Pinnotheridae de Haan, 1833

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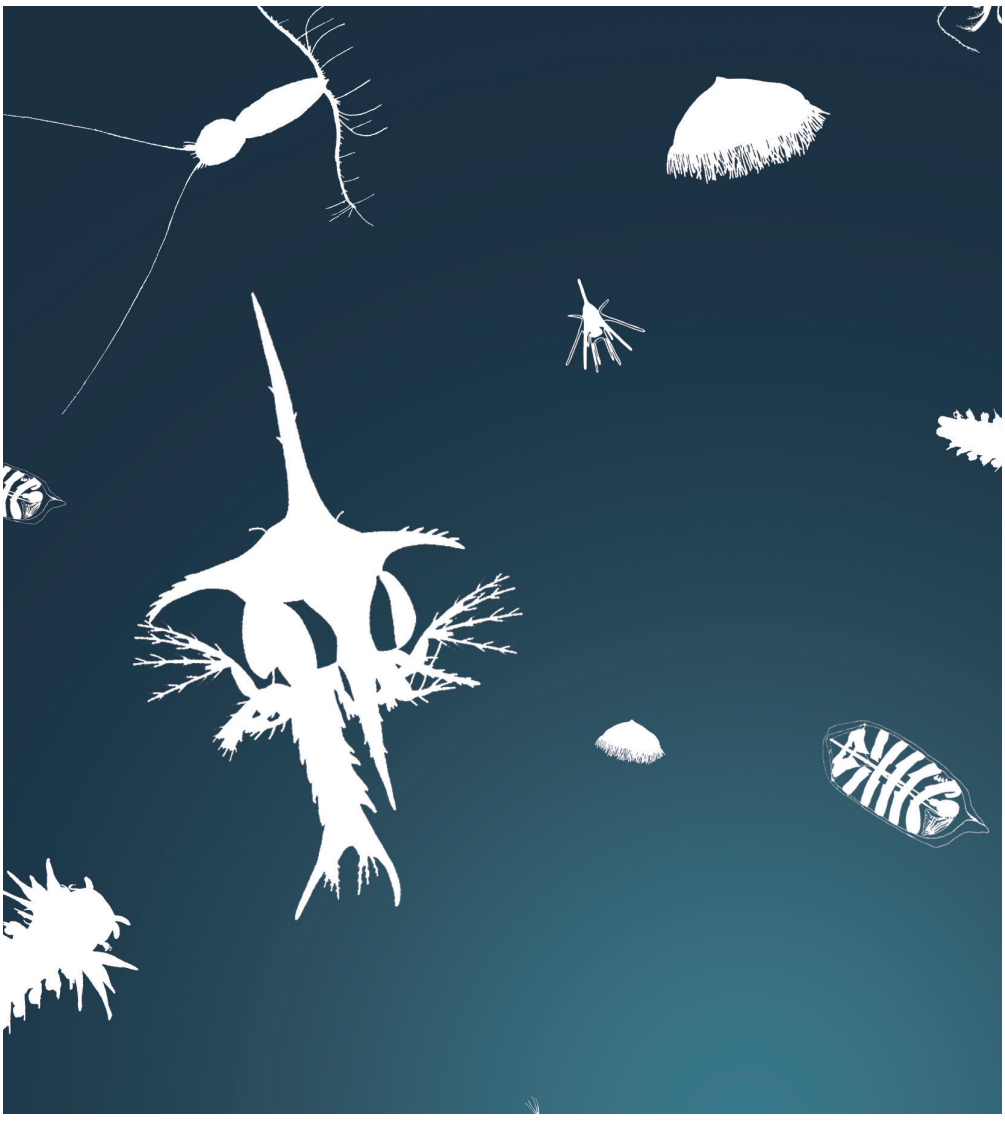

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Decapoda

Suborder: **Pleocyemata**

Infraorder: **Brachyura**

Section: **Eubrachyura**

Subsection: **Thoracothremata**

Family: **Pinnotheridae de Haan, 1833**

Author: Juan Ignacio González-Gordillo and Jose A. Cuesta

1 Summary

Pinnotheridae comprises a diverse group of small crabs that live as symbionts with invertebrates. All Pinnotheridae are marine species with a worldwide distribution, living in close relationship with their hosts. Independently of the type of host or symbiotic relationship (parasitic, commensalistic), all species with known larval development present free-living larval stages (except *Tunicotheres moseri*, where larval stages develop in the abdominal enclosure of the parental female). The larval development comprises a zoea phase, with a variable number of stages (2–5), and a megalopa phase with a single stage. Approximately 290 pinnotherid species have been described, and information on larval developmental stages is available for 54 of them. This leaflet presents the distinctive features of the larval stages for 12 out of 13 species distributed in ICES area: *Pinnixulala retinens*, *Pinnixa cylindrica*, *P. lunzi*, *Rathbunixa sayana*, *Tubicolixa chaetopterana*, *Afropinnotheres monodi*, *Dissodactylus mellitae*, *Nepinnotheres pinnotheres*, *Pinnotheres bicristatus*, *P. pectunculi*, *P. pisum*, *Tumidotheres maculatus*, and *Zaops ostreus*. Complete larval development is only known for 6 of these species. Illustrated keys to identify the known zoea and megalopa stages are included.

