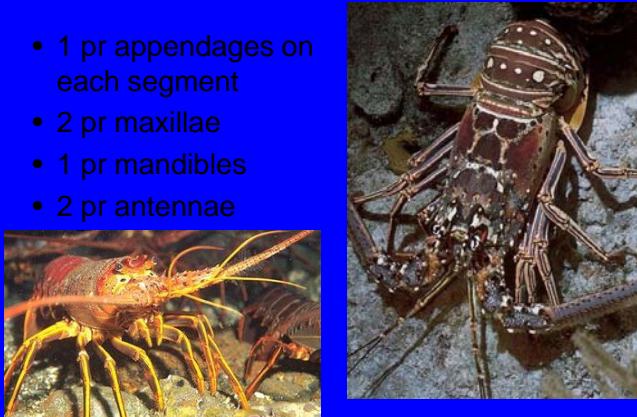
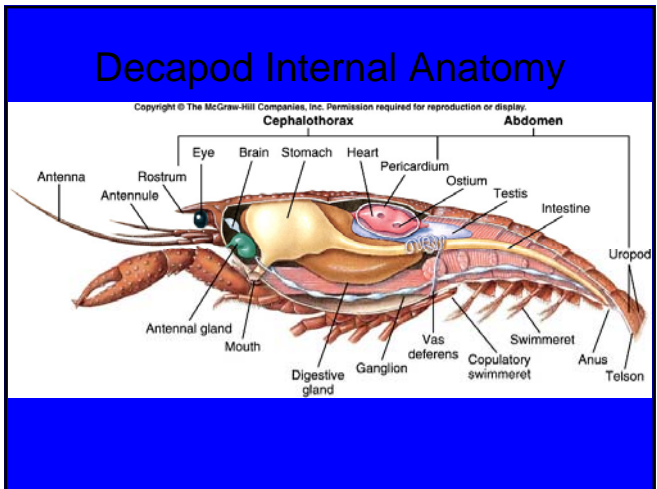
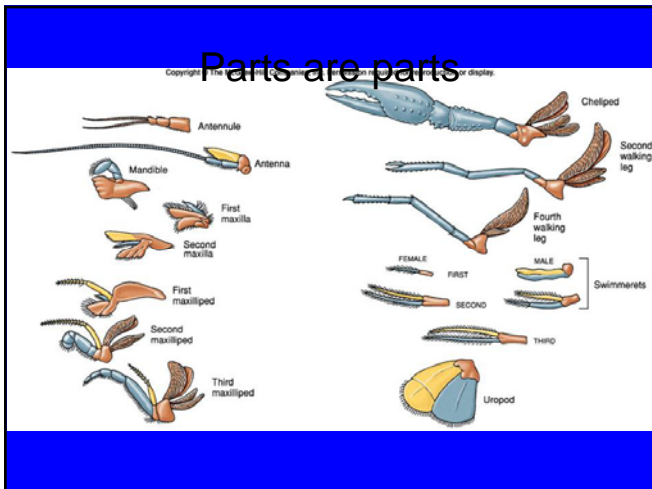
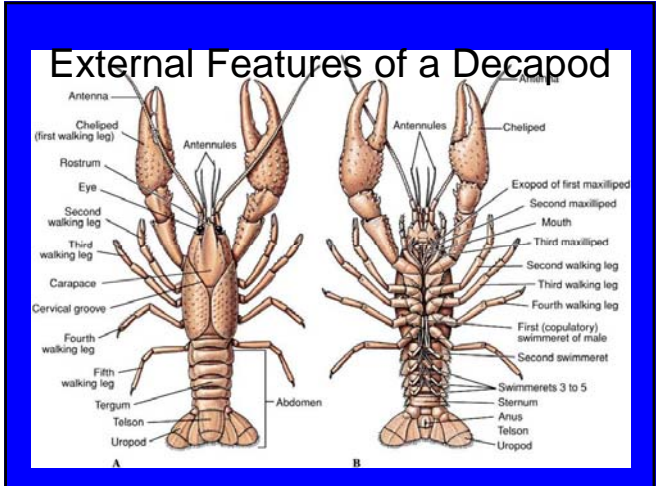
