



Research Article

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# Isopods (Crustacea, Malacostraca) from International Minho River, Iberian Peninsula



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## Abstract

Isopods are a common, diverse, and abundant group of the littoral and estuarine invertebrate fauna. This study presents a survey on the species of isopods found on the Minho River estuary, Iberian Peninsula, using plankton net, glass eel fishing bycatch, grab sampler, and sein net sampling methods. A total of 248 specimens were analysed belonging to five families with 13 species in 10 genera. Brief diagnosis, ecological notes, species distributions, figures and a key to species identifications are provided aiming to provide taxonomic support on future projects on this area.

**Keywords:** Atlantic Ocean; Distribution; Estuary; Isopoda; Taxonomy

## Introduction

Order Isopoda (Crustacea) is a diverse group with more than 10.000 valid species according to the World Register of Marine Species database [1], occupying all habitats from marine deep waters to freshwater aquifers or from deserts to mountains [2]. Isopods, known also as pillbugs, slaters and woodlice, represent a group of high range of polymorphism, characterized by a dorsoventrally compressed body shape, subdivided in three parts, a cephalon with two pairs of antennae, a pereon of seven segments with seven pairs of pereopods, a pleon of five segments with five pairs of pleopods, and a pleotelson with one pair of uropods [3]. Sexual dimorphism is present in some species, in which females carry the juveniles in a ventral marsupium; juveniles or manca lack the last pair of pereopods [2]. Meanwhile, deep sea individuals have adaptative structures, such as lack of eyes, antennae same or larger than body size, pereopods much larger than body size [4,5]. Some groundwater species with lateral compression [6], and loss of body shape in some parasitic species, i.e. pereonites become folded indistinct and with rudimentary or absent pereopods [7].

Portuguese isopod aquatic fauna remains poorly known despite recent taxonomic work, including groundwater species, e.g. [8-10], on shallow coastal waters e.g. and works from deep seas exploration expeditions on the continental Canyons and

Portuguese archipelagos of Azores, e.g. [11-13]. Macroinvertebrate surveys on the Minho River started on 1982 [14], but have been scarce with only a few works on macrobenthic ecology or specimens collected through glass eel fishing bycatch [15-17]. In this study we provide diagnostics features for the isopod fauna collected on the Minho River estuary, belonging to 13 species, 10 genera, five families and three suborders, with ecological notes, global and Portuguese distributions, and a key for species identification.

## Materials and Methods

### Study Area

Minho River, located at the northwest of the Iberian Peninsula, originates in the Meira mountains (Spain), with around 300km of extension [18]. The international section located on the last 70km represents the northwest section Spanish/Portuguese border, culminating on an estuary flowing into the Northeast Atlantic Ocean. This estuary area has a length of approximately 40km, with a total area of 23km<sup>2</sup> [16], with a mesotidal partially mixed system tending towards a salt wedge estuary during the high floods [19], providing for a variety of habitats such as salt marshes, mudflats, sandflats and freshwater making for a high species diversity. Due

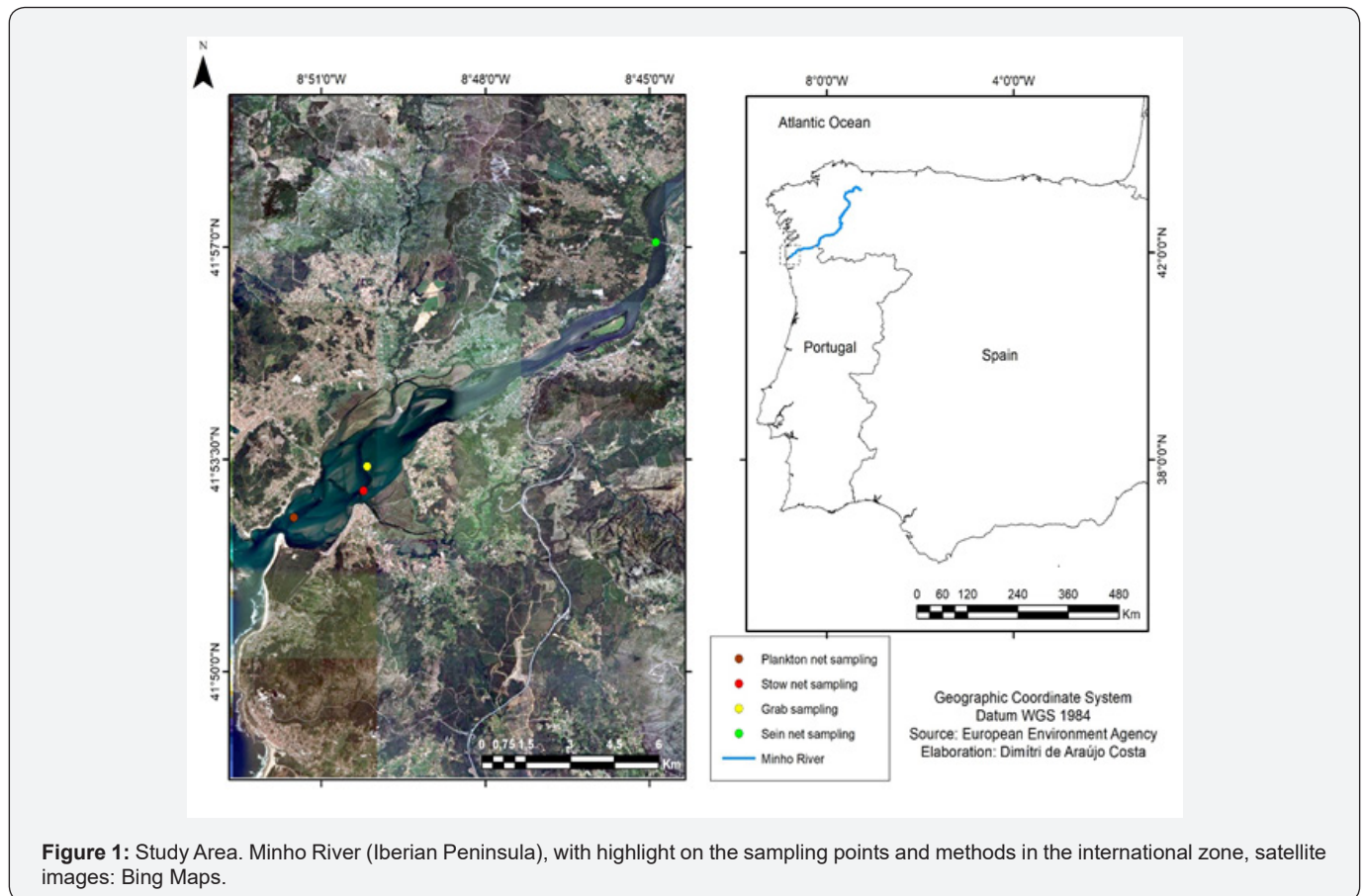
to its ecological importance, the international Minho River section (including the estuarine zone) was designated as a Natura 2000 site and as an Important Bird Area [20,21].

