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An updated checklist of Recent ostracods (Crustacea: Ostracoda) from inland waters of Sicily and adjacent small islands with notes on their distribution and ecology

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Abstract
Because of its position in the middle of the Mediterranea Sea and a complex geological history that has promoted repeated waves of biological colonization, Sicily (Southern Italy) is of particular interest from a biogeographical perspective. A number of previous investigations, dating back as far as the end of the 19th century, have contributed to gather information about the occurrence of Recent non-marine ostracods in Sicily, making this region one of the most intensively studied areas of the Central Mediterranean. Published data on ostracod distributions have been integrated through an extensive field survey on mainland Sicily and surrounding small islands and archipelagos. Altogether, 271 ostracod samples and 11 sediment samples from dry water bodies were analysed from 218 sites visited between 2002 and 2017. Sampling sites were selected to encompass all the most common types of freshwater aquatic habitats, both natural and artificial, present in the area. Thirty-nine ostracods were identified at species level and 12 at supraspecific level. The present study reports four species (*Cypria subsalsa, Eucypris mareotica, Physocypria kerkyrensis, Vestalenula boteai*) and one genus (*Vestalenula*) as new for both peninsular Italy and adjacent islands, and three species (*Candonopsis novaezelandiae, Ilyocypris inermis, Neglecandona neglecta*) and two genera (*Candonopsis* and *Physocypria*) as new for Sicily. The updated checklist of the study area now includes at least 46 nominal species and other taxa identified at supraspecific level, belonging to 28 genera in 8 families (Candonidae, Cyprididae, Cytherideidae, Darwinulidae, Hemicytheridae, Ilyocyprididae, Limnocytheridae and Notodromadidae). The present investigation represents a significant addition to the knowledge of the ostracod diversity and distribution in the Sicilian area and in Italy as a whole. It also provides a sound baseline data for further comparative faunal studies aimed at investigating the affinities and origins of the central Mediterranean inland-water ostracod faunas, and to analyse their biogeographic patterns.

Keywords: *Non-marine ostracods, Central Mediterranean Sea, ecology, biogeography, SEM*

Introduction

Most of the current knowledge on the distribution of freshwater crustaceans in the Central Mediterranean area relies on old and sparse work, which in some cases was insufficient to provide a comprehensive description of the local faunas (Marrone 2006). Furthermore, although regional checklists and identification keys are available for most of the Branchiopoda and Copepoda groups, information about Recent Ostracoda is often fragmented and in need of being revised or expanded. The studies by Gurney (1909) and Gauthier (1928a, 1928b, 1928c) for Maghreb and Margaritora et al. (1982) for Sicily are still valuable references today. Conversely, earlier contributions on inland water ostracods of Sardinia are of limited practical use because of the inadequacy of their taxonomic

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descriptions (see Pieri et al. 2015 and references therein). More recently, new surveys have provided data on the distributions of non-marine ostracods in the Central Mediterranean area, e.g. for Algeria (Samraoui et al. 1998; Ghaouaci et al. 2017), Tunisia (Zaibi et al. 2013), Balearic Islands (Zamora et al. 2005; Lucena-Moya et al. 2016), and mainland Sicily (Pieri et al. 2006). The latter paper, based on literature review and new field data from 67 water bodies (Figure 1), reported the occurrence of 25 ostracod taxa (22 at species level) belonging to 16 genera in five families. The checklist of the Recent non-marine ostracods from Italy increased the Sicilian non-marine ostracod fauna by 11 species, two genera (*Cyprideis* and *Tyrrhenocythere*) and one family (Cytherideidae), and by a putative new species, left in open nomenclature, in the genus *Eucypris* (Pieri et al., 2015).

Actually, *Cythere emarginata* (in all probability referable to *Tyrrhenocythere amnicola*) was already reported by Moniez (1889) from River Anapo, this most likely being the very first mention of a Sicilian inland water ostracod. Troia et al. (2016) reported seven ostracod species from a wetland complex from western Sicily, among them the first record of *Eucypris kerkyrensis* on the island. Curry et al. (2016) reported 12 living species from Lago Preola and Gorgo Basso (southwestern Sicily), including two species, *Fabaeformiscandona subacuta* and *Neglecandona neglecta*, new for the island. The record of a new hypogean species from a cave near Palermo, *Mixtacandona idrisi* (Mazzini et al., 2017) is a further addition to this list. Thus, the ostracod fauna of Sicily can be regarded as one of the best known at regional scale, with at least 39 species and 19 genera in six families.

In the present paper, we provide an updated and comprehensive checklist of non-marine ostracods from Sicily and adjacent small archipelagos and islets that administratively belong to Italy, along with some notes on their geographical distribution, habitat preferences and biogeographic affinities.

