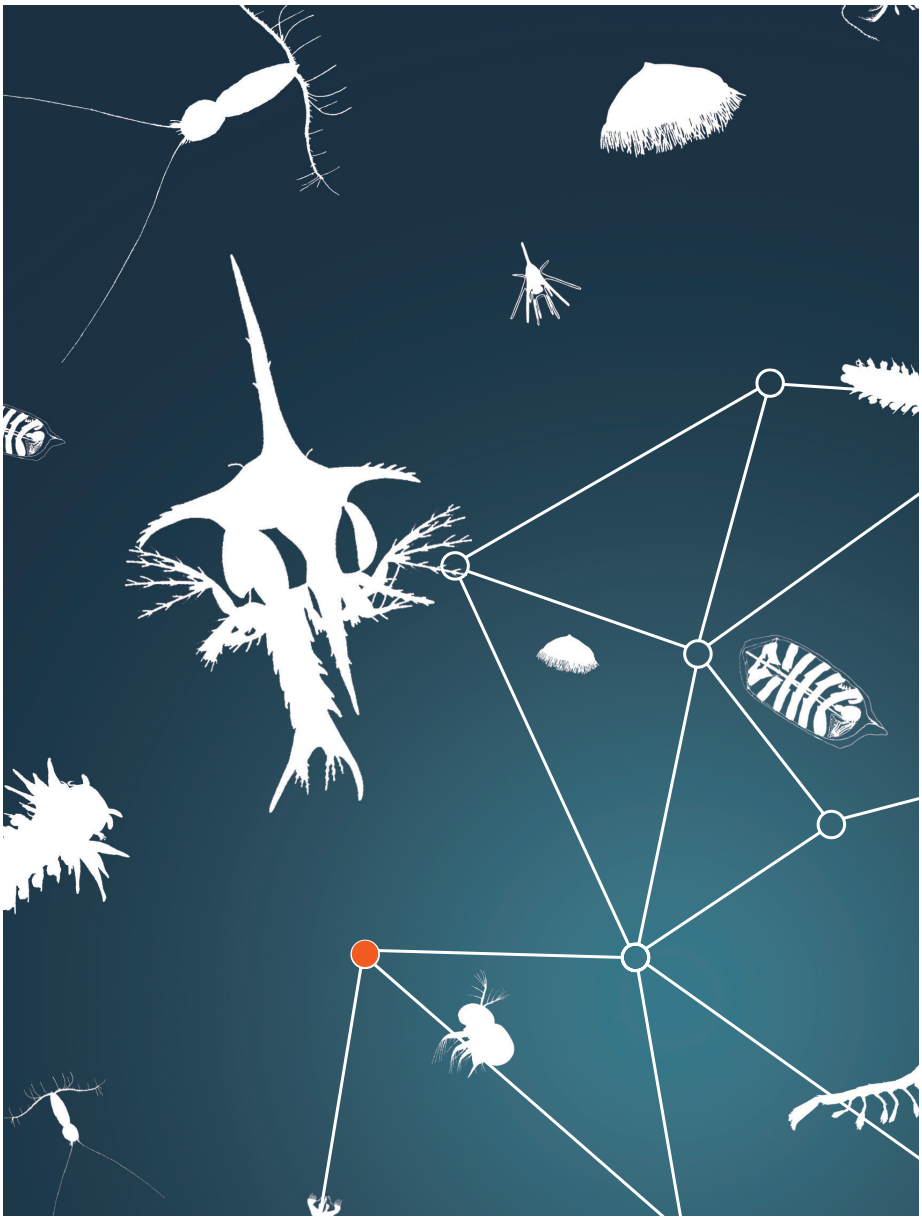
188 MAY 2019

Oithona Baird, 1843

ICES IDENTIFICATION LEAFLETS FOR PLANKTON



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Maria Grazia Mazzocchi

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Contents

1 Abstract **2**

2 Introduction **2**

3 Distribution **4**

4 Key to the *Oithona* species present in the ICES regions (after Nishida, 1985) **6**

5 Table **8**

6 Figures **9**

7 Links **11**

7.1 Links to WoRMS 11

7.2 Link to molecular information 11

7.3 Other useful links 11

8 Acknowledgements **12**

9 Terminology **13**

10 References **14**

10.1 Further reading 15

11 Author contact details **16**

Copepoda

Order: Cyclopoida
Family: Oithonidae Dana, 1853
Genus: *Oithona* Baird, 1843

Maria Grazia Mazzocchi

1 Abstract

Oithonids are abundant cyclopoid copepods that are common in marine planktonic communities worldwide. They occur over a wide latitudinal range in coastal and offshore waters, both in epipelagic and mesopelagic zones of the open ocean, as well as in brackish areas. Most species are less than 1 mm in body length and are most efficiently captured by small-mesh nets (< 200 μm). This leaflet presents the taxonomic and ecological characteristics of 14 *Oithona* species that are widely distributed in the North Atlantic and the Mediterranean Sea: *O. atlantica*, *O. brevicornis*, *O. davisae*, *O. colcarva*, *O. decipiens*, *O. longispina*, *O. nana*, *O. parvula*, *O. plumifera*, *O. robusta*, *O. setigera*, *O. similis*-group, *O. tenuis,* and *O. vivida*. The family Oithonidae is also briefly presented, together with a taxonomic key to distinguish among the three genera that belong to it. This work is largely based on the paper by Nishida (1985), the book by Boxshall and Halsey (2004), and the extensive information provided by the website on marine planktonic copepods by Razouls *et al*. (2005–2018). This is a new leaflet.

2 Introduction

The oithonids are abundant and common components of marine planktonic communities worldwide. They occur over a wide latitudinal range and variety of ecosystems, from estuaries to coastal and offshore waters, including both epipelagic and mesopelagic zones of the open ocean. Most species are less than 1 mm in body length and are most efficiently captured by small-mesh nets (< 200 μm). However, because of their great abundance, they account for a high percentage of copepod numbers in mesozooplankton samples (≥ 200 μm). The rich array of long and/or plumose setae on their appendages and their motion patterns, characterized by sinking and jumps, make them particularly suited to perceive mechanical signals generated by moving prey, which they capture with an ambush feeding mode.