**Methods**

All isopod specimens were collected during previous campaign samplings at the International Minho River, on the estuarine zone (Figure 1), with following methods: 1) plankton net with a 200µm mesh, in Caminha, Portugal (41°52'32.40"N / 8°51'30.39"W) on May, 2020; 2) glass eel fishing bycatch, in Caminha, Portugal (41°52'59.00"N / 8°50'14.00"W), during a new moon night on flood tides, using stow net (length of float lines 10m, bottom anchored lead line of 15m, height 8m, mesh size 1-2mm, covering an area of 50m<sup>2</sup>), on April, 2020; 3) on sediment sampling with a Van Veen grab sampler in Caminha, Portugal (41°53'23.00"N / 8°50'09.92"W), on September, 2020; 4) in gut contents of *Alosa* spp., captured with seine net in Goián, Spain (41°57'05.11"N / 8°44'53.39"W), on November, 2020. Granulometry calculation

was performed on GRADISTAT software version 8.0 [22].

Isopod identification was based on specialized literature e.g. [3,7,23,24]. Synonym's compilation was performed, mainly according to WORMS database and data on species description compiled from taxonomic studies e.g. [25,26]. Type material and locality data were obtained from Global Biodiversity Information Facility [27] or from original descriptions, if available. Institution acronyms on type material descriptions are: NHMUK, Natural History Museum, London; NHMD, Natural History Museum of Denmark; ZMB, Museum fur Naturkunde Berlin; RMNH, Naturalis Biodiversity Center. All specimens were photographed with a Nikon Digital Sight D5-L1 camera and a Nikon SMZ800 stereomicroscope. Specimens deposited at Arthropod Collection from Natural History Museum of the Iberian Peninsula (NatMIP - "Museu de História Natural da Península Ibérica"), sited at Aquamuseu do Rio Minho, Vila Nova de Cerveira, North Portugal. (Figure 1)



**Figure 1:** Study Area. Minho River (Iberian Peninsula), with highlight on the sampling points and methods in the international zone, satellite images: Bing Maps.

**Results**

A total of 248 individuals were recorded from the Minho River estuary, 245 from glass eel fishing bycatch, 1 from sediment sampling, 1 from plankton sampling and 1 from the gut content of *Alosa* spp., belonging to 13 species, 10 genera, five families and three suborders, as listed below.

Phylum Arthropoda Siebold, 1848

SubPhylum Crustacea Brönnich, 1772

SuperClass Multicrustacea Regier, Shultz, Zwick, Hussey, Ball, Wetzer, Martin & Cunningham, 2010

Class Malacostraca Latreille, 1802

SubClass Eumalacostraca Grobben, 1892

SuperOrder Peracarida Calman, 1904

Order Isopoda Latreille, 1817

SubOrder Cymothoidea Wägele, 1989

SuperFamily Anthuroidea Leach, 1914

Family Anthuridae Leach, 1814

**I. *Cyathura carinata* (Krøyer, 1847) (Figure 2 A-B)**

*Cyathura carinata* Richardson, 1905: 63-66, figs. 47-50 [27]; Cleret, 1960: 434-450, figs. I-XII [28]; Naylor, 1972: 20-21, fig. 6D-F [7].

Synonyms: *Anthura carinata* Krøyer, 1847: 402-407 [26].

*Anthura brunnea* in Verrill, Smith & Harger, 1883: 278 [29].

• **Type Material**

DENMARK • None designated [30]; Copenhagen [26].

• **Material Examined**

PORTUGAL 4 adults, size range 9 to 16mm; International Minho River, Caminha; 41°52'59.00"N, 8°50'14.00"W; 6 Apr. 2020; glass eel fishing bycatch; NatMIP-CMIs001 16 adults; same data as for preceding; NatMIP-CMIs 0002 25 adults; same data as for preceding; NatMIP-CMIs 0003 26 adults; same data as for preceding; NatMIP-CMIs 0004.

• **Diagnosis**

Anthurid with punctiform eyes; body elongated with keeled pereon; larger first pair of pereopods with a tooth on the inferior propodus margin; telson ovate gradually converging to a curved apex (Figure 2B); antennules on both male and female of the same size; male with copulatory stylet on the second pleopod pair [3,26,27].

• **Global distribution**

Northeast Atlantic Ocean; south and west coasts of England, South Wales, Ireland; southwest Baltic and Mediterranean [3].

• **Distribution in Portugal**

Species recorded on the Minho, Lima, Cávado, Douro, Mondego and Tejo rivers, Ria de Aveiro, Ria Formosa and in Sines [16,31-38].

• **Ecological notes**

Often found at brackish or freshwater habitats, e.g., muddy bottom, up to 5m depth [3,39].

SuperFamily Cymothoidea Leach [25]

Family Cirolanidae Dana, 1852

**II. *Eurydice affinis* Hansen, 1905 (Figure 2 C-D).**

*Eurydice affinis* Hansen 1908:367-368, Pl. 35 fig. 2A-K; Naylor, 1972: 27, fig. 8E [7]; Wolff, 1966: 223-225, figs. 2A, 3A [39].