2 Introduction

Family Pinnotheridae de Haan, 1833 belongs to the brachyuran subsection Thoracotremata Guinot, 1977. Members of Pinnotheridae are small crabs that live as endo- or ectosymbionts of invertebrates (molluscs, echinoderms, annelids, and other crustaceans; Schmitt *et al*., 1973). The symbiotic way of life, sexual dimorphism, and small size of these crabs has complicated their taxonomic classification (Becker and Türkay, 2010). The systematics of pinnotherids has been the subject of numerous revisions at different taxonomic levels (Rathbun, 1918; Balss, 1957; Manning, 1993; Ahyong and Ng, 2009; Campos, 2009; Becker and Türkay, 2010; Palacios Theil *et al*., 2016). These revisions have been based mainly on adult morphology. However, Marques and Pohle (1995), and Pohle and Marques (1998) utilized pinnotherid larval morphology when conducting phylogenetic studies; while the more recent reviews are based on molecular studies (Palacios Theil *et al*., 2016; Tsang *et al*., 2018; Palacios Theil and Felder, 2020). Pinnotheridae comprises 290 species, but larval data are available for only 54 of them (Clark and Cuesta, 2015).

Considering all changes proposed in the latest studies (Ahyong, 2018; Ng *et al*., 2019; Palacios Theil and Felder, 2020), pinnotherids are currently placed into 58 genera in 3 subfamilies. However, some generic- and subfamilial-level assignments require further studies.

Listed below are the species belonging to the Pinnotheridae family which are currently recorded in ICES area. The taxonomic status is according to WoRMS (2019):

ORDER DECAPODA

Family Pinnotheridae de Haan, 1833

Subfamily Pinnixulalinae Palacios Theil, Cuesta and Felder, 2016

Pinnixulala retinens (Rathbun, 1918)

Subfamily Pinnixinae Števcic, 2005

Pinnixa cylindrica (Say, 1818)

Pinnixa lunzi Glassell, 1937

Rathbunixa sayana (Stimpson, 1860)

Tubicolixa chaetopterana (Stimpson, 1860)

Subfamily Pinnotherinae de Haan, 1833

Afropinnotheres monodi Manning, 1993

Dissodactylus mellitae (Rathbun, 1900)

Nepinnotheres pinnotheres (Linnaeus, 1758)

Pinnotheres bicristatus García-Raso and Cuesta, 2019

Pinnotheres pectunculi Hesse, 1872

Pinnotheres pisum (Linnaeus, 1767)

Tumidotheres maculatus (Say, 1818)

Zaops ostreus (Say, 1817)

3 Distribution

Afropinnotheres monodi

ICES area distribution: from the Gulf of Cadiz (Spain) to Cascais (Portugal; Perez-Miguel, 2018).

Worldwide distribution: Atlantic – Bay of Cansado and Port-Ètienne (Mauritania), Moulay Bou Selham lagoon, mouth of the Oued Massa (Sous, Morocco); Gulf of Cadiz (Spain); from southern Portugal to Cascais (Portugal); Mediterranean – Alborán Sea (from Benalmádena to Caleta de Vélez; Perez-Miguel, 2018).

Hosts: *Cerastoderma edule*, *C. glaucum*, *Chamelea gallina*, *Donax trunculus*, *Eastonia rugosa*, *Mactra stultorum*, *Magallana gigas*, *Mytilus galloprovincialis*, *Polititapes aureus*, *Ruditapes decussatus*, *Scrobicularia plana*, *Spisula solida*, and *Venerupis corrugate* (Perez-Miguel, 2018).

Dissodactylus mellitae	ICES area distribution: from Massachusetts to Virginia (USA; Palacios Theil *et al*., 2016). Worldwide distribution: from Massachusetts to South Carolina, Northwest Florida, Texas (USA; Palacios Theil *et al*., 2016). Hosts: *Mellita quinquesperforata*, *Echinarachnius parma*, *Encope michelini*, and *Clypeaster subdepressus* (Griffith, 1987).
Nepinnotheres pinnotheres	ICES area distribution: from Gulf of Cadiz (Spain) to Ireland (Perez-Miguel, 2018). Worldwide distribution: Atlantic – from Mauritania to Ireland; Mediterranean – from Alborán to Marmara Sea (Perez-Miguel *et al*., 2019). Hosts: *Ascidia mentula*, *A. virginea*, *Halocynthia papillosa*, *Microcosmos* spp., *Phallusia mammillata*, *Atrina pectinata*, and *Pinna nobilis* (Perez-Miguel *et al*., 2019).
Pinnixa cylindrica	ICES area distribution: USA, from Massachusetts (Schmitt *et al*., 1973) to Chesapeake Bay (Rathbun, 1918). Worldwide distribution: from Massachusetts to South Carolina, west and northwest Florida (USA; Schmitt *et al*., 1973), Gulf of Mexico (Felder *et al*., 2009). Host: *Arenicola cristata* (Schmitt *et al*., 1973).
Pinnixa lunzi	ICES area distribution: Virginia (USA; Williams, 1984). Worldwide distribution: off Delmarva Peninsula, Virginia, North and South Carolina, Georgia; off Mississippi River Delta, Seven and One-Half Fathom Reef off Texas (USA; Williams, 1984). Host: *Thalassema hartmani* (Schmitt *et al*., 1973).
Pinnixulala retinens	ICES area distribution: Chesapeake Bay, South Carolina (USA; Palacios Theil *et al*., 2016). Worldwide distribution: Delaware Bay (Watling and Maurer, 1976); Little River Inlet, South Carolina; Alligator Harbor, Florida; Aransas area of Texas coast (Williams, 1984); Chesapeake Bay, South Carolina; Fort Pierce, Florida (USA); Barra del Tordo (Mexico; Palacios Theil *et al*., 2016). Hosts: symbionts living in *Upogebia affinis* galleries and worm burrows (Palacios Theil *et al*., 2016).
Pinnotheres bicristatus	ICES area distribution: Gulf of Cadiz (Spain; Cuesta *et al*., 2019). Worldwide distribution: Atlantic – Gulf of Cadiz (Spain); Mediterranean – Alborán Sea (Spain; Cuesta *et al*., 2019). Host: *Anomia ephippium* (Cuesta *et al*., 2019).
Pinnotheres pectunculi	ICES area distribution: Brittany coast (France; Becker and Türkay, 2010). Worldwide distribution: Atlantic – Brittany coast (France; Becker and Türkay, 2010); Mediterranean – San Roque, Torrox, and Nerja, Alborán Sea (Spain; Perez-Miguel *et al*., 2019).