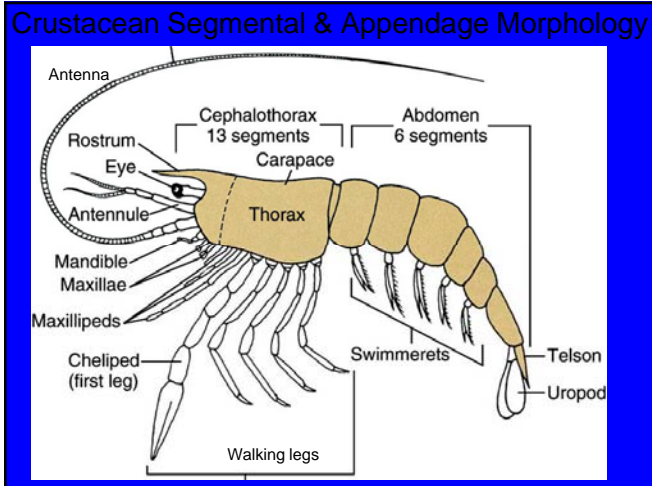
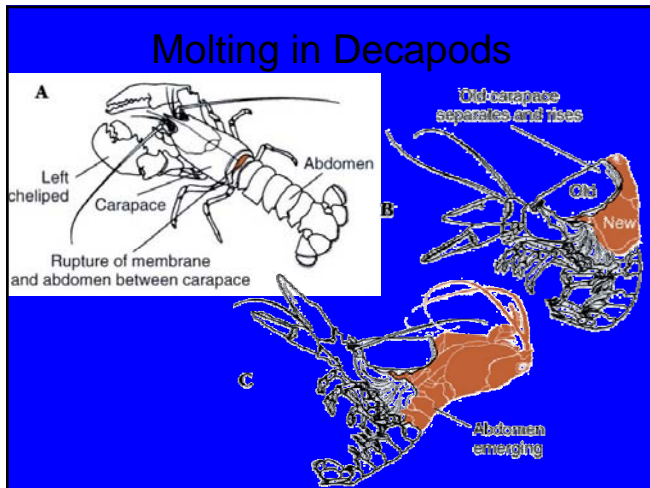
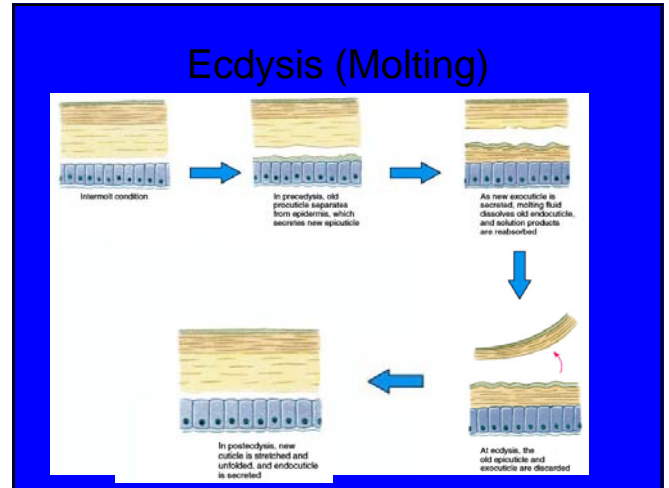
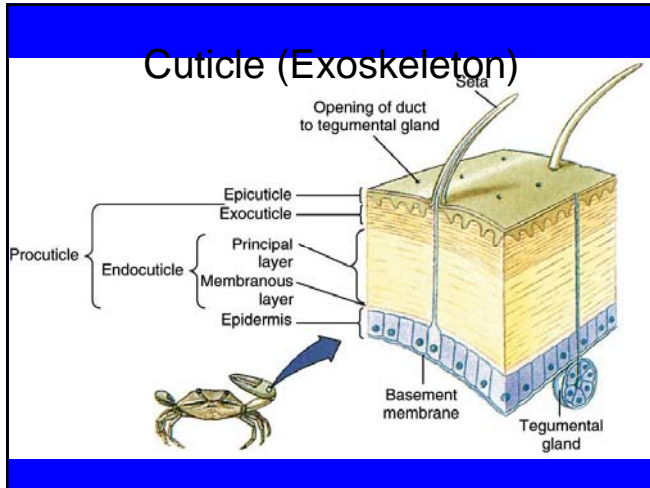


