.

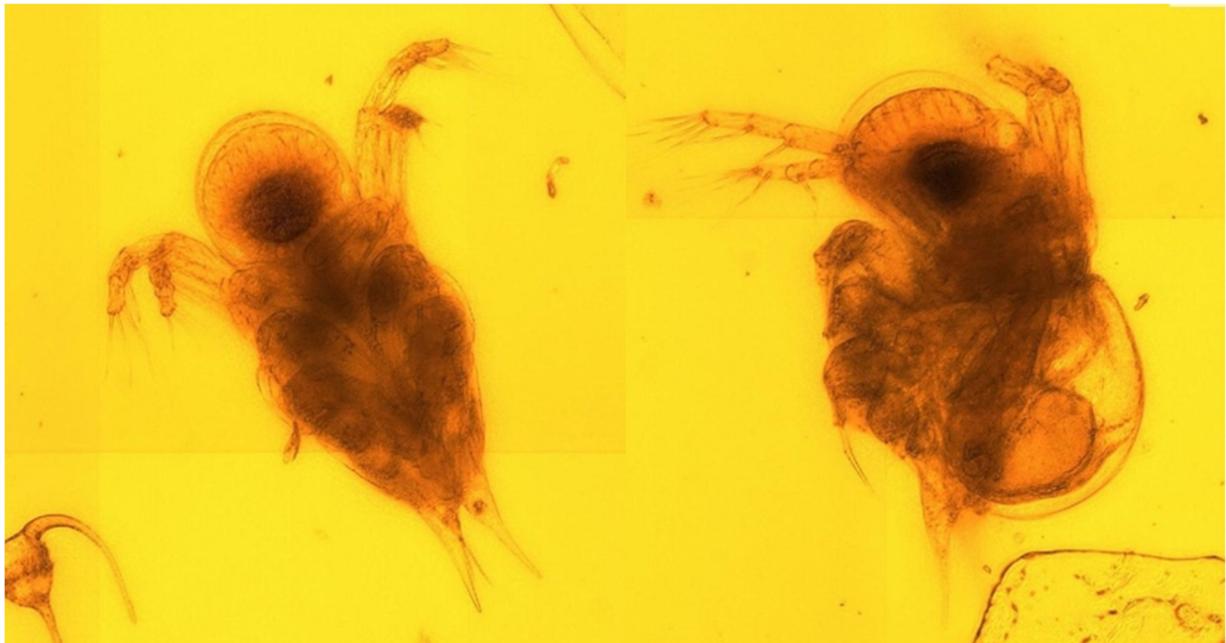


Figure 7.4: *Podon* sp.; left – ventral view, right – lateral view (photos: C. Volkmann).

Pleopsis polyphemoides

(Figure 7.5.)

- small body (in contrast to *P. leuckarti* and *P. intermedius*): average size from 0.4–0.55 mm (males) to 0.6–0.65 mm (females)
- round-shaped head with big black eyes
- head and body are offset from each other
- spherical brood pouch (looks like a **big, round** backpack)
- with THREE setae located at the joint of the first thoracic limb:
 - the only certain identification characteristic but really hard to see (it takes a bit of experience because thoracic limbs could be pretty close to each other).

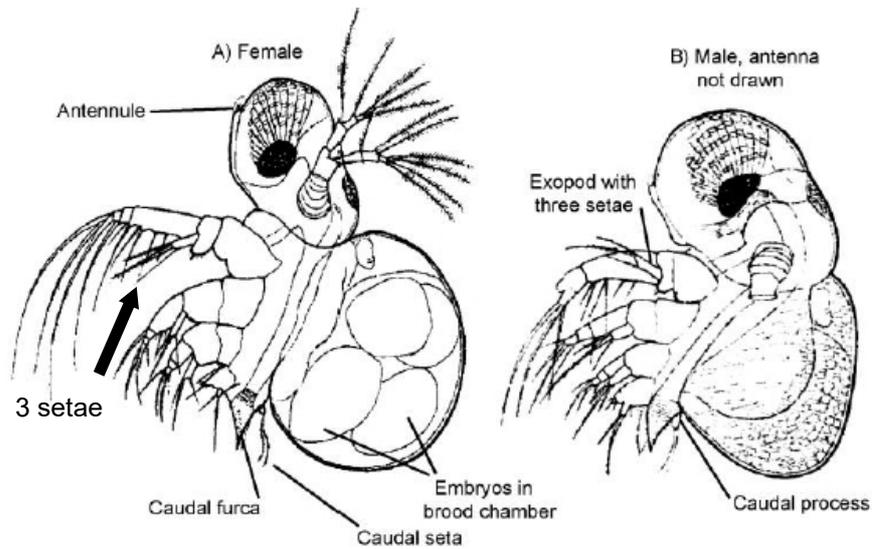


Figure 7.5: *Pleopsis polyphemoides*, female (left), male (right) (from Lilljeborg, 1901, as *P. leuckarti*).

7.1.3 Genus *Evadne* (Figures 2.5, 7.6, 7.7)

Two species from the genus *Evadne*, *E. nordmanni* and *E. anonyx*, are common in the Baltic Sea; however, it is often difficult to discriminate between these *Evadne* species according to their morphological characteristics only. The following features are attributed to *Evadne* spp.:

- round head;
- triangular-shaped carapace (very easy to recognize);
- head and body are NOT offset from each other;
- big black eyes.

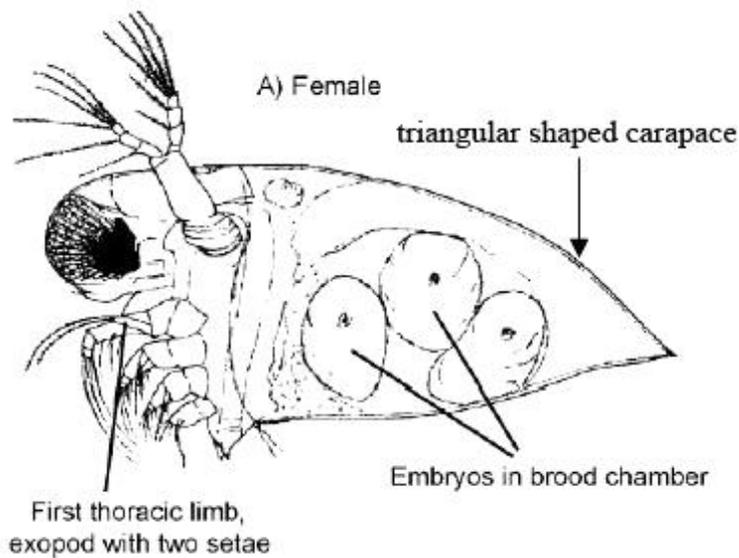


Figure 7.6: *Evadne* sp., female (from Lilljeborg, 1901).

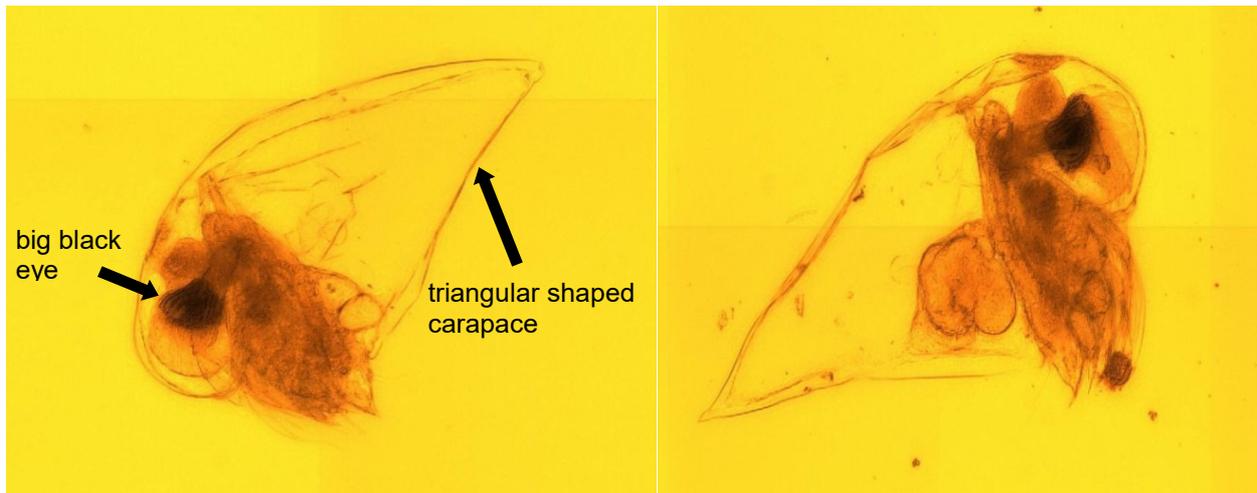


Figure 7.7: *Evadne nordmanni* (photos: C. Volkmann).

