Isopod Crustaceans
Suborder Asellota
Superfamily Janiroidea

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The Asellota, subfamily Janiroidea

- Diversity and Morphology
- Phylogenetic relationships and age
- Where to find them and how to collect them; What to expect in California
- How to identify Asellota; survey of common families
- Key to the families of the Asellota; interactive identification with DELTA INTKEY
What is a Janiroidean isopod?

- Isopod of the suborder Asellota
  - Pleon with one large merged somite, consisting minimally of telson + pleonites 3-6, anterior pleonites extremely short and ring-like
  - Male pleopod I and II highly transformed for sperm transfer; pleopod II geniculate

- Superfamily Janiroidea
  - Male pleopod I fused into single unit with sperm tube medially; pleopod II stylet form with sperm tube
  - Pereopod I carpus enlarged, not primitively propodo-subchelate
  - Pleopods I (when present) and II form operculum over remaining pleopods
Isopoda Asellota: a diverse suborder of crustaceans

- More than 2,200 species described
- >1650 species in superfamily Janiroidea
- ~58% are deep-sea

Typical shallow marine Asellotan, genus *Stenetrium*
Janiroidea: Known species richness of families

- Munnopsidae Lilljeborg, 1864
- Desmosomatidae G. O. Sars, 1897
- Haploniscidae Hansen, 1916
- Ischnomesidae Hansen, 1916
- Nannonicidae Hansen, 1916
- Macrostylidae Hansen, 1916
- Janirellidae Menzies, 1956
- Dendrotionidae Vanhöffen, 1914
- Janiroidea incertae sedis
- Mesosignidae Schultz, 1969
- Haplonunnidae Wilson, 1976
- Katianiridae Svavarsson, 1987
- Thambematidae Stebbing, 1913
- Echinothambematidae Menzies, 1956
- Mictosomatidae Wolff, 1965
- Xenosellidae Just, 2005
- Acanthaspidiidae Menzies, 1962
- Janiridae Sars, 1897
- Joeropsididae Nordenstam, 1933
- Microparasellidae Karaman, 1933
- Munnidae Sars, 1897
- Paramunnidae Vanhöffen, 1914
- Pleurocopidae Fresi & Schiecke, 1972
- Santiidae Wilson, 1987
Deep-sea Isopoda: (Asellota, Janiroidea)

- Desmosomatidae
- Dendrocionidae
- Ischnomesidae
- Echinothambematidae
- Macrostylidae
- Munnopsidae
- Haplomunnidae
Unusual Adaptations

Munnopsidae, benthopelagic species

- *Munnopsurus*

- *Paropsurus*

Credits:
Monterey Bay Research Inst.

Credits:
Karen Osborn
Some morphologies are so strange that we can only guess or imagine what they do on the sea floor!

Artist's impression of *Thylakogaster* on the abyssal plain
Relationships of Janiroidean families
Isopod have a fossil history extending back to the Paleozoic.

*Hesslerella*,
Middle Pennsylvanian,
Essex fauna, Mazon Creek
Bayesian analysis

Lins et al., submitted
Where to find Asellota in shallow marine habitats

- Marine plants and other biotic substrates (e.g., sponges, tunicates, hydroids)
  - Diver collections in plastic bags
- Epibiotics (e.g., Echinoderms, large isopods)
- Among gravel, rocks & cobbles, shallow sublittoral
  - Bucket washes; air lift
- Soft sediments, typically on surface
  - Grabs, corers, biological dredges & sleds

[See species list handouts]
Sampling probability: abyssal box coring, Pacific Ocean

Isopod Families
CCFZ box corer samples
N=81 samples
Preservation

- Depends on aims of collection
- Morphological studies
  - Aldehydes (buffered formaldehyde, gluteraldehyde solutions), transfer to >80% ethanol for general study
- Genetics
  - Pure ethanol, cold storage
- Both
  - Pure ethanol, but with ~5% glycerin to minimize brittleness
Morphology/Anatomy

- Much of janiroidean morphological diversity involves general body form
- Good news:
  - Janiroideans can be identified to genus- or species-level without dissection;
  - fragments can be identified to family or genus-level
- Bad news:
  - much of the literature was done by those unfamiliar with Asellota, so many important features are not illustrated well
  - For environmental studies using morphospecies counts, this may be less important
General point: Identification of closely related species

- Within narrowly defined regions, species can be identified comparatively.
- Co-occurring congeners often have differing phenotypes.
- Between regions, species differences can be subtle.
- “Cryptic” species only exist if you don't look for differences.
Important character complexes to consider in identifications