• **Type material**

• **Syntypes**

FRANCE • St. Lunaire; NHMD-86713 • FRANCE • Cartenet; 1 Aug. 1890; NHMD-86714 • FRANCE • St. Lunaire; NHMD-86715 • FRANCE • Cartenet; 1 Aug. 1890; NHMD-86716 • FRANCE • Cartenet; NHMD-83021 • FRANCE • St. Lunaire; ZMB-11394.

• **Material Examined**

PORTUGAL • 25 adults, size range 11 to 15mm; International Minho River, Caminha; 41°52'59.00"N, 8°50'14.00"W; 6 Apr. 2020; glass eel fishing bycatch; NatMIP-CMIs0017 • 19 adults; same data as for preceding; NatMIP-CMIs 0018 • 19 adults; same data as preceding; NatMIP-CMIs 0019.

• **Diagnosis**

Pereonite 6 with posterior angle of coxal plate acute; chromatophores (black colour) restricted to dorsal surface (Figure 2C-D); antenna scarcely reaching lateral angle of pereon (Figure 2C); endopods of uropods shorter than telson [3,7,40].

• **Global Distribution**

From the North Sea to Iberian Peninsula; British Isles and Mediterranean [3].

• **Distribution in Portugal**

Species collected along the west coast, on the south coast and Azores [10,41-43].

• **Ecological Notes**

Found in sand beaches, on intertidal High Water Neap Tide (HWNT) zone to 60m depth; free movement with the rising tide and may be present among sand grains; feeding in the water column at high tide and at night [3].

• **Remarks**

Despite being typically found on sandy beaches, this marine species presence was probably due to drifting towards the net due to the flood tides entering the estuary.

Family Gnathiidae Leach [25]

**III. *Paragnathia formica* (Hesse, 1864) (Figure 2E-F).**

*Paragnathia formica* Naylor, 1957: fig. 1A-E [44]; Naylor, 1972: 18, figs. 4A-C, 5A [7]

Synonyms: *Anceus formica* Hesse, 1864: 39-41, Pl. I fig. 28, Pl. II fig. 15, Pl. III fig. 5-7 [43]

*Anceus halidaii* Bate & Westwood 1866 [45].

*Paragnathia halidaii* Bate & Westwood 1866: 202-208 [45].

- **Type Material**

Unknown.

- **Material Examined**

PORTUGAL • 2 adult juveniles (praniza) with 4mm; International Minho River, Caminha; 41°52'59.00"N, 8°50'14.00"W; 6 Apr. 2020; glass eel fishing bycatch; NatMIP-CMIs 0029 • 1 juvenile (zuphea); International Minho River, Goián; 41°57'05.11"N, 8°44'53.39"W; Nov. 2020 ; collected from the gut content of *Alosa* spp. • 1 juvenile (zuphea) with 2.6mm; International Minho River, Caminha; 41°52'40''N, 8°51'30''W; May 2020; on a plankton net.

- **Diagnosis**

Five-segmented pylopods (in males); telson rounded

posteriorly (Figure 2F); early pranizas body length 2.5-5.0mm and with antennal flagellum of 8 segments; females and praniza with pereonites 3-5 fused and inflated [3,7].

- **Global Distribution**

Northeast Atlantic, from Scotland to Morocco [3].

- **Distribution in Portugal**

Species recorded on Azores, Aveiro and the estuaries of the Mondego and Tejo rivers [35,46,43,47].

- **Ecological Notes**

Lives at estuarine muddy banks; late pranizas with parasitic behaviour on inshore or on flatfishes (order Pleuronectiformes); Adults occur in galleries, typically with a male near the entrance and 10 to 20 females on the inner part of the gallery [3,7].



**Figure 2:** *Cyathura carinata* (Krøyer, 1847): dorsal view (A), pleotelson (B); *Eurydice affinis* Hansen, 1905, dorsal view (C), ventral view (D); *Paragnathia formica* (Hesse, 1864), dorsal view (E), telson (F). Scales: A-C,E: 1mm; D: 5mm; F: 0.5mm.

SubOrder Sphaeromatidea Wägele, 1989

SuperFamily Sphaeromatoidea Latreille, 1825

Family Sphaeromatidae Latreille, 1825

**IV. *Dynamene bidentata* Adams, 1800 (Figure 3A).**

*Dynamene bidentata* Holdich, 1968: 408-410, figs. 1, 2A1, 2B5,

2C1, 3, 4, 5 [24]; Holdich, 1970: fig.8 [48]; Naylor, 1972: 35, fig. 11A-B [7]; Holdich, 1976: fig. 2A-B [49]; Vieira et al. 2016: 5-7, figs. 1, 2A-B [50].

Synonyms: *Oniscus bidentatus* Adams, 1800: 8, Tab. II figs. 3-4 [47].

*Nesaea bidentata* Leach, 1814: 405 [25].



*Naesa bidentata* Desmarest, 1825: 295, Pl.47 fig. 2 [52]; Bate & Westwood 1866: 431-432 [45].

- **Type Material**
- **Neotype**

WALES • Milford Haven; 10 Jan. 1967; NHMUK 1968.1.3.1.

- **Material Examined**

PORTUGAL • 1 ♀ adult with 2.5mm; International Minho River, Caminha; 41°52'59.00"N, 8°50'14.00"W; 6 Apr. 2020; glass eel fishing bycatch; NatMIP-CMIs 0028.

- **Diagnosis**

Males pleotelson with two bosses joined at the bases, bidentate process sparsely rugose dorsally becoming narrower apically; females with pleotelson dome smoothly rounded on side view; length up to 7mm in males, 6mm in females [3,7,50].

- **Global Distribution**

Northeast Atlantic from France and British Isles to Morocco, Tenerife, and Gran Canaria [50].

- **Distribution in Portugal**

Species recorded along the West coast [33,57].