7.2 Copepoda

The Copepoda are lower crustaceans that are represented in plankton by three different Orders: Calanoida, Cyclopoida, and Harpacticoida. Morphologically, copepods from these three orders differ significantly in body shape and the length of their antennae (Figure 7.8).

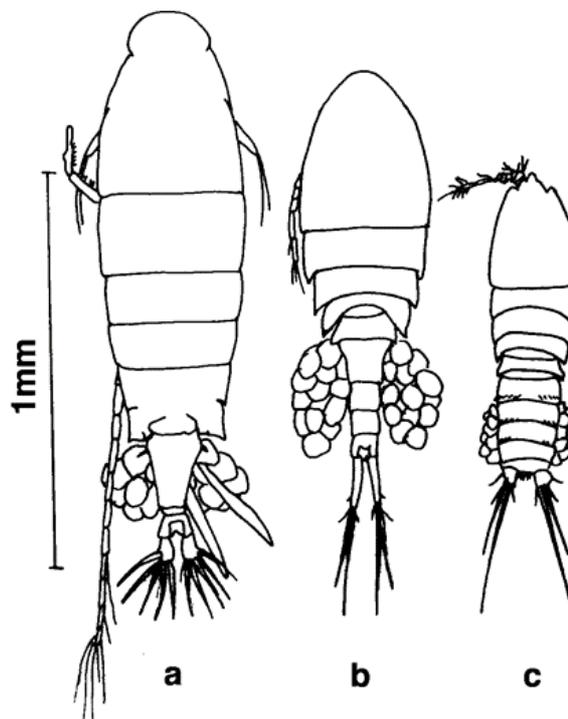


Figure 7.8: Scheme of calanoid (a), cyclopoid (b) and harpacticoid (c) copepods (after Telesh & Heerkloss, 2004).

The description of Copepoda and more details of their morphology (including adults, copepodites and naupliar stages) are given above (see Chapter 6). Calanoid copepods have more or less slim, elongated body shape and long paired first antennae, A1 (nearly as long as their body, or even longer). The body of cyclopoid copepods is slightly spindle-shaped and the antennae are clearly shorter than in calanoid copepods. The antennae are usually with setae. You can often see the eye, especially in cyclopoids. Copepods have a clear segmented cephalothorax and urosome (see Figures 6.11 and 6.12).

In contrast to cladocerans, copepods run through different developmental stages while their life cycle. Nauplius larvae, which develop from the egg, have altogether VI stages. Further on, nauplii develop into the six copepodite stages, the last one (stage VI) being the adult organism, although signs of males and females can already be distinguished at the copepodite stage V (see Figures 6.14 and 6.15).

Copepods at different developmental stages can be distinguished by certain morphological features. The best way to verify the stage is to count the number of pairs of swimming legs in relation to body size. At the first copepodite stage, the individuals have two pairs of swimming legs. After each moult one pair of legs is added. The maximum number of pairs of swimming legs (4 or 5 pairs), depending on the species, is present already at stage IV.

Another possibility to determine the stage of copepods is to count the prosome somites. However, it is necessary to mention that this method is not very reliable for a beginner at zooplankton counts because in some species the somites can be fused or there is hardly a difference between the numbers of somites at different stages.

For the only one cyclopoid copepod listed here, *Oithona similis*, it is very difficult to distinguish between the copepodite stages.

***Acartia* sp., nauplius**
(Figures 7.9, 7.10)

- anterior end of body straight (significantly more straight than in the juvenile and adult individuals of *Acartia* spp.)
- first pair of limbs is frequently stretched forward
- the body is nearly oval
- at the distal end of the body there are two short spines that are more or less parallel to each other:
 - these spines are hardly visible at the first, the smallest Nauplii-larvae stage
 - the best determination characteristic for the smallest individuals is the flat body

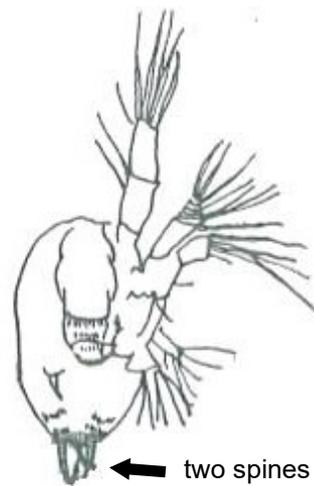


Figure 7.9: Nauplius of *Acartia* sp.

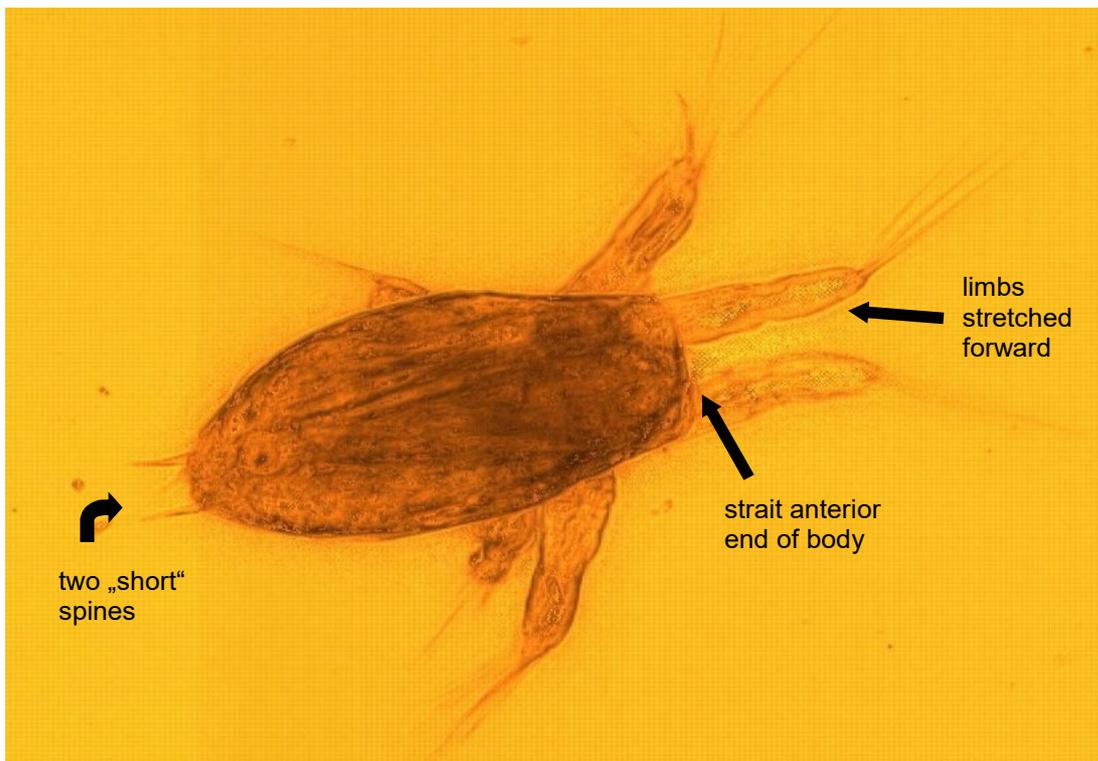


Figure 7.10: Nauplius of *Acartia* sp. (photo: C. Volkmann).

***Acartia* sp., adult**
(Figures 2.4, 7.11–7.13)

- strait, slightly edged head
- first pair of antennae is irregularly haired with long setae
- ‘hairs’ can be close-fitting to the antennae; therefore, ‘hairs’ sometimes are not easy to see in the juvenile individuals
- after two-thirds of the body length, the thorax is slightly thickened but backwards it is narrowing again
- visible eye (sometimes red colored)
- the fifth swimming leg (P5), located at the last thorax segment, in males looks like a “wrinkled pincers”
- the right first antennae of male individuals is always twisted and buckled
- the female sexual organ, the genital somite, is located at the first abdominal segment, which is thickened
- the female fifth swimming leg P5 has two spines that can be crossed:
 - you can determine the sex only for adult individuals
- 5 pairs of swimming legs at stage IV

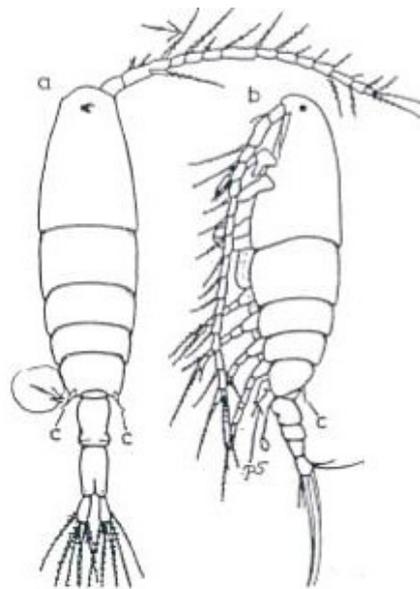


Figure 7.11: *Acartia* sp., female.