The family Oithonidae Dana, 1853 represents a planktonic lineage derived from cyclopinid-like benthic ancestors and currently includes three genera: *Oithona* Baird, 1843, *Dioithona* Kiefer, 1935 and *Limnoithona* Burckhardt, 1913. The genus *Paroithona* Farran, 1908 is considered a synonym of *Oithona* after the family revision by Abiahy (2000). The three genera can be distinguished based on the following characters (Boxshall and Halsey, 2004):

1. P5 2-segmented, with 3 or 4 spines/setae on distal (exopodal) segment…….. ***Limnoithona* Burckhardt, 1913**

P5 with at most 2 setae on the free exopodal segment…… **2**

2. Free exopodal segment of mandibular palp with 5 setae; free exopodal segment of P5 with 2 apical setae; male lacking cephalosome flap organ…… ***Dioithona* Kiefer, 1935**

Free endopodal segment of mandibular palp with 2 to 4 setae; free exopodal segment of P5 usually with only 1 seta, if 2 setae present then outer spine on middle exopodal segment of P3 and P4 lacking; male with cephalosome flap organ…… ***Oithona* Baird, 1843**

Limnoithona inhabits fresh and brackish waters of China and was introduced into the west coast of North America in the early 1990s. *Dioithona* occurs mostly in tropical marine and brackish waters and can form dense swarm in coral reefs and between submerged mangrove roots. *Oithona* is the most species rich genus of the family and includes 44+ species of which 20 are reported in the ICES area and 23 in the Mediterranean Sea.

In *Oithona*, as in all cyclopoids, the major articulation of the body occurs between the 4th and the 5th pedigerous somites. Female has prosome 5-segmented (cephalosome + 4 free pedigerous somites); anterior end of head rounded or produced into a pointed rostrum; Th4 posterior margin rounded; urosome slender, 5-segmented (excluding caudal rami) with the genital double-somite longest; setae on P4 Ri modified, bearing a flange. Male has prosome 5-segmented; anterior end of head rounded in lateral view, truncate in dorsal view; urosome 6-segmented; lateral posterior margin of cephalosome usually produced posteriorly into a flap organ; A1 with two geniculations.

