ORIGINAL ARTICLE

An annotated checklist and bibliography of the Diaptomidae (Copepoda, Calanoida) of Italy, Corsica, and the Maltese islands

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ABSTRACT

Calanoids of the family Diaptomidae are the most widespread copepods in the lentic inland waters of the Palearctic region. In Italy, studies on the family date back to the end of 19th century. Since then, several papers contributed to increase the knowledge on their presence, distribution, and ecological preferences. Nevertheless, new records for the area and the discovery of putative new species stress that the current knowledge on these inland water crustaceans is still far from being exhaustive. This paper presents an updated and annotated checklist and bibliography of the Diaptomidae of the Italian peninsula and surrounding islands, including Corsica and the Maltese islands, compiled through a critical review of the existing literature and carrying out further field research. The doubtful records reported in the literature are discussed and clarified. The updated checklist includes 30 diaptomid species and subspecies; among them, an alien species and three putative new species pending formal description are reported. About 20% of the observed species are endemic or subendemic to the study area. The faunal provinces ascribed to the Mediterranean limnofaunistic region host the highest species richness and contribute to the checklist with rare species and unique occurrences. The high species richness observed in the Mediterranean area supports the hypothesis of a long-lasting persistence of an ancient and peculiar copepod fauna.

INTRODUCTION

Calanoid copepods make up one of the major groups among inland water microcrustaceans and play an essential role in the trophic webs of lentic ecosystems, being thus a taxon of primary interest for both biogeographers and ecologists (Dussart and Defaye, 2001; Boxshall and Defaye, 2008). The strictly inland water family Diaptomidae largely dominates the water bodies of the Palearctic biogeographical region, being represented by 144 species (Boxshall and Defaye, 2008), 94 of which are reported from the western Palearctic (Błędzki and Rybak, 2016; Marrone *et al.,* 2017). In this area, Marrone *et al.* (2017) described a complex scenario of post-glacial recolonization of the northern latitudes and highlighted the outstanding diversity of the family in the central and eastern Mediterranean countries comprised between 40° and 45° N, from Italy to the Balkan peninsula and Asia Minor, although the limited number of recent synoptic works available for these areas was underlined as well.

The first comprehensive data on Italian Diaptomidae were compiled by Stella (1979a, 1982, 1984) who reported 20 species for the country, brought later to 21 with the inclusion of the stygobitic *Troglodiaptomus sketi* Petkovski, 1978 (Stoch, 1984; Stella, 1995). Later, Stoch (2006a) reported the occurrence of 26 diaptomid taxa (belonging to 25 species) for Italy. Marrone *et al*. (2017) listed 26 autochthonous diaptomid species (subspecies were not considered) for mainland Italy, Corsica, Malta, and the Italian side of the Alps. Belmonte (2018) reported 27 species for the whole Italian fauna, including the non-native *Eudiaptomus gracilis* (Sars, 1863). However, due to the inherent synoptic nature of this last paper, the presence of some taxa was overlooked or was not critically discussed, and a complete repository of the bibliographical sources dealing with the family Diaptomidae in the study area was not provided.

Although the Diaptomidae is admittedly the dominant calanoid family occurring in the Holarctic inland waters (Dussart and Defaye, 2002), other families are represented in the study area. Temoridae, with the occurrence of *Heterocope saliens* (Lilljeborg, 1862) (Stoch, 2006a), Pseudodiaptomidae, with *Calanipeda aquaedulcis* Kritschagin, 1873 (Stoch, 2006a, Vecchioni et al., 2019), and Centropagidae, with the non-native *Boeckella triarticulata* (Thomson, 1883) (Ferrari and Rossetti, 2006; Alfonso and Belmonte, 2008), occur in the inland waters of the study area, whereas representatives of the families Acartiidae and Pseudodiaptomidae can be found in coastal ponds and lagoons, with brackish and marine waters (Belmonte, 2018).

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The aims of the present paper are (i) to compile an updated checklist of Diaptomidae in Italy, Corsica, and the Maltese islands based on a critical review of recent literature and unpublished data, (ii) to assemble an exhaustive repository of the literature dealing with the diaptomids of the study area between 2000 and 2020, and (iii) to carry out a biogeographical analysis of the diaptomids occurring in the study area, with a focus on the affinities existing with neighbouring west-Palearctic limnofaunistic regions *sensu* Illies (1967).

METHODS

Study area

The geographical area covered by the present paper includes the limnofaunistic region "ITA" as defined by Illies (1967), *i.e.*, mainland Italy, Sicily, Sardinia, Maltese islands, and Corsica, with the addition of the Italian slope of the Alps. The study area is then divided in the zoogeographical provinces defined by Minelli *et al*. (2006) as modified by Stoch (2006b), along with some islands which administratively belong to different countries but are geographically and geologically part of the study area, *i.e.*, Corsica and the Maltese islands (Fig. 1). A minor modification to the above-mentioned provinces was made by the authors to the Tyrrhenian province, adding to it some coastal plains in Campania and Calabria which share climatic and geomorphological features with this province (Fig. 1). All the zoogeographical provinces were then grouped in five macroareas based on their climatic, geographic, and physiographic features (Tab. 1). The shapefile of the mentioned provinces is provided as supplementary material available online (File S1).

Bibliographical review and nomenclature

An exhaustive database of the papers citing the presence of diaptomids up to December 2020 was compiled for the whole study area based on the datasets of the authors,