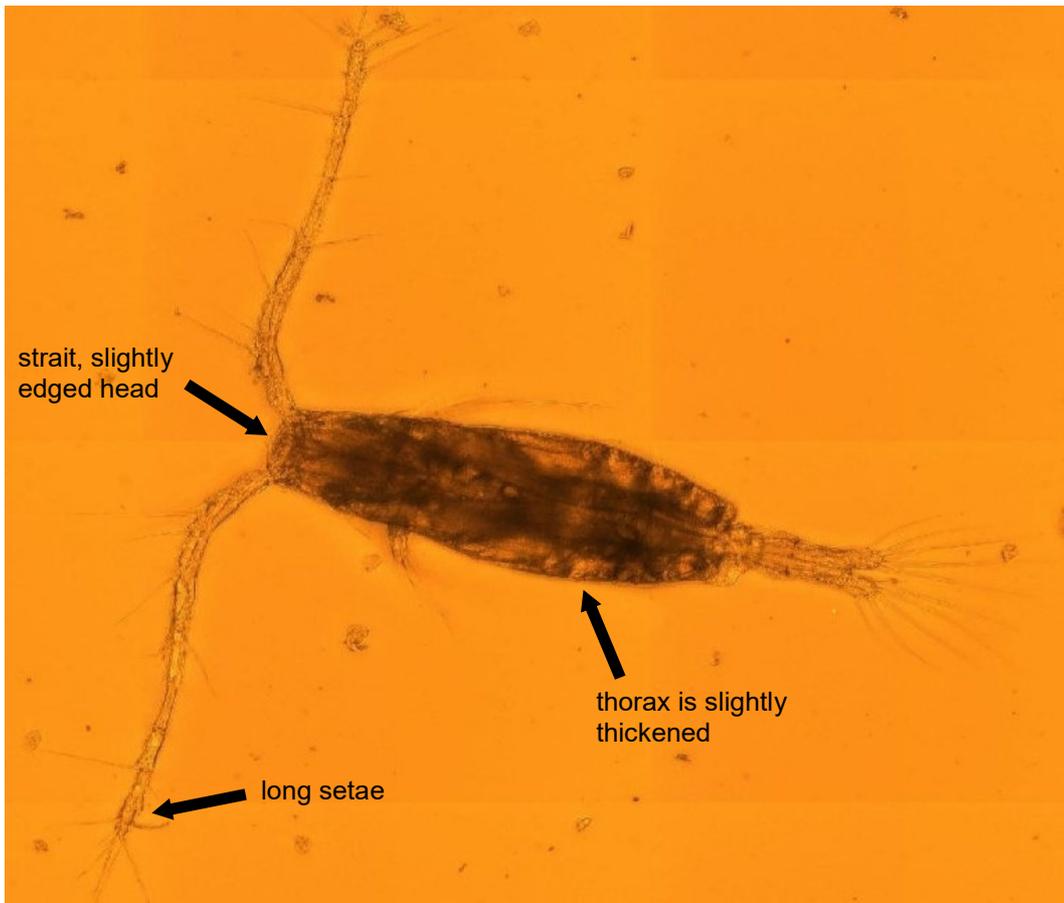


Figure 7.12: *Acartia* sp., female (photo: C. Volkmann).



Figure 7.13: *Acartia* sp., male (photo: H. Rohde).

***Centropages* sp., nauplius**
(Figures 7.14, 7.15)

- round-shaped anterior end of body
- the body is getting continuously narrower backwards
- at the end of the body there is a long, thin median spine (relatively easy to recognize)



Figure 7.14: *Centropages* sp., nauplius



Figure 7.15: *Centropages* sp., nauplius (photo: C. Volkmann).

***Centropages hamatus*, adult**
(Figures 2.11, 7.16–7.18)

- head is getting narrower to the tip
- thorax is getting continuously narrower towards abdomen (especially in the juvenile individuals)
- the first antennae (A1) is relatively thick, with many short setae; in preserved samples often looks bent downward from the tip of the head
- the male P5 looks like a claw arm
- the last thoracic segment has one lateral spine at each distal corner:
 - sometimes these lateral spines are difficult to see in juvenile individuals
 - spines of female individuals are curved and significantly larger than in males
- the first abdominal segment in females is thickened
- 5 pairs of swimming legs at stage IV

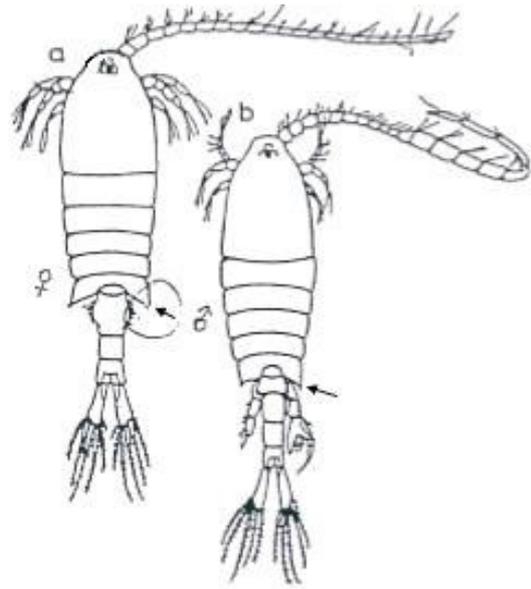


Figure 7.16: *Centropages hamatus*: female (left) and male (right); arrows show lateral spines at the last thoracic segment.



Figure 7.17: *Centropages hamatus*, male; arrows show the lateral spine at the last thoracic segment and the antenna bent downwards (photo: H. Rohde).

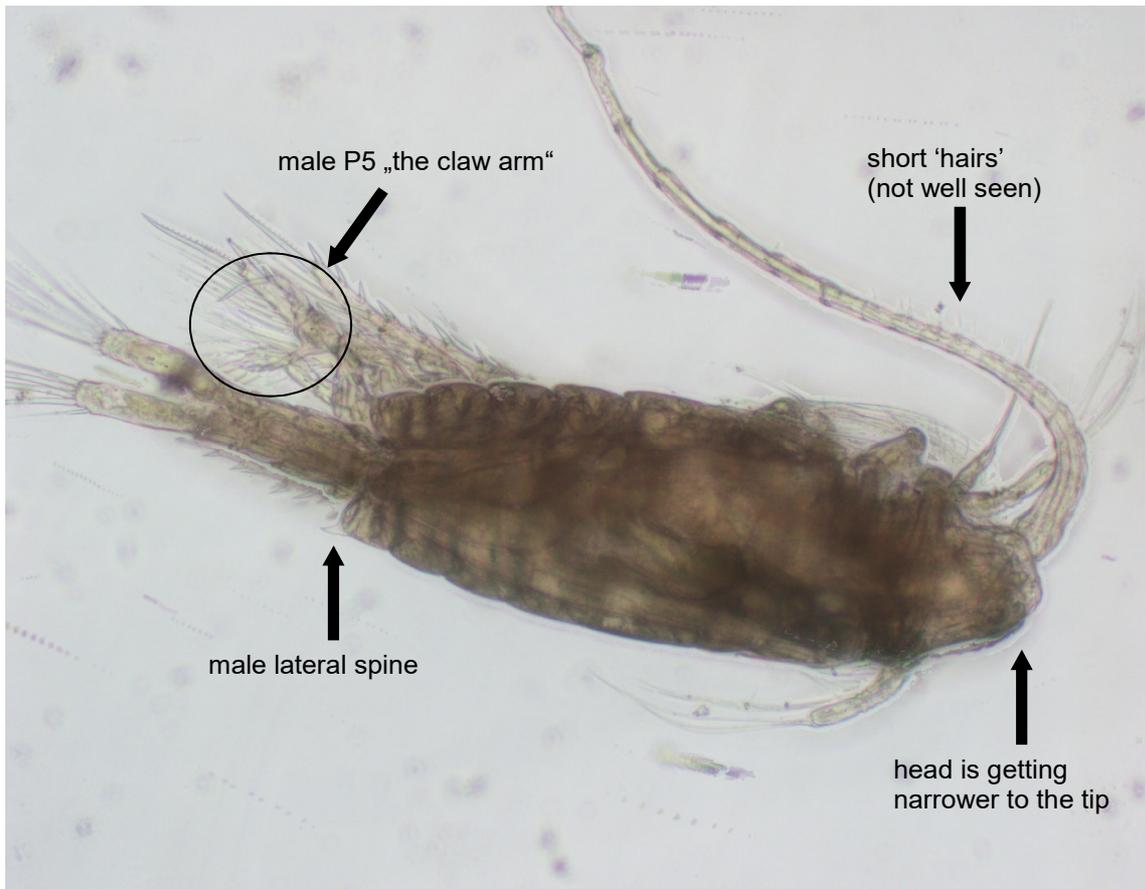


Figure 7.18: *Centropages hamatus*, male; arrows show the taxonomically important features (photo: H. Rohde).