The developmental stages have been described for a few *Oithona* species, i.e., *O. nana* (Murphy, 1923), *O. brevicornis* (Uchima, 1979), nauplii of *O. atlantica, O. plumifera,* and *O. similis* (Takahashi and Uchiyama, 2007). Original and published information on copepodites of *O. nana* and *O. similis* have been collated in the identification guide of Conway (2012).

Only *Oithona* adult females are presented in this leaflet. Males are much less abundant or rare, and likely less represented in samples since they are not retained by the nets due to their smaller size. For some species, males are not yet described.

The diagnostic characters for species identification in *Oithona* females are: 1) the shape of the rostrum and caudal rami, 2) the number of Se on Re P1-P4, and 3) the armature and development of Md and Mx1. The most practical characters for routine diagnosis of the most common species are the rostrum and the setation of the swimming legs.

This leaflet presents the taxonomic and ecological characteristics of the 14 *Oithona* species that are widely distributed in the North Atlantic and the Mediterranean Sea: *O. atlantica*, *O. brevicornis*, *O. davisae*, *O. colcarva*, *O. decipiens*, *O. longispina*, *O. nana*, *O. parvula*, *O. plumifera*, *O. robusta*, *O. setigera*, *O. similis*-group, *O. tenuis, and O. vivida*.

3 Distribution

O. atlantica (F: 0.60-1.43 mm); epi-mesopelagic; present in the entire world ocean from the Arctic to the Antarctic, including the ICES area and the Mediterranean Sea. Not yet reported only in the central south Atlantic and in the Gulf of Thailand, Malaysia-Indonesia–Philippines.

O. brevicornis (F: 0.48-0.79 mm); epipelagic; marine and brackish; present from ~ 50° N to ~ 40° S; within this latitudinal range, not reported in the central tropical Pacific, Australia and central south Atlantic. Present in the southern margin of the ICES area and in the Mediterranean Sea.

O. colcarva (F: 0.48-0.75 mm); in coastal and estuarine waters; present in the Caribbean Sea, Sargasso Sea, Cape Cod, Nova Scotia, Newfoundland, recently recorded in the eastern Mediterranean Sea.

O. davisae (F: 0.49-0.62 mm); inlet species; considered as an example of introduced species in North America and Chile, probably by transoceanic ships coming from Asia; first record in the Atlantic Ocean in early 2000s, as probable recent introduction; invader expanding along the Black Sea coast since 2009 (Temnykh and Nishida, 2012); probably invasive in the northern Wadden Sea (North Sea) (Cornils and Wend-Heckmann, 2015).

O. decipiens (F: 0.55-0.81 mm) epi-mesopelagic; present from ~ 50° N to ~ 40° S with the exclusion of Chile, Brazil and Argentina, central south Atlantic, Gulf of Guinea and Australia.

O. longispina (F: 0.92-1.55 mm); epipelagic; widely distributed from ~ 40° N to ~ 40° S in the Pacific Ocean and in the Mediterranean Sea; reported only from the central-south sector of the Atlantic Ocean.

O. nana (F: 0.31-0.95 mm); cosmopolitan; euryhaline, epipelagic; distributed in neritic waters, estuaries, and harbours, but present also in open waters; distributed in the whole world ocean with the exclusion of sub-Antarctic and Antarctic.

O. parvula (F: 0.45-0.50 mm); epi- to bathypelagic; distributed from ~ 40° N to ~ 40° S; in the ICES area, present off W Hebrides Islands, in coastal western Ireland, Norway and in the Mediterranean Sea.

O. plumifera (F: 0.83-1.54 mm); marine, sometimes brackish; epipelagic; widely distributed from ~ 50° N to the Antarctic. Not present in the Arctic.

O. robusta (F: 1.40-1.65 mm); epi-mesopelagic; reported from ~ 40° N to ~ 40° S; not present in high latitudes; not reported (yet) in the ICES area.

O. setigera (F: 1.10-2.04 mm); epi-mesopelagic, bathypelagic; present in the world ocean from ~ 50° N to ~ 50° S, with the exclusion of the Arctic and Antarctic oceans.