- **Ecological Notes**

Common in rocky shores, from MTL to LWS; juveniles on intertidal algae that they feed upon; adults in rock crevices or empty tests of the barnacle *Perforatus perforatus* (Bruguière, 1789) in which they breed; each male usually with several females [3,50].

#### V. *Dynamene magnitorata* Holdich, 1968 (Figure 3B-C)

• *Dynamene magnitorata* Holdich, 1968: 417-418 [24], figs. 2A4, 2B3, 2C3, 10; Holdich, 1976: fig.4A-B [49]; Vieira et al. 2016: 11-13, figs. 2C-D, 3C-D [50].

- **Type Material**
- **Holotype**

FRANCE • 1 ♂; Roscoff, Bretagne; 16 Sep. 1958; RMNH. CRUS.I.1695.

- **Paratypes**

FRANCE • Roscoff, Bretagne; NHMUK 1968.1.3.17-18 • FRANCE • 8; Roscoff, Bretagne; 16 Sep. 1958; RMNH.CRUS.I.1696 • FRANCE • 1; Pointe Barfleur, Normandie; 26 Oct. 1958; RMNH. CRUS.I.1697.

- **Material Examined**

PORTUGAL • 1 ♀ adult, size 4.5mm; International Minho River, Caminha; 41°52'59.00"N, 8°50'14.00"W; 6 Apr. 2020; glass eel fishing bycatch; NatMIP- CMIs 0021 • 2 ♀ adults, size range 4 to 4.5mm, 1 ♂ adult with 5mm and 1 ♂ pre-adult with 4mm; same data as for preceding; NatMIP- CMIs 0022 • 1 adult ♂ with

4.5mm, same data as for preceding NatMIP- CMIs 0023.

- **Diagnosis**

Pleotelson on males with two bosses fused by a stalk, in which each boss with a prominent, apical, subsidiary projection, bidentate processes apically tuberculate with similar width along their lengths (Figure 3B); females with a mid-dorsal projection at posterior margin of pleotelson (Figure 3C); maximum males' length 6mm, 4.8mm in females; lobes on maxillipedal palp thick, first longer than third [3,24].

- **Global Distribution**

Northeast Atlantic, from France to the Iberian Peninsula; British islands; Macaronesian archipelagos; Mediterranean Sea along European and African coasts and Egypt [51].

- **Distribution in Portugal**

Present on all mainland Portuguese coastline, Madeira and Azores archipelagos [50-53].

- **Ecological notes**

Juveniles amongst lower shore and upper sublittoral algae, e.g., *Chondrus crispus* Stackhouse, 1797, and coralline ones; adults live in crevices, in barnacle tests (*Balanus crenatus* Bruguière, 1789), amongst clumps of ascidians, in sponges channels (e.g., *Halichondria* spp.), and associated with seagrass *Zostera* sp. [53].

#### VI. *Ischyromene lacazei* Racovitza, 1908 (Figure 3D-E).

• *Ischyromene lacazei* Racovitza, 1908: 64, figs. 1-3 [53]; Holdich, 1968: fig. 12 [24]; Schuller & Wägele 2005: 165-166, fig. 1 [54].

- **Type Material**
- **Syntypes**

FRANCE • Banyuls-sur-Mer; 42.5N, 3.1E; 10 May 1909; ZMB 13768 • FRANCE • Banyuls-sur-Mer; NHMD-84847.

- **Material Examined**

PORTUGAL • 1 adult with 3.5mm; International Minho River, Caminha; 41°52'59.00"N, 8°50'14.00"W; 6 Apr. 2020; glass eel fishing bycatch; NatMIP-CMIs 0020.

- **Diagnosis**

First pleopod covers pleopods 2-5; pleon smooth and pleotelson with conspicuous tuberculation; pleotelson almost triangular shape, with the median region vaulted on both sides of the midline; apical foramen opens dorsally, visible as an open slit from above (Figure 3E); both uropod rami apically rounded [54].

- **Global Distribution**

Mediterranean and Iberian Peninsula [54].

- **Distribution in Portugal**

Species recorded along the West Portuguese coast [51].

- **Ecological Notes**

Found at marine shallow waters; usually associated with barnacles [54].

**VII. *Lekanesphaera hookeri* (Leach, 1814) (Figure 3F).**

*Lekanesphaera hookeri* Jacobs, 1987: 51-55, fig. 17 [55].

Synonyms: *Sphaeroma hookeri* Leach, 1814: 433 [25]; Desmarest, 1825: 300; Bate & Westwood 1866: 410-411 [45]; Jansen, 1970: fig.2 [54]; Naylor, 1972: 32, fig. 10G-H [7].

*Exosphaeroma pulchellum* Colosi, 1921: 3-4 [57].

- **Type Material**

ENGLAND • Norfolk [25]; unknown data.

- **Material Examined**

PORTUGAL • 1 adult with 4mm; International Minho River, Caminha; 41°52'59.00"N, 8°50'14.00"W; 6 Apr. 2020; glass eel fishing bycatch; NatMIP-CMIs 0027.

- **Diagnosis**

Pereopod 1 with around to 20 setae smooth-like on ischium and on merus; uropods with external margin of exopod almost

smooth; pleotelson dorsal surface with two longitudinal rows of tubercles; antenna peduncle with 5 articles and flagellum with 12-16 articles ; interior endite of maxilliped with fringe of robust, plumose setae with swollen base on semi-circular distal margin; pleotelson subapically concave and slightly upcurved in side view; uropod reaching slightly beyond the posterior margin of pleotelson; maximum males length 10.5mm, 8.5mm in females [3,7,55].