***Pseudocalanus* sp., nauplius**
(Figures 7.19, 7.20)

- in general, the biggest of all Copepoda Nauplius larvae mentioned here
- the posterior end of the body looks telescopically drawn-out with a few short spines at the end (looks a bit like a paw)



Figure 7.19: *Pseudocalanus* sp., nauplius.

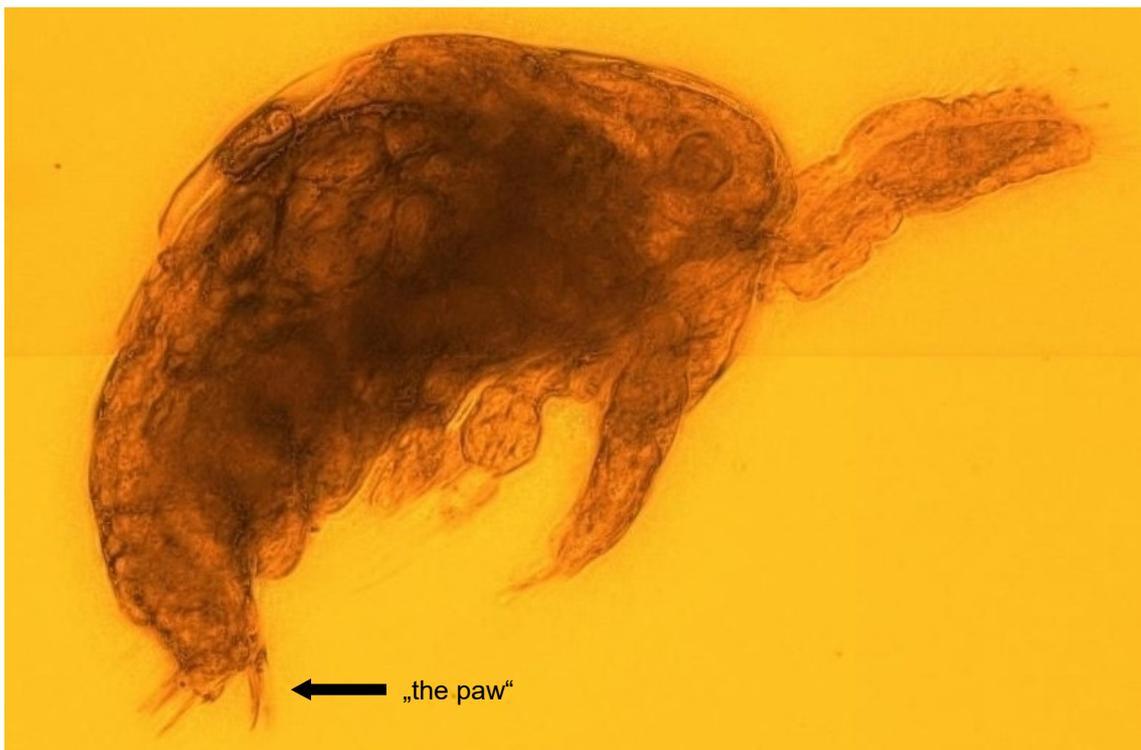


Figure 7.20: *Pseudocalanus* sp., nauplius (photo: C. Volkmann).

***Pseudocalanus elongatus*, adult**

(Figures 2.3, 7.21, 7.22)

- round-shaped head
- straight and elongated body
- first antennae (A1) sometimes slightly short haired, especially at the tip
- antennae A1 often runs straight along the thorax
- relatively slim, straight and long abdomen:
 - with a short furca, in contrast to *Eurytemora affinis* and *Temora longicornis*
- male individuals with a quite long spine at P5:
 - not easy to recognize between other limbs (thorakopods)
- female individuals with a thickened first abdominal segment (the genital segment):
 - at dorsal view, you can see inside the segment something that looks like two “air bubbles” - these are the ovaries
- maximum number of swimming legs at stage IV: female - 4, male - 5 pairs

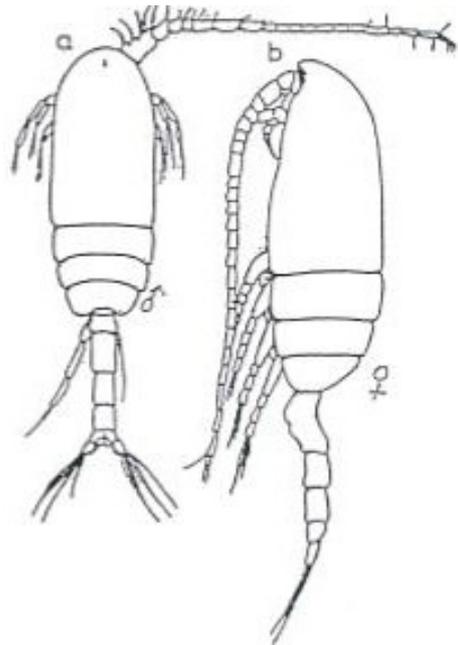


Figure 7.21: *Pseudocalanus elongatus*, male (left) and female (right).

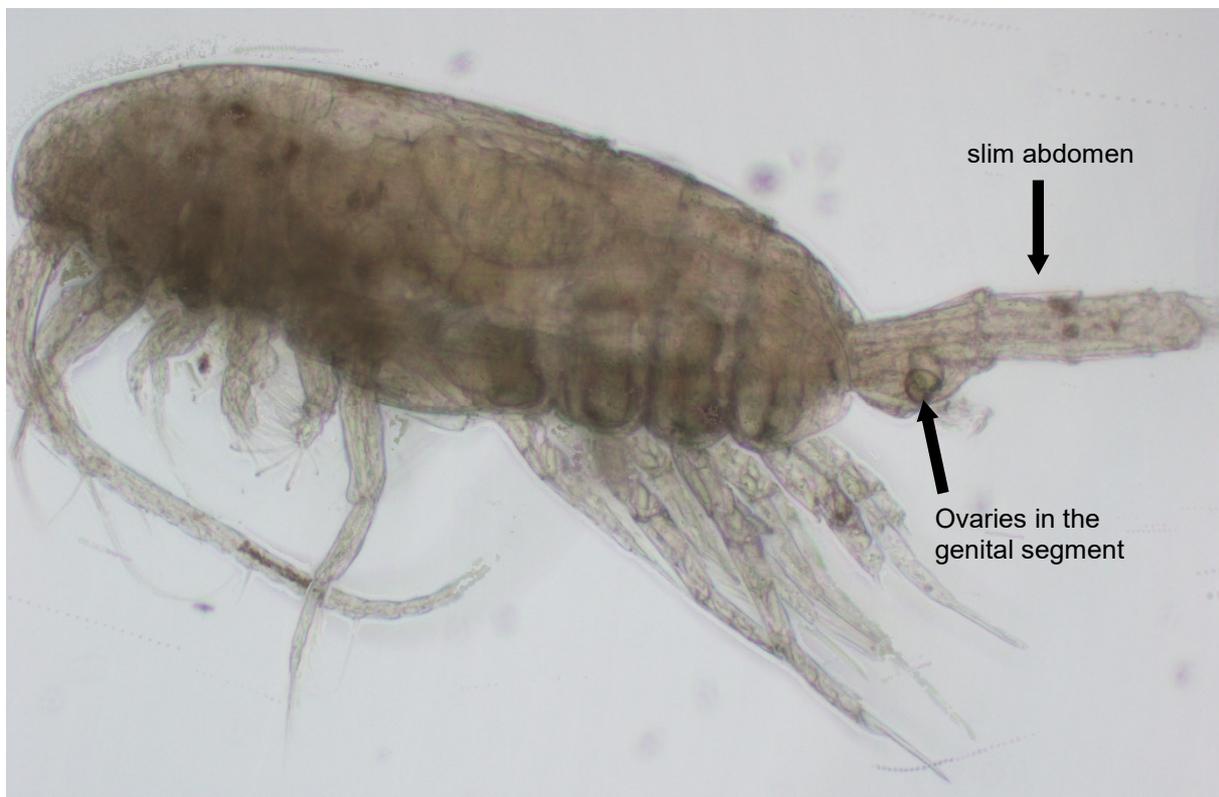


Figure 7.22: *Pseudocalanus elongatus*, female (photo: H. Rohde).