Materials and methods

The present study is part of a broader survey aimed at investigating the crustacean fauna of inland aquatic habitats of Sicily and adjacent islands (Marrone

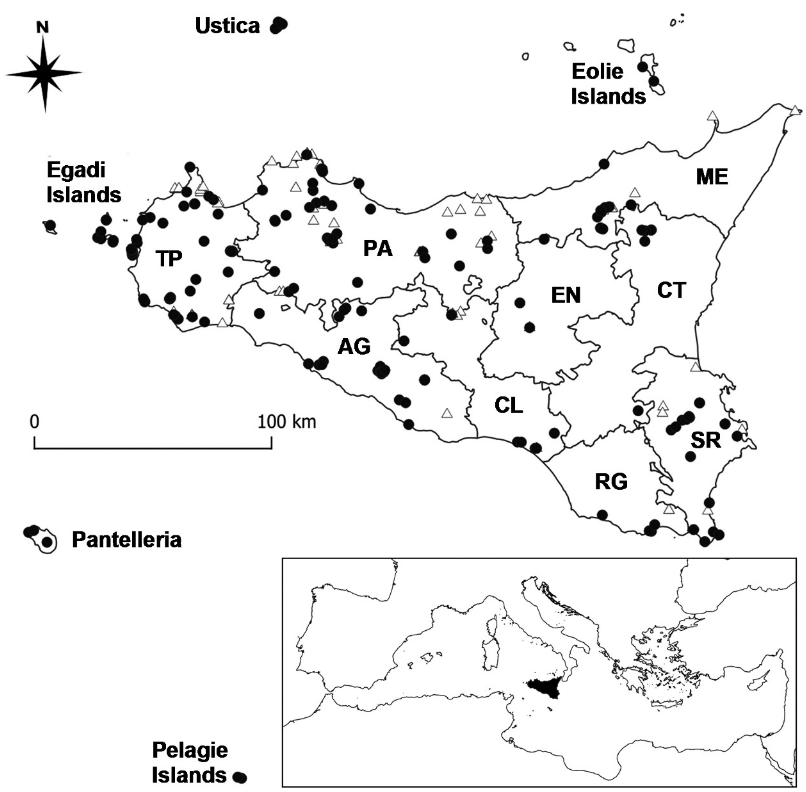

Figure 1. Geographic position of Sicily in the Mediterranan Sea (lower panel) and sampling sites considered in the present study (•) and by Pieri et al. 2006 (Δ).
AG: Agrigento; CL: Caltanissetta; CT: Catania: EN: Enna; ME: Messina; PA: Palermo; RG: Ragusa; SR: Siracusa; TP: Trapani.

2006; Marrone et al. 2006a, 2006b, 2009, 2017; Alfonso et al. 2010; Faraone et al. 2017; Vecchioni et al. 2017, 2019a, 2019b).

Sicily is the largest (25,460 km^2) island in the Mediterranean basin. Its territory is characterised by a high morphological and bioclimatic heterogeneity (Marrone et al. 2009). The total annual precipitation ranges from less than 400 mm y^{-1} at lower elevations to 1300 mm y^{-1} at higher altitudes, and the mean annual temperature ranges between 10.8°C and 18.9°C (Liuzzo et al. 2015). Under these semi-arid climatic conditions, freshwater ecosystems are mainly made up by small-sized, temporary habitats and by man-made reservoirs (Naselli-Flores et al. 1998).

Sampling sites were selected to encompass the most common and representative types of natural and man-made aquatic environments present in the study area. Forty-four samples collected in the frame of present survey were already used to complement the dataset of the Italian checklist of non-marine ostracods, so that their occurrence in Sicily was anticipated there (Pieri et al. 2015). Three sites considered by Curry et al. (2016) (Lago Preola and Gorgo Basso) and by Troia et al. (2016) (Margio di Gallitello-Anguillara) were also sampled in the present study (identified as TP011, TP079 and TP124, respectively). With few exceptions, only surface water bodies were sampled. Altogether, 271 samples containing ostracods were collected from 211 sites sampled between November 2002 and March 2017. Most of the sites (176) were visited only once, and the remaining ones on different occasions, up to 11 times for TP124 (Table I). *Ex situ* rehydration of sediment collected from 11 dry temporary habitats, using the "Sars' method" as described in Marrone et al. (2019), allowed to study the ostracod communities from further 10 sites and obtain additional data for AG018 (listed as SRL – sediment re-hydrated in the laboratory in Table I). Three samples were not further analysed because only early larval stages were found, and corresponding sites were excluded from the list of Table I. Out of a total of 218 retained sites, 182 were located on the main island, two on the Eolie Islands, seven on Ustica, eight on the Egadi Islands, three on Pantelleria and 16 on the Pelagie Islands (Figure 1). Geographical coordinates were recorded *in situ* with a hand-held GPS (Magellan 310). In most of the sampling sites, water temperature and electric conductivity were measured *in situ* using a portable digital meter (HI-9835 Multiparameter). Distribution maps were produced using QGIS v. 3.4.15 (QGIS Development Team 2018).

Ostracods were collected with a handnet with a mesh size of 200 µm. Selected specimens were sorted in the laboratory under a binocular microscope and then fixed in 90% ethanol. Both soft parts (dissected in glycerine and stored in sealed slides) and valves (stored dry in micropaleontological slides) were checked for taxonomic identification, at species level whenever possible, using Maness and Kaesler (1987), Rossetti and Martens (1998), Meisch (2000), Scharf et al. (2014) and Rasouli et al. (2016). For selected taxa, valves were also examined by SEM using a Philips XL-30 microscope and soft parts were illustrated with a light transmission microscope (Zeiss 47 30 11–9901) with a camera lucida. Each dissected specimen was labelled with an alphanumeric code consisting of two alphabetical characters followed by a number. All the material used for this study is housed at the Department of Chemistry, Life Sciences and Environmental Sustainability, University of Parma. Taxonomic nomenclature follows Meisch et al. (2019). Species authorships are listed in Table II. Distribution maps and SEM images of ostracods found in this study are available as online electronic supplementary material (Figures S1-S21).