- Head frontal margin
- Basal articles of antenna, antennula
- Pereopod I: how distal articles rotate or oppose one another; robustness; setation & spines
- Position of coxae and projections (spines, plates, lappets) on tergites
- Body segments: setation, spines and projections; relative shape; tagmosis (integrated groups of segments)
- Pleotelson: shape relative to last pereonite, spines setation, position of anus and opercular pleopods
- Uropods
Pereopod I grasping

- Basal taxa (Aselloidea, Stenetrioidea) opposing segments between dactylus (d) and propodus (p)
- Most janiroideans: propodus+dactylus oppose the carpus
- Some have opposition between all three segments (e.g., Munnidae)
Dactylar Claws (= unguis)

- Basal taxa have two nearly equal sized claws
- Janiridae have 3 claws
- Most others have 2 claws, with ventral claw (2) reduced or modified in various ways
Isopod head with mouthparts

- Antennula
- Antenna
- Labrum
- Mandible palp
- Mandible
- Maxillula
- Maxillipeds
- Maxilla
- (removed)
Head frontal margin

- Head frontal margin projecting anteriorly
  - Without frontal lobes
  - With frontal lobes
- Head frontal margin not projecting anteriorly
  - Without rostrum
  - With rostrum
Antennula emerging from head basal article directed:

1) Anteriorly (e.g., Janiridae)
2) Anterodorsally (e.g., Haplomunnidae)
3) Anterodorsally and laterally (e.g., Echinothambematidae)
4) Anterolaterally or laterally (e.g., Paramunnidae)
5) Posterodorsally (e.g., Macrostylidae)
Antennae geniculate

Paramunnidae

Joeropsididae

Haploniscidae

Janiridae

Not Geniculate
Position of coxa IV on body

- Pereopod IV coxae inserting on mediolateral margin; associated pereonite is often short
- Pereopod IV coxae inserting on anterolateral margin; associated pereonite is often somewhat elongate
Natasome (= Munnopsidae)

Posterior pereonites 5-7 and pleon integrated into natasome, dorsal surface vaulted, with enlarged pereonal musculature

- Eurycope
- Munnopsurus
- Acanthocope
- Storhyngura

Posterior pereonites 5-7 serially homolous and not especially integrated with pleon, pereonal musculature not distinctly enlarged

- Janira
- Santia
- Thambema
Survey of more common families

- Focus on shallow water and more common deep sea families. Fresh water and non-janirotean families omitted for now.
- A few rare families are mentioned
- Data currently based on exemplar species and genera, usually the type species of several genera
- DELTA database discussed at end is a work in progress.
Janiridae

- Primarily shallow water group
- Can occur in high densities in patches
- Colorful if viewed alive – speckled pigment patches
- Sexual dimorphism in pereopod I or size
Janiridae, *sensu stricto*

Look for 3 claws on walking legs and elongate carpus on the first leg.

**Tropical and subtropical Carpias**
Janirids as currently classified but probably belong in another family-level group.

- *Ectias turqueti*
- *Caecianiropsis psammophila*
- *Microjanira dentifrons*
Joeropsididae

- Many species in *Joeropsis*, with rarer southern hemisphere genera
- Pigment patterns useful for distinguishing species
- Micropredators on benthic copepods
Other Joeropsididae

**Scaphojoeropsis**

Figure 14. *Scaphojoeropsis multicarinata* gen. nov., sp. nov., holotype. c, cephalon, anterolateral view; ptd, apex of pleotelson, dorsal view; ptv, apex of pleotelson, ventral view, setae omitted. Habitus scale bar: 1 mm.

**Rugojoeeropsis**

Figure 8. *Rugojoeeropsis rugosa* gen. nov., sp. nov., holotype. a, antennae (1 and 2, right, dorsal view); up, uropod, left, ventral view. Habitus scale bar: 1 mm.
Acanthaspidiidae

- Group transitional to deep water
- Shallower occurring species have eyes
Janirellidae

- Deep-sea epibenthic
- May be found on hard substrates or manganese nodules
- Large bodied species frequent
- Projections or spines on all lateral margins
Munnidae

- Epibenthic, quick runners ("squirrels of the sea")
- Pedunculate eyes
- Long legs and antennae usually lost in sampling

Munnidae, *Munna* sp.