O. similis - group	(F: 0.43-1.20 mm); epi- to bathypelagic; cosmopolitan distribution but with preference for cold waters, temperate and high latitudes. Recent studies have highlighted genetic and morphological differences between *Oithona similis* populations from different areas, which indicates that this is not a truly cosmopolitan species but a complex of several cryptic or pseudo-cryptic species (Cornils et al., 2017; Cepeda et al., 2012);
O. tenuis	(F: 0.96-1.37 mm); epipelagic; distributed from ~ 40° N to ~ 40° S; present in the Mediterranean Sea, not reported in the ICES area.
O. vivida	(F: 0.68-0.83 mm); epipelagic; distributed from ~ 40° N to ~ 40° S; present in the Mediterranean Sea, not reported in the ICES area, in Chile, Brazil, Argentina, central south Atlantic and Australia.

4 Key to the *Oithona* species present in the ICES regions (after Nishida, 1985)

1. Head produced into pointed rostrum; posteroventral margin of caudal ramus naked……..... **2**

Head rounded or produced into pointed rostrum; posteroventral margin of caudal ramus serrate……. **10**

2. P3 Re2 with 1 Se……... **3**

P3 Re2 without Se……..... **4**

3. Rostrum produced ventrally; P1 B2 without inner distal marginal seta; P1-P3 Re3 with 3 Se…… ***O. robusta* Giesbrecht, 1891**

Rostrum produced anteriorly; P1 B2 with 1 inner distal marginal seta; anterior 1/3 of genital double-somite swollen laterally with anterior part of swelling rounded……. ***O. vivida* Farran, 1913**

4. Rostrum produced anteriorly, visible dorsally……... **5**

Rostrum produced ventrally, not visible dorsally…….. **9**

5. P1 Re3 with 3 Se; P2 Re2 without Se; Re3 with 2 Se ***O. setigera* (Dana, 1849)**

P1 Re3 with 2 Se…….. **6**

6. P2-P4 Re1 with 1 Se; P2-P4 B1 without distal inner marginal seta; in lateral view, head produced antero-ventrally into gradually narrowing rostrum…… ***O. tenuis* Rosendorn, 1917**

P2-P4 Re1 without Se…….. **7**

7. Genital double-somite with tuft of hairs……... ***O. plumifera* Baird, 1843**

Genital double-somite without tuft of hairs…… **8**

8. P4 Re3 distal Se curved near the base; its length < 0.75 times the terminal spine…… ***O. atlantica* Farran, 1908**

Re3 distal Se straight near the base; its length > 0.85 times the terminal spine…….. ***O. longispina* Nishida, 1977**

9. P1 Re2 with 1 Se……..... ***O. similis* Claus, 1866**

P1 Re2 without Se…… ***O. decipiens* Farran, 1913**

10. P1 - P4 Ri 2-segmented; rostrum rounded in lateral view; P2 Ri2 with 5, P3 Ri2 with 4-5 inner marginal setae……. ***O. parvula* (Farran, 1908)**

P1-P4 Ri 3-segmented……. **11**

11. P4 Re3 with 1-2 Se; Md B2 with 1 thick spine and 1 slender seta on distal margin; A2 B1-2 with 2 moderately thick and 1 minute seta; Mx1 Li1 distal marginal seta short, not extending to tip of Li3 terminal spinulose seta…… ***O. nana* Giesbrecht, 1892**

P4 Re3 with 1-2 Se; Md B2 with 2 thick spines or 2 blunt hooks; A2 B1-2 with 2 moderately thick setae only without 1 minute seta; P3 Re3 with 3 Se; P4 Re1-3 with 1, 1, 2 Se; P5 free segment with 1 terminal seta…… **12**

12. Rostrum rounded in ventral view; bluntly pointed in lateral view..... …… ***O. colcarva* Bowman, 1975**

Rostrum sharply pointed in ventral view…… **13**

13. Genital double-somite and urosome segment 3 with dorsal transverse row of setules; genital double-somite with lateral hairs; Mx1 Ri with 3 setae……..... ***O. brevicornis* Giesbrecht, 1891**

Genital double-somite and urosome segment 3 without dorsal transverse row of setules or lateral hairs; Mx1 Ri with 1 seta……. ……. ***O. davisae* Ferrari & Orsi, 1984**

5 Table

Table 1. Comparative summary of the head shape (p, pointed; r, rounded; NVD, rostrum not visible dorsally) and of the number of outer marginal spines (Se) on the exopod (Re) segments 1–3 of the swimming legs 1–4 (P1–4) in the females of *Oithona* species presented in this leaflet.