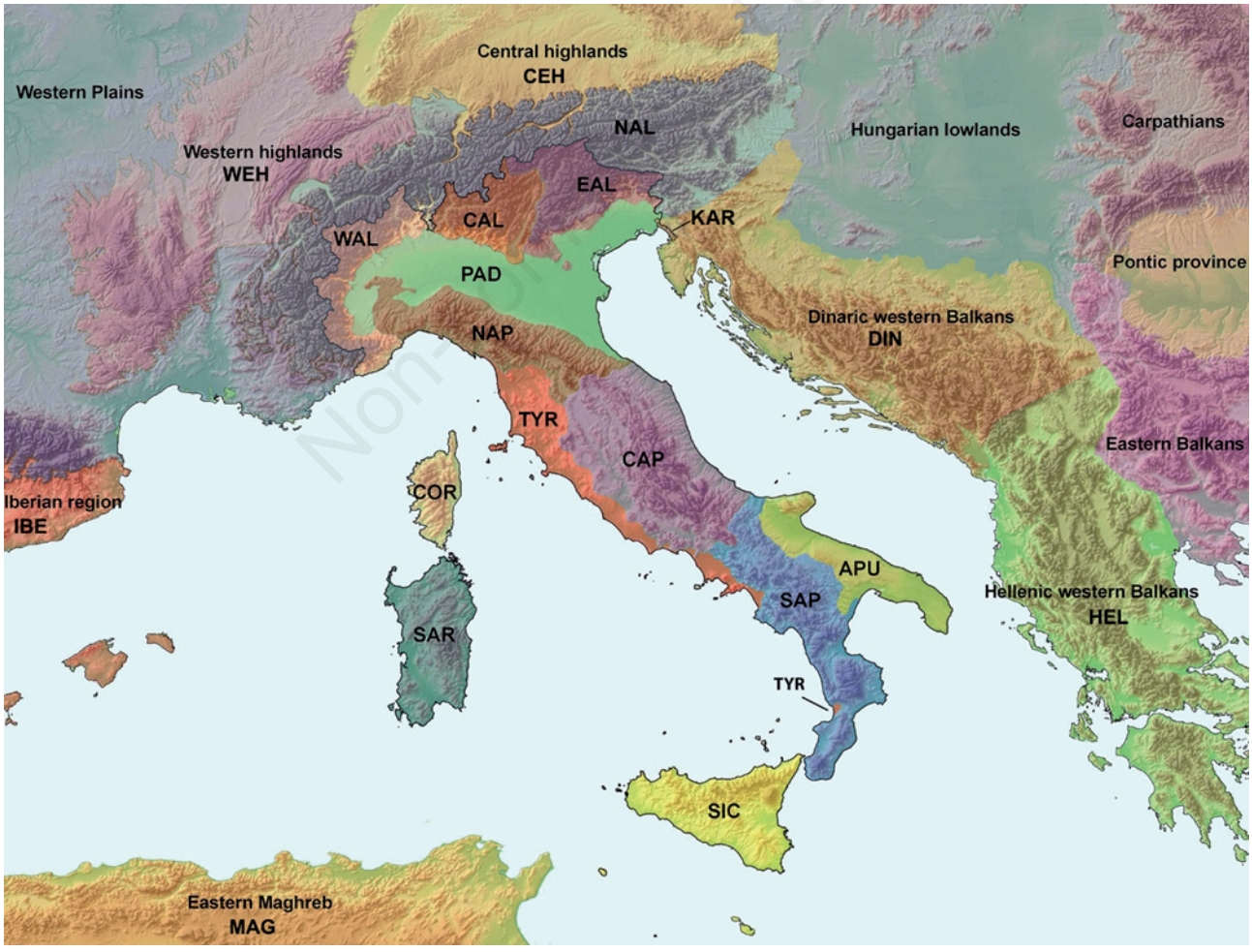

Fig. 1. The Italian zoogeographical provinces and neighbouring limnofaunistic regions (see text for details).

including 'grey literature', plus an extensive literature search through the databases of SCOPUS (www.scopus.com) and Google Scholar (https://scholar. google.it/). As regards the occurrence data pertaining to the politically Italian part of the study area, the bibliography included in the electronic material associated to the paper by Stoch (2006a) was considered exhaustive and reliable for all the papers published before 2000. Conversely, the whole literature dealing with the diaptomids of Corsica and the Maltese islands was carefully reviewed.

All obtained occurrence data were critically revised and, when possible, checked through dedicated sampling surveys. Particular attention was paid to the check of the occurrence data reported by strictly ecological papers where the accurate identification of copepods was not the primary aim of the work, since identifications might have been carried out by non-specialists of the taxon.

Diaptomid nomenclature used herein is largely based on Dussart and Defaye (2002), with the only exception of taxa described or changed in rank after that publication (see Marrone *et al*., 2017 for details).

In the updated and annotated checklist presented here, the scientific name of each taxon is followed by the acronyms of the provinces where it is known to occur (Fig. 1; Tab. 1). When the presence of a taxon in a given province was considered doubtful or marginal, the acronym of the province is reported among round or square brackets, respectively, and the case is discussed in detail. Marginal occurrences are those represented by a single or few records occurring at the boundary of the species range and usually in atypical environments, which were confirmed by at least two authors and\or by specimens preserved in collections. Occurrences which do not fall under the previous conditions or were not confirmed by subsequent research in the same or neighbouring sites are considered doubtful.

All the references mentioning the presence of diaptomid species and subspecies in the study area are also reported, from 2000 up to December 2020 (for the Italian references), or from 1894 to December 2020 for the references pertaining to Corsica (France) and the Maltese islands (Malta).

Data analysis

The affinities among the diaptomid faunas of the zoogeographical provinces reviewed here and the neighboring limnofaunistic regions described in Marrone *et al*. (2017) were investigated. The occurrence data about Diaptomidae occurring in the regions surrounding the study area were retrieved from Marrone *et al.* (2017) with some changes: i) since in the frame of the present work the subspecies are explicitly treated, the taxon reported as *Eudiaptomus padanus* (Burckhardt, 1900) for "Dinaric western Balkans" (DIN) by Marrone *et al*. (2017) is here reported as *Eudiaptomus padanus etruscus* (Losito, 1901); ii) a new limnofaunistic unit was added, coded NAL ("Northern Alps"), to include the "Alpine region" (ALP) of Marrone *et al*. (2017) excluding the Italian part of the Alps; iii) the Italian province KAR (*i.e.*, the part of the DIN region included within the Italian administrative borders) was included in DIN;(iv) the taxa *Hemidiaptomus* cf. *inermis* Kiefer, 1954 and *Eudiaptomus* sp. EMILIA-ROMAGNA, which were not listed by Marrone *et al*. (2017) are here included in the analyses (see text).

The occurrences of *Diaptomus cyaneus* Gurney, 1909 in TYR, *Hemidiaptomus gurneyi* (Roy, 1927) in SAR, *Eudiaptomus zachariasi* (Poppe, 1886) in KAR,

Tab. 1. List of the zoogeographical provinces of the study area, their acronyms, macroareas, area (in km^2) and diaptomid species richness.

Macroarea	Province	Acronym	Area (km2)	Species
Alpine	Central Alps	CAL	15,618	7
Alpine	Eastern Alps	EAL	20,290	5
Alpine	Western Alps	WAL	17,488	5
Apennine	Central Apennines	CAP	48,475	9
Apennine	Northern Apennines	NAP	28,035	3
Apennine	Southern Apennines	SAP	36,724	5
Balkan	Karst plateau	KAR	268	2
Mediterranean	Apulia	APU	18,829	13
Mediterranean	Corsica	COR	8731	6
Mediterranean	Sardinia	SAR	24,104	8
Mediterranean	Sicily and Malta	SIC	26,028	11
Mediterranean	Tyrrhenian area	TYR	19,855	4
Padanian	Padanian plain	PAD	46,031	6

Eudiaptomus intermedius (Steuer, 1897) in WAL, and *Arctodiaptomus wierzejskii* (Richard, 1888) in WAL were not included in the occurrence matrix analyzed since their actual occurrence is doubtful in the mentioned areas (see below). Likewise, the analyzed occurrence matrix did not include *Mixodiaptomus kupelwieseri* (Brehm, 1907) in WAL and *Arctodiaptomus alpinus* (Imhoff, 1885) in NAP because the species have been considered marginal presences there. Moreover, the occurrence of *Eudiaptomus gracilis* in the Italian provinces was not included in the matrix since the species is currently considered non-native in the whole study area (Marrone *et al*., 2017). The resulting matrix included 55 species and subspecies of Diaptomidae and 19 biogeographical units (13 of which are the Italian zoogeographical provinces described above: File S2).