Results

Information on geographic location and the hydroperiod regime of the studied sites is given in Table I, along with data on water temperature and electric conductivity for most of them. These latter data on physical and chemical characteristics of water must be considered as purely indicative, given the high daily and seasonal variability they are subject to, especially in temporary habitats. Temperature data will not be further considered here.

The elevation of sampling sites ranges from 0 to 1524 m a.s.l.; about 50% of the sites occur below 250 m a.s.l. Temporary habitats are far more numerous than permanent ones, and ponds and rock pools are the most frequently sampled habitat types. Approximately 47% of the sampled sites occurs in areas characterized by carbonate rocks, 19% by sedimentary siliceous rocks, and 17% by clayey-gypseous formations; water conductivity is below 2000 µS cm^{-1} in 57% and above 12000 µS cm^{-1} in 13% of the sites for which data are available (Figure 2).

Altogether, 39 ostracod species were identified during this survey, which belong to the superfamilies Cypridoidea (four families), Darwinuloidea (one family) and Cytheroidea (three families) (Table II). An additional 12 taxa were identified at supraspecific

Table I. List and main characteristics of sampling sites considered in this study. In bold sites on small islands or archipelagos. The first two letters of the site code refer to the province in which the site is located (see Figure 1). SRL: sediment re-hydrated in the laboratory; T: temporary; P: permanent; nd: not determined.

Code	Site name	Sampling date	Municipality	Latitude	Longitude	Height a. s.l. (m)	Prevalent lithology	Habitat	Hydroperiod	Water temperature (°C)	Conductivity (μS cm^{-1})
AG009	Marina di Palma	12/25/06	Palma di Montechiaro	37.172010	13.718546	0	Gypseous	Swamp	T	nd	nd
AG010	Pozza della Posidonia	12/06/04	Lampedusa e Linosa	35.496558	12.624831	0	Carbonatic	Rock pool	T	nd	nd
AG012	Pozza 2 di Cala Francese	12/06/03	Lampedusa e Linosa	35.496247	12.625732	10	Carbonatic	Rock pool	T	18.4	866
AG013	Pozza 3 di Cala Francese	12/06/03	Lampedusa e Linosa	35.494661	12.626252	10	Carbonatic	Rock pool	T	20.6	3990
AG018	Pozza 1 di Cala Greca	12/06/03	Lampedusa e Linosa	35.503662	12.586060	20	Carbonatic	Rock pool	T	19.6	1025
		SRL								nd	nd
AG021	Pozza 1 di Case Teresa	12/06/03	Lampedusa e Linosa	35.522778	12.540278	110	Carbonatic	Carbonatic	T	19.0	548
AG023	Pozza 1 di Cala dei Conigli	12/05/03	Lampedusa e Linosa	35.515548	12.558605	79	Carbonatic	Rock pool	T	15.3	963
AG024	Pozza 1 di Taccio Vecchio	12/06/03	Lampedusa e Linosa	35.521546	12.613244	58	Carbonatic	Rock pool	T	20.0	3990
AG025	Pozza 2 di Taccio Vecchio	12/06/03	Lampedusa e Linosa	35.519931	12.614505	47	Carbonatic	Rock pool	T	20.0	1098
AG027	Pozza 1 del Vallone Forbice	12/06/03	Lampedusa e Linosa	35.515293	12.546000	55	Carbonatic	Rock pool	T	15.0	820
AG032	Stagno 1 delle Macalube	10/27/06	Aragona	37.376559	13.596994	260	Clayey - gypseous	Pond	T	22.0	19180
AG033	Stagno 2 delle Macalube	12/25/13	Aragona	37.376960	13.596613	260	Clayey - gypseous	Pond	T	11.2	5500
AG034	Stagno 3 delle Macalube	12/25/13	Aragona	37.376361	13.596704	274	Clayey - gypseous	Pond	T	9.6	7000
AG035	Stagno 4 delle Macalube	05/20/06	Aragona	37.376226	13.597045	260	Clayey - gypseous	Pond	T	21.2	5616
AG036	Stagno 5 delle Macalube	04/15/07	Aragona	37.375968	13.595796	260	Clayey - gypseous	Pond	T	19.0	8580
AG037	Stagno 6 delle Macalube	05/20/06	Aragona	37.375643	13.594978	260	Clayey - gypseous	Pond	T	21.2	5616
AG038	Stagno 7 delle Macalube	05/20/06	Aragona	37.375511	13.595229	260	Clayey - gypseous	Pond	T	22.4	11600
AG039	Stagno 8 delle Macalube	04/15/07	Aragona	37.375485	13.595331	260	Clayey - gypseous	Pond	T	18.7	5530
AG040	Stagno 9 delle Macalube	01/06/06	Aragona	37.375305	13.595334	260	Clayey - gypseous	Pond	T	10.7	1909
AG041	Stagno 10 delle Macalube	02/01/03	Aragona	37.375696	13.595643	260	Clayey - gypseous	Pond	T	15.3	2871
		04/15/07								17.5	9060
AG043	Stagno 12 delle Macalube	10/27/06	Aragona	37.375631	13.597734	260	Clayey - gypseous	Pond	T	22.0	11070
AG052	Piscina abbandonata del Villaggio Abbani	nd	Lampedusa e Linosa	35.857872	12.881369	6	Artificial (concrete)	Reservoir	T	nd	nd
AG056	Pozzo Macalube 1	04/13/08	Aragona	37.381426	13.584863	291	Clayey - gypseous	Well	P	15.2	12420
AG057	Pozza Macalube 1	04/13/08	Aragona	37.382907	13.586608	282	Clayey - gypseous	Ground pool	T	19.0	1576
AG058	Abbeveratoio Macalube 3	04/13/08	Aragona	37.397200	13.597083	334	Clayey - gypseous	Trough	P	17.6	622
AG059	Abbeveratoio Macalube 4	04/13/08	Aragona	37.375182	13.612494	285	Clayey - gypseous	Trough	T	16.4	1998