***Temora* sp., nauplius**
(Figures 7.23, 7.24)

- round-shaped anterior end of body
- body elongated but not oval
- two spines at the distal end of the body that are more or less parallel to each other but unequal in length (easy to see)
- sometimes the longer spine is aborted (but actually it is also well seen)



Figure 7.23: *Temora* sp., nauplius.



Figure 7.24: *Temora* sp., nauplius (photo: C. Volkmann).

***Temora longicornis*, adult**
(Figures 2.4, 7.25, 7.26)

- round-shaped head
- pear-shaped body at the dorsal view (very significant!)
- at the lateral view it has a kind of “hump”
- quite long furca
- the first antennae is bristly haired and often slightly curved
- male P5 looks like a big claw
- 5 pairs of swimming legs at stage IV

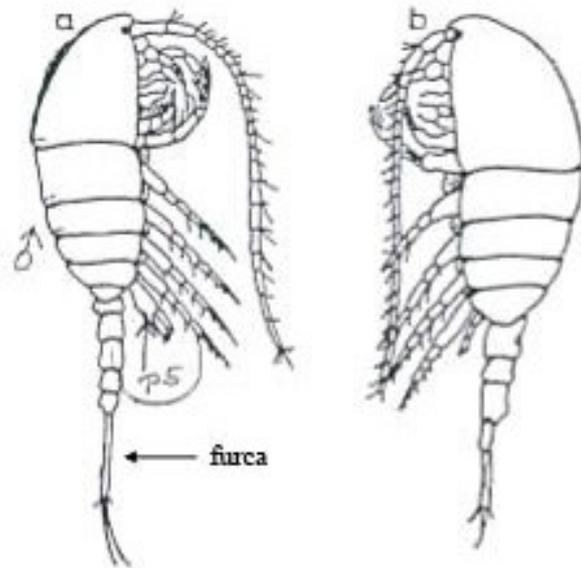


Figure 7.25: *Temora longicornis*, male (a, left) and female (b, right).



Figure 7.26: *Temora longicornis*, female (photo: C. Volkmann).

***Eurytemora* sp., nauplius**
(Figures 7.27, 7.28)

- round-shaped anterior end of body
- tear-shaped body
- at the distal end of the body – two long, robust spines that are more or less parallel to each other:
 - spines are longer than in *Acartia* nauplii

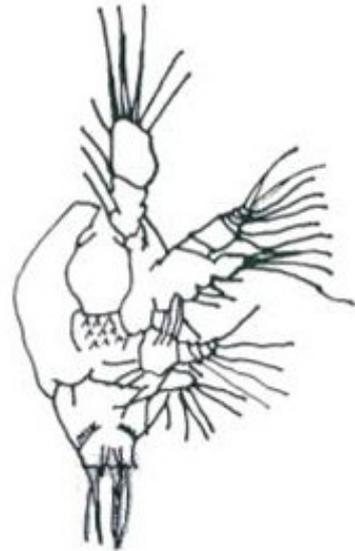


Figure 7.27: *Eurytemora* sp., nauplius.

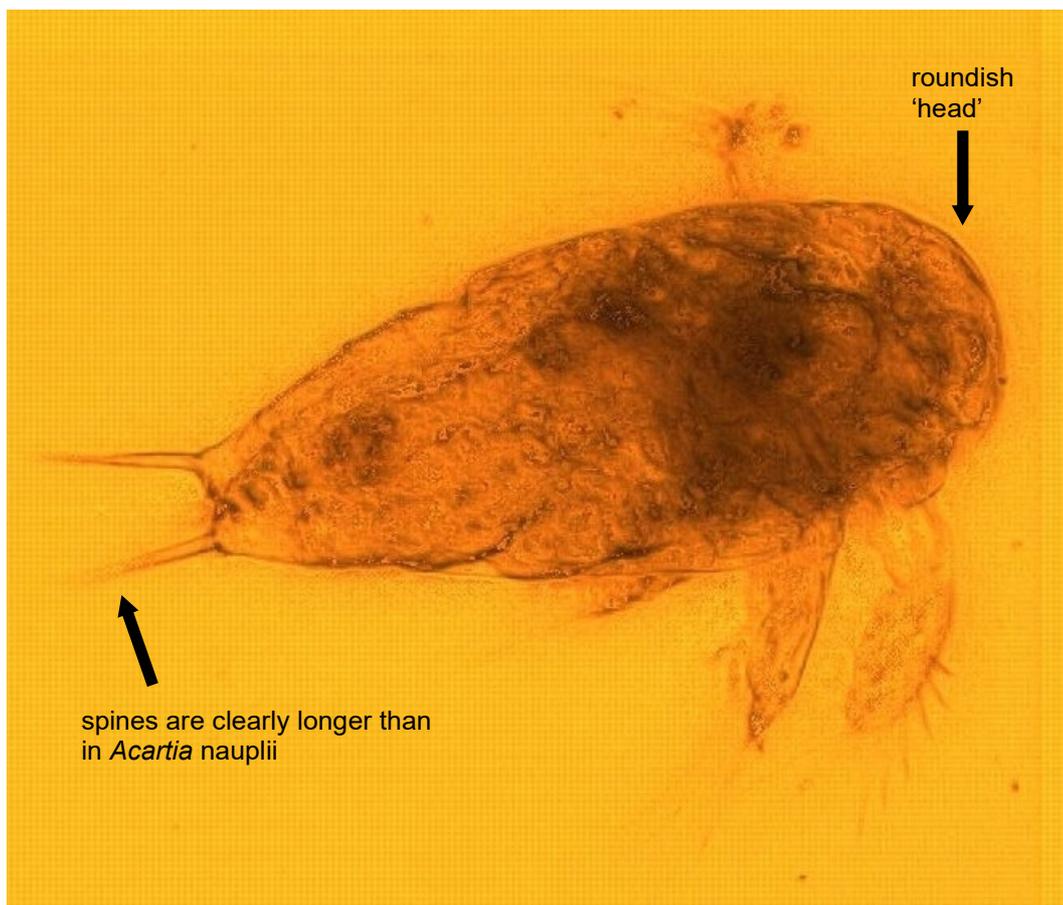


Figure 7.28: *Eurytemora* sp., nauplius (photo: C. Volkmann).

***Eurytemora affinis*, adult**
(Figures 7.29, 7.30)

- relatively round-shaped head
- slim body shape (no hump or pear-shaped body, unlike in *T. longicornis*)
- first antennae is often slightly curved in fixed condition
- the furca is nearly as long as the abdomen
- the last thoracic segment of female individuals is winged at the lateral corners
- the male P5 looks like a claw

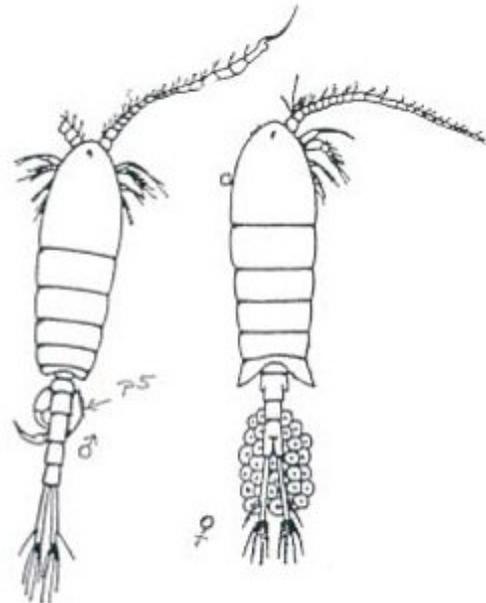


Figure 7.29: *Eurytemora affinis*, male (left) and female (right).