The similarities among the diaptomid faunas were analysed using non-metric Multi-Dimensional Scaling (nMDS). The resemblance matrix of the occurrence data was based on the Jaccard index. The Spearman's correlation coefficient was used to identify the species that mostly contributed to the characterisation of each biogeographical unit. Species which were not significant ($p>0.05$) were not considered further. Analyses were performed using the software PRIMER-E v.6.1.11 (Clarke and Gorley, 2006), including the PERMANOVA+ v.1.0.1 add-on package (Anderson *et al*., 2008).

RESULTS

Overall, 29 diaptomid species and 1 subspecies, three of them still pending a formal description, were recorded in the study area (Tab. 2). In addition to the species listed below, Kiefer (1978) and Dussart and Defaye (2002) reported the presence of *Arctodiaptomus similis* (Baird, 1859) in Sardinia, although no other data were provided by these authors to substantiate the record of this species, which occurs in eastern Europe and the Middle East (Marrone *et al.*, 2014). A review of the correspondence between late prof. E. Stella and prof. F. Kiefer (now deposited in F. Stoch library) led to the finding of an explicit mention of a single female *Arctodiaptomus* specimen from Sardinia whose morphology and chaetotaxy were compatible with *A. similis* (File S3). An effort spent in March 2018 aimed at collecting the species in Sardinia was unfruitful (F. Marrone and F. Stoch, *pers. obs.*). Pending further evidence, its occurrence in a Sardinian sample (a single female was found, and no further specimens were obtained from the samples re-examined by E. Stella upon Kiefer's request, as written in the letter: File S3) is here tentatively ascribed to the mislabelling or "contamination" of the studied sample, and *A. similis* is thus excluded from the Sardinian and Italian fauna.

Annotated checklist

Subfamily DIAPTOMINAE Kiefer, 1932

Acanthodiaptomus denticornis (Wierzejski, 1887). WAL, CAL, EAL. In the study area, this species is limited to the Alpine mountain range (Stoch, 2006a). *Other references*: Jersabek *et al*., 2001; Angeli *et al*., 2002; Tolotti *et al.*, 2006; Bruno *et al.*, 2010; Marrone *et al.*, 2017; Belmonte, 2018.

Arctodiaptomus (Arctodiaptomus) kerkyrensis (Pesta, 1935). SAP, APU, SIC. This species has a distribution limited to the southern part of the Italian peninsula and Sicily. The first record in the study area was reported by Licchelli *et al*. (2003) for the Southern Apennines. Later, other point records followed in Sicily (Marrone *et al*., 2006a) and Apulia (G. Alfonso, F. Marrone and F. Stoch, *unpubl. data*). *Other references*: Belmonte *et al.*, 2006; Marrone, 2006; Marrone *et al.*, 2006b, 2009, 2019; Belmonte, 2018.

Arctodiaptomus (Arctodiaptomus) sp. SICILY. SIC. Following Stella (1984, and references therein), Naselli-Flores and Barone (2002), Marrone and Naselli-Flores (2004), Stoch (2006a), Marrone (2006), and Marrone *et al.* (2006a, 2006b) reported the occurrence of *Arctodiaptomus stephanidesi* (Pesta, 1935) in Sicily, also reported as "*Arctodiaptomus stefanidesi*" (sic!) in Belmonte (2018). In fact, the Sicilian populations ascribed to this taxon belong to a putative new species, currently pending a formal description (Marrone *et al.*, 2009; 2017). *Other references*: Marrone *et al.*, 2013, 2014, 2019.

Arctodiaptomus (Arctodiaptomus) wierzejskii (Richard, 1888). (WAL), CAP, APU, SAR, COR, SIC. This widespread Palearctic species is present in Corsica (Schachter and Champeau, 1969), Sardinia (Stoch, 2006a), Apulia (Alfonso and Belmonte, 2011; Alfonso *et al.*, 2016) and in a single high-altitude site in the central Apennine area (Stoch, 2006a). Moreover, it is present in Malta (Marrone *et al.*, 2009; Montevago *et al.*, 2020), although the species seems to be absent from mainland Sicily (F. Marrone, 2006a, and *pers. obs.*). Its occurrence in Lake Orta, north-western Italy (Bonacina and Pasteris, 2001) was temporary, following a period of high pollution, and the species is no more part of the zooplankton community of the lake (Piscia *et al*., 2016). *Other references*: Champeau, 1971; Champeau and Thiéry, 1990; Lanfranco and Cassar, 2003; Scirocco *et al.*, 2008; Alfonso and Belmonte, 2013; Marrone *et al.*, 2013, 2017; Belmonte, 2018.

Arctodiaptomus (Rhabdodiaptomus) alpinus (Imhoff, 1885). WAL, CAL, EAL, [NAP]. A widely distributed species throughout the Palearctic region (Dussart and Defaye, 2002) including the Mediterranean island of Crete (Marrone *et al.*, 2019). Some doubts on the con-

specificity of the Mongolian and European populations were raised by Marrone *et al.* (2015). In the study area, it occurs on the whole Alpine mountain range, both in permanent and temporary water bodies (Jersabek *et al.*, 2001; Stoch, 2006a). Its only record in NAP is the lake Giacopiane (Giussani *et al.*, 1986). *Other references*: Jersabek *et al*., 2001; Angeli *et al*., 2002; Manca and Armiraglio, 2002; Marchetto *et al*., 2004; Tolotti *et al.*, 2006; Tiberti, 2011; Tiberti and Barbieri, 2011; Iacobuzio and Tiberti, 2011; Magnea *et al.*, 2013; Tiberti and Iacobuzio, 2013; Tiberti *et al.*, 2013, 2014a, 2014b, 2016, 2019, 2020a, 2020b; Marrone *et al.*, 2014, 2017; Belmonte, 2018.

Arctodiaptomus (Rhabdodiaptomus) salinus (Daday, 1885). APU, SIC, SAR. A halophilous species currently reported only for Sardinia (Stoch, 2006a), Sicily (Marrone *et al.*, 2006a) and a single coastal wetland in Apulia (Alfonso and Belmonte, 2011). *Other references*: Marrone, 2006; Marrone *et al.*, 2006b, 2009, 2013, 2017; Alfonso *et al.*, 2010; Anufriieva and Shadrin, 2015; Belmonte, 2018.

Copidodiaptomus numidicus (Gurney, 1909). SIC, SAR, COR. A western Mediterranean species, absent in the Italian peninsula but rather common in Corsica (Schachter and Champeau, 1969), Sardinia (Stoch, 2006a; Fadda *et al*., 2011), and Sicily (Stoch, 2006a;

Tab. 2. Checklist of the Italian Diaptomidae and their occurrence in the Italian zoogeographical provinces.