**ZOOLOGY**  
 Phylum : **Arthropoda**  
 Subphylum: **Crustacea**

- 1 pr appendages on each segment
- 2 pr maxillae
- 1 pr mandibles
- 2 pr antennae



- Nervous system –ladder like
- Modified nefridia, nefrocytes
- Colorless blood, open circulating system
- Gill breathing
- Gonochoristic
- Sexual and Asexual reproduction
- Indirect development

Kingdom (Regnum) : Animalia  
 Phylum (Phyllum) : **Arthropoda**  
 Subphylum (Subphyllum): Crustacea  
 Class (Classis): **Anostraca**

- ### Fairy shrimp (Anostraca)
- ✓ Lateral compression of the body
  - ✓ absence of carapax
  - ✓ furca at tail is appendage shaped like a leaflet
  - ✓ homonomous segmentation
  - ✓ Multifunctional thoracic limb (locomotion, eating, sensory function, and breathing)
  - ✓ Compound eyes
  - ✓ The females can produce eggs either in the usual way or via parthenogenesis.
  - ✓ Freshwater or seawater
- 
- The diagram shows a lateral view of a fairy shrimp, highlighting its segmented body and the tail furca.

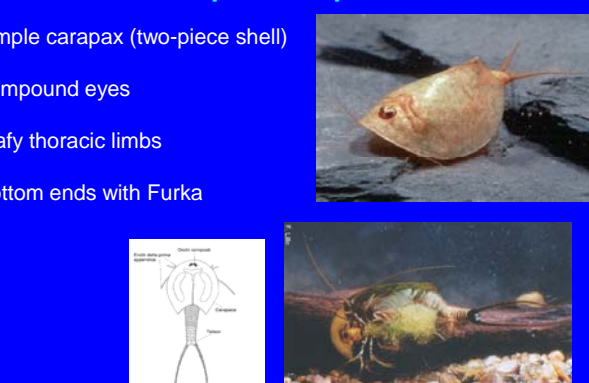
Preserved specimen in collection  
***Branchipus stagnalis***



Kingdom (Regnum) : Animalia  
 Phylum (Phyllum) : **Arthropoda**  
 Subphylum (Subphyllum): Crustacea  
 Class (Classis): **Phyllopoda**  
 1. Order (Ordo): **Notostraca**

Preserved specimen in collection  
***Lepidurus apus***

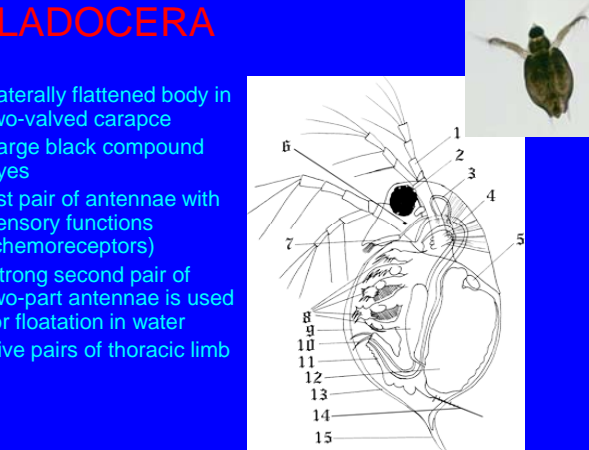
simple carapax (two-piece shell)  
 compound eyes  
 leafy thoracic limbs  
 bottom ends with Furca



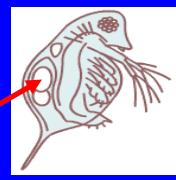
Kingdom (Regnum) : Animalia  
 Phylum (Phyllum) : **Arthropoda**  
 Subphylum (Subphyllum): Crustacea  
 Class (Classis): **Phyllopoda**  
 3. Order (Ordo): **Cladocera (water fleas)**