(*Continued*)

Table I. (Continued).

Code	Site name	Sampling date	Municipality	Latitude	Longitude	Height a. s.l. (m)	Prevalent lithology	Habitat	Hydroperiod	Water temperature (°C)	Conductivity (μS cm^{-1})
		12/25/13								9.0	2152
AG060	Stagno agricolo Macalube 2	04/13/08	Aragona	37.368831	13.601225	267	Clayey - gypseous	Reservoir	P	17.8	4330
AG061	Abbeveratoio Macalube 5	12/25/13	Aragona	37.382026	13.617290	301	Clayey - gypseous	Trough	P	6.0	4000
AG062	Stagno 14 delle Macalube	04/15/07	Aragona	37.375538	13.597555	270	Clayey - gypseous	Pond	T	20.0	4420
AG063	Stagno 13 delle Macalube	04/15/07	Aragona	37.374359	13.601428	270	Clayey - gypseous	Pond	T	20.0	2420
AG064	Stagno 15 delle Macalube	04/15/07	Aragona	37.377030	13.597199	264	Clayey - gypseous	Pond	T	19.0	5670
AG067	Abbeveratoio 6 delle Macalube	05/04/08	Aragona	37.372595	13.600150	nd	Clayey - gypseous	Trough	T	nd	nd
AG068	Stagno 17 delle Macalube	05/04/08	Aragona	37.374933	13.598978	261	Clayey - gypseous	Ground pool	T	nd	nd
AG070	Prato allagato della Quisquina	03/19/09	Santo Stefano Quisquina	37.611384	13.520311	952	Clayey - gypseous	Ground pool	T	11.3	522
AG084	Fiume Magazzolo - Madonna dell'Olio	10/24/10	Bivona	37.593084	13.412494	304	Carbonatic	River	P	17.2	2670
AG085	Pozzetto di Linosa	10/13/10	Lampedusa e Linosa	35.865639	12.869389	31	Artificial (concrete)	Reservoir	T	nd	nd
AG089	Stagno 1 di Malvizzo	12/25/12	Favara	37.266841	13.679804	125	Carbonatic	Reservoir	T	10.0	5300
AG091	Pozza presso la Diga Furore	12/25/12	Agrigento	37.255364	13.708779	153	Carbonatic	Ground pool	T	15.8	2260
AG092	Stagno 1 di Naro	12/25/12	Naro	37.338720	13.802263	526	Carbonatic	Reservoir	T	11.6	966
AG093	Stagno 2 di Naro	12/25/12	Naro	37.337492	13.802164	514	Carbonatic	Reservoir	T	10.0	1800
AG094	Stagno 3 di Naro	12/25/12	Naro	37.337465	13.802697	515	Carbonatic	Reservoir	T	9.7	2290
AG095	Pozza in roccia Sanguedolce	12/06/03	Lampedusa e Linosa	35.522548	12.546396	8	Carbonatic	Rock pool	T	15.0	820
AG096	Pozza in roccia presso Sambuca	SRL	Sambuca di Sicilia	37.617898	13.037683	307	Carbonatic	Rock pool	T	nd	nd
AG097	Fontana Canfuto	08/18/13	Bivona	37.624694	13.446640	561	Artificial (concrete)	Trough	T	22.3	496
AG098	Fontana del Savuco	08/18/13	Bivona	37.618278	13.437978	512	Artificial (concrete)	Trough	P	16.6	596
AG100	Pozza Sanguedolce 2	SRL	Lampedusa e Linosa	35.518508	12.547207	91	Carbonatic	Rock pool	T	nd	nd
AG101	Pozza Taccio Vecchio 1	SRL	Lampedusa e Linosa	35.516037	12.600922	43	Carbonatic	Rock pool	T	nd	nd
AG102	Pozza Taccio Vecchio 2	SRL	Lampedusa e Linosa	35.515419	12.600638	37	Carbonatic	Rock pool	T	nd	nd
AG103	Pozza Taccio Vecchio 3	SRL	Lampedusa e Linosa	35.514832	12.600636	33	Carbonatic	Rock pool	T	nd	nd
AG107	Abbeveratoio di Borgo Bonsignore	01/08/14	Ribera	37.419427	13.260438	44	Artificial (concrete)	Trough	T	10.8	2560
AG108	Abbeveratorio presso Lago Gorgo	01/08/14	Cattolica Eraclea	37.413679	13.309262	41	Artificial (concrete)	Trough	T	15.6	3850
AG109	Abbeveratoio sulla SP30	01/08/14	Cattolica Eraclea	37.426071	13.330468	25	Artificial (concrete)	Trough	T	13.8	686

(*Continued*)

Table I. (Continued).

