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A checklist of isopods (Crustacea: Isopoda) in Slovenia

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Abstract. Isopods are a diverse peracarid crustacean group with marine, freshwater and terrestrial representatives. Isopod species lists were typically prepared according to different habitats, which was also the case for Slovenia. Here, we prepared the first unified overview of isopod species of Slovenia, which is also the first list of marine isopods in the country. We examined scientific publications, research reports and institutional databases. A total of 125 species have been recorded in Slovenia, of which 30 are marine, 21 are found in inland waters, and 74 are terrestrial. Of these, we report seven marine and one terrestrial species for the first time. A major part of freshwater isopod richness is linked to the subterranean environment, where most endemic species for the country can be found. Among marine species, many are parasites, with potential economic impact, and two species are considered introduced. When the new species list was compared to the valid national Red List of endangered species from 2002 and the Decree on Protected Wild Animal Species from 2004, only 41 species retained the same taxonomic status. Taking into consideration the recent taxonomic insights, many synonyms and invalid taxa call for a revison of the national Red List of Malacostraca and other nature protection acts.

Key words: Peracarida, marine, freshwater, terrestrial, subterranean, fauna

Izvleček. Pregled vrst rakov enakonožcev (Crustacea: Isopoda) Slovenije – Enakonožci so pestra skupina rakov valilničarjev z morskimi, sladkovodnimi in kopenskimi predstavniki. Seznami vrst enakonožcev običajno predstavljajo posamezne habitate, kar drži tudi za Slovenske. V tem prispevku smo pripravili prvi skupni pregled vrst enakonožcev v Sloveniji, ki je tudi prvi pregled morskih vrst enakonožcev v državi. Nekateri, zlasti morski paraziti imajo lahko tudi negativen ekonomski učinek. Pregledali smo predhodno zbrane podatke o pojavljanju enakonožcev na ozemlju Slovenije v znanstvenih in strokovnih prispevkih, poročilih raziskav ter podatkovnih bazah sodelujočih ustanov. Skupno je bilo v Sloveniji zaznanih 125 vrst, od tega 30 morskih, 21 v celinskih vodah in 74 kopenskih. V tem prispevku prvič poročamo o pojavljanju sedmih morskih in ene kopenske vrste. Velik delež vrstnega bogastva enakonožcev je vezan na podzemlje, kjer lahko najdemo tudi večino slovenskih endemitov v celinskih vodah in na kopnem. Med morskimi vrstami je mnogo parazitov, ki imajo lahko ekonomski vpliv, ter dve tujerodni vrsti. Če prenovljeni seznam vrst primerjamo z veljavnim Rdečim seznamom ter Uredbo o zavarovanih prosto živečih živalskih vrstah, zgolj 41 vrst ohrani enake taksonomske statuse. Številni sinonimi in neveljavni taksoni glede na trenutno taksonomijo skupine kažejo na potrebo po reviziji nacionalnega Rdečega seznama višjih rakov ter drugih varstvenih aktov.

Ključne besede: Peracarida, morski, celinske vode, kopenski, podzemni, favna

Introduction

Isopods are a diverse order of peracarid crustaceans, with over 10,000 described species worldwide (Boyko et al. 2008). They inhabit almost all marine, freshwater, and terrestrial environments, from the deep sea to deserts (Sfenthourakis & Taiti 2015). Most species of the order are marine, while among non-marine ones, the suborder Oniscidea represents more than three quarters of known species (Boyko et al. 2008). This suborder is one of the few crustacean groups successful in terrestrial habitats, being an order of magnitude richer in terrestrial species than terrestrial decapods or amphipods (Broly et al. 2013).

Isopods are important decomposers of plant matter both in aquatic (Wilson 2008) and terrestrial environments (David 2014; Sfenthourakis & Taiti 2015); on land, they may contribute greatly to soil formation (Zimmer 2002; David 2014). Numerous marine isopods live in close association with other benthic organisms and many are parasites, often on fish (Poore & Bruce 2012). Parasitic and wood-boring marine isopods can have a considerable negative economic impact (Borges et al. 2014; Čolak et al. 2018). Isopods are also a very successful arthropod group in subterranean freshwater and terrestrial environments (Coineau & Boutin 2004; Hobbs 2012; Sfenthourakis & Hornung 2018).

As decomposers that tend to accumulate metals in their tissues, isopods are important experimental organisms in ecotoxicology, particularly in studies dealing with metal and nanoparticle toxicity. Terrestrial species are particularly well studied in this respect (van Gestel et al. 2018), but ecotoxicological studies have also been performed on aquatic species (Lukančič et al. 2010; Plahuta et al. 2017). This has been one of the most flourishing research topics concerning this group in the past few decades (Vittori & Dominko 2022). Isopods are also important in basic research, particularly in developmental biology, studies of microbe-host interactions and, as their representatives span various degrees of adaptation to terrestrial life, the study of the transition from water to land (Hornung 2011; Vittori & Dominko 2022). Isopods, particularly representatives of the genus *Asellus*, are also some of the best studied subterranean invertebrates and serve as models for studying adaptations to the subterranean environment (Konec et al. 2015; Re et al. 2018; Balázs et al. 2021).

Due to the success of isopods in the sea, in inland waters, and on land, studies of their diversity are generally in the domains of four categories of biologists: marine zoologists, limnologists, speleobiologists, and researchers dealing with the edaphic fauna. As a result, it is challenging to bring lists of species records together. Additionally, many isopods inhabit different subterranean habitats, aquatic as well as terrestrial. Caves harbour isopods that are amphibious or secondarily aquatic, particularly among Oniscidea (Sfenthourakis & Taiti 2015).

In Slovenia, overviews of species occurrence were made separately according to different habitats. For terrestrial species, Karaman (1966) and Potočnik (1989) assembled checklists for the former state of Yugoslavia in the Western Balkans, with species listed separately for each federal republic (now countries), including the territory of Slovenia. Potočnik published several works on the terrestrial isopods of Slovenia (Potočnik 1979, 1980, 1981, 1984, 1992; Potočnik & Novak 1980). As for aquatic isopods, a checklist with descriptions of known distributions was published in the overview of all aquatic crustaceans for the former state of

Yugoslavia (Sket 1967). The Asellidae, in particular, are well studied, with integrated occurrence, habitat, and molecular data now available in the World Asellidae Database, including data from Slovenia (Saclier et al. 2024). Only a few publications are available on the occurrence of marine isopods in Slovenia (Sket 2008; Tratar 2010). A checklist of crustaceans occurring in the Gulf of Trieste was compiled more than a century ago by Graeffe (1902), with many of the species likely occurring also in the Slovenian part of the Gulf.

The aim of this contribution is to provide an updated checklist of isopods in Slovenia that considers taxonomic revisions and data acquired after the 1980s. It represents a reference point regarding the present state of knowledge and can form the basis for planning much needed systematic studies of the isopod fauna in marine, freshwater, and terrestrial environments. An overview of species was needed also to evaluate the current species richness of isopods, identify newly introduced species and provide a reference for a revision of protective legislation.

Materials and methods

Data were mostly collected from published species checklists that either focus on or include isopods and other references that report on the occurrence of isopods in Slovenia. The information from such literature sources that refer to subterranean taxa and/or subterranean habitats were extracted from the database SubBioDB (a taxonomic distributional database, established and managed by the Subterranean Biology Laboratory (SubBioLab) at the Department of Biology, Biotechnical Faculty, University of Ljubljana). The overview of marine taxa was based mostly on records from specimen collections of the Marine Biology Station Piran (MBP), which is a part of the National Institute of Biology in Slovenia. Finally, data were supplemented with those from the database of the Center of Cartography of Fauna and Flora in Slovenia.