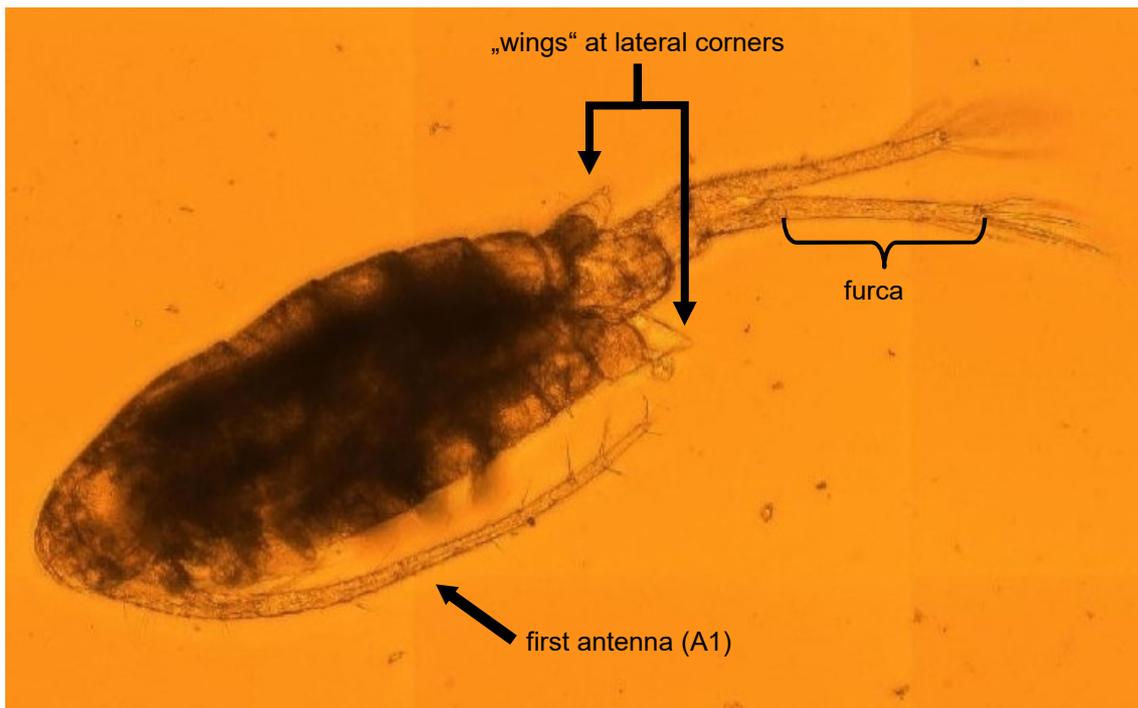


Figure 7.30: *Eurytemora affinis*, female (photo: C. Volkmann).

***Oithona* sp. (Cyclopoida), nauplius**
(Figures 7.31, 7.32):

- round-shaped anterior end of body
- relatively elongated, oval body
- two first pairs of limbs often stretched forward
- two short posterior spines at the end of the body are directed to the center (it looks like they form one big, short median spine)

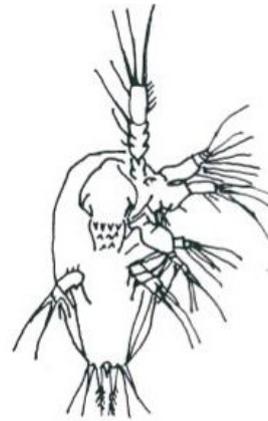


Figure 7.31: *Oithona* sp., nauplius.



Figure 7.32: *Oithona* sp., nauplius (photo: C. Volkmann).

***Oithona similis* (Cyclopoida), adult**

(Figures 7.33, 7.34):

- first antennae (A1) are irregularly armored with relatively long setae (shown by arrow)
- the whole body (cephalothorax + thorax) is pronouncedly spindle-shaped
- the relation cephalothorax + thorax and abdomen + furca is close to 1:1
- the first antennae of female individuals are as long as the whole body
- the first antennae of male individuals is shorter and buckled like a “clothes hanger”

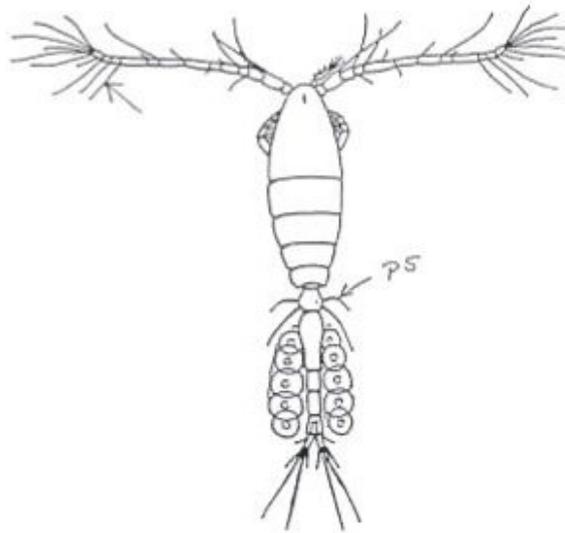


Figure 7.33: *Oithona similis*, female.

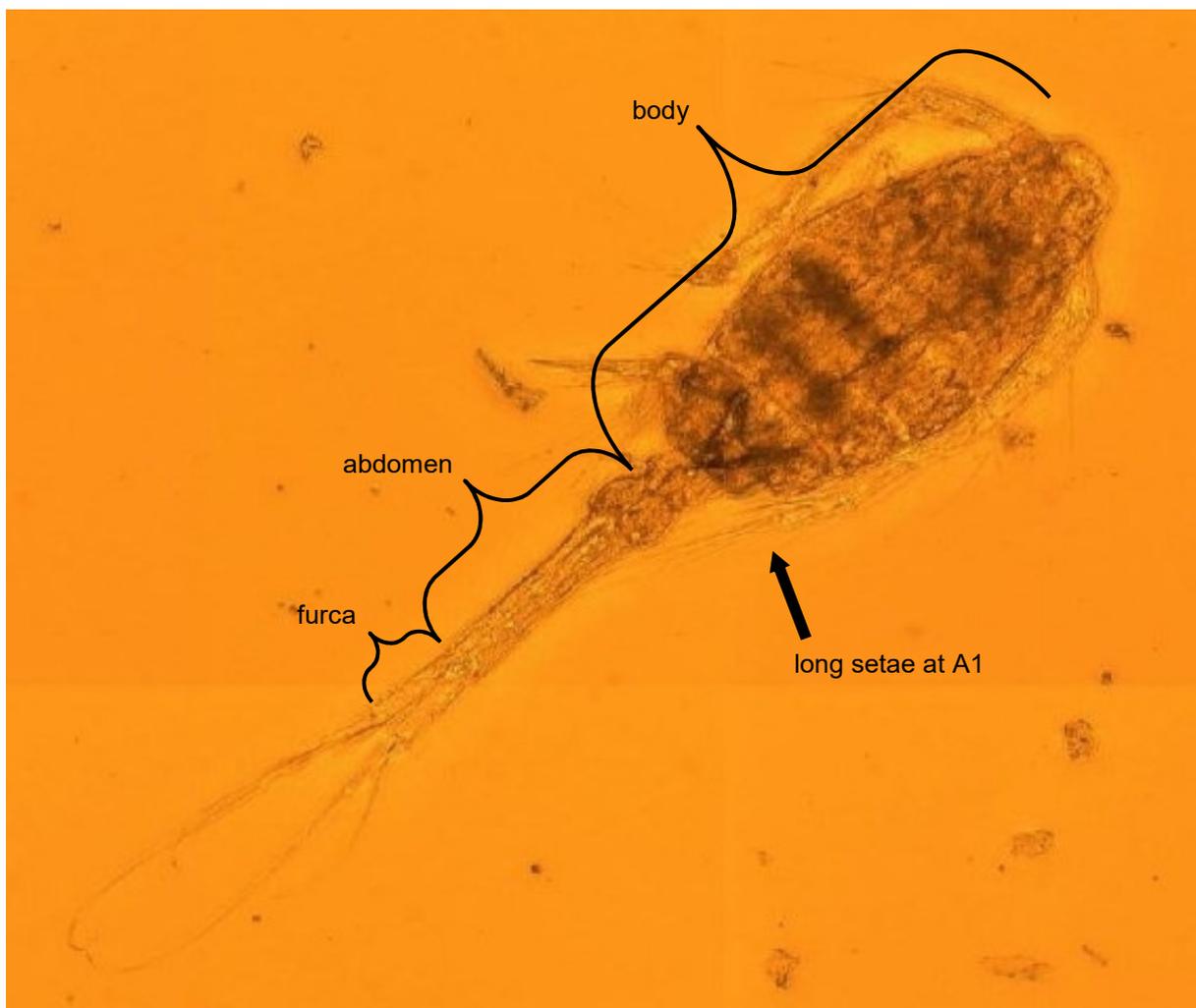


Figure 7.34: *Oithona similis*, female (photo: C. Volkmann).