Species	Head	P1	P2	P3	P4
O. atlantica	p	1,1,2	1,0,2	1,0,1	0,0,1
O. brevicornis	p, NVD	1,1,3	1,1,3	1,1,3	1,1,2
O. colcarva	p, NVD	1,1,3	1,1,3	1,1,3	1,1,2
O. davisae	p, NVD	1,1,3	1,1,3	1,1,3	1,1,2
O. decipiens	p, NVD	1,0,2	1,1,2	1,0,1	0,0,0
O. longispina	p	1,1,2	1,0,2	1,0,1	0,0,1
O. nana	r	1,1,3	1,1,3	1,1,3	1,1,2
O. parvula	r	1,1,2	1,1,2	1,1,2	1,1,1
O. plumifera	p	1,1,2	1,0,2	1,0,1	0,0,1
O. robusta	p	1,1,3	1,1,3	1,1,3	1,1,2
O. setigera	p	1,1,3	1,0,2	1,0,1	0,0,1
O. similis	p, NVD	1,1,2	1,0,1	1,0,1	0,0,1
O. tenuis	p	1,1,2	1,0,2	1,0,1	0,0,1
O. vivida	p	1,1,3	1,1,3	1,1,2	1,1,2

6 Figures

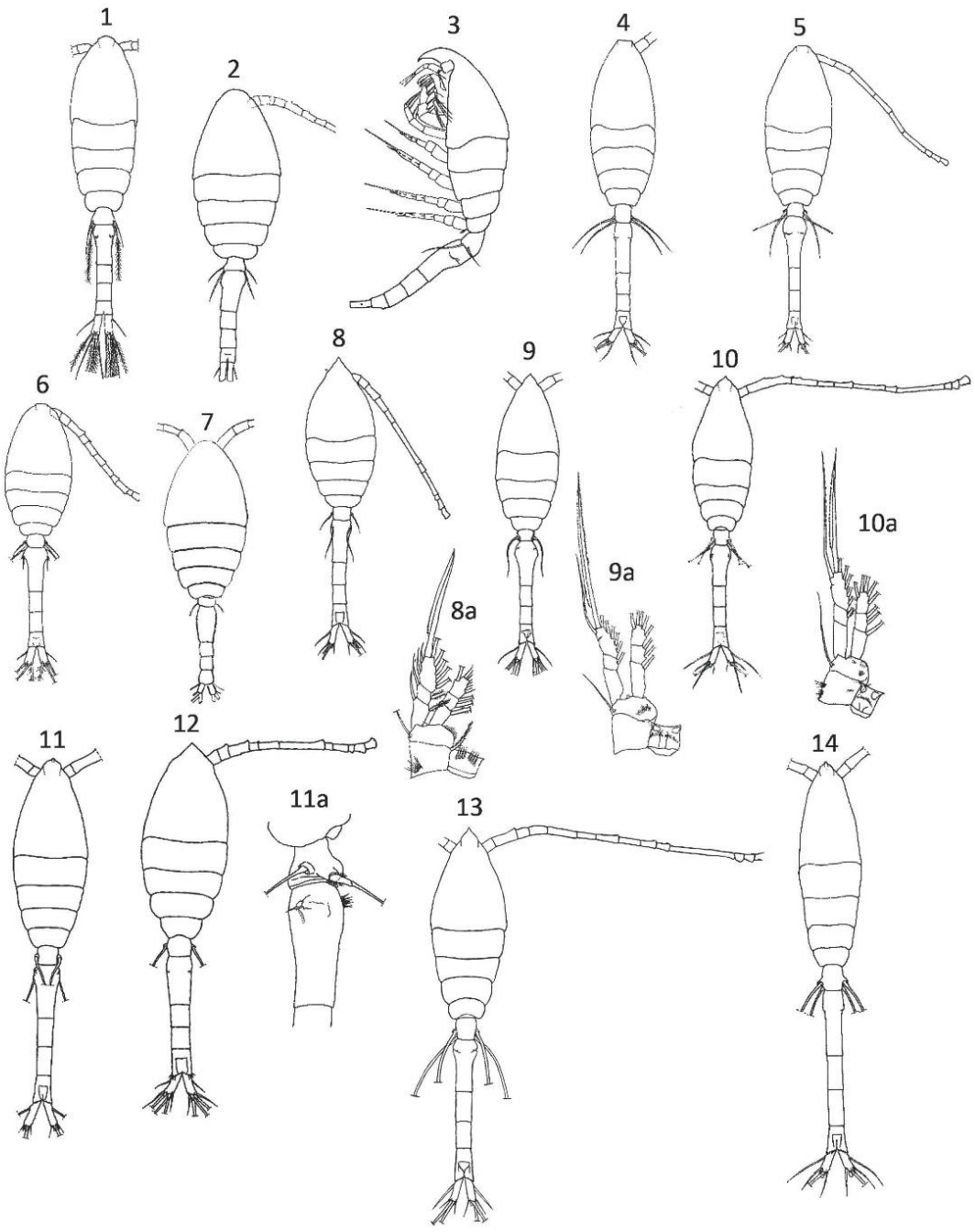


Figure 1. Dorsal (1, 2, 4–14) or lateral (3) views of *Oithona* females (not to scale). 1. *O. brevicornis*; 2. *O. colcarva*; 3. *O. davisae*; 4. *O. decipiens*; 5. *O. similis*; 6. *O. nana*; 7. *O. parvula*; 8. *O. vivida*, 8a. P4; 9. *O. atlantica*, 9a. P4; 10. *O. longispina*, 10a. P4; 11. *O. plumifera*, 11a. lateral view of the genital double-somite 12. *O. robusta*; 13. *O. setigera*; 14. *O. tenuis*. 1, 4–6, 8–14: from Nishida (1985); 2: from Bowman (1975); 3: from Ferrari and Orsi (1984); 7: redrawn from Sars (1918, Pl. CXIV as *Paroithona parvula*).