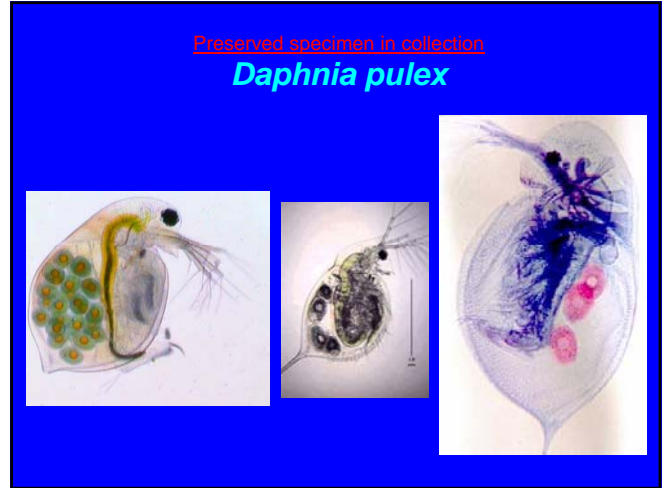
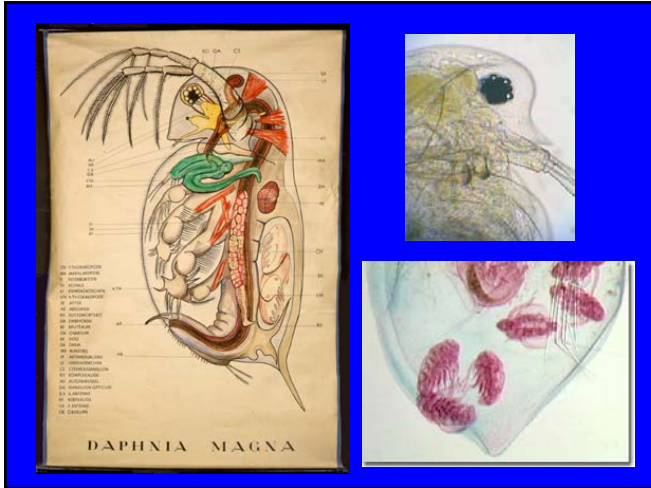
**CLADOCERA**

- ✓ Laterally flattened body in two-valved carapax
- ✓ Large black compound eyes
- ✓ 1st pair of antennae with sensory functions (chemoreceptors)
- ✓ Strong second pair of two-part antennae is used for floatation in water
- ✓ Five pairs of thoracic limb



- ✓ gonochorism, sexual dimorfism, direct development
- ✓ Variation in parthenogenesis with sexual reproduction
- ✓ females in summer produce unfertilized eggs --> from which parthenogenetic females are hatched --> under stress factor are hatched males, which is followed by sexual reproduction --> the females produce ephippium (drop-like formation containing 2 eggs passing the adverse conditions)
- ✓ filtering plankton, scraping attached algae, predators





**taxonomy**

predatory species

Filtering species

Ctenopoda

Anomopoda

A taxonomic diagram shows 'taxonomy' branching into 'predatory species' and 'Filtering species'. Below are images of a ladybug (predatory) and a copepod (filtering). Further down are images of *Monia*, *Daphnia*, *Bosminia*, and *Ceriodaphnia*.

Sididae  
Holopedidae

Chydoridae  
Bosminidae  
Daphniidae  
Moinidae

Preserved specimen in collection  
**Anomopoda**

Microscopic images of various Anomopoda species are shown, labeled with their families: (Chydoridae), (Bosminidae), (Daphniidae), (Ceriodaphnia sp.), and (Macrothricidae).

Kingdom (Regnum) : Animalia  
Phylum (Phyllum) : **Arthropoda**  
Subphylum (Subphyllum): Crustacea  
**Class (Classis): (Copepoda)**

Teardrop shaped body and large antennae  
Absence of carapax - sclerotization of body surface (CaCO<sub>3</sub>)  
Copepods have a compound, median single eye (2-3 ocelli), usually bright red and in the centre of the transparent head

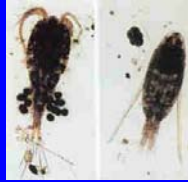
The first pair of antennae are often long and conspicuous - floatation  
Swimming with the two-part thoracic appendages

The abdomen is typically narrower than the thorax, and contains five segments without any appendages, except for some tail-like "rami" at the tip.