In addition to reviewing existing literature, we also checked the extensive terrestrial isopod collection in the Slovenian Museum of Natural History in Ljubljana (SMNH), deposited there by Franc Potočnik. In the collection, we focused on species with a single record to confirm their identifications and presence in the country. We were able to successfully identify previously reported and deposited material of *Philoscia muscorum*, *Porcellio marginalis* (Potočnik 1984), and *Oniscus asellus* (Potočnik 1980). We also consulted publicly accessible databases, the World Register of Marine Species (WoRMS Editorial Board 2023), the Global Biodiversity Information Facility (GBIF 2023), and the Pan-European Species Directories Infrastructure (PESI 2023).

As subspecies were often not reported and their statuses are in need of reassessment, the list is limited to species and the current statuses of subspecies are only discussed regarding protective legislation. The presence of each species is referenced by listing a single published reference, which in most cases represents the most recent publication that includes the species. The previous checklists we refer to should be used to identify primary sources of the records. For species previously not included in checklists, we provide the source publications reporting on their occurrence. In the case of unpublished records, we provide detailed localities where the species in question were recorded.

Even though we acknowledge that some isopods cannot be placed in a single habitat category, we add information on the preferred habitat (terrestrial, freshwater, or marine), and mark obligate subterranean species separately as well as information on whether a species is introduced, endemic, or parasitic. We also point out species that were scientifically described from the territory of Slovenia.

In a special section, we list the species that have been reported in the literature, but there is reasonable doubt that they occur in Slovenia.

Changing taxonomy and improved knowledge results in changes in taxonomic statuses and new species descriptions. Considering the time lag since the publication of the last checklists of isopods and since the acceptance of the national Red List of Malacostraca (Ur. l. RS 2002), taxonomic and status changes could be expected. We prepared an overview of the current national Red List and an overview of changed statuses due to changes in taxonomy. Statuses of subspecies included in the Red List were checked in the World Register of Marine Species (WoRMS Editorial Board 2023). While we discuss the current taxonomic validity of the species in these lists, this is to spur the revision of legislation documents and not to determine or change the protection statuses of recorded species.

Results

Overview of the species checklist

A total of 125 species of isopods, belonging to seven suborders, 31 families and 62 different genera, can be confirmed for Slovenia (Tab. 1). For eight species, the presence in the country had not been published before, hence we provide the first data on their occurrence in Tab. 2. Eight species that have been reported for the country in past publications cannot reliably be considered as part of the Slovenian fauna. We comment on this in Tab. 3.

Table 1. An overview of isopod species confirmed to be present in Slovenia, listed in alphabetical order and according to suborders and families. A published reference for their occurrence in the country is provided, while detailed locality data on species reported for the first time are given in Tab. 2. The main habitat of each species is given in a separate column. The addition of the letter T marks obligate subterranean (or troglobiotic) species. Species marked with asterisks were scientifically described from Slovenia. Endemic, introduced, and ectoparasitic species are marked in the Remarks column.

Tabela 1. Pregled vrst enakonožcev, potrjenih v Sloveniji. Razporejeni so v abecednem vrstnem redu po podredovih in družinah. Dodane so objavljene reference pojavljajočih se vrst, natančni podatki o lokalitetah vrst, o katerih poročamo prvič, pa so podane v tabeli 2. Glavni habitat vsake vrste je podan v ločenem stolpcu. Črka T označuje obligatno podzemeljske (troglobiotske) vrste. Vrste, ki so označene z zvezdicami, so bile opisane iz Slovenije. Endemične, tujerodne in ektoparazitske vrste so označene v predzadnjem stolpcu.

Higher taxon	Species	Habitat	Remarks	Reference
Asellota				
Asellidae	*Asellus aquaticus* (Linnaeus, 1758)	freshwater		Sket 1967
	Asellus kosswigi Verovnik, Prevorčnik & Jugovic 2009	freshwater - T		Konec et al. 2015
	Proasellus coxalis (Dollfus, 1892)	freshwater		Sket 1967
	Proasellus deminutus (Sket, 1959) *	freshwater - T	endemic	Sket 1972
	Proasellus intermedius (Sket, 1965)	freshwater - T		Sket 1967
	Proasellus istrianus (Stammer, 1932)	freshwater		Sket 1967
	Proasellus orientalis Sket, 1965 *	freshwater - T	endemic	Sket 1971
	Proasellus parvulus (Sket, 1960) *	freshwater - T	endemic	Sket 1967
	Proasellus slavus (Remy, 1948)	freshwater - T		Sket 1972
	Proasellus slovenicus (Sket, 1957) *	freshwater - T	endemic	Sket 1967
	Proasellus vulgaris (Sket, 1965) *	freshwater - T	endemic	Sket 1967
Janiridae	*Jaera nordmanni* (Rathke, 1836)	marine		Tratar 2010
	Janira maculosa Leach, 1814	marine		new (MBP)
Munnidae	*Uromunna petiti* (Amar, 1948)	marine		Tratar 2010
Stenasellidae	*Balkanostenasellus skopljensis* (Karaman, 1937)	freshwater - T		Sket & Velkovrh 1981
Cymothoida				
Anthuridae	*Anthura gracilis* (Montagu, 1808)	marine		Sket 2003
	Cyathura carinata (Krøyer, 1847)	marine		Vrišer 2003
Cirolanidae	*Natatolana borealis* (Lilljeborg, 1851)	marine	ectoparasite	Vrišer 2003
	Sphaeromides virei (Brian, 1923)	freshwater - T		Sket 1964
Cymothoidae	*Anilocra physodes* (Linnaeus, 1758)	marine	ectoparasite	Vrišer 2003
	Ceratothoa parallela (Otto, 1828)	marine		Sket 2003
	Nerocila bivittata (Risso, 1816)	marine		Sket 2003
Expanathuridae	*Eisothistos macrurus* Wägele, 1979	marine		Lipej et al. 2016
Gnathiidae	*Gnathia dentata* (G. O. Sars, 1872)	marine	ectoparasite	Tratar 2010
	Gnathia oxyuraea (Lilljeborg, 1855)	marine	ectoparasite	new (MBP)
	Gnathia vorax (Lucas, 1849)	marine	ectoparasite	Tratar 2010
Paranthuridae	*Paranthura japonica* Richardson, 1909	marine	introduced	Ragkousis et al. 2020
Epicaridea				
Bopyridae	*Bopyrus squillarum* Latreille, 1804	marine	ectoparasite	Vrišer 2003
Limnoriidea				
Limnoriidae	*Limnoria tripunctata* Menzies, 1951	marine		Sket 2003
Oniscidea				
Agnaridae	*Orthometopon dalmatinum* (Verhoeff, 1901)	terrestrial		Vilisics & Lapanje 2005