Code	Site name	Sampling date	Municipality	Latitude	Longitude	Height a.s.l. (m)	Prevalent lithology	Habitat	Hydroperiod	Water temperature (°C)	Conductivity (μS cm^{-1})
AG110	Pozzetto elettrico presso Lago Gorgo	01/08/14	Montallegro	37.414042	13.322809	76	Artificial (concrete)	Well	T	nd	nd
AG111	Pozzanghera delle Macalube	12/25/13	Aragona	37.373722	13.602198	274	Clayey - gypseous	Ground pool	T	12.7	5120
AG112	Canaletta Macalube	12/25/13	Aragona	37.381869	13.617408	304	Clayey - gypseous	Ground pool	T	14.2	2210
CL002	Lago Sfondato	06/01/05	Marianopoli	37.582022	13.947263	370	Clayey - gypseous	Pond	P	25.5	11560
		07/01/05								25.6	13950
		08/01/05								26.1	13090
		09/01/05								25.1	14660
		11/01/05								16.8	8045
		01/01/06								11.6	9520
		02/01/06								12.6	7271
		03/01/06								12.6	4570
CL008	Piana del Signore 2	12/10/11	Gela	37.056270	14.304114	8	Clayey - gypseous	Swamp	T	19.3	14020
		02/23/12								13.8	5810
CL012	Pozzanghera 2 presso il Lago Sfondato	02/19/06	Marianopoli	37.580782	13.943656	370	Clayey - gypseous	Ground pool	T	nd	nd
CL013	Pozzanghera 1 presso il Lago Sfondato	01/20/05	Marianopoli	37.578418	13.942398	400	Clayey - gypseous	Ground pool	T	13.1	2200
		02/19/06								nd	nd
CL014	Pantano di via Re Minosse	12/10/11	Gela	37.084101	14.223526	9	Clayey - gypseous	Swamp	T	15.5	15690
		02/23/12								15.5	1530
CL015	Pantano di via Chopin	12/10/11	Gela	37.082757	14.241474	9	Clayey - gypseous	Swamp	T	13.1	5660
		02/23/12								12.4	2800
CL020	Stagno artificiale di Contrada Arcia	01/07/11	Niscemi	37.109732	14.397863	253	Clayey - gypseous	Reservoir	P	nd	nd
CL022	Piana del Signore 3	12/10/11	Gela	37.056174	14.310896	13	Clayey - gypseous	Swamp	T	18.5	14,200
		02/23/12								15.8	6210
CL023	Monte Conca - Inghiottitoio P4 RET	05/18/13	Campofranco	37.489722	13.713611	275	Clayey - gypseous	Well	P	15.3	3341
		05/18/13								nd	nd
		05/18/13								nd	nd
CT003	Pozza 1 del Gurrida	03/21/04	Randazzo	37.857286	14.905647	860	Volcanic	Ground pool	T	24.5	490
CT004	Vigneto del Gurrida	03/21/04	Randazzo	37.856698	14.903351	860	Volcanic	Ground pool	T	14.4	450
CT007	Sciare di Santa Venera	03/21/04	Maletto	37.855591	14.875536	870	Volcanic	Pond	T	11.2	184
CT011	Pian del Lago	01/20/08	Maletto	37.816127	14.871569	1002	Volcanic	Swamp	T	10.3	458
CT014	Sciare di Santa Venera 2	04/18/12	Maletto	37.858999	14.860570	866	Volcanic	Pond	T	14.5	304
CT020	Pantano della Sovarita	01/25/12	Vizzini	37.175858	14.795144	779	Sedimentary siliceous	Swamp	T	nd	nd
		01/25/13								nd	nd

(*Continued*)

Table I. (Continued).