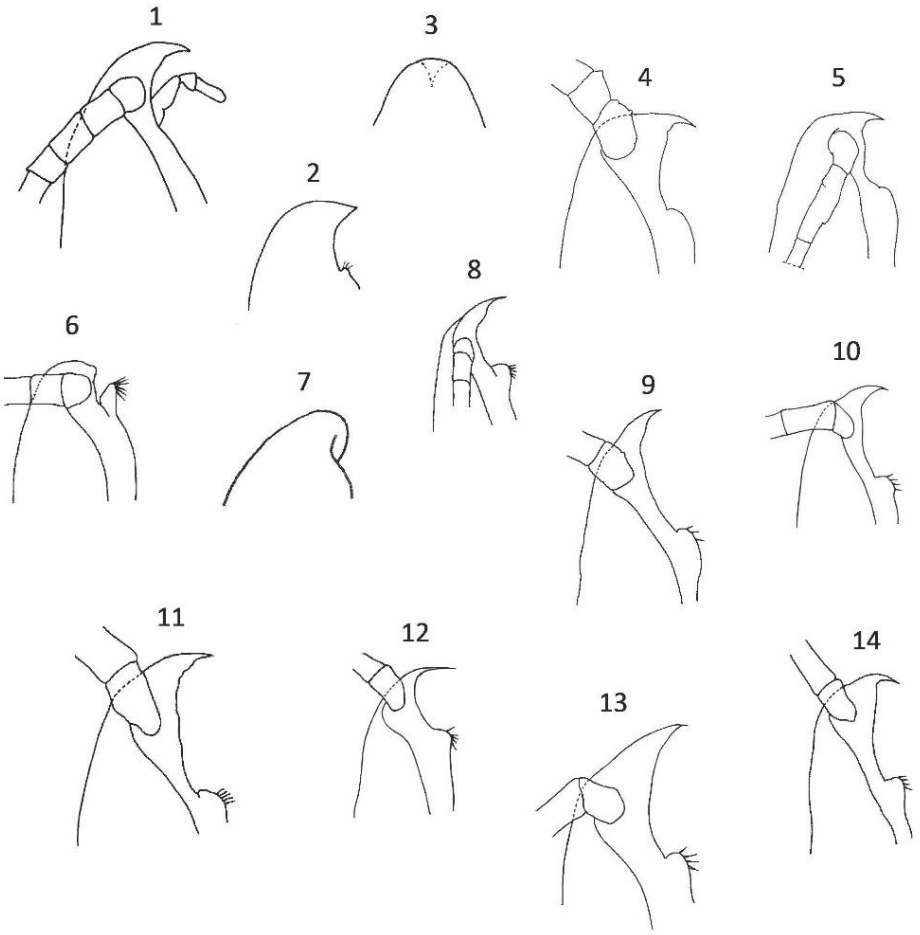


Figure 2. Lateral (1, 2, 4–14) or dorsal (3) views of *Oithona* female frontal margin (not to scale). 1. *O. brevicornis*; 2. *O. colcarva*; 3. *O. davisae*; 4. *O. decipiens*; 5. *O. similis*; 6. *O. nana*; 7. *O. parvula*; 8. *O. vivida*; 9. *O. atlantica*; 10. *O. longispina*; 11. *O. plumifera*; 12. *O. robusta*; 13. *O. setigera*; 14. *O. tenuis*. 1, 4–6, 8–14: from Nishida (1985); 2: from Bowman (1975); 3: from Ferrari and Orsi (1984); 7: redrawn from Sars (1918, Pl. CXIV as *Paroithona parvula*).

7 Links

7.1 Links to WoRMS

O. atlantica – http://www.marinespecies.org/aphia.php?p=taxdetails&id=106642

O. brevicornis – http://www.marinespecies.org/aphia.php?p=taxdetails&id=106643

O. colcarva – http://www.marinespecies.org/aphia.php?p=taxdetails&id=353993

O. davisae – http://www.marinespecies.org/aphia.php?p=taxdetails&id=353995

O. decipiens – http://www.marinespecies.org/aphia.php?p=taxdetails&id=106644

O. longispina - http://www.marinespecies.org/aphia.php?p=taxdetails&id=106649

O. nana – http://www.marinespecies.org/aphia.php?p=taxdetails&id=106651

O. parvula – http://www.marinespecies.org/aphia.php?p=taxdetails&id=815821

O. plumifera - http://www.marinespecies.org/aphia.php?p=taxdetails&id=106652

O. robusta – http://www.marinespecies.org/aphia.php?p=taxdetails&id=106654