Higher taxon	Species	Habitat	Remarks	Reference
	Orthometopon planum (Budde-Lund, 1885)	terrestrial		Potočnik 1990
	Protracheoniscus hermagorensis Verhoeff, 1927	terrestrial		Potočnik 1989
	Protracheoniscus politus (C. Koch, 1841)	terrestrial		Potočnik 1989
Armadillidae	*Armadillo officinalis* Duméril, 1816	terrestrial		Potočnik 1989
Armadillidiidae	*Armadillidium opacum* (C. Koch, 1841)	terrestrial		Potočnik 1989
	Armadillidium carniolense Verhoeff, 1901	terrestrial		Potočnik 1989
	Armadillidium klugii Brandt, 1833	terrestrial		Potočnik 1989
	Armadillidium nasatum Budde-Lund, 1885	terrestrial		Vilisics & Lapanje 2005
	Armadillidium pallasii Brandt, 1833	terrestrial		Potočnik 1989
	Armadillidium scaberrimum Stein, 1859	terrestrial		Potočnik 1989
	Armadillidium versicolor Stein, 1859	terrestrial		Potočnik 1989
	Armadillidium vulgare (Latreille, 1804)	terrestrial		Potočnik 1989
Cylisticidae	*Cylisticus convexus* (De Geer, 1778)	terrestrial		Potočnik 1989
Detonidae	*Armadilloniscus ellipticus* (Harger, 1878)	terrestrial		Potočnik 1989
Halophilosciidae	*Halophiloscia couchii* (Kinahan, 1858)	terrestrial		Potočnik 1989
	Halophiloscia hirsuta Verhoeff, 1928	terrestrial		Potočnik 1989
Ligiidae	*Ligia italica* Fabricius, 1798	terrestrial		Potočnik 1989
	Ligidium germanicum Verhoeff, 1901	terrestrial		Potočnik 1989
	Ligidium hypnorum (Cuvier, 1792)	terrestrial		Potočnik 1989
Mesoniscidae	*Mesoniscus graniger* (Frivaldszky, 1865)	terrestrial		Potočnik & Novak 1980
Oniscidae	*Oniscus asellus* Linnaeus, 1758	terrestrial		Potočnik 1989
	Oroniscus calcivagus Verhoeff, 1908 *	terrestrial		Potočnik 1989
Philosciidae	*Chaetophiloscia cellaria* (Dollfus, 1884)	terrestrial		Potočnik 1989
	Chaetophiloscia elongata (Dollfus, 1884)	terrestrial		Potočnik 1989
	Chaetophiloscia hastata Verhoeff, 1929	terrestrial		Potočnik 1989
	Chaetophiloscia splitensis Verhoeff, 1930	terrestrial		Potočnik 1989
	Lepidoniscus minutus (C. Koch, 1838)	terrestrial		Potočnik 1989
	Philoscia affinis Verhoeff, 1908	terrestrial		Potočnik 1989
	Philoscia muscorum (Scopoli, 1763) *	terrestrial		Potočnik 1989
Platyarthridae	*Platyarthrus hoffmannseggii* Brandt, 1833	terrestrial		Potočnik 1989
Porcellionidae	*Porcellio dilatatus* Brandt, 1831	terrestrial		Potočnik 1989
	Porcellio laevis Latreille, 1804	terrestrial		Potočnik 1989
	Porcellio longicornis Stein, 1859	terrestrial		Potočnik 1990
	Porcellio marginalis Budde-Lund, 1885	terrestrial		Potočnik 1989
	Porcellio scaber Latreille, 1804	terrestrial		Potočnik 1989

Higher taxon	Species	Habitat	Remarks	Reference
	Porcellio spinicornis Say 1818	terrestrial		Potočnik 1989
	Porcellionides pruinosus (Brandt, 1833)	terrestrial		Potočnik 1989
Trachelipodidae	*Porcellium conspersum* (C. Koch, 1841)	terrestrial		Potočnik 1981
	Porcellium fiumanum (Verhoeff, 1901)	terrestrial		Potočnik 1989
	Trachelipus arcuatus (Budde-Lund, 1885)	terrestrial		Potočnik 1989
	Trachelipus camerani (Tua, 1900)	terrestrial		Vilisics & Lapanje 2005
	Trachelipus nodulosus (C. Koch, 1838)	terrestrial		Potočnik 1989
	Trachelipus rathkii (Brandt, 1833)	terrestrial		Potočnik 1989
	Trachelipus ratzeburgii (Brandt, 1833)	terrestrial		Potočnik 1989
	Trachelipus razzautii (Arcangeli, 1913)	terrestrial		Potočnik 1989
	Trachelipus vespertilio (Budde-Lund, 1896)	terrestrial		Vittori 2022
Trichoniscidae	*Alpioniscus strasseri* (Verhoeff, 1927)	terrestrial - T		Potočnik 1989
	Androniscus degener Brian, 1927	terrestrial - T		Potočnik & Novak 1981
	Androniscus dentiger Verhoeff, 1908	terrestrial		Potočnik 1989
	Androniscus roseus (C. Koch, 1838)	terrestrial		Potočnik 1989
	Androniscus stygius (Nemec, 1897)	terrestrial - T		Potočnik 1989
	Androniscus subterraneus (Carl, 1906)	terrestrial - T		Potočnik 1989
	Buddelundiella cataractae Verhoeff, 1930	terrestrial		Potočnik 1989
	Calconiscellus gottscheensis (Verhoeff, 1927) *	terrestrial		Potočnik 1989
	Calconiscellus karawankianus (Verhoeff, 1908) *	terrestrial		Potočnik 1989
	Haplophthalmus abbreviatus Verhoeff, 1928*	terrestrial		Potočnik 1989
	Haplophthalmus danicus Budde-Lund, 1880	terrestrial		Potočnik 1989
	Haplophthalmus fiumaranus Verhoeff, 1908	terrestrial		Potočnik 1989
	Haplophthalmus mengii (Zaddach, 1844)	terrestrial		Potočnik 1989
	Haplophthalmus rhinoceros Verhoeff, 1930	terrestrial		Potočnik 1989
	Hyloniscus adonis Verhoeff, 1927 *	terrestrial		Potočnik 1989
	Hyloniscus riparius (C. Koch, 1838)	terrestrial		Potočnik 1989
	Hyloniscus vividus (C. Koch, 1841)	terrestrial		Potočnik 1989
	Moserius percoi Strouhal, 1940 *	terrestrial - T		Potočnik 1989
	Tachysoniscus austriacus (Verhoeff, 1908)	terrestrial		Potočnik 1989