Code	Site name	Sampling date	Municipality	Latitude	Longitude	Height a. s.l. (m)	Prevalent lithology	Habitat	Hydroperiod	Water temperature (°C)	Conductivity (μS cm^{-1})
EN001	Lago di Pergusa	05/18/14	Enna	37.515234	14.306980	667	Gypseous	Lake	T	nd	nd
EN008	Stagno 2 di C.le del Contrasto	03/18/08	Cerami	37.847105	14.396224	1100	Sedimentary siliceous	Pond	T	nd	nd
EN009	Pozza km 111,5 S.S. 120	03/19/08	Cerami	37.515234	14.306980	693	Sedimentary siliceous	Pool	T	nd	nd
EN027	Stagno temporaneo presso Calascibetta	12/16/14	Calascibetta	37.610898	14.266996	642	nd	Pool	T	nd	nd
ME001	Maulazzino	10/09/06	Alcara Li Fusi	37.943887	14.674999	1440	Sedimentary siliceous	Pool	T	11.5	nd
ME009	Stagno dell'istmo di Vulcanello	03/03/04	Lipari	38.419717	14.958050	3	Volcanic	Pond	T	26.0	>3990
ME010	Terme di San Calogero	04/09/04	Lipari	38.476389	14.908611	160	Volcanic	Thermal spring	P	34.0	2440
ME012	Lago Maulazzo	10/09/06	Alcara Li Fusi	37.939509	14.671669	1440	Sedimentary siliceous	Reservoir	P	13.2	nd
		09/27/08								15.0	100
ME013	Pozza 4 della Dorsale dei Nebrodi	10/09/06	Cesarò	37.951944	14.698331	1200	Sedimentary siliceous	Pond	P	11.5	nd
ME030	Stagno di Contrada Cicogna	04/18/12	Cesarò	37.877265	14.666127	1312	Sedimentary siliceous	Pond	T	6.0	40
ME032	Pozza 1 di Piano Cicogna	03/21/04	Cesarò	37.876301	14.666131	1320	Sedimentary siliceous	Ground pool	T	19.1	80
ME033	Stagno Nebrodi 1	12/04/05	Cesarò	37.952271	14.699423	1320	Sedimentary siliceous	Ground pool	T	8.5	309
ME035	Biviere di Cesarò	10/09/06	Cesarò	37.050032	14.719685	1278	Sedimentary siliceous	Lake	P	13.7	nd
		09/27/08								14.0	117
ME036	Stagno dei Tricotteri	12/04/05	Cesarò	37.935781	14.673703	1480	Sedimentary siliceous	Pond	T	8.7	87
		01/01/06								nd	nd
		01/20/07								nd	nd
ME039	Pozza di Portella Femmina Morta	03/01/07	Cesarò	37.919168	14.654162	1524	Sedimentary siliceous	Ground pool	T	18.0	86
ME042	Pantano Zappulla	03/08/07	Capri Leone	38.118098	14.699372	0	Carbonatic	Swamp	T	17.0	1279
ME044	Stagno di Contrada Buffali	05/04/08	Cesarò	37.872255	14.676383	1252	Sedimentary siliceous	Pond	T	21.0	193
ME056	Stagno di Acque dei Vitelli	09/27/08	Caronia	37.910001	14.466886	1280	Sedimentary siliceous	Pond	T	nd	nd
ME070	Sorgente elocrena a est del Lago Cartolari	10/07/06	Tortorici	37.956784	14.820693	1410	Sedimentary siliceous	Spring	P	18.1	nd
PA004	Gorgo di Serra Guarneri	02/22/05	Cefalù	38.011154	14.090277	334	Carbonatic	Pond	T	9.3	175

(*Continued*)

Table I. (Continued).

Code	Site name	Sampling date	Municipality	Latitude	Longitude	Height a. s.l. (m)	Prevalent lithology	Habitat	Hydroperiod	Water temperature (°C)	Conductivity (μS cm^{-1})
PA005	Abbeveratoio di Torre dell'Orsa	02/22/05	Cinisi	38.190825	13.122927	10	Artificial (concrete)	Reservoir	T	nd	nd
PA010	Gorgo delle Fate	02/22/05	Gibilmanna	37.973760	14.007739	787	Carbonatic	Pond	T	8.2	118
PA013	Gorgo di Manco d'Ogliastro	02/22/05	Gratteri	37.966436	13.945941	358	Carbonatic	Pond	T	9.3	165
PA014	Abbeveratoio di Marineo	04/19/13	Marineo	37.946113	13.406259	500	Artificial (concrete)	Trough	P	nd	nd
PA021	Gorgo 1 di Dingoli	02/21/05	Piana degli Albanesi	38.006107	13.311394	718	Sedimentary siliceous	Pond	T	8.2	210
PA022	Gorgo di Maganoce	02/21/05	Piana degli Albanesi	37.959490	13.310232	785	Carbonatic	Pond	T	8.8	460
PA023	Gorgo di Serra Daino	02/22/05	Pollina	38.006852	14.132817	450	Sedimentary siliceous	Pond	T	16.2	118
PA025	Pozza in roccia di Barcarello	11/23/13	Sferracavallo	38.212994	13.290428	25	Carbonatic	Rock pool	T	nd	nd
		01/06/13								nd	nd
PA028	Vasca di Barcarello	04/26/09	Palermo	38.212218	13.289715	13	Artificial (concrete)	Reservoir	T	nd	nd
PA029	Lago Bomes	03/19/04	Sclafani Bagni	37.823823	13.820875	865	Sedimentary siliceous	Pond	T	15.2	150
PA031	Pozze alla foce del Torrente Nocella	07/31/04	Trappeto	38.085312	13.073547	5	Carbonatic	Pond	T	27.9	1530
PA032	Gorgo Secco	02/22/05	Belmonte Mezzagno	38.033889	13.364160	603	Carbonatic	Pond	T	7.4	196
PA034	Gorgo Mennula	02/22/05	Misilmeri	38.015252	13.399030	518	Carbonatic	Pond	T	8.4	232
PA036	Gorgo di Rebuttone	02/21/05	Altofonte	38.028333	13.326664	700	Carbonatic	Pond	T	8.8	170
		04/19/13								nd	nd
PA051	Abbeveratoio di Goethe	11/01/02	Palermo	38.156091	13.356434	228	Artificial (concrete)	Reservoir	T	nd	nd
PA053	Gorgo di Colobria	03/06/04	Castronovo di Sicilia	37.719765	13.506324	936	Sedimentary siliceous	Pond	T	8.0	214
PA057	Dolina della Rocca d'Entella	05/05/05	Contessa Entellina	37.774912	13.117056	484	Gypseous	Pond	T	nd	nd
PA065	Gorgo Tramontana	03/06/10	Ustica	38.717001	13.185126	16	Volcanic	Pond	T	17.0	440
PA068	Uricieddi	01/13/03	Ustica	38.694506	13.162708	66	Volcanic	Rock pool	T	8.9	210
PA069	Gorgo di San Bartolicchio	02/11/03	Ustica	38.700092	13.172652	43	Artificial (concrete)	Reservoir	T	9.0	150
PA073	Pozza Lunga	03/05/10	Ustica	38.719594	13.178021	16	Volcanic	Ground pool	T	18.7	3170
PA074	Gorgo di Pollicino	07/04/13	Petralia Soprana	37.823410	14.127241	1290	Sedimentary siliceous	Pond	P	nd	450
PA079	Gorgo del Cerro	02/19/12	Corleone	37.889944	13.394575	750	Sedimentary siliceous	Pond	T	nd	nd
		04/19/13								nd	423
PA084	Pozza degli Incidenti	02/21/05	Corleone	37.882777	13.381256	680	Sedimentary siliceous	Ground pool	T	8.5	565