- **Global Distribution**

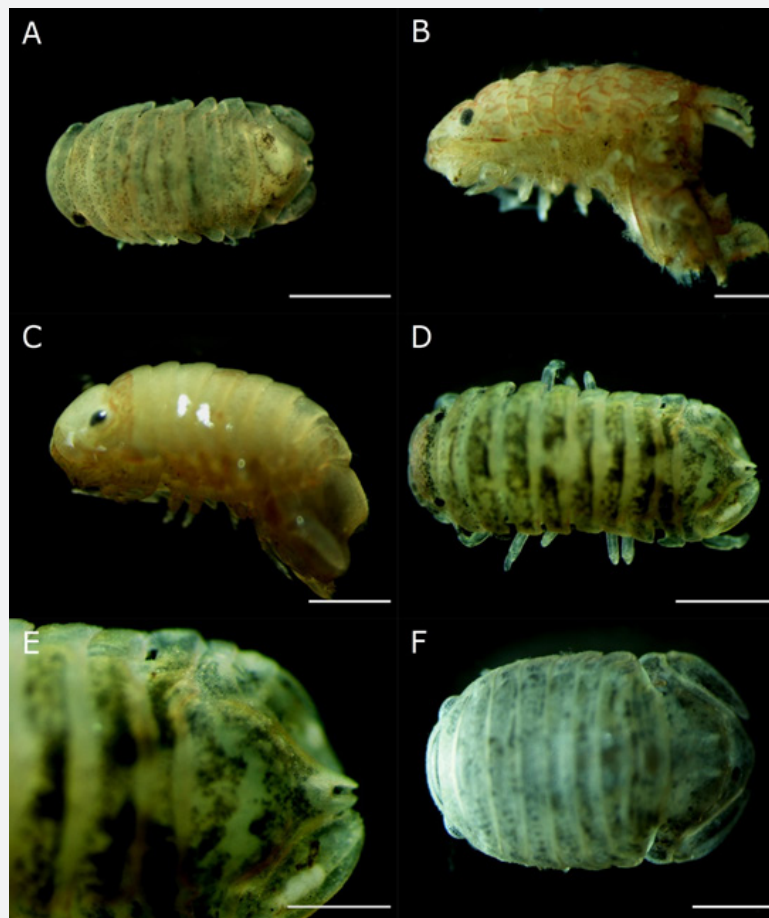
Northeast Atlantic from Poland, including Baltic Sea to Morocco; Mediterranean; Adriatic and Aegean Sea [54].

- **Distribution in Portugal**

Species recorded on Aveiro [35] and on the Mondego estuary [46].

- **Ecological Notes**

In estuaries near to upper limit of Extreme High-Water Springs (EHWS), euryhaline species, usually in ditches brackish water, on riverbanks, on muddy bottoms, under stones, and amongst seagrasses [3].



**Figure 3:** *Dynamene bidentata* (Adams, 1800), female dorsal view (A); *Dynamene magnitorata* Holdich, 1968: male (B), female (C); *Ischyromene lacazei* Racovitza, 1908: dorsal view (D), pleotelson (E); *Lekanesphaera hookeri* (Leach, 1814): dorsal view (F). Scales: A-D,F: 1mm; E: 0,5mm.

**VIII. *Lekanesphaera levii*** (Argano & Ponticelli, 1981) (Figure 4A)

*Lekanesphaera levii* Jacobs, 1987: 46-48, fig. 15 [55]

Synonyms: *Sphaeroma monodi* Naylor, 1972: 34, fig. 10I-J [7]

*Sphaeroma levii* Argano & Ponticelli 1981: 229-232 [58]

- **Type Material**

ROMANIA • Constanta [58]; Unknown data.

- **Material Examined**

PORTUGAL • 1 adult with 4mm; International Minho River, Caminha; 41°52'59.00"N, 8°50'14.00"W; 6 Apr. 2020; glass eel fishing bycatch; NatMIP-CMIs 0024 • 7 adults, size range 2.7 to 4mm; same data as for preceding; NatMIP-CMIs 0025 • 7 adults; same data as for preceding; NatMIP-CMIs 0026.

- **Diagnosis**

Pereopod 1 with up to 50 setae smooth-like on ischium, around 60 on merus, and 3-8 in a distal row on the propodus; first three pereopods, and maxilliped palp (with prominent lobes on articles 2-4) with sparsely plumose setae; uropods usually with 6-7 slight striations on outer margin of exopod; pleotelson with smooth dorsal surface, subapically concave and slightly upcurved on side view for both sexes, posterior margin narrower in males; males up to 12mm, females 8mm [7,55,59].

- **Global Distribution**

Northeast Atlantic from Belgium to the Mediterranean and Southwest British coast [3,55].

- **Distribution in Portugal**

Common along the entire coast [14,34,55] and in Óbidos Lagoon [60].

- **Ecological Notes**

Brackish species occurring between Mean Tide Level (MTL) and Low Water Neap (LWN), under stones or in rock crevices [7].

**IX. *Lekanesphaera rugicauda*** (Leach, 1814) (Figure 4B).

*Lekanesphaera rugicauda* Jacobs, 1987: 48-50, fig. 16 [54].

Synonym: *Sphaeroma rugicauda* Leach, 1814: 405,433 [25]; Desmarest, 1825: 300-301; Bate & Westwood 1866: 408-409 [45]; Naylor, 1972: 34, fig. 10D-F [7].

- **Type Material**

- **Syntype**

SCOTLAND • 4; Argyll, Ulva Island; NHMUK 1979.424.

- **Material Examined**

PORTUGAL • 2 adults, size range 14 to 15mm, 2 juveniles,

size range 2 to 3mm; International Minho River, Caminha; 41°52'59.00"N, 8°50'14.00"W; 6 Apr. 2020; glass eel fishing bycatch; NatMIP-CMIs 0013 • 4 adults, size range 5 to 15mm, 1 juvenile with 2mm; same data as for preceding; NatMIP-CMIs 0014 • 7 adults, size range 5 to 15mm, 3 juveniles, size range 2 to 3 mm; same data as for preceding; NatMIP-CMIs 0015 • 7 adults, 3 juveniles; same data as for preceding; NatMIP-CMIs 0016.

- **Diagnosis**

Pereopod 1 with up to 30 smooth setae on ischium, merus with up to about 20 setae, propodus distal row with two or one; uropod exopod outer edge exopod almost smooth; pleotelson dorsal surface covered with tubercles, posterior margin broadly rounded, extending beyond uropods in adult males; males up to 10mm; females, 7.5mm [55].