Higher taxon	Species	Habitat	Remarks	Reference
	Thaumatoniscellus speluncae Karaman, Bedek & Horvatović, 2009	terrestrial - T		Polak et al. 2012
	Titanethes albus (C. Koch, 1841) *	terrestrial - T		Potočnik 1989
	Trichoniscus carniolicus Strouhal, 1939 *	terrestrial		Potočnik 1989
	Trichoniscus illyricus Verhoeff, 1931	terrestrial		Potočnik 1989
	Trichoniscus matulici Verhoeff, 1901	terrestrial		Potočnik 1989
	Trichoniscus provisorius Racovitza, 1908	terrestrial		new
	Trichoniscus stammeri Verhoeff, 1932 *	terrestrial - T	endemic	Potočnik 1989
Tylidae	*Tylos europaeus* Arcangeli, 1938	terrestrial		Potočnik 1989
Sphaeromatidea				
Sphaeromatidae	*Campecopea hirsuta* (Montagu, 1804)	marine		new (MBP)
	Cymodoce truncata Leach, 1814	marine		Vrišer 2003
	Dynamene bicolor (Rathke, 1836)	marine		Tratar 2010
	Dynamene edwardsi (Lucas, 1849)	marine		Tratar 2010
	Lekanesphaera hookeri (Leach, 1814)	marine		Sket 1967
	Monolistra bericum (Fabiani, 1901)	freshwater - T		Sket 1967
	Monolistra bolei (Sket, 1960) *	freshwater - T	endemic	Sket 1967
	Monolistra calopyge Sket, 1982 *	freshwater - T	endemic	Sket 1982
	Monolistra caeca Gerstaecker, 1856 *	freshwater - T		Sket 1967
	Monolistra racovitzai Strouhal, 1928 *	freshwater - T		Sket 1967
	Monolistra spinosa (Racovitza, 1929) *	freshwater - T	endemic	Sket 1967
	Monolistra spinosissima (Racovitza, 1929) *	freshwater - T	endemic	Sket 1967
	Monolistra velkovrhi Sket, 1960 *	freshwater - T		Sket 1967
	Paracerceis sculpta (Holmes, 1904)	marine	introduced	Ferrario et al. 2018
	Sphaeroma serratum (J. C. Fabricius, 1787)	marine		Vittori 2021
Valvifera				
Arcturidae	*Astacilla longicornis* (Sowerby, 1806)	marine		new (MBP)
	Astacilla dilatata G. O. Sars, 1883	marine		Sket 2003
Hognathidae	*Cleantis prismatica* (Risso, 1826)	marine		new (MBP)
Idoteidae	*Idotea balthica* (Pallas, 1772)	marine		Vrišer 2003
	Stenosoma appendiculatum (Risso, 1826)	marine		new (MBP)
	Stenosoma lancifer (Miers, 1881)	marine		new (MBP)
	Synischia hectica (Pallas, 1772)	marine		Lipej et al. 2013

The highest proportion of species, 74 (nearly 60%), are terrestrial (suborder Oniscidea), with the greatest richness found in the family Trichoniscidae with 26 species (Fig. 1). It is only in this family that terrestrial obligate subterranean species can be found (eight species). Other terrestrial families with more than five species are Armadillidiidae, Philosciidae, Porcellionidae and Trachelipodidae. There is only one terrestrial species endemic to Slovenia: *Trichoniscus stammeri* (Tab. 1 and Fig. 2). While it is difficult to be certain which of the currently cosmopolitan species present in Slovenia are native, no demonstrably introduced terrestrial species have been recorded so far.

Figure 1. Proportions of freshwater, marine and terrestrial isopods in Slovenia (inner level) and proportions of different families in each of these categories (outer level). Families represented by a single species are grouped under »Other«.
Slika 1. Razmerja enakonožcev celinskih vod ter morskih in kopenskih enakonožcev v Sloveniji (notranji nivo) ter razmerja med družinami v vsaki kategoriji (zunanji nivo). Zaradi preglednosti družine, zastopane z zgolj eno vrsto, niso prikazane ločeno.

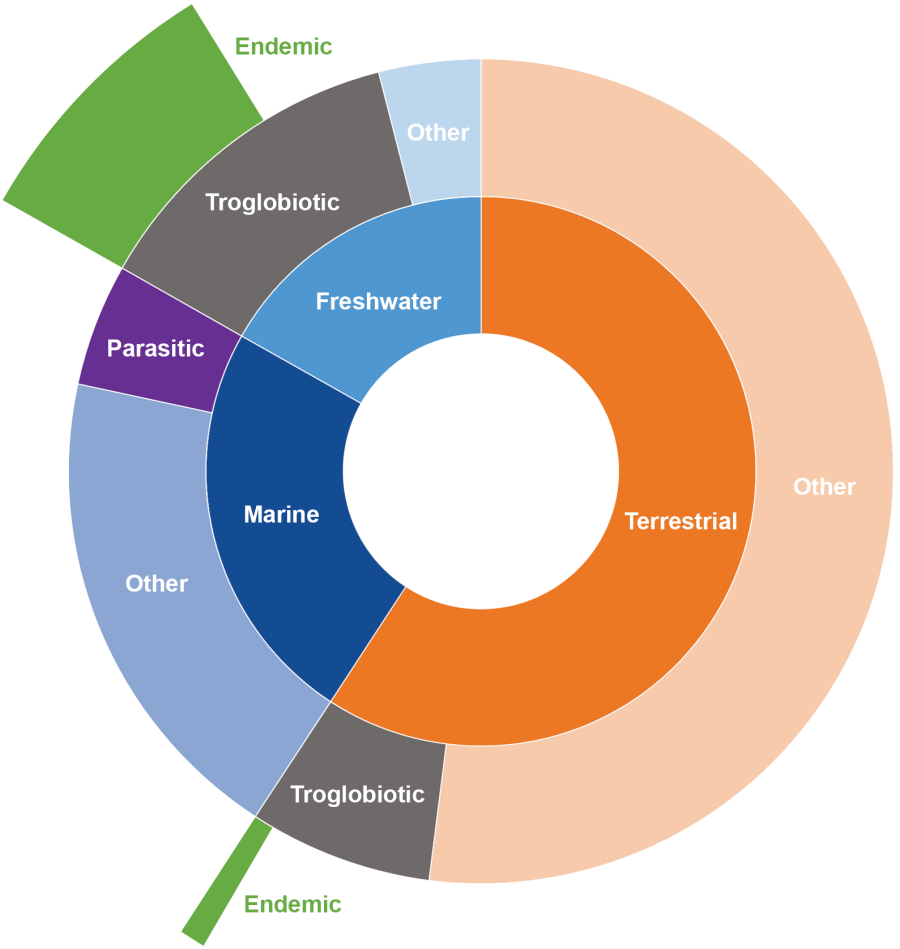

Figure 2. Proportions of freshwater, marine and terrestrial isopods (inner level) and corresponding proportions of parasitic species for marine isopods and troglobiotic species for the remaining two categories (second level). The proportion of endemic species is presented separately (outer level). There are no known endemic marine species.
Slika 2. Razmerja enakonožcev celinskih vod, morskih in kopenskih enakonožcev (notranji nivo) ter pripadajoči deleži parazitov pri morskih enakonožcih in troglobiontov pri ostalih dveh kategorijah (drugi nivo). Delež endemitov je podan ločeno (zunanji nivo). Morski endemiti niso znani.

The second group richest in species are marine isopods, with 30 species (approximately 25% of all species). Sphaeromatidae are the most diverse family with eight species, followed by Gnathiidae and Idoteidae (Fig. 1). The list contains two non-indigenous species: *Paracerceis sculpta* and *Paranthura japonica*. Both can be considered as established non-indigenous species in the Slovenian Sea. Eight species can be categorised as parasites (Fig. 2), predominantly with fish hosts. An exception is *Bopyrus squillarum*, which is hosted by *Palaemon* decapods.

The freshwater harbours a total of 21 species (about 15% of all), of which only three are not considered to be bound to subterranean habitats (Tab. 1 and Fig. 2). The most representatives in freshwater belong to Asellidae, followed by Sphaeromatidae (Fig. 1). The most species-rich genera in both families, *Proasellus* and *Monolistra*, respectively, are represented with nine species each. Many species in these genera are endemic to Slovenia. Specimens from the genus *Microcharon* were reported but were not identified to species level in the publication that lists this record (Brancelj et al. 2016). As a result, we only list the genus at this point.