		Alpine		Balkan	Padanian	Apennine		Mediterranean						
Taxa	**Acronym**	**WAL**	**CAL**	**EAL**	**KAR**	**PAD**	**NAP**	**CAP**	**SAP**	**TYR**	**APU**	**SIC**	**SAR**	**COR**
Diaptominae														
Acanthodiaptomus denticornis (Wierzejski, 1887)	Acaden	1	1	1										
Arctodiaptomus (Arctodiaptomus) kerkyrensis (Pesta, 1935)	Arcker								1		1	1		
Arctodiaptomus (Arctodiaptomus) sp. SICILY	Arcsp											1		
Arctodiaptomus (Arctodiaptomus) wierzejskii (Richard, 1888)	Arcwie	(1)						1			1	1	1	1
Arctodiaptomus (Rhabdodiaptomus) alpinus (Imhoff, 1885)	Arcalp	1	1	1			[1]							
Arctodiaptomus (Rhabdodiaptomus) salinus (Daday, 1885)	Arcsal										1	1	1	
Copidodiaptomus numidicus (Gurney, 1909)	Copnum											1	1	1
Copidodiaptomus steueri (Brehm, 1904)	Copste		1	1				1	1		1			
Diaptomus (Chaetodiaptomus) cyaneus Gurney, 1909	Diacya	1						1		(1)	1	1	1	1
Diaptomus (Chaetodiaptomus) serbicus Gjorgjewič, 1907	Diaser									1	1	1		
Eudiaptomus gracilis (Sars, 1863)	Eudgra	1*	1*			1*		1*						
Eudiaptomus intermedius (Steuer, 1897)	Eudint	(1)	1		1	1	1	1						
Eudiaptomus padanus etruscus (Losito, 1901)	Eudetr					1		1		1	1			
Eudiaptomus padanus padanus (Burckhardt, 1900)	Eudpad	1	1			1								
Eudiaptomus sp. EMILIA-ROMAGNA	Eudsp					1								
Eudiaptomus vulgaris (Schmeil, 1898)	Eudvul		1					1	1					
Eudiaptomus zachariasi (Poppe, 1886)	Eudzac				(1)			1						
Hemidiaptomus (Gigantodiaptomus) superbus (Schmeil, 1895)	Hemsup					1								
Hemidiaptomus (Hemidiaptomus) gurneyi (Roy, 1927)	Hemgur									1	1	1	(1)	
Hemidiaptomus (Occidodiaptomus) cf. *inermis* Kiefer, 1954	Hemine										1			1
Hemidiaptomus (Occidodiaptomus) ingens (Gurney, 1909)	Heming											1		
Hemidiaptomus (Occidodiaptomus) roubaui (Richard, 1888)	Hemrou												1	
Mixodiaptomus kupelwieseri (Brehm, 1907)	Mixkup	[1]				1	1	1	1	1	1	1	1	1
Mixodiaptomus incrassatus (Sars, 1903)	Mixinc										1		1	
Mixodiaptomus laciniatus laciniatus (Lilljeborg, 1889)	Mixlac	1	1											1
Mixodiaptomus lilljeborgi (Guerne and Richard, 1888)	Mixlil							1	1		1		1	
Mixodiaptomus tatricus (Wierzejski, 1883)	Mixtat		1	1			1							
Paradiaptominae														
Metadiaptomus chevreuxi (Guerne and Richard, 1894)	Metche											1		
Neolovenula alluaudi (Guerne and Richard, 1890)	Neoall										1			
Speodiaptominae														
Troglodiaptomus sketi Petkovski, 1978	Troske				1									

**non-indigenous occurrence; (1): doubtful record; [1]: marginal occurrence.*

Marrone *et al.,* 2006a). *Other references*: Champeau, 1971; Champeau and Thiéry, 1990; Marrone, 2006; Marrone *et al.,* 2006b, 2009, 2013, 2017; Alfonso *et al.,* 2010; Fadda *et al.,* 2014, 2016; Troia *et al*., 2016; Belmonte, 2018; Naselli-Flores and Marrone, 2019; Vecchioni *et al*., 2019, 2020.

Copidodiaptomus steueri (Brehm, 1904). CAL, EAL, CAP, SAP, APU. The species occurs in the Adriatic hydrographic basins of Italian peninsula and northern Balkans (Stoch, 2006a; Ternjej and Stanković, 2007; Alfonso *et al.*, 2010; Alfonso and Belmonte, 2011). The report of the species for an artificial lake in southern Sardinia (Cioglia *et al*., 1969) is erroneous and due to a misidentification of the closely related *C. numidicus* as confirmed by recent samples collected from the lake (F. Marrone and F. Stoch, *pers. obs*). *Other references*: Garibaldi *et al*., 2003; Bettinetti *et al.,* 2012; Leoni, 2017; Marrone *et al.*, 2017; Belmonte, 2018.

Diaptomus (Chaetodiaptomus) cyaneus Gurney, 1909. WAL, CAP, (TYR), APU, SIC, SAR, COR. This species is rather common in the temporary ponds of Corsica (Schachter and Champeau, 1969), Sardinia (Stoch, 2006a), Sicily (Marrone *et al.* 2006a) and Apulia (Alfonso and Belmonte, 2011; Alfonso *et al.* 2016). Moreover, high-altitude populations of the species are reported for temporary water bodies in the Central Apennine area (Stoch, 2006a), and for permanent lakes in Corsica (Pesta, 1938) and on the western Alps, where the species occurs both on the French (Pirocchi, 1947; Dussart, 1957) and Italian slopes (Marrone and Stoch, *unpublished data*). The occurrence of the species in the ponds of the Nature Reserve "Oasi di Palo", near Rome (Mura and Brecciaroli, 2003) is doubtful and may actually refer to *D. serbicus* (Brecciaroli, *in litteris*). Moreover, the Apulian sites reported for the species by Scirocco *et al*. (2008) must in fact be referred to *Diaptomus serbicus* (Alfonso and Belmonte, 2011). *Diaptomus castor* Jurine, 1820 reported for Ile Rousse (Corsica) by Richard (1894-1895) is here ascribed to a misidentification of *D. cyaneus* since *D. castor* does not occur in the Mediterranean area (Kiefer, 1978), and the record was published before the description of *D. cyaneus* (Gurney, 1909). *Other references*: Champeau, 1971; Champeau and Thiéry, 1990; Marrone and Naselli-Flores, 2004; Marrone 2006; Marrone *et al*. 2006b, 2009, 2013, 2017; Alfonso and Belmonte, 2013; Troia *et al*., 2016; Belmonte, 2018; dos Santos-Silva *et al*., 2018.

Diaptomus (Chaetodiaptomus) serbicus Gjorgjewič, 1907. TYR, APU, SIC. *D. serbicus* is the westernmost species of the *mirus* group within the genus *Diaptomus* (Kiefer, 1972). In the study area, the species is so far only reported for temporary ponds in Latium (*e.g.*, Stoch 2006a), Sicily (Marrone *et al.*, 2006a), and Apulia (Alfonso and Belmonte, 2011). *Other references*: Vagaggini *et al*., 2002; Marrone, 2006; Marrone *et al*., 2006b, 2009, 2010, 2013, 2017, 2019; Seminara *et al.*, 2015, 2016; Belmonte, 2018; dos Santos-Silva *et al*., 2018.