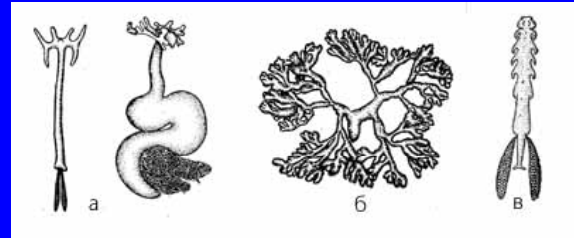
Gonochorism, sexual dimorfism - females have at the abdomen sacs filled by eggs, in male antennae or the last pair of thoracic legs are transformed into an auxiliary copulatory apparatus

They have indirect development: the nauplius larva, metanauplius, kopepodit and the adult

Preserved specimen in collection  
**Cyclops strenuus**



**Parasitic species**



Preserved specimen in collection  
**Achtheres sp.**



Kingdom (Regnum) : Animalia  
Phylum (Phyllum) : **Arthropoda**  
Subphylum (Subphyllum): Crustacea  
Class (Classia): **(Branchiura)**

**(Branchiura)**

Ectoparasites of fish  
Dorsoventrally flattened body  
Oval carapax  
4 pairs of two-part thoracic appendages serving for movement  
Head appendages adapted for parasitism (attaching to the host - jaw transformed into suction disk, spike-like mandibles)  
Finny abdomen ends by furca  
Gonochorism with direct development



Preserved specimen in collection  
**(Argulus foliaceus)**

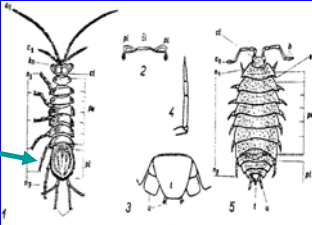


Kingdom (Regnum) : Animalia  
 Phylum (Phylum) : **Arthropoda**  
 Subphylum (Subphylum): Crustacea  
 Class (Classis): **(Malacostraca)**  
 Order (Ordo): **Isopods (Isopoda)**

They are typically flattened dorso-ventrally  
 Absence of carapax  
 Compound sessile eyes  
 Each segment bears a pair of "legs"  
 Presence of leafy respiratory appendage at the abdomen

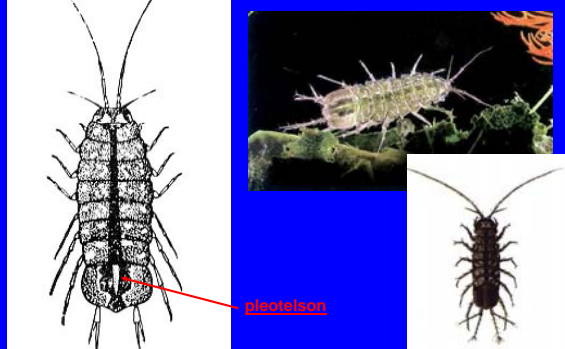
## Isopoda

- **Suborder Asellota**
- The fusion of pleonites 5, 4 and sometimes 3 to the pleotelson
- **Suborder (Oniscoidea)**
- Separated abdominal elements