There are eight marine and one terrestrial species for which no data have been published (Tab. 1). In Table 2 we provide information on records that confirm the presence of these species in Slovenia. New marine species for the Slovenian fauna were collected during sampling procedures of the marine benthic communities, conducted during various projects of the Marine Biological Station from 2008 onward. The new terrestrial species was recorded in synanthropic habitats, but it is widespread in Europe and has been reported from the Balkans before (Schmalfuss 2003). It is therefore difficult to assess whether it has been introduced or not.

Table 2. Details of records confirming the presence of eight marine and one terrestrial isopod species in Slovenia. The abbreviation MBP refers to Marine Biological Station of the National Institute of Biology.
Tabela 2. Podrobnosti novih najdb, ki potrjujejo pojavljanje osmih morskih in enega kopenskega enakonožca v Sloveniji. Kratica MBP označuje Morsko biološko postajo Nacionalnega inštituta za biologijo.

Family	Species	Locality	Lat, Lon (WGS84)	Date	Leg./ Det.	Remarks
Arcturidae	*Astacilla longicornis*	Sea at Strunjan	45.535900, 13.601967	10.06.2008	MBP/B. Mavrič	
Sphaeromatidae	*Campecopea hirsuta*	Piran, sea under medieval wall	45.529000, 13.573067	10.06.2008	MBP/B. Mavrič	
		Sea at Cape of Piran	45.530567, 13.565100	18.06.2008	MBP/B. Mavrič	
		Sea near the coastal road between Koper and Izola	45.548150, 13.700650	26.06.2008	MBP/B. Mavrič	
		Sea at Debeli Rtič	45.592617, 13.714683	17.06.2008	MBP/B. Mavrič	
		Sea at the youth rehabilitation centre at Debeli Rtič	45.587583, 13.706983	17.06.2008	MBP/B. Mavrič	
		Laguna Bernardin	45.514833, 13.573117	12.06.2008	MBP/B. Mavrič	
		Port of Piran	45.526583, 13.566733	12.06.2008	MBP/B. Mavrič	
		Sea at Jadranka Izola	45.539167, 13.670000	18.05.2009	MBP/B. Mavrič	
		Sea under the wall in front of Marina Portorož	45.504167, 13.594167	19.05.2009	MBP/B. Mavrič	
		Portorož beach	45.512778, 13.593611	19.05.2009	MBP/B. Mavrič	
Hognathidae	*Cleantis prismatica*	Sea soft bottom sample, Sv Nikolaj	45.574167, 13.740000	10.06.2009	MBP/B. Mavrič	

Family	Species	Locality	Lat, Lon (WGS84)	Date	Leg./ Det.	Remarks
		Sea soft bottom sample, Koper at the end of Semedelska road	45.543333, 13.720278	29.5.2009	MBP/B. Mavrič	
		Sea soft bottom sample, Strunjan, in front of Salina	45.526111, 13.601667	18.5.2009	MBP/B. Mavrič	
		Sea soft bottom sample, wall in front of Marina Portorož	45.504167, 13.594167	19.5.2009	MBP/B. Mavrič	
		Seagrass meadow in front of Strunjan	45.527594, 13.600892	21.5.2018	MBP/B. Mavrič	
Gnathiidae	*Gnathia oxyuraea*	Soft bottom taken with Van Veen grab, Bay of Sv. Jernej	45.594983, 13.709600	8.9.2021	MBP/B. Mavrič	National monitoring location VT2P2
Janiridae	*Janira maculosa*	Pacug	45.526186, 13.589369	10.8.2012	MBP/B. Mavrič	Within colonies of Mediterranean stony coral (*Cladocora caespitosa*) from the depth of 3–6 m
		Cape Strunjanček, Strunjan	45.537217, 13.601753	22.8.2012	MBP/B. Mavrič	Several invidivudals, within the colonies of Mediterranean stony coral (*Cladocora caespitosa*) from the depth of 3–6 m
Idoteidae	*Stenosoma appendiculatum*	Sample of muddy bottom taken with Van Veen grab at cape Ronek	45.542750, 13.624000	10.6.2019	MBP/B. Mavrič	National monitoring location VT4P12
	Stenosoma lancifer	Sea at Sv. Nikolaj 1	45.574167, 13.740000	10.6.2009	MBP/B. Mavrič	
		Sv. Nikolaj 2	45.574444, 13.737222	10.6.2009	MBP/B. Mavrič	
		Lazaret	45.590833, 13.719444	26.5.2009	MBP/B. Mavrič	
Trichoniscidae	*Trichoniscus provisorius*	Garden in Središče ob Dravi	46.395278, 16.266944	29.9.2019, 29.8.2021	M. Vittori/ M. Vittori	
		Fallen tree in front the Biotechnical Faculty main building, Ljubljana	46.048972, 14.475583	14.6.2023, 2.8.2023	U. Bogataj, K. Kunčič, M. Vittori/ M. Vittori	

There are eight species that were reported in some sources but cannot be considered as part of the Slovenian fauna due to different reasons (Tab. 3). They should be excluded from the list until a documented confirmation of their presence in the country is available.

Table 3. Excluded isopod species and species the presence of which cannot be currently confirmed and are therefore removed from the checklist of Slovenian isopod fauna.
Tabela 3. Izločene vrste enakonožcev in vrste, ki jih trenutno ne moremo potrditi, zato so izvzete iz seznama vrst enakonožcev Slovenije.

Family	Species	Source of record	Explanation
Asellidae	*Proasellus pavani* (Arcangeli, 1942)	PESI 2023	This species is mentioned in the PESI database. However, there are no other records, a primary source, or GBIF data that would support its occurrence in Slovenia.
Armadillidae	*Armadillidium dollfusi* Verhoeff, 1902	Potočnik 1979	According to Schmalfuss (2003), the record of this species from Slovenia might be a misidentification. Its known distribution is in northwest Italy (Schmalfuss 2003). We were able to locate one lot in SMNH that matches one of the published records of *A. dollfusi* in terms of year and locality (»Pred Planinsko jamo 1970«), but the *Armadillidium* specimens in this vial appear identical with *Armadillidium carniolense*. The presence of this species should be confirmed before considering it a part of Slovenian fauna.
	Armadillidium granulatum Brandt, 1833	PESI 2023	Mentioned in the PESI database, but not documented otherwise.
	Armadillidium quinquepustulatum Budde-Lund, 1885	Potočnik 1979	According to Schmalfuss (2003), the record of the species from Slovenia is likely a misidentification. Its known distribution is in southeast France (Schmalfuss 2003). This species was reported from a single locality (Potočnik 1979), but we were not able to find the corresponding material in SMNH at this point. Its presence should be confirmed.
Gnathiidae	*Paragnathia formica* (Hesse, 1864)	Lipej et al. 2013	The collected individuals of this species were in larval stages (pranizae) and their determination uncertain.
Idoteidae	*Stenosoma viridula*	Avčin et al. 1973; Lipej et al. 2013	This species is currently considered a synonym of *Synischia hectica* (Charfi-Cheikhrouha 2000) and is excluded from the list under this name.