Eudiaptomus gracilis (Sars, 1863). WAL, CAL, PAD, CAP. According to Riccardi and Rossetti (2007) and Marrone *et al.* (2017) *Eudiaptomus gracilis* is to be considered an alien species in Italy, although its status was never tested through a thorough analysis. The older citations for this species in Italy are due to misidentifications and must be referred to other species (Kiefer, 1968; Stoch, 2006a), and the first certain record dates back to the early 1980s (de Bernardi *et al*., 1984). *E. gracilis* is currently widespread in northern and central Italy (F. Stoch., *unpublished data*), possibly threatening native diaptomid species (*e.g.*, Riccardi and Giussani, 2007; Visconti and Manca, 2010). *Other references*: Viaroli *et al*., 2002; Rossetti et al., 2003a, 2003b; Margaritora *et al.*, 2006; Gherardi *et al.*, 2008; Fontanella *et al.*, 2009; Rossetti *et al.*, 2009; Tavernini *et al.*, 2009b; Visconti and Manca, 2011; Riccardi *et al.*, 2012; Belmonte, 2018; Lepori *et al*., 2018; Piscia *et al*. 2018; Visconti *et al*. 2018; Lepori, 2020; Lepori and Capelli, 2020; Setubal *et al*., 2020; Tanentzap *et al*., 2020.

Eudiaptomus intermedius (Steuer, 1897). (WAL), CAL, KAR, PAD, NAP, CAP. Stoch (2006a) reports several occurrence localities of the species in central and northern peninsular Italy, whereas its occurrence in the Western Alps remains doubtful. The species was reported from a lake in the Lys Valley (Aosta) by Brian (1927); however, recent surveys in the area (F. Stoch, *pers. obs.*) failed to confirm its presence. Marrone *et al.* (2011b) and Galassi *et al*. (2017) reported the occurrence of a stygomorphic population of the species for the Frasassi cave system, in The Marches. *Other references*: Moroni and Bellavere, 2001; Tavernini and Rossetti, 2001; Rossetti *et al*., 2002, 2004; Tavernini *et al*., 2003; Rossetti, 2005; Bondavalli *et al.,* 2006; Rossetti *et al.,* 2006; Tavernini *et al.,* 2009a; Riccardi *et al*., 2012; Ferrari *et al.,* 2014; Marrone *et al.,* 2017; Belmonte, 2018; Rogora *et al*., 2018.

Eudiaptomus padanus etruscus (Losito, 1901). PAD, CAP, TYR, APU. This taxon was described by Losito (1901, erroneously reported with the date 1911 in Stella, 1984) as *Diaptomus etruscus* from Bracciano Lake, Latium. In his revision of the genus *Eudiaptomus*, Kiefer (1968) reported *E. padanus etruscus* for several lakes and ponds in central Italy, while describing '*E. padanus etruscus* forma *sexsetosa* (nov.)' from lakes Bracciano, Bolsena and Albano based on the presence of six setae on the third segment of endopods of P2-P4 instead of seven as reported by Losito. Being

the name '*sexsetosa*' not available due to the year of description (after 1960: ICZN, art. 45.6), Kiefer (1978) redescribed it as *'Eudiaptomus padanus etruscosexsetosus* n. subsp.'; in this way two different subspecies of the same species resulted present in the type locality of *E. padanus etruscus*, *i.e.* Lake Bracciano. For some reason Kiefer was not aware of this fact, and the same nomenclature was adopted in the field guide by Stella (1982). Finally, Stella (1984) pointed out the variability of the number of setae in the lakes of central Italy, and attributed all the material of ponds and lakes of Central Italy to *Eudiaptomus padanus etruscus*; accordingly, we consider *E. padanus etruscosexsetosus* as a junior synonym of *E. padanus etruscus*, an opinion suggested also by Stoch (2006a). *E. padanus etruscus*, which occurs also along the Croatian Adriatic coastal area (Ternjej and Stanković, 2007), is widely distributed in ponds and lakes of central and southern Italy as well as in ponds of the eastern Padanian plain (Stoch, 2006a and references reported below). The species is present also in Apulia, where it was erroneously reported (see below) as *E. vulgaris* by Alfonso and Belmonte (2011) and Belmonte (2018). *Other references*: Margaritora *et al*., 2001, 2003; Ferrara *et al*., 2002; Vagaggini *et al*., 2002; Riccardi and Rossetti, 2007; Riccardi *et al*., 2012; Seminara *et al*., 2008, 2015, 2016; Marrone *et al.,* 2017; Belmonte, 2018.

Eudiaptomus padanus padanus (Burckhardt, 1900). WAL, CAL, PAD. *Eudiaptomus padanus* was described from Lake Maggiore by Burckhardt (1900) as '*Diaptomus graciloides* Lillj. var. nov. *padana'*; in a further paper (Burckhardt, 1914) it was considered as a good species, *Diaptomus padanus*. For this reason, following ICZN rules (art. 45.6) the name *'padanus'* is valid and attributed to Burckhardt (1900). The species is widely distributed in the larger Italian subalpine lakes as well as in smaller, permanent basins and rivers (*Diaptomus larianus* Baldi, 1925 from Como Lake and *Eudiaptomus vulgaris sicidae* Pirocchi, 1940 are junior synonyms of this species). *Other references*: Manca *et al*., 2000, 2004; Cotta-Ramusino and Leoni, 2001; Viaroli *et al*., 2002; Rossetti *et al*., 2003a; Stoch, 2006a; Riccardi and Giussani, 2007; Riccardi and Rossetti, 2007; Rossetti *et al*., 2009; Stefani *et al*., 2010; Visconti *et al*., 2010, 2011, 2018; Riccardi *et al*., 2012; Piscia *et al*., 2016, 2018; Morabito, 2017; Marrone *et al.,* 2017; Belmonte, 2018; Lepori, 2020; Tanentzap *et al*., 2020.

Eudiaptomus sp. EMILIA-ROMAGNA. PAD. Tavernini *et al.* (2009b) reported the presence of a putative new *Eudiaptomus* species in two sand-pit lakes in Emilia Romagna. A recent re-examination of this material and further surveys (G. Alfonso, F. Marrone and F. Stoch, *pers. obs.*) confirm this supposition, and this taxon is currently pending a formal description. *Other references*: none.

Eudiaptomus vulgaris (Schmeil, 1898). CAL, CAP, SAP. The species is reported for a few localities on the central (Stella, 1984; Stoch, 2006a; Osella and Pannunzio, 2013) and southern Apennines (Stella, 1979b; Alfonso *et al.,* 2010), and it was cited in a single occasion for rock pools on the Karst Plateau near Trieste (Pirocchi, 1942; Ranzoli *et al.,* 1979). However, the presence of the species on the Karst Plateau is probably erroneous (Stoch, 2006a): after over twenty years of intensive sampling performed in the period 1984-2005 in the same rock-pools and in neighbouring ponds and pools, no diaptomids were found in rock-pools environments, while *E. intermedius* only was collected in ponds and pools of KAR area (Stoch, 2006a; F. Stoch, *unpubl. data*). For this reason, and considering that the specimens were not found in Stella collection (University of Rome: F. Stoch, *pers. obs.*), the species is considered absent in KAR, and its citations in Karst rock pools probably due to mislabelling. Moreover, the diaptomid reported in Apulia as *E. vulgaris* by Alfonso and Belmonte (2011) and Belmonte (2018) is in fact *Eudiaptomus padanus etruscus* (G. Alfonso, *pers. obs.*). The species was recently collected in a pond in South Tyrol (CAL) by F. Stoch (*unpubl. data*). Finally, Stella (1957) reported *E. vulgaris* for a lake ("Lago Abissale") inside the cave of "Bue Marino", in Sardinia. The re-examination of the samples in Stella crustacean collection by one of us (F. Stoch) allowed to assess that this sample was in fact intermixed with pond fauna coming from the Italian peninsula, so that an exchange of labels is the most probable explanation of this erroneous record. The "Lago Abissale" is in fact mainly a sea arm entering the coastal cave and thus completely unsuitable for the presence of this diaptomid species (F. Stoch, *pers. obs*.); accordingly, Casale *et al.* (2008) excluded it from the checklist of that cave, and consequently from SAR. *Other references*: Stella, 1984; Marrone *et al*., 2013, 2017.