O. setigera - http://www.marinespecies.org/aphia.php?p=taxdetails&id=106655

O. similis - http://www.marinespecies.org/aphia.php?p=taxdetails&id=106656

O. tenuis - http://www.marinespecies.org/aphia.php?p=taxdetails&id=106658

O. vivida - http://www.marinespecies.org/aphia.php?p=taxdetails&id=106659

7.2 Link to molecular information

https://www.ncbi.nlm.nih.gov/nuccore/?term=oithona

7.3 Other useful links

http://copepedia.org/?id=T4000007

8 Acknowledgements

I deeply acknowledge Shuhei Nishida, for his support, careful review and kind permission to exploit his fundamental work on *Oithona* taxonomy. I am grateful to the Atmosphere and Ocean Research Institute, University of Tokyo, for permitting the use of the figures published in Nishida (1985): Taxonomy and distribution of the family Oithonidae (Copepoda, Cyclopoida) in the Pacific and Indian Oceans. Bulletin of the Ocean Research Institute, University of Tokyo, No. 20: 1-167. I wish also to thank Geoff Boxshall for his careful revision of this leaflet and Inês M. Dias for the digital improvement of the figures.

9 Terminology

A1-A2	antennae 1-2
B1-B2	basal segments 1-2
Li	inner lobe
Md	mandible
Mx1	maxillae 1
P1-P4	swimming legs 1-4
P5-P6	legs 5-6
Re1-Re3	exopod segments 1-3
Ri1- Ri3	endopod segments 1-3
Se	external marginal spine
Th4	thorax segment 4

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