Family	Species	Source of record	Explanation
Ligiidae	*Ligia oceanica* (Linnaeus, 1767)	Avčin et al. 1973	This species is found along the coasts of the North Atlantic and the Baltic Sea (Schmalfuss 2003), very far from Slovenia. The source of the record lists this species as being abundant in Strunjan Bay (Avčin et al. 1973), but the species that is indeed abundant is *Ligia italica*. *Ligia oceanica* has never been reported by other researchers in Slovenia, despite extensive work in the area (Potočnik 1984). It is therefore most likely that this report was a misidentification.
Porcellionidae	*Leptotrichus panzerii* (Audouin, 1826)	PESI 2023	Mentioned in the PESI database, but not documented otherwise.
Sphaeromatidae	*Dynamene bidentata* (Adams, 1800)	Sket 2003	The species *D. bidentata*, mentioned by Sket (2003), is not present in the Mediterranean Sea according to Vieira et al. (2016), hence the records should be regarded as *D. bicolor*.
Trichoniscidae	*Hyloniscus mariae* Verhoeff, 1908	PESI 2023	Mentioned in the PESI database, but not documented otherwise.
	Titanethes dahli Verhoeff, 1926	Polak et al. 2012	This species is currently considered as a form of *T. albus* and not a separate species (Karaman & Horvatović 2018).
	Trichoniscus strasseri	Schmalfuss 2003	This species was described from the Croatian island of Cres (Verhoeff 1938; Schmölzer 1965; Karaman 1966) and has not been recorded in Slovenia to our knowledge, nor has its presence in Slovenia been reported in the literature listed for this species in the World Catalogue (Schmalfuss 2003). The listing of Slovenia as its distribution range is likely an error.

Overview of isopod taxa in Slovenian legislation and comments on their validity

There are 72 different isopod taxa included in Slovenian nature protection legislation, although only 41 of the species bear the same name and the same protection status after considering taxonomic changes (Tab. 4).

Four species names have become synonymous with other valid names, where the taxonomic status can simply be transferred to the new name (*Armadillidium albanicum*, *Armadilloniscus litoralis*, *Trichoniscus turgidus*, *Tylos latreillei*; Tab. 4). One species of the genus *Monolistra* is no longer accepted as a species. As a result, its status is transferred to the valid subspecies (Tab. 4).

Table 4. An overview of isopod taxa listed in the Slovenian Red Data List (Ur. l. RS. 2002) and the Decree on Protected Wild Animal Species (Ur. l. RS. 2004). The column RL (Red List) marks the status of the species in the Slovenian Red Data list: E - endangered, V- vulnerable, R - rare, K - data deficient, I – not evaluated. The column Decree marks whether the species is listed in the Appendix 1A (species protected) or 2A (species' habitat protected) in the Decree on Protected Wild Animal Species.

Tabela 4. Pregled taksonov enakonožcev, naštetih v Rdečem seznamu višjih rakov (Ur. l. RS. 2002) in Uredbi o zavarovanih prosto živečih živalskih vrstah (Ur. l. RS. 2004). V stolpcu RL so označeni statusi vrst v Rdečem seznamu: E – ogrožena, V – ranljiva, R – redka, K - premalo znana, I – neopredeljena vrsta. Zadnji stolpec označuje, ali je vrsta našteta v Prilogi 1A (vrste, katerih živali so zavarovane) oz. Prilogi 2A (vrste, katerih habitat je varovan) Uredbe o zavarovanih prosto živečih živalskih vrstah.

Taxon	Valid taxon	Status	RL	Decree
Androniscus dentiger croaticus	Subspecies not valid	not transferred	R	
Androniscus roseus buccarensis	Subspecies not valid	not transferred	K	
Androniscus roseus dolinensis	Subspecies not valid	not transferred	R	
Androniscus roseus hamuligerus	*Androniscus roseus hamuligerus*	valid	R	
Androniscus stygius cavernarum	Subspecies not valid	not transferred	K	
Androniscus stygius dentatus	*Androniscus stygius dentatus*	valid	R	
Androniscus stygius scabridus	*Androniscus stygius scabridus*	valid	R	
Androniscus stygius strasseri	*Androniscus stygius strasseri*	valid	K	
Androniscus stygius stygius	*Androniscus stygius stygius*	valid	R	
Androniscus subterraneus degener	*Androniscus degener*	transferred to species	R	
Androniscus subterraneus nodosus	Subspecies not valid	not transferred	R	
Armadillidium albanicum	*Armadillidium klugii*	synonym; transferred to valid species	R	
Armadillidium carniolense schoebli	*Armadillidium carniolense*	transferred to species	R	
Armadillidium dollfusi	*Armadillidium dollfusi*	valid	K	
Armadillidium opacum	*Armadillidium opacum*	valid	K	
Armadillidium pallasii	*Armadillidium pallasii*	valid	K	
Armadillidium scaberrimum	*Armadillidium scaberrimum*	valid	K	
Armadilloniscus litoralis	*Armadilloniscus ellipticus*	synonym; transferred to valid species	E	
Asellus aquaticus	*Asellus aquaticus*	valid	V	
Asellus aquaticus cavernicolus	*Asellus aquaticus cavernicolus*	valid		2A
Balkanostenasellus skopljensis	*Balkanostenasellus skopljensis*	valid	R	2A
Buddelundiella cataractae	*Buddelundiella cataractae*	valid	R	
Calconiscellus gottscheensis	*Calconiscellus gottscheensis*	valid	K	
Calconiscellus karawankianus	*Calconiscellus karawankianus*	valid	K	
Chaetophiloscia cellaria	*Chaetophiloscia cellaria*	valid	E	
Chaetophiloscia splitensis	*Chaetophiloscia splitensis*	valid	E	
Halophiloscia aristotelis	*Halophiloscia couchii*	synonym; transferred to valid species	E	
Halophiloscia couchii	*Halophiloscia couchii*	valid	E	
Halophiloscia hirsuta	*Halophiloscia hirsuta*	valid	E	
Haplophthalmus abbreviatus	*Haplophthalmus abbreviatus*	valid	K	
Haplophthalmus fiumaranus dolinensis	*Haplophthalmus fiumaranus dolinensis*	valid	R	
Haplophthalmus fiumaranus fiumaranus	*Haplophthalmus fiumaranus fiumaranus*	valid	K	