Hosts: *Chamalea gallina, Clausinella fasciata, Glycymeris glycymeris, Venus casina,* and *V. verrucosa* (Perez-Miguel *et al*., 2019).

Pinnotheres pisum

ICES area distribution: from the Gulf of Cadiz (Spain) to the North Sea and southern Scandinavia (Triay-Portella *et al*., 2018).

Worldwide distribution: Atlantic – Canary Islands (Spain), from the Gulf of Cadiz (Spain) to the North Sea and southern Scandinavia; Mediterranean – from Alborán to Marmara Sea (Triay-Portella *et al*., 2018).

Hosts: *Acanthocardia echinata*, *Arctica islandica*, *Arenomya arenaria*, *Atrina pectinata*, *Chamelea gallina*, *Ch. striatula*, *Cerastoderma edule*, *C. glaucum*, *Donax trunculus*, *D. variegata*, *D. venustus*, *D. vittatus*, *Gari fervensis, Laevicardium crassum, Lutraria lutraria, Mactra stultorum, Modiolus modiolus, Mya arenaria, Mytilus edulis, M. galloprovincialis, Ostrea edulis, Pinna nobilis, Ruditapes decussatus, Spisula solida, S. elliptica, S. subtruncata,* and *Venus verrucosa* (Perez-Miguel *et al*., 2019).

Rathbunixa sayana

ICES area distribution: USA, from Vineyard Sound (Massachusetts) to Virginia (Camp *et al*., 1977).

Worldwide distribution: from Vineyard Sound (Massachusetts) to Beaufort (North Carolina); Hutchinson Island (East Central Florida; Camp *et al*., 1977); from Sarasota Bay (Florida) to Grand Isle (Louisiana; USA); Amapa, Para, Pernambuco, São Paulo (Brazil; Williams, 1984).

Hosts: symbionts living in the burrows of worms and mud shrimp (Palacios Theil *et al*., 2016).

Tubicolixa chaetopterana

ICES area distribution: USA, from Wellfleet (Massachusetts) to Virginia (Williams, 1984).

Worldwide distribution: Wellfleet (Massachusetts, USA) to Rio Grande do Sul (Brazil; Williams, 1984).

Hosts: *Amphitrite ornata*, *Chaetopterus variopedatus*, and *Lepidophthalmus louisianensis* (Palacios Theil *et al*., 2016).

Tumidotheres maculatus

ICES area distribution: from Massachusetts to Virginia (USA, Palacios Theil *et al*., 2016).

Worldwide distribution: from Massachusetts to south Florida, from west Florida to Texas (USA); northwest Cuba, Jamaica, Puerto Rico, Virgin Islands, Bocas del Toro (Panama), Twin Cays (Belize), Uruguay, Argentina (Palacios Theil *et al*., 2016).

Hosts: *Mya arenaria, Modiolus americanus, M. modiolus, Mytilus edulis, M. edulis platensis, Perna perna, Ostrea puelchana, Anomia simplex, Aequipecten tehuelchus, Argopecten gibbus, A. irradians, Placopecten magellanicus, Atrina rigida, A. seminuda, A. serrata,* and *Chama macerophylla* (Palacios Theil *et al*., 2016).

Zaops ostreus

ICES area distribution: from Massachusetts to Virginia (USA; Palacios Theil *et al*., 2016).

Worldwide distribution: from Massachusetts to south Florida, Texas (USA); northwest Cuba, Guadeloupe, Bocas del Toro (Panama), Twin Cays (Belize), from Pernambuco to Santa Catarina (Brazil; Palacios Theil *et al*., 2016).

Hosts: *Crassostrea virginica, C. rhizophorae, Anomia simplex, Mytilus edulis, Pecten* spp., and, occasionally, living as symbionts in *Chaetopterus* spp. tubes (Palacios Theil *et al*., 2016).