7.3 Rotifera

Rotifera, or rotifers in English usage, is a group of microscopic aquatic or semi-aquatic unsegmented, bilaterally symmetrical pseudocoelomate invertebrates. In general, a rotifer consists of head, body and foot (for the details of morphology of rotifers see Chapter 6, Figure 6.5; more details, references and additional photographs of rotifers can be found in: Telesh & Heerkloss, 2002).

In comparison with the Cladocera and Copepoda, most Rotifera are rather small and more diverse in body shape. Body of most planktonic species of rotifers (except for the members of the genus *Asplanchna*) is smaller than 0.3 mm; however, some species have long spines (e.g. *Kellicottia*) or appendages (e.g. *Filinia*) that far exceed this length. The body of a rotifer may be cylindrical, sack- or bell-shaped, or laterally or dorso-ventrally flattened to various degrees; it may have thick cuticle or may be covered with lorica (carapace).

Morphologically, rotifers possess two main distinctive features: corona and mastax (for details see Chapter 6). Corona (a wheel organ) is the ciliated region at the apical end (head) of a rotifer. Corona is not always visible; sometimes it is withdrawn into body, especially in the preserved rotifers. Mastax is a muscular pharynx possessing a complex set of hard jaws called trophi (Figure 6.6). In some genera, the foot is lacking; but even if present, it may not be visible in the preserved animals because it is drawn into the body.

Identification of rotifers is based on the presence/absence of lorica, presence/absence of foot, body size and shape, body morphology, shape and morphology of lorica, and type of mastax. Species identification of the illoricate rotifers is possible only by examination of live organisms. Rotifers with lorica can be identified to species level also in the preserved samples, using the shape and structure of their lorica.

Here we describe and demonstrate only several rotifer species: *Keratella cochlearis*, *Keratella cochlearis* forma *tecta*, *Keratella quadrata*, *Brachionus quadridentatus* and *Synchaeta* sp.

Keratella cochlearis (Figures 2.7, 7.35)

- no foot
- lorica dorsally curved, ventrally flattened or concave; with 6 anterior spines of almost equal length and one median posterior spine (thick, ventrally curved posterior spine in *K. cochlearis* f. *baltica*, and no posterior spine in *K. cochlearis* f. *tecta*):
 - dorsal surface of lorica with central line, on either side of which is a net-like pattern of lines and “fields” enclosed or partially enclosed by them
 - posterior spine may be long or short, varying seasonally and cyclically in length
 - lorica (with spines) <320 µm; male <90 µm. Lorica of *K. cochlearis* f. *tecta* <150 µm
- single red eye



Figure 7.35: *Keratella cochlearis* (photo: C. Volkmann).

Keratella quadrata
(Figures 2.5, 2.7, 7.36)

- no foot
- lorica almost rectangular, posterior end with 2 parallel or diverging spines usually long to medium, thin, sometimes short, usually of equal length, left spine may be shorter or absent, sometimes no posterior spines; very polymorphic
- lorica <350 μm , male <100 μm

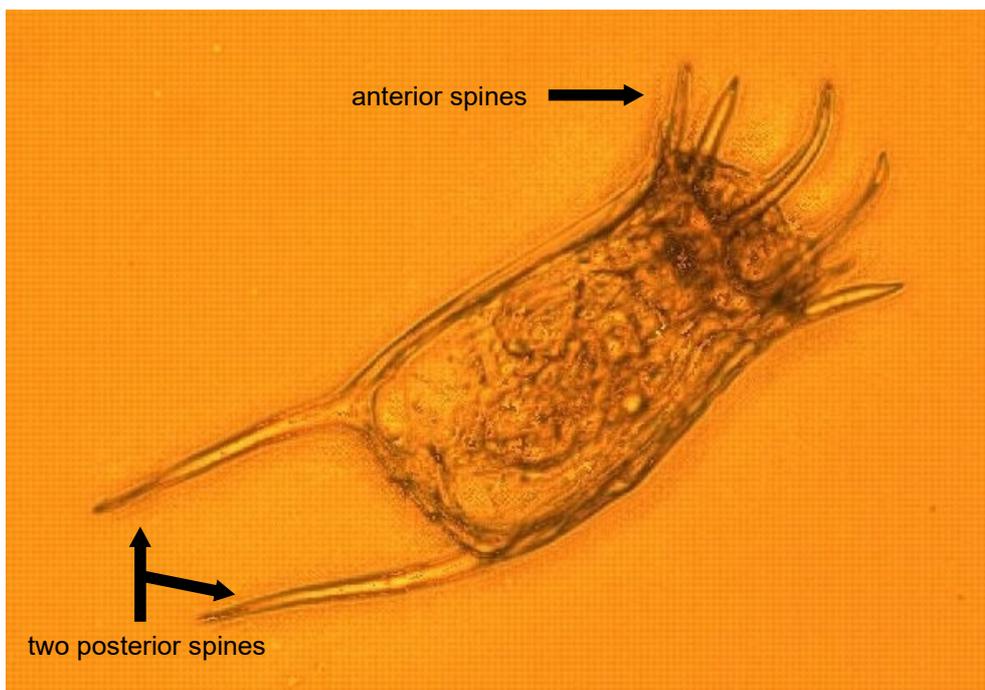


Figure 7.36: *Keratella quadrata* (photo: C. Volkmann).

Brachionus quadridentatus

(Figure 2.5, 7.37)

- lorica with 6 anterior spines, median pair usually long, curved to lateral or ventral
- posterior spines absent or present, short or long (seasonal variation in spine length occurs)
- foot opening tube-shaped, projecting ventrally with short lateral spines
- lorica often asymmetrical, length <415 μm ; male <150 μm

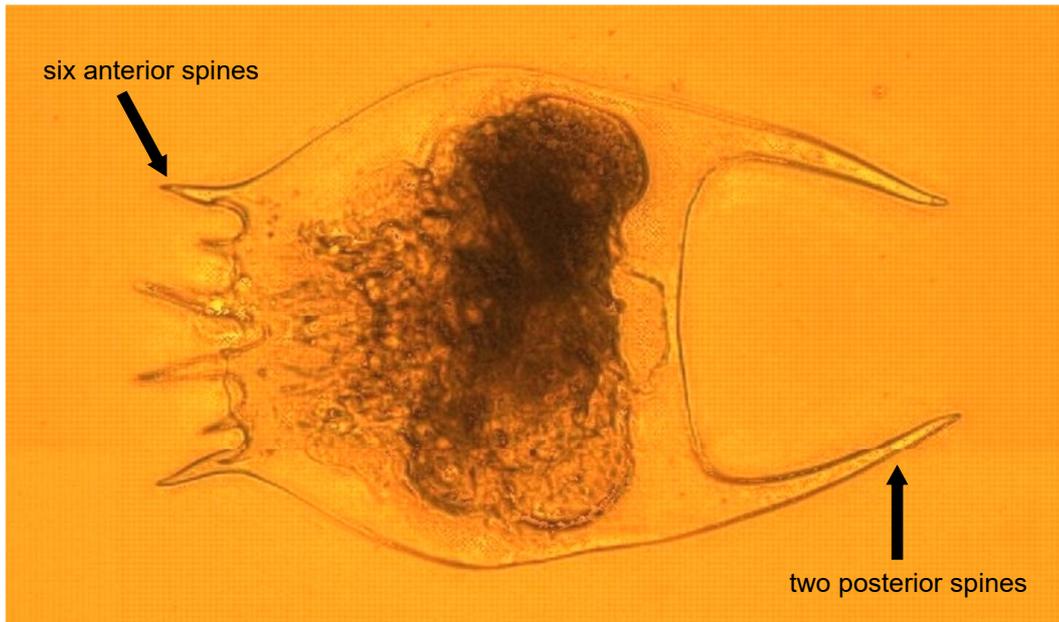


Figure 7.37: *Brachionus quadridentatus* (photo: C. Volkmann).

Synchaeta sp.