Eudiaptomus zachariasi (Poppe, 1886). CAP, (KAR). This species was first reported by Tonolli (1959) for the "Pantani di Forca Canapine", in the central Apennine Mountains (CAP), where in 2010 *E. zachariasi* was still present with a thriving population (G. Alfonso, F. Marrone and F. Stoch, *pers. obs.*). Conversely, the occurrence of the species in artificial ponds in the garden of the castle of Miramare (Trieste, north-eastern Italy: Langhans, 1907, Tonolli, 1959, Stella, 1984) was not confirmed by recent surveys and the local extinction of the species could be possibly related to the introduction of fish in those ponds (G. Alfonso and F. Stoch, *pers. obs.*). Since occurrence

sites in north-eastern Italy were limited to man-made water bodies, its autochthony in this area is doubtful. *Other references*: Stoch, 2006a; Marrone *et al.,* 2017.

Hemidiaptomus (Gigantodiaptomus) superbus (Schmeil, 1895). PAD. *H. superbus*, currently unanimously considered one of the rarest Palearctic diaptomid species (Dussart, 1967; Kiefer, 1978; Einsle, 1993), was recently found in the Padanian province (Marrone *et al.,* 2011a). This is the only record of a representative of the subgenus *Gigantodiaptomus* south of the Alps. According to Einsle (1993) the species should be ascribed to the subgenus *Hemidiaptomus* s. str. This proposal is also supported by a cladistic analysis of the genus *Hemidiaptomus* based on morphological characters (Marrone *et al.,* 2013). However, to date no exhaustive molecular evidence is available to support this option, so that it is here conservatively maintained within the subgenus *Gigantodiaptomus* in accordance with Dussart and Defaye (2002). *Other references*: Marrone *et al.,* 2017; Belmonte, 2018.

Hemidiaptomus (Hemidiaptomus) gurneyi (Roy, 1927). TYR, APU, SIC, (SAR). The commonest and most widespread *Hemidiaptomus* species in Italy, *H. gurneyi* inhabits temporary ponds and pools of the coastal areas of Tuscany (Marrone *et al*., 2010), Latium (Stoch, 2006a), Calabria (Marrone *et al*., 2013) and Apulia, where it is also present in ponds of the Gargano promontory over 600 m asl (Alfonso and Belmonte, 2011). It is also reported for medium to high-altitude temporary water bodies in Sicily (Marrone *et al*., 2006a, 2006b). The record of the species for a single site in Sardinia (Margraf and Maas, 1982) lies out of the distribution range of the species and could not be confirmed in spite of extensive samplings carried out by the authors with the explicit aim of checking its presence, and hence it is likely erroneous. *Other references*: Vagaggini *et al*., 2002; Mura and Brecciaroli, 2003; Marrone, 2006; Marrone *et al.,* 2009; 2016, 2017; Scirocco *et al.,* 2008; Seminara *et al.,* 2015, 2016; Belmonte, 2018.

Hemidiaptomus (Occidodiaptomus) cf. *inermis* Kiefer, 1954. APU, COR. According to Marrone *et al.* (2013), the Corsican populations of the species reported as *Hemidiaptomus ingens inermis* by Schachter and Champeau (1969) and the Apulian populations of the species reported as *Hemidiaptomus ingens* by Alfonso and Belmonte (2011) and Alfonso *et al.* (2016) should rather be ascribed to a different species, which is morphologically very similar to *Hemidiaptomus inermis*. However, in the light of the pronounced morphological conservatism of Diaptomidae, a molecular comparison with the topotypical population of *H. inermis* s.str. (La Reghaïa, Algeria; Kiefer, 1954) should be carried out to check their conspecificity. Pending such a revision, we report this species here as *Hemidiaptomus* cf. *inermis*. *Other references*: Alfonso and Belmonte, 2013; Champeau, 1971; Champeau and Thiéry, 1990; Marrone *et al.,* 2017.

Hemidiaptomus (Occidodiaptomus) ingens (Gurney, 1909). SIC. First recorded in Italy by Marrone and Naselli-Flores (2004). According to Marrone *et al.* (2013), *H. ingens* s. str. only occurs in Tunisia and Sicily, where it inhabits temporary ponds located at low altitude. The taxon indicated as *H. ingens inermis* in Corsica (Schachter and Champeau, 1969) and as *H. ingens* in Apulia (Alfonso and Belmonte, 2011; Alfonso *et al.,* 2016) is rather to be ascribed to *Hemidiaptomus* cf. *inermis* (see above). *Other references*: Marrone, 2006; Marrone *et al.,* 2006a, 2006b, 2009, 2010, 2017; Troia *et al.,* 2016.

Hemidiaptomus (Occidodiaptomus) roubaui (Richard, 1888). SAR. Within the study area, this species is so far only known from Sardinia, where it occurs in temporary water bodies both in the central and northern parts of the island (Margraf and Maas, 1982; Stoch, 2006a; Boix *et al.,* 2017). *Other references*: Bagella *et al.,* 2010, 2011; Marrone *et al.,* 2013, 2017; Belmonte, 2018.

Mixodiaptomus incrassatus (Sars, 1903). APU, SAR. The known distribution of the species in the study area only includes northern Sardinia (Stella 1984) and Apulia (Alfonso and Belmonte, 2011), where the species occurs in temporary ponds located in arid and semi-arid areas, often co-occurring with other diaptomids. *Other references*: Alfonso and Belmonte, 2013; Alfonso *et al.,* 2016; Marrone *et al.,* 2017; Belmonte, 2018.

Mixodiaptomus kupelwieseri (Brehm, 1907). [WAL], PAD, NAP, CAP, SAP, TYR, APU, SIC, SAR, COR. It is the most widely distributed species in the study area, occurring throughout the Italian peninsula, Corsica, Sardinia, and Sicily (Stella, 1984; Schachter and Champeau, 1969; Stoch, 2006a; Marrone *et al.,* 2006a; Alfonso and Belmonte, 2011). The occurrence in WAL, being related to a single pond located at 390 m a.s.l. (lake La Mula, near Novara) (Ravera, 1951), can be considered marginal. *Other references*: Champeau, 1971; Champeau and Thiéry, 1990; Moroni and Bellavere, 2001; Tavernini and Rossetti, 2001; Vagaggini *et al*., 2002; Mura and Brecciaroli, 2003; Tavernini *et al*., 2003; Rossetti *et al*., 2004; Marrone, 2006; Marrone *et al*., 2006b, 2009, 2011a, 2017; Tavernini, 2008; Tavernini *et al.,* 2005, 2009a; Ferrari *et al*., 2014; Seminara *et al*., 2008, 2015, 2016; Troia *et al.,* 2016; Belmonte, 2018.