*Salvatiella*
Munnidae

- Zoromunna: Not all munnids have eyes
Santiidae (syn: Antiasidae)

- Benthic, hard substrates typically
- Related to Munnidae; pedunculate eyes; pereopod I propodocarposubchelate
- Uropod always with protopod, but can be uniramous
Paramunnidae

- Epibenthic, shallow marine to deep-sea
- Pedunculate eyes, antennula lateral
- Typically flattened, but not always
- Highest diversity in southern hemisphere

Paramunna bilobata
Other Paramunnidae

Pentaceration lancifera

Paramunnidae, Pleurogonium californiense

FIGURE 6. Pentaceration lancifera sp. nov. Holotype, ♂, p1, peraeopod 1, p2 – 2, pleopods 1 and 2, pt v, pleotelson ventral
Dendrotonidae

- Rarer group, transitional to deep-sea
- Shallow water genera with eyes
- Pereopod I may be secondarily propodo-subchelate
Haplomunnidae

- Morphologically diverse family
- Strictly deep-sea epibenthic
- Rare in most areas
- Related to Dendrotonidae but with tiny uropods and typically spinier bodies

Thylakogaster lobotourus

Haplomunna hubbsi

Abyssaranea rupis
Pleurocopidae

- Tiny inhabitant of hard or biotic shallow water substrates
- Micropredator
- Propodo-subchelate perepod I
- Thin pedunculate eyes
Munnopsidae

- Good swimmers
- Elongate anterior legs and antennae are usually lost in collection
- Most are epibenthic but with many holopelagic or benthopelagic species (see Osborn list)
- Some genera lack natapods on pers V-VII
Other Munnopsidae

Munnopsidae
subfamily
Ilyarachninae
Ilyarachna
acarina

1 mm

Munnopsidae
Munnopsurus sp.A

antennula

uropod

male pleopod I

Benthopelagic Munnopsidae

- **Munnopsurus**

- **Paropsurus** – giants of the family

Credits:
- Monterey Bay Research Inst.
- Karen Osborn
Nannoniscidae

- Benthic deep-sea
- Always with projecting frons and biramous uropods
- Varying degrees of loss of articulation in the posterior pereonites and pleotelson

*Nannoniscidae Nannonisconus latepleonous*

*Thaumastasoma sp.*
Other Nannoniscidae

*Nannoniscus oblongus*

*Exiliniscus hansenii*

**FIGURE 2.** *Nannoniscus oblongus* Sars. 1870 (Hjeltefjord Norway, AM P.74562), adult male, all parts drawn in situ. A: body, dorsal and lateral view. C: left antennula, dorsal view. D: right pereopod I. E: right pereopod VII. Scale bars: A, B, 0.5 mm; C–E, 0.1 mm.

Desmosomatidae

- Benthic deep-sea but can be found on outer shelf
- After Munnopsidae, most diverse family
- Appear similar to Nannonicidae, but always with coxae at margin of pereon
Other Desmosomatidae
Ischnomesidae

- Deep-sea benthic
- Body always thin and elongate, especially pereonite 5
- Legs similar throughout, except for pereopod I, which is usually robust, carposubchelate
Haploniscidae

- Most “isopod” of the deep-sea isopods; walking legs all similar; body typically with continuous margin
- Head frontal margin not projecting, but clypeus often robust
- Varying loss of articulations in posterior pereonites
- Some species can enroll

Haploniscus bicuspis

Hydroniscus sp. 527 GoM
Other Haploniscidae

Haploniscus castillatus

Figure 2. Haploniscus castillatus sp. nov., holotype, male, K40766, 3.9 mm: A, dorsal view; B, anterior body, straight dorsal view; C, lateral view; D, posterior body, straight dorsal view; E, posterior body, ventral view.

Antennuloniscus menziesi

cl
**Macrostylidae**

- Deep-sea infaunal, burrower
- Fossosome
- Uropods elongate uniramous, stiff; often lost
- Over 70 described species, but many more unknown
- Being revised

**Figure 1.** *Macrostylis dorsatella* n. sp. A-E, holotype. A, dorsal habitus, include ornamentation and fine setation omitted. B, left pereopod III ischium, close-up. C, pleotelson, ventral. D, right uropod, close-up. E, lateral habitus. Scales: A, D-E = 1 mm, B-C = 0.5 mm.
Other rare taxa

- Xostylus
- Dactylostylis
- Trichopleon
- Mictosoma, Mictosomatidae
- Xenosella, Xenosellidae
Key to the Janiroidean families

- Derived from a Mesquite phylogenetic database
- Converted to a DELTA database of exemplar species
- Converted to a family database and key generated
- BETA version – work in progress!
- Interactive identification using INTKEY (part of the DELTA system)
End