- **Global Distribution**

Northeast Atlantic from Sweden down to Morocco and Azores islands, also on Baltic Sea [54].

- **Distribution in Portugal**

Species recorded on Aveiro and Azores [34,41].

- **Ecological Notes**

Brackish waters species common in sheltered estuarine situations, from MTL to EHWS occurring mostly on salt marshes with muddy substrates with aquatic vegetation, capable of surviving large fluctuations of temperature and salinity [3,7,55].

**X. *Sphaeroma serratum*** (Fabricius, 1787) (Figure 4C).

*Sphaeroma serratum* Jacobs, 1987: 3-19, fig. 3 [54].

Synonyms: *Oniscus conglobator* Pallas, 1766: 194-195, Tab. XIV figs. 18-19 [62].

*Oniscus serratus* Fabricius, 1787: 242 [61].

*Sphaeroma serrata* Leach, 1814: 405 [25].

- **Type material**

- **Neotype**

GREENLAND • Bredemilet; 60.7N, 46.7E; 23 Jul. 1912; NHMD-85927

- **Material Examined**

PORTUGAL • 1 adult with 4mm; International Minho River, Caminha; 41°53'23.00"N, 8°50'09.92"W; Sep. 2020; 4.8m depth, on fine sand, 35.63x10<sup>-5</sup> ppm salinity; NatMIP-CMIs 0031.

- **Diagnosis**

Palp segments 2-4 robust and lacking lobes, interior margins straight bearing dense fringes of long fine plumose setae; ischium of pereopod 1 with up to about 60 plumose setae in two rows, propodus with a distal row of 15-20 setae; pereopods 1-3 with

plumose setae; pleotelson smooth, convex inside view; uropods reaching beyond the posterior margin of pleotelson, external margin of exopod uropod with 4-7 pronounced teeth on caudal part; males up to 11.5mm, and females to 10mm [3,55].

- **Global Distribution**

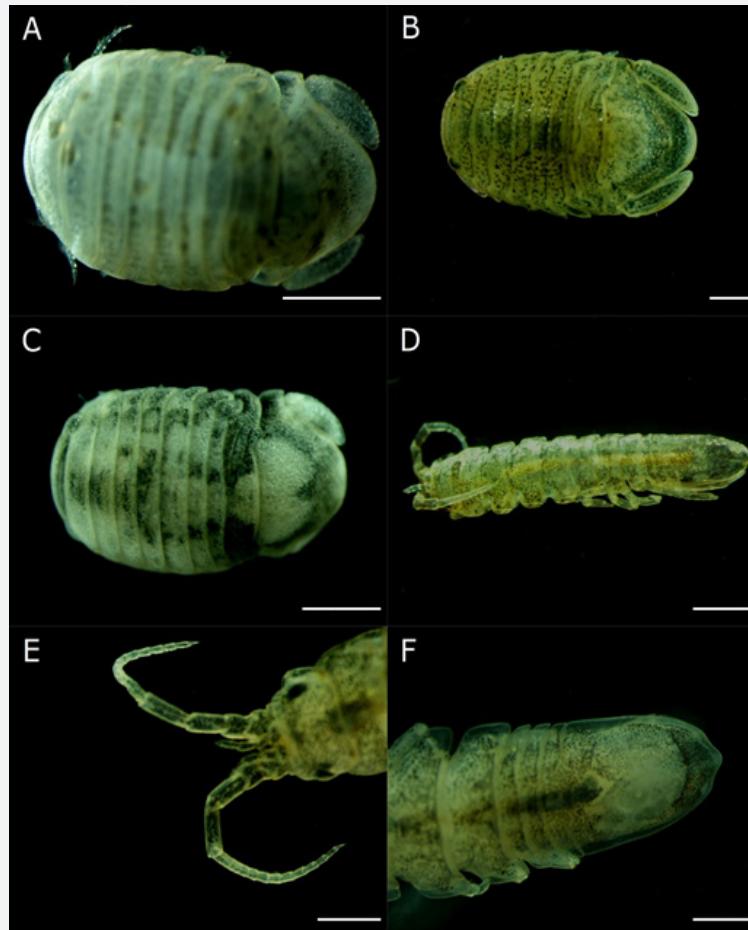
Northeast Atlantic from British islands to Morocco; Mediterranean and Black Seas [55].

- **Distribution in Portugal**

Recorded on the estuaries of the Minho, Douro, Cávado rivers, Ria de Aveiro, São Julião, Madeira and Azores [30,31,34,51,55,62].

- **Ecological notes**

Intertidal, often in sheltered places on High Water Springs (HWS) under stones or in crevices; around MTL on marine coasts [3,55].



**Figure 4:** *Lekanesthesphaera levii* (Argano & Ponticelli, 1981): dorsal view (A); *Lekanesthesphaera rugicauda* (Leach, 1814): dorsal view (B); *Sphaeroma serratum* (Fabricius, 1787): dorsal view (C); *Idotea chelipes* (Pallas, 1766): dorsal view (D), cephalon (E), pleotelson (F). Scales: A,C-F: 1mm; B: 3mm.

SubOrder Valvifera Sars, 1883

Family Chaetiliidae Dana, 1849

**XI. *Saduriella losadai* Holthuis, 1964 (Figure 5A-B)**

*Saduriella losadai* Holthuis, 1964: 30-35, figs. 1-2 [63].

- **Type material**

- **Holotype**

SPAIN • 1 ♀; Rio Ulla, Lugo; 18 Jul. 1963; RMNH.CRUS.I.1601.

- **Paratypes**

SPAIN • 6; Rio Ulla, Lugo; 18 Jul. 1963; RMNH.CRUS.I.1602 • 6; same data as for preceding; RMNH.CRUS.I.1603 • 6; same data as for preceding; RMNH.CRUS.I.1604 • 1; same locality as for preceding; 5 Jul. 1963; RMNH.CRUS.I.1605.