4 Number and general morphology of larval stages

The larval development of pinnotherids involves two larval phases: zoea and megalopa. The zoea phase is characterized by a globose carapace and a pleon. The pleon, together with the maxillipeds, is used for motility in a synchronous manner.

The zoea phase includes several larval stages (zoea stages). Unlike other families of crabs, whose larvae show certain distinctive characteristics for the entire group, pinnotherid zoea larvae exhibit high morphological variability among different species. For example, the carapace may bear dorsal and lateral spines, only lateral spines, or it can be naked; pleonal dorsal knobs may appear on pleonite II, or on pleonite II and III; and the telson can be furcated, trilobated, or furcated with a central lobe. This morphological variability among species is also evident in the number of zoea stages, which may range from 2 to 5. The best way to distinguish pinnotherid zoea stages is to consider the setation of exopodites of maxillipeds I and II, and the degree of pleopodal development. A comparison between these features is shown in Table 1.

The megalopa phase includes only one larval stage, which is easily recognizable by its crab-like form, with a depressed carapace and well developed pereiopods.

Larval diagnostic features

Characteristics of the zoeal stages:

i) All possible combinations of spines on the carapace, from all absent to all present. When lateral spines are present, they are inserted posteriorly, close to the ventral margin of the carapace, and directed backwards.

ii) Antennae can be absent or strongly reduced to a small protopod. In case of reduction, an exopod can be present as a small seta. In other cases, the protopodal process can be well developed, with or without an exopod. When the exopod is present, it is reduced to a small seta.

iii) Maxillule endopod with 0, 4 setae on the proximal and distal segments, respectively.

iv) Maxilla endopod with 1 + 2 setae. Zoea I with 4 + 1 marginal setae on the exopod (scaphognatite).

v) Maxilliped I basis with 2 + 2 + (2 or 3) + 3 setae. Zoea I with 2, 2, 1, 2, 5 setae on the endopod.

vi) Maxilliped II basis with (0/1) + 1 + 1 + 1 setae and 0, 5 setae on the endopod.

vii) Pleon with or without lateral expansions or distolateral processes on pleonite V.

viii) Dorsolateral knobs on pleonite II, or pleonite II and III.

ix) Telson variable. Three main types:

a) trilobated,

b) furcated with or without spines on furcae,

c) furcated with a median lobe; with or without spines on furcae.

Characteristics of the megalopa stage:

i) Antennal flagellum short, with 2–4 segments.

ii) Mandibular palp absent, or when present, 2-segmented with variable setation 0, 0–16.

iii) Maxilliped II endopod with 4 segments, distal segment inserted subterminally.

iv) Maxilliped III endopod without dactylus or very reduced, sometimes inserted subterminally.

v) Pleon with 5 or 6 pleonites.

vi) Pleopodal endopods with 2–3 cincinnuli.

vii) Uropods absent.

Selected references of larval descriptions

A selection of relevant papers is listed below for the identification of pinnotherid larvae species in ICES area.

- ***Rathbunixa sayana***: Under previous scientific name *Pinnixa sayana*; Sandifer (1972), brief description of zoeal stages (ZI–ZV) from plankton specimens.
- ***Tubicolixa chaetopterana***: Under previous scientific name *Pinnixa chaetopterana*; Sandifer (1972), brief description of zoeal stages (ZI–ZV) from plankton specimens.
- ***Afropinnotheres monodi***: Marco-Herrero *et al*. (2016), complete description of larval stages (ZI–ZIV + M) reared in the laboratory.
- ***Dissodactylus mellitae***: Marques and Pohle (1996), complete description of larval stages (ZI–ZIII/ZIV + M) reared in the laboratory.
- ***Nepinnotheres pinnotheres***: Under previous scientific name *Pinnotheres pinnotheres*; Atkins (1955), complete description of larval stages (ZI–ZII + M) reared in the laboratory and collected from plankton.
- ***Pinnotheres bicristatus***: Marco-Herrero *et al*. (2018), as *Pinnotheres* spp., description of larval stages (ZII–ZIV + M) collected from plankton and identified by DNA barcoding.
- ***Pinnotheres pisum***: Atkins (1955), complete description of larval stages (ZI–ZIV + M) reared in the laboratory and collected from plankton.
- ***Tumidotheres maculatus***: Under previous scientific name *Pinnotheres maculatus*; Costlow and Bookhout (1966), complete description of larval stages (ZI–ZV + M) reared in the laboratory.
- ***Zaops ostreus***: Under previous scientific name *Pinnotheres ostreum*; Sandoz and Hopkins (1947), complete description of larval stages (ZI–ZV + M) reared in the laboratory.

Listed below are pinnotherid species in ICES area for which larval descriptions are not available or are incomplete:

- ***Pinnixulala retinens***: Palacios Theil *et al*. (2016), only description of pleon and antenna of zoea I.
- ***Pinnixa cylindrica***: Sandifer (1972), brief description of ZI reared in the laboratory.
- ***Pinnixa lunzi***: No larval data.
- ***Pinnotheres pectunculi***: No larval description, only confocal images of zoea I (lateral view; Becker, 2010).