Preserved specimen in collection


### Asellota (Asellus aquaticus)




pleotelson

## Oniscoidea


**(Oniscidae)** - three-part end of antenna, narrow uropods



**(Porcellionidae)** – two-part end of antenna, narrow uropods

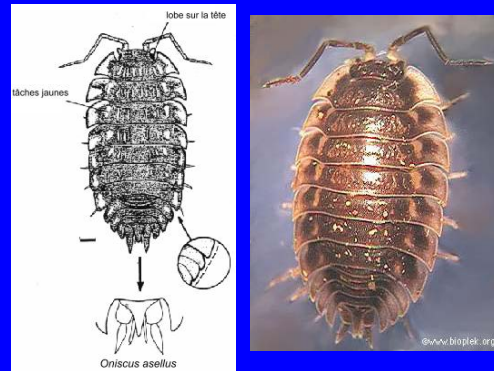


**(Armadillidiidae)** - two-part end of antenna, wide uropods



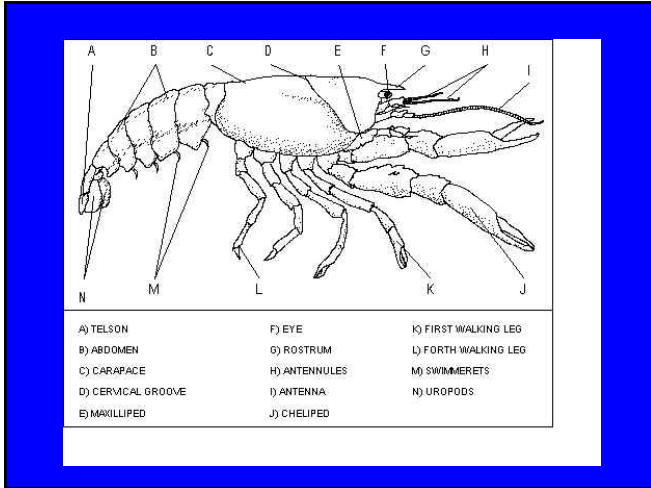
Preserved specimen in collection

### (Oniscus asellus)






Oniscus asellus





taxons:

- garnats:** garnáti a krevety 
- crayfish:** crawfish (claw), langouste (absence of claws, an extremely long antennae), lobsters (presnece of big claws) 
- crabs** 

## Reptantia of Czech Republic

**INDIGENOUS SPECIES:**  
*(Astacus astacus)* 15 - 25 cm, short, broad claws  
*(Austropotamobius torrentium)* 7-9 cm. broad claws

**INTRODUCED SPECIES:**  
*(Astacus leptodactylus)* – up to 25 cm. long narrow claws  
*(Orconectes limosus)* – from North America. Marked red stains.  
*(Pacifastacus leniusculus)* – from North America.  
*(Procambarus clarkii)* - kept in aquaculture (USA) or as aquarium species

## Determination of species from CR

Obr. 2: Hlavohrušní krunjře raků - s výjimkou raka červeného všichni žijí v našich vodách. Rak červený má na rozdíl od všech ostatních druhů sblížené žábrosrdeční švy (šipka).  
 Podle Pöckl et al. (b. v.)  
 upravil J. Mourek

## Astacus astacus

Obr. 11: Rak říční (samec) z boku. Patrné jsou dva páry postorbitálních líst (šipky). Zákolanský potok, 26. 6. 2006. Foto J. Mourek

### Austropotamobius torrentinum

**Obr. 13:** Rak kamenný (samice) - Hlavní díl těla. Patří se jemu pár podstatně větších štítků a velké špičaté brádky (2). *Stavovce* 2006, 26, 4. 2006. Foto: V. Dohal

**Obr. 13:** Rak kamenný (samice) z boku. Kamenní mají jeden pár postorbálních štítků (šipky), které se směrem dozadu postupně ztlumují. *Základní pozn. 26. 6. 2006.* Foto: V. Dohal

### Astacus leptodactylus

**Obr. 14:** Rak lebední (mladý samec). Patrně jsou dva páry postorbálních štítků (1) a velké množství drobných trnů na stranách hlavy (2). Mladí samci a samice nemají tak výrazné postorbální štítky jako imaturní stáří samců (lev. a úst. 13). *Waldhorn u Znojma 22. 7. 2006.* Foto: J. Štroupek

### Orconectes limosus


Invasive species

**Obr. 17:** Rak americký - Hlavní anatómické znaky jsou příčně členěné pařezy zobákových štítků a tříleté období spánku od srpna listopadu. *Waldhorn u Znojma 22. 7. 2006.* Foto: J. Štroupek


### Homarus americanus

### Panulirus interruptus


### Crab development




**Eggs**  
A close-up of a few of the millions of eggs produced in a single batch. At 12 days old the pigmented eye is obvious, and they are near to hatching. Each egg is about 0.3 mm in diameter.



**Zoea 1**  
The first zoeal stage has a body length of about 1.2mm, is very photo-positive and can swim rapidly. Duration 3 - 4 days. Zoea are carnivorous and feed on zooplankton



**Megalopa**  
Large claws have developed to capture prey. About mid-way through this stage it settles out of the plankton and moves inshore. Duration 7 - 9 days



**1st crab**  
The first crab stage is around 4mm long and weighs only 13 mg; it does not yet have the typical adult shape. Duration 3 - 4 days. Crabs continue to moult and grow very quickly. In aquaculture they can mature and spawn by six months of age.

## Eriocheir sinensis