Mixodiaptomus laciniatus laciniatus (Lilljeborg, 1889). WAL, CAL, COR. Until the middle of the 20th century, the nominotypical subspecies of *Mixodiaptomus*

laciniatus was present in several large, subalpine lakes of the western and central Alps, from where it later disappeared possibly due to eutrophication and pollution, surviving only in Lake Maggiore (Stella, 1984; Stoch, 2006a). Visconti and Manca (2010) raised some concerns about its long-term survival due to the competition with the non-indigenous *Eudiaptomus gracilis*. However, the species luckily still survives in Lake Maggiore, although with a smaller population (Morabito, 2017; R. Piscia, *pers. com*.). The species is also present in a single pond in Corsica (Schachter and Champeau, 1969; F. Marrone and F. Stoch, *pers. obs*). *Other references*: Champeau, 1971; Champeau and Thiéry, 1990; Manca *et al*., 2004 ; Marrone *et al.,* 2017; Belmonte, 2018; Lepori, 2020 ; Tanentzap *et al*., 2020.

Mixodiaptomus lilljeborgi (Guerne and Richard, 1888). CAP, SAP, APU, SAR. A widespread and euryecious species, currently known from Sardinia (Stoch, 2006a; Boix *et al.,* 2017), northern Apulia (Alfonso and Belmonte, 2011), and Central and Southern Apennines (Stoch, 2006a). *Other references*: Belmonte *et al*., 2006; Alfonso *et al.,* 2010; Bagella *et al.,* 2010, 2011; Marrone *et al.,* 2017; Belmonte, 2018.

Mixodiaptomus tatricus (Wierzejski, 1883). EAL, CAL, NAP. A species whose distribution in the study area is restricted to the high-altitude ponds and pools of the Eastern and Central Alps, and Northern Apennines (Stoch, 2006a). *Other references*: Jersabek *et al*., 2001; Moroni and Bellavere, 2001; Tavernini *et al*., 2003; Rossetti *et al*., 2004; Tavernini, 2008; Tavernini *et al.,* 2005, 2009a; Riccardi *et al.,* 2012; Marrone *et al*., 2017; Belmonte, 2018.

Subfamily PARADIAPTOMINAE Kiefer, 1932

Metadiaptomus chevreuxi (Guerne and Richard, 1894). SIC. The species is reported for two temporary water bodies on Favignana island, Sicily (Marrone and Naselli-Flores, 2005; Marrone *et al*., 2020). *Other references*: Stoch, 2006a; Marrone, 2006; Marrone *et al.,* 2006a, 2006b, 2009, 2017; Belmonte, 2018.

Neolovenula alluaudi (Guerne and Richard, 1890). APU. Within the study area, this species occurs exclusively in Apulian temporary ponds, often co-occurring with other diaptomid species (Alfonso and Belmonte, 2013). *Other references*: Alfonso *et al.,* 2016; Marrone *et al.,* 2017; Belmonte, 2018.

Subfamily SPEODIAPTOMINAE Borutzky, 1962

Troglodiaptomus sketi Petkovski, 1978. KAR. This is the only stygobitic species known for the Italian fauna. *T. sketi* inhabits exclusively the phreatic karstic waters of the Dinaric area (Brancelj, 1991) and was reported for the first time for Italy by Stoch (1984) for several caves of the karstic plateau near Trieste and Gorizia, where it is quite common (Stoch, 2006a). A different subspecies (*T. sketi postojnae* Brancelj, 1987) was described from the Postojna-Planina cave system in Slovenia, and later considered a junior synonym of *T. sketi* by Brancelj (1991). *Other references*: Brancelj, 2001, 2005; Stoch, 2017; Brancelj *et al*., 2020.

Species richness and distribution in the zoogeographical provinces

On average, Italian provinces hosted 6.5±3.1 species (mean ± standard deviation) each (Tab. 1). However, species richness is not evenly distributed, and the highest diversity was observed in provinces belonging to the Mediterranean macroarea, *i.e.*, in APU and SIC, hosting 13 and 11 species, respectively.

Ten diaptomid species were only observed in the Mediterranean macroarea (*i.e.*, APU, SIC, COR, SAR, TYR), and were absent from other macroareas (see text above, and Tab. 2). Other species were limited to the Alpine and the Padanian macroareas (2 species each), or to the Karst Plateau and the Apennines (1 species each).

The nMDS plot (first two axes) of the Italian provinces and neighbouring limnofaunistic regions (Fig. 2a) shows a well-defined clustering based on the factor macroarea. Two distant and well-characterised clusters include the Italian Alpine provinces (on the left side of the plot) versus the Mediterranean biogeographical units (on the right side of the plot). Iberian (IBE) and Maghreb (MAG) limnofaunistic regions grouped together with the provinces here ascribed to the Mediterranean areas, with only TYR slightly isolated. Hellenic (HEL) and Dinaric (DIN) limnofaunistic regions (the latter including the Italian province KAR) were also plotted together and separated from the other provinces and regions. The northern part of the Alps (NAL) was more related to the Central and Western Highlands (respectively CEH and WEH) than to the Italian Alps (EAL, CAL, WAL). Central and Southern Apennines (CAP and SAP) were more similar each other than to the Northern Apennines (NAP). The Padanian (PAD) province was plotted separately from the other areas, although close to the NAP area.

The species characterizing each macroarea were represented as vectors whose length was proportional to Spearman's correlation coefficient between their presence and nMDS axes (Fig. 2b). Two Paradiaptominae and several Diaptominae species (*Mixodiaptomus incrassatus*, *M. lilljeborgi, M. kupelwieseri*, *Arctodiaptomus wierzejskii*, *A. salinus*, *Diaptomus cyaneus*, *Copidodiaptomus numidicus* and the genus *Hemidiaptomus* - with the sole exception of *H. superbus*, found only in PAD) were characteristic of the Mediterranean area. The Alpine region was characterised by *Arctodiaptomus alpinus, Acanthodiaptomus denticornis* and *Mixodiaptomus tatricus*,

although the latter also occurs in NAP. The presence of a species and a subspecies of the genus *Eudiaptomus,* namely *E. intermedius* and *E. padanus etruscus,* was related to the Apennine region, although the latter also occurs in two Mediterranean provinces (TYR and APU).

DISCUSSION

The diaptomid fauna of the study area is dominated, in terms of species richness, by the genera *Eudiaptomus*, *Mixodiaptomus*, *Arctodiaptomus,* and *Hemidiaptomus*, whereas the other genera are represented only by one or at most two species each. Out of the 30 diaptomid species and subspecies recorded in the study area, two species (*Eudiaptomus* sp. EMILIA ROMAGNA and *Arctodiaptomus* sp. SICILY) are new to science and still waiting for a formal description. Moreover, pending a revision of *H. ingens* s.l., the identity of the species ascribed here to *Hemidiaptomus* cf. *inermis* remains doubtful, and could be considered as a species close to *H. ingens* (Marrone *et al*., 2013).