5 Taxonomic key

Zoeal stages

1. Telson trilobated (Figure 7b)…… **2**
Telson bifurcated (Figure 1b)……..... **6**

2. Dorsal and lateral spines of the carapace absent (Figure 4a, 7a, 7b)…….. **3**
Dorsal and lateral spines of the carapace present (Figure 1a, 2a, 2c, 3a, 5, 9b)……. **5**

3. Rostral spine well developed (Figure 6)……... ***Pinnotheres pisum***
Rostral spine reduced, not easily visible (Figure 4a)…… **4**

4. Inner pair of serrulate setae of telson longer than medial lobe (Figure 4b)..……
…… ***Pinnotheres bicristatus***
Inner pair of serrulate setae of telson shorter than medial lobe (Figure 7b)…….
……. ***Zaops ostreus***

5. Zoea I with pereiopods and pleopod buds, zoea II with pereiopods and pleopod buds elongated (last zoea stage)……... ***Nepinnotheres pinnotheres***
Zoea I and zoea II without pereiopods and pleopod buds; these appear in zoea III, and are elongated in zoea IV (last zoea stage; Figure 8)……...
…… ***Afropinnotheres monodi***

6. Fifth pleonite laterally expanded (Figure 1b)…… **7**
No lateral expansion of the fifth pleonite (Figure 10a)……. **9**

7. Telson with a medial lobe well developed (Figure 1b)…….. ***Tubicolixa chaetopterana***
Telson without medial lobe (Figure 2b)…….. **8**

8. Distance between tips of telson furcae < telson width (Figure 2b)…….....
……. ***Rathbunixa sayana***
Distance between tips of telson furcae > telson width (Figure 3b)…….....
……. ***Pinnixa cylindrica***

9. Dorsal spine well developed and longer than rostral spine. Telson furcae without dorsal spines (Figure 10b)…… ***Tumidotheres maculatus***
Dorsal spine shorter than rostral spine. Telson furcae with one pair of small dorsal spines (Figure 9a)…… ***Dissodactylus mellitae***

Megalopa stage

1. Carapace with dorsal spines present (Figure 11a, 11b)…….. ***Tumidotheres maculatus***
Carapace without dorsal spines (Figure 12, 13a–17a)…….... **2**

2. Antennal flagellum 3 articulated (Figure 13b, 17b)……..... **3**
Antennal flagellum 2 articulated (Figure 14b–16b)……... **4**

3. Long terminal setae only on distal article of antennal flagellum (Figure 13b)…….
……. ***Pinnotheres pisum***
Long terminal setae on the two last terminal articles of the antennal flagellum (Figure 17b)……... ***Afropinnotheres monodi***

4. Distal article of the antennal flagellum with 1 long terminal seta (Figure 15b)
……... ***Dissodactylus mellitae***
Distal article of the antennal flagellum with 2–3 terminal setae (Figure 14b, 16b) **5**

5. Distal article of the antennal flagellum with 2 long terminal and 1 shorter subterminal setae (Figure 16b)……... ***Pinnotheres bicristatus***
Distal article of the antennal flagellum with 1 long and 1 short terminal setae (Figure 14b)……. **6**

6. Carapace with tubercles/protuberances, especially one developed on the cardiac region (Figure 14a)……. ***Nepinnotheres pinnotheres***
Carapace without well-defined tubercles or protuberances (Figure 12)……
……. ***Zaops ostreus***