(*Continued*)

Table I. (Continued).

Code	Site name	Sampling date	Municipality	Latitude	Longitude	Height a. s.l. (m)	Prevalent lithology	Habitat	Hydroperiod	Water temperature (°C)	Conductivity (μS cm^{-1})
PA085	Pozza di Contrada Castellaccio	02/21/05	Corleone	37.893280	13.371701	593	Sedimentary siliceous	Ground pool	T	9.2	170
PA087	Pozza dello Zù Santino	12/20/03	Corleone	37.907989	13.418035	845	Sedimentary siliceous	Ground pool	T	9.0	3926
PA097	Stagno X6	08/18/04	Monreale	37.968884	13.126659	230	Carbonatic	Reservoir	P	28.9	nd
PA103A	Gorgo di Pietra Giordano A	07/04/13	Geraci Siculo	37.852606	14.127682	1323	Sedimentary siliceous	Pond	P	nd	nd
PA103B	Gorgo di Pietra Giordano B	07/04/13	Geraci Siculo	37.852613	14.121550	1323	Sedimentary siliceous	Pond	P	nd	nd
PA110	Cisterna Solunto	01/10/15	Santa Flavia	38.094180	13.532090	170	Artificial (concrete)	Reservoir	T	nd	58
PA111	Stagno 4 di Monte Genuardo	04/05/09	Contessa Entellina	37.695695	13.180137	1067	Sedimentary siliceous	Ground pool	T	12.0	189
PA112	Stagno 1 di Santa Maria del Bosco	11/25/07	Contessa Entellina	37.708336	13.204001	895	Sedimentary siliceous	Reservoir	T	16.2	81
PA114	Gorgo di Pizzo Selva a Mare	12/04/07	Palermo	37.995868	13.582122	679	Carbonatic	Pond	T	10.6	270
PA116	Margio di Dingoli	02/21/05	Palermo	38.005078	13.309582	718	Sedimentary siliceous	Swamp	T	11.1	nd
PA118	Gebbia di Borgo Molara	02/21/05	Palermo	38.075788	13.313339	130	Artificial (concrete)	Reservoir	T	nd	492
PA119	Gebbia di Monte Pellegrino	07/29/08	Palermo	38.155056	13.361114	229	Artificial (concrete)	Reservoir	P	24.6	nd
PA121	Laghetto 2 di Coda di Riccio	04/19/13	Corleone	37.873333	13.398449	870	Sedimentary siliceous	Artificial pond	P	nd	920
PA153	Stagno di Xireni	10/11/09	Castellana Sicula	37.763332	13.991018	816	Clayey - gypseous	Pond	T	21.0	nd
PA171	Uricieddi 1	03/05/10	Ustica	38.694893	13.162919	63	Volcanic	Rock pool	T	nd	1100
PA173	Cisterna del Biacco - Rupe Falconiera	03/06/10	Ustica	38.711367	13.197183	140	Volcanic	Rock pool	T	15.0	247
PA176	Cisterna del *Proasellus* - Rupe Falconiera	03/06/10	Ustica	38.711305	13.195483	140	Volcanic	Rock pool	P	13.0	806
PA177	Stagno agricolo 1 della Valle dello Jato	03/07/10	Monreale	37.986027	13.180797	315	Carbonatic	Reservoir	P	14.8	587
PA179	Stagno agricolo 3 della Valle dello Jato	03/07/10	Monreale	37.965258	13.128743	224	Carbonatic	Reservoir	P	16.0	593
PA196	Laghetto del Bomes	03/24/12	Sclafani Bagni	37.823907	13.820260	872	Sedimentary siliceous	Pond	T	15.0	246
PA197	Stagno di Sclafani Bagni	04/24/12	Sclafani Bagni	37.800718	13.829353	644	Carbonatic	Pond	T	16.5	nd
PA199	Abbeveratoio sul sentiero per Gorgo Cerro	04/19/13	Monreale	37.890410	13.397044	748	Sedimentary siliceous	Trough	P	nd	nd
PA200	Lago Castellaro	ago-2014	Collesano	37.886198	13.959074	1500	Carbonatic	Marsh	P	nd	nd
PA201	Sorgente delle Fontane	07/07/14	Palermo	38.103497	13.313012	103	Carbonatic	Spring	P	16.6	585

(*Continued*)

Table I. (Continued).