Taxon	Valid taxon	Status	RL	Decree
Haplophthalmus fiumaranus dolinensis, fiumaranus	*Haplophthalmus fiumaranus*	transferred also to species	R, K	
Haplophthalmus mengii	*Haplophthalmus mengii*	valid	K	
Haplophthalmus rhinoceros	*Haplophthalmus rhinoceros*	valid	R	
Hyloniscus vividus	*Hyloniscus vividus*	valid	K	
Lekanesphaera hookeri	*Lekanesphaera hookeri*	valid	V	2A
Lepidoniscus minutus carniolensis	*Lepidoniscus minutus carniolensis*	valid	R	
Lepidoniscus minutus carniolensis	*Lepidoniscus minutus*	transferred also to species	R	
Lepidoniscus minutus pannonicus	Subspecies not accepted	not transferred	K	
Monolistra bolei	*Monolistra bolei*	valid	R	2A
Monolistra brevispinosa	*Monolistra bolei brevispinosa*	transferred to subspecies	R	2A
Monolistra caeca	*Monolistra caeca*	valid		2A
Monolistra calopyge	*Monolistra calopyge*	valid	R	2A
Monolistra racovitzai	*Monolistra racovitzai*	valid		2A
Monolistra racovitzai conopyge	*Monolistra racovitzai conopyge*	valid	R	
Monolistra schottlaenderi	*Monolistra schottlaenderi*	valid		2A
Monolistra spinosa	*Monolistra spinosa*	valid		2A
Monolistra spinosissima	*Monolistra spinosissima*	valid	R	2A
Monolistra velkovrhi	*Monolistra velkovrhi*	valid	V	2A
Moserius percoi	*Moserius percoi*	valid	R	
Oroniscus calcivagus	*Oroniscus calcivagus*	valid	R	
Philoscia affinis	*Philoscia affinis*	valid	K	
Porcellio dilatatus	*Porcellio dilatatus*	valid	K	
Porcellio marginalis	*Porcellio marginalis*	valid	R	
Porcellium conspersum	*Porcellium conspersum*	valid	R	
Proasellus parvulus	*Proasellus parvulus*	valid	R	
Proasellus pavani orientalis	*Proasellus orientalis*	transferred to species	R	
Proasellus slavus histriae	*Proasellus slavus histriae*	valid	R	
Proasellus slavus variabilis	nomen nudum	not transferred	K	
Proasellus slovenicus	*Proasellus slovenicus*	valid	R	
Protracheoniscus hermagorensis	*Protracheoniscus hermagorensis*	valid	K	
Sphaeromides virei	*Sphaeromides virei*	valid		2A
Sphaeromides virei virei	*Sphaeromides virei virei*	transferred to species	R	
Trachelipus arcuatus	*Trachelipus arcuatus*	valid	K	
Trachelipus nodulosus	*Trachelipus nodulosus*	valid	K	
Trachelipus pseudoratzeburgi apenninorum	Subspecies not accepted	not transferred	K	
Trachelipus razzautii	*Trachelipus razzautii*	valid	K	
Trichoniscus carniolicus	*Trichoniscus carniolicus*	valid	R	
Trichoniscus stammeri	*Trichoniscus stammeri*	valid	R	
Trichoniscus turgidus	*Trichoniscus matulici*	synonym; transferred to new species	I	
Tylos latreillei	*Tylos europaeus*	synonym; transferred to new species	E	

For three subspecies that are no longer considered valid, the protection status can be transferred to the species level (Tab. 4). This does not apply for seven other invalid subspecies where the species had more subspecies without protection statuses present in the country. The species therefore cannot assume the status determined for a single (invalid) subspecies without a re-evaluation of the whole species status. Interestingly, the national Red List also mentions a subspecies that is a *nomen nudum*. The subspecies was listed, with an explanation that it had not yet been described, in the publication that proposed Red List statuses for freshwater Malacostraca (Sket 1992). However, it was never formally described.

The new status of the currently valid species *Haplophthalmus fiumaranus* could be taken from both subspecies that had protection statuses determined, i.e. *H. f. dolinensis* and *H. f. fiumaranus*. In such cases, both statuses are being transferred. According to the Red List (Ur. l. RS 2002), the highest protection status would be favoured, in this case rare instead of data deficient species. But as a status re-evaluation for the new taxon could reveal that a more suitable status would be »vulnerable«, we consider it safer to suggest both statuses, while ultimately a re-evaluation can determine the most suitable status.

Discussion

The present work provides the first complete checklist of all isopods from different habitats in Slovenia, and a list of species that cannot be considered as part of Slovenian fauna even though listed in some literature sources. The number of terrestrial species has remained roughly the same as in the most recent checklist (Potočnik 1992), but some species have been removed (mostly synonyms) and others added: one that we report in this work and five reported in recent publications (Vilisics & Lapanje 2005; Polak et al. 2012; Vittori 2022). In freshwater, there is a greater increase in the number of species as compared to Sket (1967), as new species have been described and certain subspecies elevated to species status. The list for marine isopods is the first comprehensive overview of the group for the country.

The species richness of terrestrial isopods is greatest in the Mediterranean region of Europe and decreases northward (Hornung 2011). The richness of terrestrial isopods in Slovenia is high for its size, as it is comparable to larger countries in the Balkans (Sfenthourakis & Hornung 2018). This is very likely related to the geographic diversity within the country, which includes the coast with suitable habitats for littoral species, numerous caves with troglobionts, as well as diverse surface habitats for widespread species of the Balkans and Central Europe. We should also consider that the terrestrial isopod fauna in Slovenia has been well studied in the past (Karaman 1966; Potočnik 1989) which, however, does not apply for all countries in Southeast Europe.

Although terrestrial isopods generally have limited dispersal abilities (Hornung 2011), there is only one terrestrial species endemic to Slovenia (*T. stammeri*). A species until recently considered endemic for Slovenia is *Calconiscellus gottscheensis*. However, this species has also been found in caves in nearby regions of Croatia (Jana Bedek, personal communication). *Trichoniscus carniolicus*, another species that used to be considered endemic (Potočnik 1992), has also been reported in Austria (Strouhal 1968), while *Oroniscus calcivagus* has been recorded

in Italy according to GBIF data supported by a deposited museum specimen (GBIF 2023). *Moserius percoi* was first described from a single female collected in 1885 (Strouhal 1940) from a cave near the border between Slovenia and Italy. The species was later discovered also in Tuscany in Italy (Taiti & Ferrara 1995), at a large geographical distance from its type locality. An examination of further specimens, especially males, from Slovenia would be welcome, as it could offer additional confirmation that both known populations of *M. percoi* belong to the same species.

There are some terrestrial isopod species that are expanding their ranges in Europe, particularly in synanthropic environments. These are predominantly Mediterranean species that have become cosmopolitans due to human introduction (Szlavecz et al. 2018). The ten most common woodlice in urban environments (Szlavecz et al. 2018) have already been recorded in synanthropic habitats in Slovenia, although some of these species have only been reported on single occasions (*Porcellio dilatatus*, *Porcellio laevis*), which makes it difficult to assess how common and widespread they are and whether or not they are permanently present. None of these species can be considered introduced.

A note must be made regarding the records of *Trachelipus illyricus*. Although the World catalogue of terrestrial isopods (Schmalfuss 2003) considers *T. illyricus* a synonym of *Trachelipus camerani* and one of its subspecies, *T. illyricus lasiorum*, a synonym of *Trachelipus ratzeburgii*, Schmidt (1997) synonymised *T. illyricus* exclusively with *T. ratzeburgii* and not *T. camerani* in his revision of the genus. While this synonymization was based only on the examination of male pereopod 7 and pleopod 1, these characters should be sufficient to distinguish *T. ratzeburgii* from *T. camerani*. Based on these considerations, it is best to regard past records of *T. illyricus* as *T. ratzeburgii*.

The richness of freshwater species is remarkable considering the size of Slovenia. Most of this richness is found in subterranean waters, which are also home to the greatest number of Slovenian endemic isopods. Parallels with this can be found in the freshwater fauna of amphipods in Slovenia, the great majority of which inhabit groundwater (Fišer et al. 2021). However, even groundwater species with distributions reaching into neighbouring countries have small distribution ranges (Stoch 1989; Prevorčnik et al. 2010; Konec et al. 2016).

The recorded isopod richness in the Slovenian Sea is relatively high compared to regions of similar size elsewhere in the Adriatic (Zavodnik & Kovačić 2000; Zavodnik et al. 2006). Thirty recorded species in the Slovenian Sea represent almost 40% of all species listed for the Adriatic Sea (Castelló et al. 2020). Among new species for the country, the records of *Campecopea hirsuta* in samples from hard bottom upper mediolittoral taken at different locations along the Slovenian coast and identified on the basis of well-defined characters (Bruce & Holdich 2002) are, to our knowledge, the first records of this species for the Adriatic Sea.