- **Material Examined**

PORTUGAL • 6 adults, size range 12 to 17mm, 5 juveniles, size range 4 to 6mm, coloration light brown with dark speckles or dark brown with lighter speckles; International Minho River,



Caminha; 41°52'59.00"N, 8°50'14.00"W; 6 Apr. 2020; glass eel fishing bycatch; NatMIP-CMIs 0009 • 8 adult, size range 12 to 17mm, same data as for preceding; NatMIP-CMIs 0010 • 9 adults, 2 juveniles; same data as for preceding; NatMIP-CMIs 0011 • 7 adults, 3 juveniles; same data as for preceding; NatMIP-CMIs 0012.

- **Diagnosis**

Wide cephalon concave in the middle; 1 segmented antennular flagellum reaching beyond the end of the antennal peduncle, antennal flagellum with 7-9 segments (Figure 5B); pereonite 1 without coxal plate, coxal plates on other pereonites visible from dorsal view; pleotelson elongated and triangular [63].

- **Global Distribution**

Endemic to the Iberian Peninsula [64].

- **Distribution in Portugal**

Species recorded on the Minho River [16], Ria de Aveiro [34] and on the Mondego River [66].

- **Ecological Notes**

Poorly known brackish waters species.

- **Remarks**

Species only known from the Northwest Iberian Peninsula except for the single specimen collected on the Guadalquivir estuary [64] requiring further investigation on distribution and ecology of this species.

Family Idoteidae Samouelle, 1819

## XII. *Idotea chelipes* (Pallas, 1766) (Figure 4D-F).

*Idotea chelipes* Naylor, 1972: 40, fig. 13B,E [7].

Synonyms: *Oniscus chelipes* Pallas, 1766: 194 Tab. XIV, fig. 16 [61].

*Oniscus viridis* Slabber, 1778: 104-106, Pl. XII, fig. 4-5 [66].

*Idotea salinarium* Dollfus, 1895: 39-40, fig. 21 [67].

*Idotea angusta* Sars, 1897: 83-84, Pl. XXXIV, fig. 2 [68].

*Idothea viridis* Sars, 1897: 83-84, Pl. XXXIV, fig. 2 [68].

*Idotea viridis* Collinge, 1917: 745, Pl. VII figs. 70-80 [69]; Naylor, 1955: figs. 1,2,7,8 [7].

- **Type Material**

DENMARK • Jutland Peninsula [61]; Unknown data.

- **Material Examined**

PORTUGAL • 1 adult with 12mm; International Minho River, Caminha; 41°52'59.00"N / 8°50'14.00"W; 6 Apr. 2020; glass eel fishing bycatch; NatMIP-CMIs 0005 • 2 adults; same data as for preceding; NatMIP-CMIs 0006 • 1 adult specimen; same data as for preceding; NatMIP-CMIs 0007 • 10 adults, size range 5 to 12mm; same data as for preceding; NatMIP-CMIs 0008.

- **Diagnosis**

Body slender adult males ranging 15mm, adult females from 6 to 10mm; antennule extending well beyond article 3 of antennal peduncle (Figure 4E); antennal flagellum longer than the peduncle; narrow coxal plates, only those of pereonites 5-7 reaching the posterior border; pleotelson with sides subparallel, slightly curved in the mid-dorsal line; posterior border with a median tooth, hardly acute, and with obtuse lateral corners (Figure 4F) [7].

- **Global Distribution**

Northeast Atlantic from Norway down to Mediterranean [3].

- **Distribution in Portugal**

Recorded in Ria de Aveiro [36], and on the Tejo River [35].

- **Ecological Notes**

Brackish waters species common among intertidal waters in sheltered estuaries [7].

## XIII. *Stenosoma lancifer* (Miers, 1881) (Figure 5C-D)

*Stenosoma lancifer* Dollfus 1897: 5, fig. 13 [71]

Synonyms: *Idotea acuminata* var. *lanciformis* Miers, 1881: 61 [70]

*Idotea appendiculata* Bate & Westwood 1866: 396-397 [45]

*Synisoma lancifer* Collinge, 1917: 751, Pl. XI figs. 115-128 [69]; Naylor, 1972: 46, fig. 14B [7]

- **Type Material**

ENGLAND • Sidmouth [44]; Unknown data.

- **Material Examined**

PORTUGAL • 2 adults, size range from 24 to 27mm; International Minho River, Caminha; 41°52'59.00"N / 8°50'14.00"W; 6 Apr. 2020; glass eel fishing bycatch; NatMIP-CMIs 0030.

- **Diagnosis**

Pereon with triangular coxal plates and serrated lateral borders; pleotelson sides concave anteriorly, expanding about two-thirds of its length backwards, then narrowing sharply to an elongate median projection (Figure 5D); males up to 22-25mm, female smaller [7].