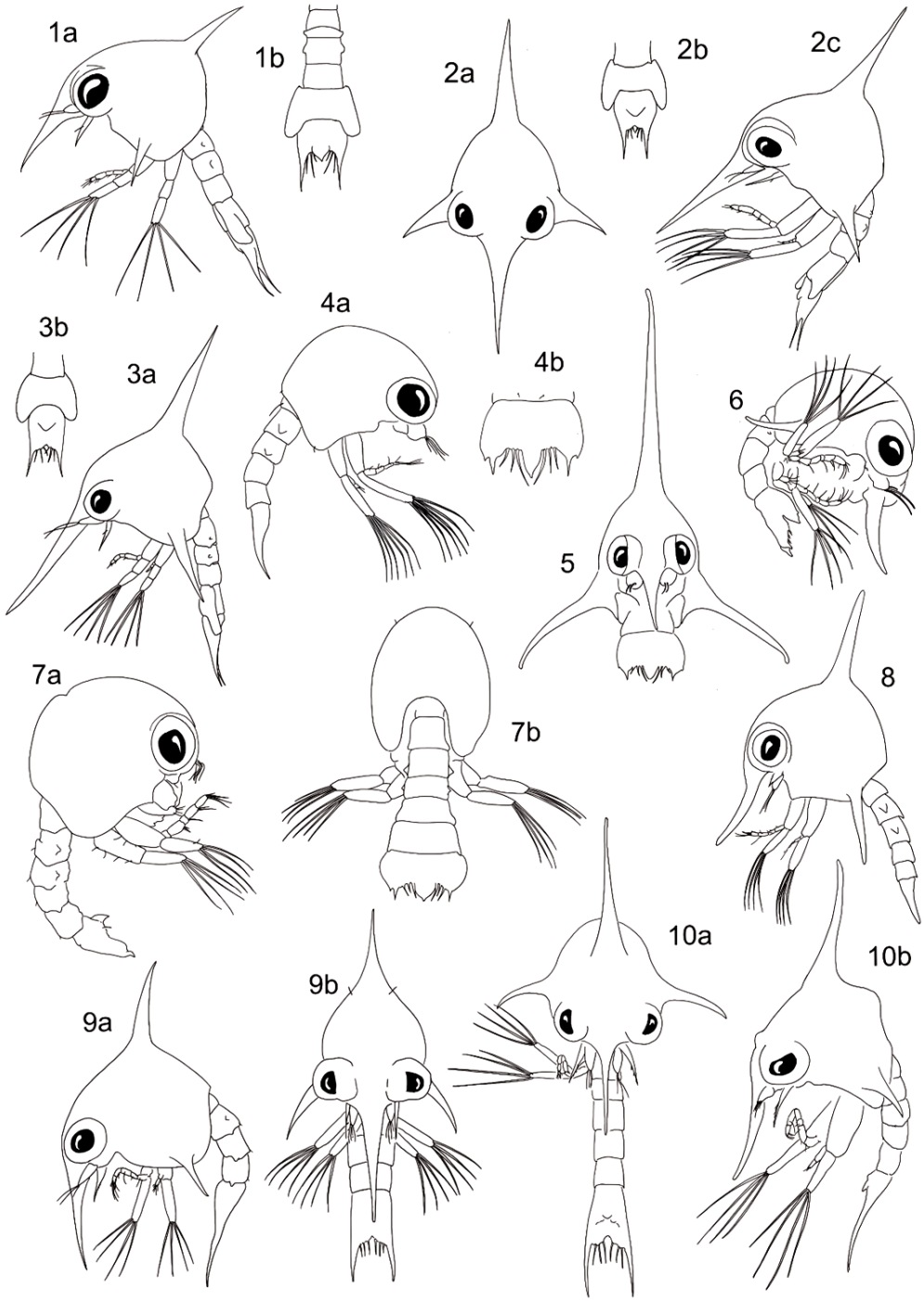
6 Table

Table 1. Distinctive features of pinnotherid zoeal stages, recorded in ICES area.

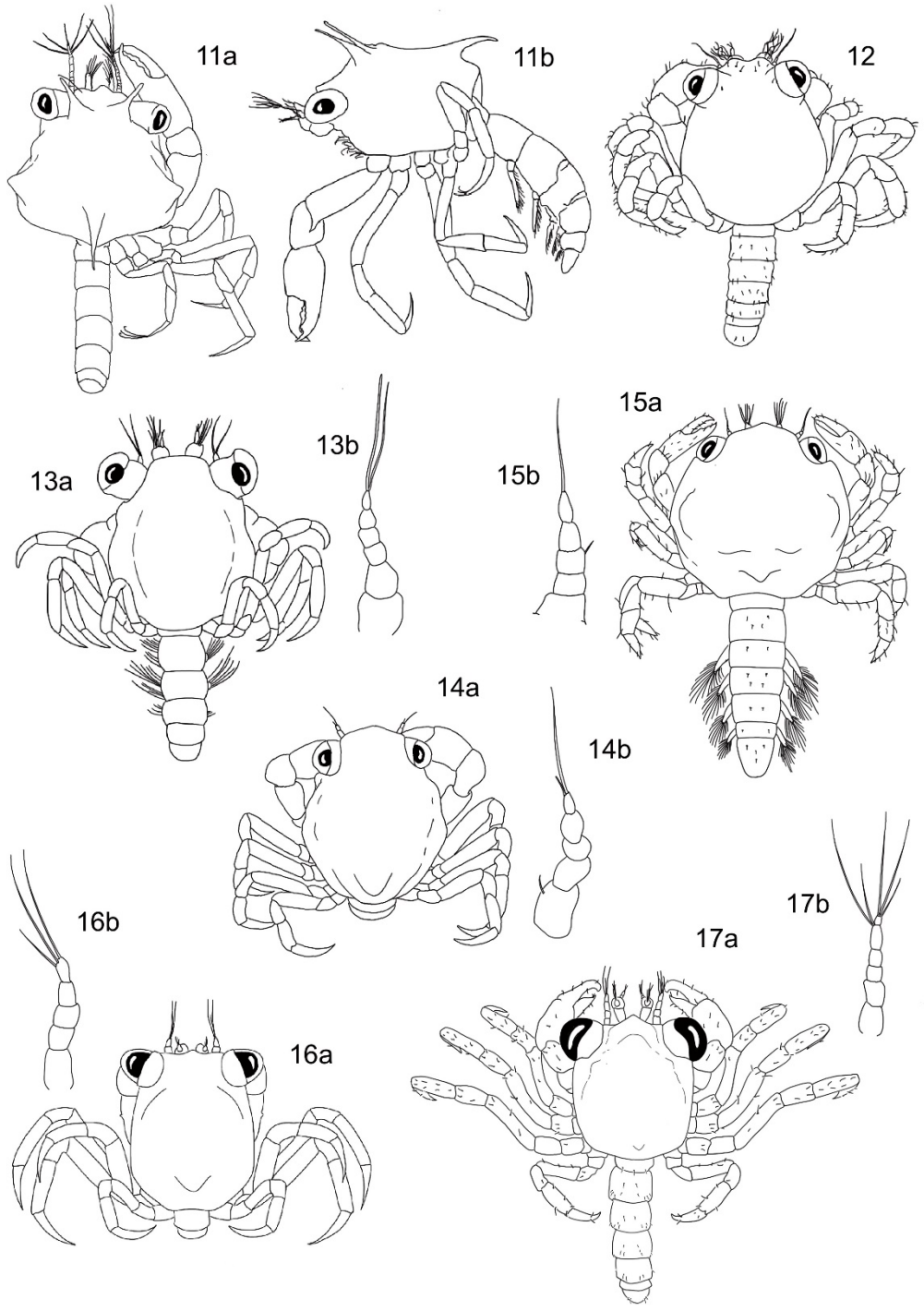
Species	Number of zoea stages	Setation of Mxp I *	Stage with uniramous pleopod buds	Stage with biramous pleopod buds
Afropinnotheres monodi	4	4,6,8,9	ZIII	ZIV
Dissodactylus mellitae	4	4,6,8,9-10	ZIV	-
Nepinnotheres pinnotheres	2	4,6	ZII	-
Pinnixa cylindrica	no data	4	no data	no data
Pinnixa lunzi	no data	-	no data	no data
Pinnixulala retinens	no data	no data	no data	no data
Pinnotheres bicristatus	4	4,6,7-8,7-8	ZIII	ZIV
Pinnotheres. pectunculi	no data	4	no data	no data
Pinnotheres. pisum	4	4,6,8,8-9	ZIV	-
Rathbunixa. sayana	5	4,6,8-9,10,10	ZIV	ZV
Tubicolixa chaetopterana	5	4,6,8,10,10	ZIV	ZV
Tumidotheres maculatus	5	4,6,8,9,9	ZIV	ZV
Zaops ostreus	4	4,6,8,10	ZIII	no data