(Figures 2.5, 7.38)

- foot short or fairly short, toes short, usually 2
- body bell- or cone-shaped, cuticle very thin and transparent
- head more or less convex, usually bearing 4 characteristic stiff sensory bristles or styli arising from triangular prominences
- corona of groups of cirri, also cirri on laterally-extending or dependent “ears” or auricles
- eye usually present, single or double, red or purple, and often pigment spots on head
- Notes: in preserved samples, rotifer species from the genus *Synchaeta* contract into completely unidentifiable mass; therefore, identification of these rotifer species requires examination of live organisms in addition to preserved samples that should be used for study of trophi

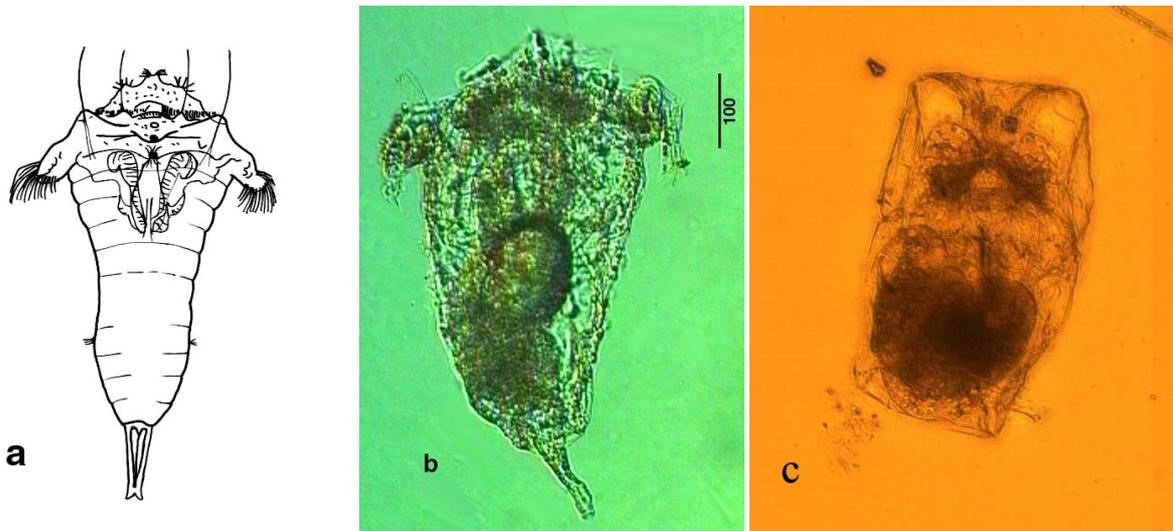


Figure 7.38: *Synchaeta* sp. **a**, *Synchaeta grandis*, female, dorsal view, modified and redrawn from Kutikova (1970); **b**, *Synchaeta grandis*, live individual (photo: I. Telesh); **c**, *Synchaeta* sp., preserved, leg and head withdrawn into body (photo: C. Volkmann).

7.4 Meroplanktonic larvae (Figures 2.8, 2.9, 7.39–7.42)

Meroplanktonic larvae are larval stages of bottom-dwelling organisms that live in plankton for certain, usually relatively short time. Most often you can find in plankton samples the larval stages of Cirripedia (*Balanus* sp.), Polychaeta and Mollusca (Bivalvia or Gastropoda). Larval stage of *Balanus* is nauplius, which looks similar to nauplii of copepods; larvae of Polychaeta and Mollusca look similar to adult organisms. Some illustrations are given below.

***Balanus* sp., nauplius** (Figure 7.39)

- carapace with two projections that look like “horns” laterally at the anterior part of body
- carapace elongated to a long spine at the posterior end
- this carapace shape is unique and, therefore, nauplius of *Balanus* sp. cannot be confused with any other nauplii

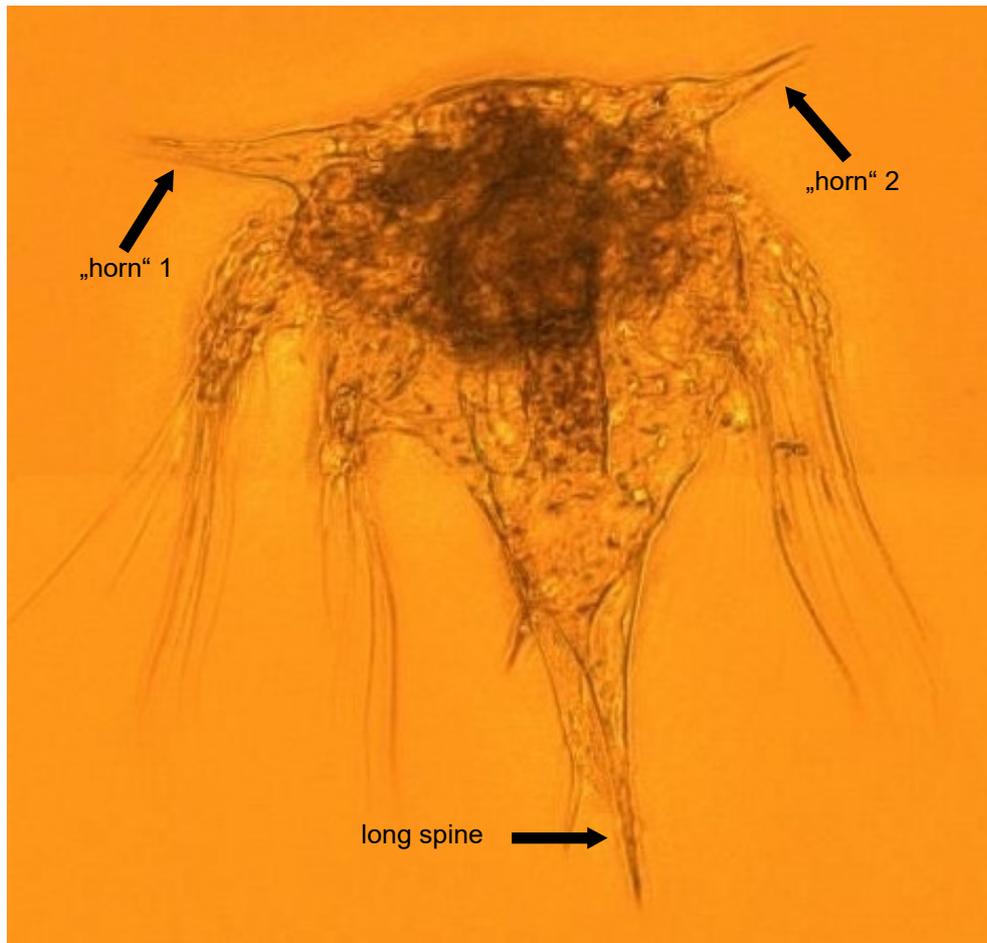


Figure 7.39: *Balanus* sp., nauplius (photo: C. Volkmann).



Figure 7.40: Polychaeta, larvae (photo: C. Volkmann).

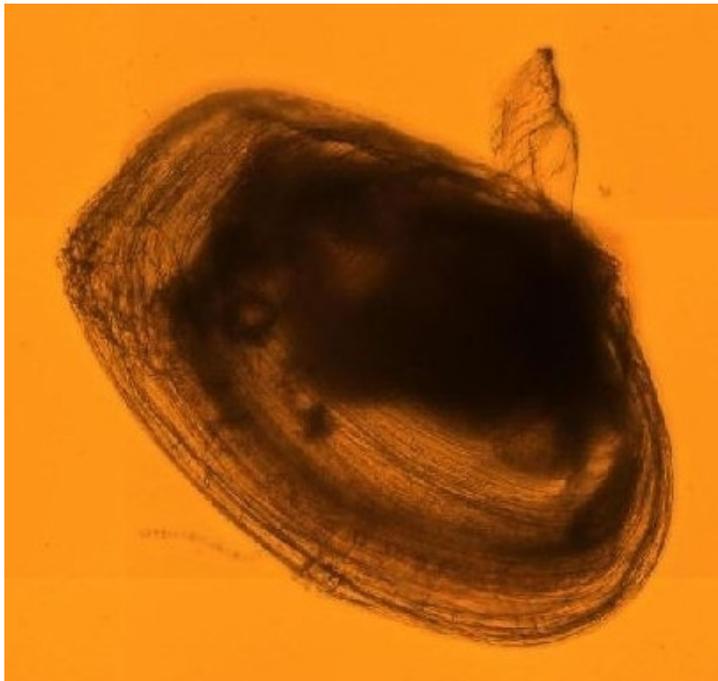


Figure 7.41: Bivalvia, larvae (photo: C. Volkmann).



Figure 7.42: Gastropoda, larvae (photo: C. Volkmann).

More information and photographs of the Baltic Sea zooplankton can be found in Telesh & Heerkloss, 2002, 2004; Telesh et al., 2009, and references therein (see the list of References).