- **Global Distribution**

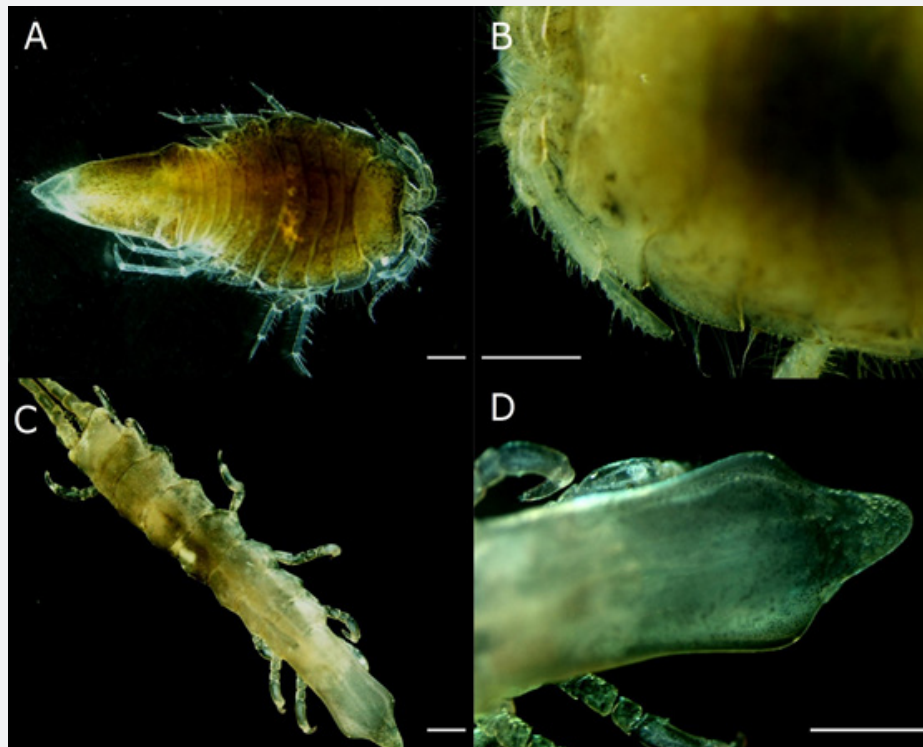
Northeast Atlantic coast from France to the Mediterranean and Southwest England [3].

- **Distribution in Portugal**

Species recorded along the West coast [50,71]

- **Ecological Notes**

Usually found around algae and under stones on Low Water Slack Tide (LWST) [3].



**Figure 5:** *Saduriella losadai* Holthuis, 1964: dorsal view (A), cephalon (B); *Stenosoma lancifer* (Miers, 1881): dorsal view (C), pleotelson (D). Scales: A-D: 1mm.

Key to the International Minho River isopod species

1	Uropods ventral forming an operculum covering the pleopods	2
	Uropods lateral forming a caudal fan	4
2	Pleon with 2 distinct segments	3
	Pleon with 4 distinct segments; pleotelson triangular	<i>Saduriella losadai</i>
3	Pleon with two distinct segments plus one partially sutured with telson; pleotelson with expansion on middle part	<i>Stenosoma lancifer</i>
	Pleon with two distinct segments plus one partially sutured with telson; body slender; antenna 1 extending beyond article 3 of antenna 2 peduncle	<i>Idotea chelipes</i>
4	With five pairs of pereopods and thoracomere 2 fused with cephalon	<i>Paragnathia formica</i>
	With seven pairs of pereopods and thoracomere not fused with cephalon	5
5	Body elongated nearly cylindrical; pereopod 1 subchelate	<i>Cyathura carinata</i>
	Body not elongated, pereopod 1 neither enlarged or subchelate	6
6	Pleon with five distinct somites plus one fused with telson; antennal peduncle with 4 articles; pleotelson with round apical border; chromatophores only on dorsal surface	<i>Eurydice affinis</i>
	Pleon with less than five distinct somites, more than one fused with telson	7
7	Pereonite 6 without processes	8
	Pereonite 6 with two elongated processes	12
8	Telson posterior border rounded	9
	Telson posterior border with a semi-circular slit	13
9	Pereopods 1-3 and maxillipede palp with plumose setae; uropod exopod serrated	<i>Spheroma serratum</i>
	Pereopods 1-3 and maxillipede palp with smooth setae	10

10	Uropod exopod with 6 or 7 teeth	<i>Lekanesphaera levii</i>
	Uropod exopod smooth or with 2 or 3 teeth	11
11	Dorsal surface of pleotelson with two longitudinal rows of tubercles	<i>Lekanesphaera hookeri</i>
	Dorsal surface of pleotelson granular	<i>Lekanesphaera rugicauda</i>
12	Pleotelson with two hemispherical bosses joined at the bases	<i>Dynamene bidentata male</i>
	Pleotelson with two bosses joined by a short stem, each boss with apical projection	<i>Dynamene magnitorata male</i>
13	Pleotelson with tubercles	<i>Ischyromene lacazei</i>
	Pleotelson smooth	14
14	Pleotelson rounded on side view	<i>Dynamene bidentata female</i>
	Pleotelson with dorsal projection on side view	<i>Dynamene magnitorata female</i>

## Discussion

All species collected are within the boundaries of their known distribution, although most of them are new records for the Minho River estuary, mainly due to the lack of information on macroinvertebrates for this specific area. From the 248 specimens collected, 245 come from glass eel fishing bycatch, with an expected higher number of species and individuals for this method due to the area covered by the net, with specimens being sampled from the top of the water column to the bottom, and marine species drifting towards the net due to the flood tides entering the estuary [16].

Except for the species *Cyathura carinata* (Krøyer, 1847), *Saduriella losadai* Holthuis, 1964, *Lekanesphaera levii* (Leach, 1814) and *Sphaeroma serratum* (Fabricius, 1787) [15,16] all the other 9 species are new records for the international Minho River. The point of collection of *S. serratum* coincides with the samplings of this species [15,14]. Previous studies focused on ecological aspects, which contained lists of species, which in this manuscript some of these that were collected have been revised and morphologically described on taxonomic approach. Consequently, this is the first descriptive taxonomic study on Portuguese estuarine zone.

The most comparable study comes from Ria de Ferrol [72], on the Spanish Northwest coast approximately 200 km north from the Minho River estuary, where 39 isopod species were mentioned on a deep survey on the area studied. From the 13 species collected on the Minho River, 12 were also found on Ria de Ferrol only *S. losadai* being absent, with the northern most record on the Ulla River, Spain. A depth research is required to fully understand the composition and distribution of this group for the Portuguese coast, with different sampling methods concerning different habitats e assemblages.

## Conclusion

This represents the first taxonomic study of Isopoda from the

International Minho River, contributing for isopod Portuguese and Iberian fauna, due to localization of this river. Bycatch method was efficient for sampling these animals, which possibly indicates that other species could appear if the sampling effort were greater and regular over time. Minho River presents potentialities, still unknown, mainly in the descriptive aspect, that still need to be discovered, in view of its importance and its strategic position, flowing into the Atlantic Ocean.

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