* Distal setation of the exopodite of maxiliped I (Mxp I) is shown for each zoea stage from zoea I, separated by commas.

7 Figures



Figures 1–10. General morphology of Pinnotheridae zoeae: 1. *Tubicolixa chaetopterana* (ZI), 1a. lateral view, 1b. pleon; 2. *Rathbunixa sayana* (ZI), 2a. frontal view, 2b. posterior part of pleon, 2c. lateral view; 3. *Pinnixa cylindrica* (ZI), 3a. lateral view, 3b. posterior part of pleon; 4. *Pinnotheres bicristatus* (ZII), 4a, lateral view, 4b, telson; 5. *Nepinnotheres pinnotheres* (ZI), frontal view; 6. *Pinnotheres pisum* (ZI), ventrolateral view; 7. *Zaops ostreus* (ZI), 7a. lateral view, 7b. posterior view; 8. *Afropinnotheres monodi* (ZI), lateral view; 9. *Dissodactylus mellitae* (ZI), 9a. lateral view, 9b. frontal view; 10. *Tumidotheres maculatus* (ZI), 10a. frontal view, 10b. lateral view. All figures redrawn from: 1, Sandifer (1972) as *Pinnixa chaetopterana*; 2, Sandifer (1972) as *Pinnixa sayana*; 3, Sandifer (1972) as *Pinnixa cylindrica*; 4, Marco-Herrero *et al.* (2017) as *Pinnotheres* spp.; 5, Atkins (1955) as *Pinnotheres pinnotheres*; 6, Atkins (1955); 7, Sandoz and Hopkins (1947) as *Pinnotheres ostreum*; 8, Marcos-Herrero *et al.* (2016); 9, Marques and Pohle (1996); 10, Costlow and Bookhout (1966) as *Pinnotheres maculatus*. Drawings not to scale.



Figures 11–17. General morphology of *Pinnotheridae* megalopa: 11. *Tumidotheres maculatus*, 11a. dorsal view, 11b. lateral view; 12. *Zaops ostreus*, dorsal view; 13. *Pinnotheres pisum*, 13a. dorsal view, 13b. antenna; 14. *Nepinnotheres pinnotheres*, 14a. dorsal view, 14b. antenna; 15. *Dissodactylus mellitae*, 15a. dorsal view, 15b. antenna; 16. *Pinnotheres bicristatus*, 16a. dorsal view, 16b. antenna; 17. *Afropinnotheres monodi*, 17a. dorsal view, 17b. antenna. All figures redrawn from: 11, Costlow and Bookhout (1966) as *Pinnotheres maculatus*; 12, Sandoz and Hopkins (1947) as *Pinnotheres ostreum*; 13, Atkins (1955); 14, Atkins (1955) as *Pinnotheres pinnotheres*; 15, Marques and Pohle (1996); 16, Marco-Herrero *et al*. (2017) as *Pinnotheres* spp.; 17, Marco-Herrero *et al*. (2016). Drawings not to scale.