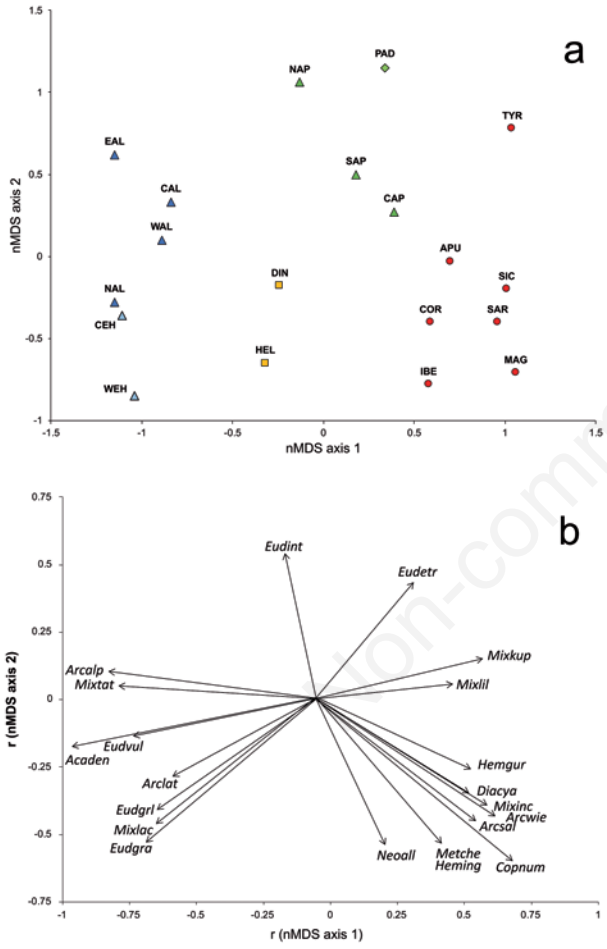

Fig. 2. a) Plot on the plane defined by the first two axes of nMDS ordination of the Italian zoogeographical provinces and neighboring regions based on their diaptomid fauna; groups (different symbols and colours) are defined by the factor 'macroarea' (Tab. 1). b) Plot of the Spearman's correlation coefficients ($p<0.05$) of the presence of diaptomid species (represented as vectors) with the first two axes of the nMDS ordination. Arclat, *Arctodiaptomus laticeps*; Eudgrl, *Eudiaptomus graciloides*; the acronyms of the other species are included in Tab 2.

Six species and subspecies, *i.e.*, 20% of the whole native diaptomid fauna, are endemic or subendemic (*sensu* Rabitsch and Essl, 2009) to the study area. These are *Arctodiaptomus* sp. SICILY and *Eudiaptomus* sp. EMILIA-ROMAGNA (endemic), and *Copidodiaptomus steueri*, *Eudiaptomus padanus padanus*, *E. padanus etruscus*, and *E. intermedius* (subendemic).

Most of the species are widespread in the study area (Stoch, 2006a) albeit some taxa are currently known from few or single localities each, and the long-term persistence of their populations should therefore be monitored over time. These are *Mixodiaptomus laciniatus*, *Eudiaptomus* sp. EMILIA-ROMAGNA*, E. zachariasi*, and *Hemidiaptomus superbus*, which are currently known from a single occurrence locality each, and *Metadiaptomus chevreuxi* and *Hemidiaptomus ingens*, which are known from two occurrence localities each.

Eudiaptomus gracilis, the only non-indigenous diaptomid species occurring in the study area, is currently expanding its distribution southwards, and a significant impact on ecologically-similar native *Eudiaptomus* species is likely, as shown by the evidence collected in northern Italy (Riccardi and Giussani, 2007; Visconti and Manca, 2010).

The species richness observed in the studied provinces ranges from 2 (KAR) to 13 (APU). The low species richness of KAR must be ascribed to the small geographical extension of this province, which is de facto separated from the neighbouring DIN region only by an administrative boundary. The highest species richness was observed in the Mediterranean macroarea, which hosts 19 species and contributes with 10 exclusive occurrences to the diaptomid fauna of the study area. This includes the representatives of the subfamily Paradiaptominae, together with eight Diaptominae species and subspecies (Tab. 2). The high species richness observed in the provinces belonging to the Mediterranean macroarea is probably related to the climatic stability of the area during the Quaternary, which enabled species-rich and ancient diaptomid communities to survive through the Pleistocene climatic fluctuations. This hypothesis is also supported by the distribution of the so-called '*Hemidiaptomus* ponds' (Sahuquillo and Miracle, 2013), *i.e.*, temporary ponds hosting rich and unusual crustacean communities characterized by the presence of species of the subgenus *Occi-*

dodiaptomus, which are limited to the Mediterranean provinces and are currently considered relics of ancient wetlands (Sahuquillo and Miracle, 2013; Alfonso *et al.,* 2016). Moreover, the presence of a diversified physiography and of complex "pondscapes" including a significant number of temporary water bodies further contributes to the current diaptomid diversity of the Mediterranean provinces. In particular, the high suitability of temporary ponds for diaptomid multi-species coexistence is well known, the most representative case being APU, where the co-occurrence of up to five diaptomids in a single site was reported (Alfonso and Belmonte, 2013; Alfonso *et al.,* 2016). However, most of the non-Mediterranean macroareas, with the sole exception of the Apennines, host species, genera and even subfamilies non found in the other areas (Tabs. 1 and 2).

The similarity among the provinces (and macroareas) are illustrated by the results of the nMDS ordination plot (Fig. 2). The Alpine provinces of the study area (WAL, CAL, and EAL) show a remarkable similarity, whereas the diaptomid fauna of the northern slopes of the Alps is significantly different from these, and closer to Central European faunas (*i.e.*, those occurring in CEH and WEH). This seemingly counterintuitive pattern can be explained by mountain ranges acting as barriers to diaptomid dispersal, as already stressed by Marrone *et al.* (2017). On the contrary, and in spite of their geographical distance, the affinities between the Mediterranean and neighbouring provinces are evident, thus demonstrating that the sea straits and basins can be easily crossed by diaptomids capable of producing resting eggs. Sea crossing is possible thanks to passive dispersal mediated by biological and physical vectors (Incagnone *et al*., 2015).

Overall, the diaptomid fauna of the study area is characterized by a high degree of endemism and is well defined with respect to the neighboring areas, thus underlining its significant contribution to the inland water biodiversity of the Western Palearctic and further stressing the role of the Alps as an effective barrier preventing faunal exchanges between southern and northern areas.

In conclusion, although the study area has been investigated for about 150 years, numerous species new to the area or even to Science have been discovered during the last twenty years, suggesting that the diaptomid diversity of the area is still underestimated. We hope this work encourages further investigations to achieve a more comprehensive picture of the diaptomid fauna of the area under consideration.

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SUPPLEMENTARY MATERIALS

File S1 (zip). Shapefile of the Italian zoogeographical provinces.

File S2 (pdf). Matrix of the 55 species distributed in the 19 bioregions considered in the statistical analysis, acronyms and full name of each bioregion.

File S3 (pdf). Scanned copy of a letter sent by prof. Friedrich Kiefer to prof. Emilia Stella on July 17th, 1973.

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