Slovenian coastal waters are continuously monitored by the Marine Biology Station of the National Institute of Biology, generally providing good insight into the benthic fauna. Nevertheless, dedicated publications dealing with isopods are scarce. Several specimens await determination to species level, such as those from the genus *Eurydice* (Pitacco et al. 2013) and *Arcturus* (Vrišer 2003). An additional problem with marine isopod taxonomy is that species descriptions, especially those from the late 19th and early 20th centuries, are vague and incomplete, calling for species redescriptions (Rincón et al. 2018). More systematic studies of

marine species are needed to improve our knowledge of the richness and the distribution of native isopods and to detect potential invasive species. The latter is important as numerous marine isopods can have considerable economic impact. Wood boring isopods, such as *Limnoria tripunctata*, can damage infrastructure (Borges et al. 2014), whereas parasitic taxa, such as representatives of Gnathiidae and Cymothoidae, can affect fisheries.

Even though research in some isopods, for example those in terrestrial habitats, has a long history in Slovenia, very little information is available on their distribution patterns. In the future, systematic distribution studies of the isopod fauna can fill this gap, resulting in distribution maps as prepared for ants in the territory of Slovenia by Bračko (2023), or for the terrestrial isopod fauna of Belgium, a country of similar size (Boeraeve et al. 2022). In addition, we can expect the detection of further terrestrial isopod species. Some species have likely been missed either by chance due to limited sampling or due to species not yet described at the time of collection. There is considerable likelihood that further species remain to be discovered in subterranean habitats. The use of molecular methods will further help identify species, as large genetic diversity has been confirmed within freshwater isopods and new species descriptions may follow. In the Slovenian Sea, the marine isopod fauna is also likely richer than is currently known and more studies are needed.

Further studies in different habitats are important also to detect introductions of alien species. Changes in land use and climate as well as transport of alien species due to increased traffic of goods provides opportunities for the introduction or natural expansion of species currently not found in Slovenia. In this way, several terrestrial isopod species have been spreading across Europe in recent years, such as *Armadillidium arcangelii* (Noél et al. 2022), *A. nasatum* and *Agabiformius lentus* (Cochard et al. 2010). In the Slovenian Sea, several introduced species have been identified, and emphasis should be put on detecting new ones, as they can have ecological and economic consequences.

If we compare the Decree on Protected Wild Animal Species (Ur. l. RS. 2004), listing twelve species and one subspecies as protected, and the national Red List with 45 species and 9 subspecies with determined statuses (Ur. l. RS. 2002), there are some inconsistencies between the two documents. According to the Decree, all taxa with protection statuses should be listed in the Red List, but this is not always the case, as the Red List has not been updated since its publication in 2002. For example, there is only one subspecies of *Monolistra*, *M. racovitzai conopyge*, included in the Red List, but *M. racovitzai* is protected according to the Decree. In another case, it is vice versa. The subspecies *Asellus aquaticus cavernicolus* is listed in the Decree, while the species *A. aquaticus* has vulnerable status in the Red List. In such cases, the status is valid also for the subspecies. These examples point out the need for a review of the current national Red List of endangered species, as taxonomy and knowledge of the distribution of species have changed. Importantly, more data on species distribution, habitat requirements and temporal changes in distribution would help improve the assignment of conservation statuses. The acquisition of such data has been performed on a scale comparable to the size of Slovenia in Flanders (De Smedt et al. 2022). The lack of data was also pointed out as an important issue by researchers who prepared the initial publications proposing Red List statuses for isopod taxa in Slovenia (Potočnik 1992; Sket 1992). In these publications, endemism, small documented distribution ranges, threats to habitats and type localities in Slovenia were major criteria for the proposal of Red List statuses and protective measures. Even though we provide comments on the potential transfer of statuses in the current situation, this should not be treated

as a suggestion on species/subspecies statuses in the reviewed Red List. The latter should be made by expert work considering all relevant taxonomic and distributional data on each taxon and an evaluation of its conservation status in the country.

Povzetek

Enakonožci so skupina višjih rakov z več kot 10.000 vrstami, od katerih nekatere živijo v morju, druge v sladkih vodah, številne pa so kopenske (Boyko et al. 2008). So pomembni razkrojevalci tako v vodnih kot kopenskih okoljih. Med vodnimi predstavniki je precej parazitov, najpogosteje na ribah, in ti so lahko ekonomsko pomembni (Čolak et al. 2018). Številni so pomembni razkrojevalci v vodnih in kopenskih okoljih (Wilson 2008; David 1012). Enakonožci so uspešna skupina tudi v podzemlju (Coineau & Boutin 2004; Sfenthourakis & Hornung 2018). Zaradi njihove ekološke pestrosti so pregledi njihovega vrstnega bogastva razdrobljeni in običajno ločeni po habitatih. Za ozemlje Slovenije obstajajo starejši seznami vrst, ki obravnavajo bodisi vrste celinskih vod (Sket 1967) bodisi kopenske vrste (Potočnik 1989), za morske pa takšnega seznama še ni bilo. V tem prispevku smo pripravili prvi skupni pregled vrst enakonožcev v Sloveniji. Pregled upošteva spremembe taksonomije ter vrste, zaznane v zadnjih treh desetletjih. Podatke o pojavljanju vrst smo zbrali iz objavljene literature ter podatkovnih baz Nacionalnega inštituta za biologijo, Oddelka za biologijo Biotehniške fakultete Univerze v Ljubljani ter Centra za kartografijo favne in flore. Skupno smo v Sloveniji zaznali 125 vrst enakonožcev, od tega 30 morskih vrst, 21 vrst v celinskih vodah in 74 kopenskih vrst. Med morskimi po pestrosti prevladuje družina Sphaeromatidae, ki je na račun rodu *Monolistra* močno zastopana tudi v podzemeljskih celinskih vodah. V slednjih je najpestrejša družina Asellidae, na kopnem pa prednjači družina Trichoniscidae. V tem prispevku prvič poročamo o pojavljanju sedmih morskih in ene kopenske vrste. Velik delež vrstnega bogastva enakonožcev celinskih vod in na kopnem sestavljajo vrste, živeče v podzemlju, med katerimi je tudi večina (10) slovenskih endemitov. V površinskih celinskih vodah ter na kopnem najdemo zgolj po eno endemično vrsto. Med morskimi vrstami je šest parazitov ter dve tujerodni vrsti, medtem ko tujerodnih vrst v ostalih dveh kategorijah nismo zasledili. Zgolj 41 vrst, navedenih v Pravilniku o uvrstitvi ogroženih rastlinskih in živalskih vrst v rdeči seznam (Ur. l. RS 2002) ter v Uredbi o zavarovanih prosto živečih živalskih vrstah (Ur. l. RS 2004), je v trenutni taksonomiji ohranilo svoje taksonomske statuse, medtem ko so številne v zakonodaji navedene vrste in podvrste bodisi neveljavni taksoni bodisi sinonimi drugih vrst enakonožcev. To kaže na potrebo po reviziji varstvenih aktov. Za vzpostavitev ustreznega varstva enakonožcev bi bilo nujno pridobivanje podatkov o njihovi razširjenosti in njenem spreminjanju, ki trenutno manjkajo.

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