8 Links to further information

WoRMS

Afropinnotheres monodi	http://www.marinespecies.org/aphia.php?p=taxdetails&id=241175
Dissodactylus mellitae	http://www.marinespecies.org/aphia.php?p=taxdetails&id=158412
Nepinnotheres pinnotheres	http://www.marinespecies.org/aphia.php?p=taxdetails&id=107469
Pinnixa cylindrica	http://www.marinespecies.org/aphia.php?p=taxdetails&id=158447
Pinnixa lunzi	http://www.marinespecies.org/aphia.php?p=taxdetails&id=158449
Pinnixulala retinens	http://www.marinespecies.org/aphia.php?p=taxdetails&id=1264347
Pinnotheres bicristatus	http://www.marinespecies.org/aphia.php?p=taxdetails&id=1361098
Pinnotheres pisum	http://www.marinespecies.org/aphia.php?p=taxdetails&id=107473
Pinnotheres pectunculi	http://www.marinespecies.org/aphia.php?p=taxdetails&id=107472
Rathbunixa sayana	http://www.marinespecies.org/aphia.php?p=taxdetails&id=1424659
Tubicolixa chaetopterana	http://www.marinespecies.org/aphia.php?p=taxdetails&id=1424673
Tumidotheres maculatus	http://www.marinespecies.org/aphia.php?p=taxdetails&id=158460
Zaops ostreus	http://www.marinespecies.org/aphia.php?p=taxdetails&id=445250

Molecular information

Selected 16S and COI DNA barcode sequences of the species from the family Pinnotheridae, present in ICES area. In the cases where several sequences existed for the same species, links are presented for all sequences, and for selected 16S and COI DNA barcode sequences. The selection was performed based on the following criteria: when several sequences existed for the same species: (i) most recent and/or longest sequence, (ii) the sequence included in previous phylogenetic studies, and (iii) testing by BLAST. All 16S and COI DNA barcode sequences are adopted from Genbank, and were tested by BLAST.

Afropinnotheres monodi	https://www.ncbi.nlm.nih.gov/nuccore/?term=txid1699869[Organism:noexp]
16S sequence	https://www.ncbi.nlm.nih.gov/nuccore/KU679625
COI sequence	https://www.ncbi.nlm.nih.gov/nuccore/MF134397

Dissodactylus mellitae	https://www.ncbi.nlm.nih.gov/nuccore/?term=txid1912799[Organism:noexp]
16S sequence	https://www.ncbi.nlm.nih.gov/nuccore/KU679651
COI sequence	No data
Nepinnotheres pinnotheres	https://www.ncbi.nlm.nih.gov/nuccore/?term=txid585942[Organism:noexp]
16S sequence	https://www.ncbi.nlm.nih.gov/nuccore/EU935001
COI sequence	https://www.ncbi.nlm.nih.gov/nuccore/MF134398
Pinnixa cylindrica	https://www.ncbi.nlm.nih.gov/nuccore/?term=txid585913[Organism:noexp]
16S sequence	KU679690-94 (sequence code range)
COI sequence	No data
Pinnixa lunzi	No data
Pinnixulala retinens	https://www.ncbi.nlm.nih.gov/nuccore/?term=txid764359[Organism:noexp]
16S sequences	https://www.ncbi.nlm.nih.gov/nuccore/KU679638
	https://www.ncbi.nlm.nih.gov/nuccore/KU679639
COI sequence	No data
Pinnotheres bicristatus	https://www.ncbi.nlm.nih.gov/Taxonomy/Browser/wwwtax.cgi?id=2507654
16S sequences	MK426940-44 (sequence code range)
COI sequences	MK468903-07 (sequence code range)
Pinnotheres pisum	https://www.ncbi.nlm.nih.gov/nuccore/?term=txid364894[Organism:noexp]
16S sequences	https://www.ncbi.nlm.nih.gov/nuccore/KU679724
	https://www.ncbi.nlm.nih.gov/nuccore/KU679725
COI sequence	https://www.ncbi.nlm.nih.gov/nuccore/MK308325
Pinnotheres pectunculi	https://www.ncbi.nlm.nih.gov/nuccore/?term=txid2003343[Organism:noexp]
16S sequences	https://www.ncbi.nlm.nih.gov/nuccore/MF069147

	https://www.ncbi.nlm.nih.gov/nuccore/MF069148
COI sequences	https://www.ncbi.nlm.nih.gov/nuccore/MF134395
Rathbunixa sayana	https://www.ncbi.nlm.nih.gov/nuccore/?term=txid585920[Organism:noexp]
16S sequences	https://www.ncbi.nlm.nih.gov/nuccore/KU679719
	https://www.ncbi.nlm.nih.gov/nuccore/KU679720
COI sequences	No data
Tubicolixa chaetopterana	https://www.ncbi.nlm.nih.gov/nuccore/?term=txid585912[Organism:noexp]
16S sequences	KU679708-14 (sequence code range)
COI sequences	No data
Tumidotheres maculatus	https://www.ncbi.nlm.nih.gov/nuccore/?term=txid585956[Organism:noexp]
16S sequences	KU679631-35 (sequence code range)
COI sequence	https://www.ncbi.nlm.nih.gov/nuccore/MF490123
Zaops ostreus	https://www.ncbi.nlm.nih.gov/nuccore/?term=txid1912812[Organism:noexp]
16S sequences	KU679653-58 (sequence code range)
COI sequence	KU172690-92 (sequence code range)

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