Code	Site name	Sampling date	Municipality	Latitude	Longitude	Height a.s.l. (m)	Prevalent lithology	Habitat	Hydroperiod	Water temperature (°C)	Conductivity (μS cm^{-1})
PA202	Pozzo 1 Palermo	07/08/14	Palermo	38.145190	13.362240	24	Carbonatic	Well	P	19.8	835
RG004	Pozza di Pozzallo	12/25/05	Pozzallo	36.715944	14.825936	1	Carbonatic	Rock pool	T	14.6	2030
		05/18/14								17.4	87100
RG006	Pantano Maganuco	12/22/05	Pozzallo	36.717912	14.815730	0	Carbonatic	Swamp	T	14.7	3900
RG013	Fiume Irminio	07/03/13	Scicli	36.788596	14.601872	19	Carbonatic	Rock pool	T	nd	nd
RG014	Pozza 2 di Pozzallo	SRL	Pozzallo	36.715443	14.824465	1	Carbonatic	Rock pool	T	nd	1934
SR010	Pantano Morghella	12/16/06	Pachino	36.697979	15.113314	0	Carbonatic	Swamp	T	16.0	8910
SR018	Pantano Ponterio	12/16/06	Pachino	36.663169	15.071279	5	Carbonatic	Swamp	T	18.3	35400
SR020	Pantano Cuba	12/16/06	Pachino	36.711616	15.022629	1	Carbonatic	Swamp	P	16.5	14260
SR021	Pantano Piccolo Vendicari	07/20/05	Noto	36.809231	15.102828	5	Carbonatic	Lake	P	32.7	50940
SR026	Fiume Cassibile	10/29/04	Noto	36.989438	15.027768	393	Carbonatic	River	P	16.3	319
SR038	Pozzo di Giarranauti - Cugnarello	10/10/10	Ferla	37.129208	14.998615	506	Carbonatic	Well	P	nd	nd
SR039	Kamentiza di Filiporto	SRL	Ferla	37.131145	15.018599	376	Carbonatic	Rock pool	T	nd	nd
SR042	Fiume Anapo	10/10/10	Cassaro	37.094896	14.944872	399	Carbonatic	River	P	18.0	553
SR043	Fiume Ciane	05/18/14	Siracusa	37.054611	15.251033	5	Carbonatic	River	P	18.5	1220
SR052	Fiume Anapo 2	06/22/13	Cassaro	37.137361	15.034161	235	Carbonatic	River	P	nd	nd
SR053	Fiume Anapo 3	06/23/13	Cassaro	37.105586	14.967114	360	Carbonatic	River	P	nd	nd
SR054	Pozza in roccia del Calcinara	SRL	Sortino	37.141480	15.031267	251	Carbonatic	Rock pool	T	25.9	432
SR055A	Villasmundo Pozza Piccola SIC Ogliastri	01/05/17	Melilli	37.190325	15.084719	250	Carbonatic	Rock pool	T	nd	nd
		03/06/17								nd	nd
SR055B	Villasmundo Pozza Grande SIC Ogliastri	01/05/17	Melilli	37.190325	15.084719	250	Carbonatic	Rock pool	T	nd	nd
		03/06/17								nd	nd
SR056A	Pozza 108 SIC Palombara	01/05/17	Melilli	37.104182	15.197951	135	Carbonatic	Rock pool	T	nd	nd
SR056B	Pozza 107 SIC Palombara	01/05/17	Melilli	37.104182	15.197951	135	Carbonatic	Rock pool	T	nd	nd
		03/06/17								nd	nd
SR059	Pozzo II di Portopalo	10/11/06	Portopalo di Capo Passero	36.674063	15.111327	6	Carbonatic	Well	P	22.6	nd
TP004	Gorgo Borruso	02/21/05	Castellamare del Golfo	38.045125	12.863711	106	Marly	Pond	T	9.1	255
		04/19/13								nd	nd
TP006	Gorgo di Baglio Cofano	02/21/05	Custonaci	38.103134	12.677361	245	Carbonatic	Pond	T	9.8	524
TP007	Macarese 1	02/21/05	Custonaci	38.099445	12.660830	18	Carbonatic	Rock pool	T	16.2	392
TP011	Lago Preola	01/30/14	Mazara del Vallo	37.619884	12.642252	3	Carbonatic	Swamp	T	12.1	3430
		06/17/16								nd	3300

(*Continued*)

Table I. (Continued).

Code	Site name	Sampling date	Municipality	Latitude	Longitude	Height a. s.l. (m)	Prevalent lithology	Habitat	Hydroperiod	Water temperature (°C)	Conductivity (μS cm^{-1})
TP014	Castello della Pietra 1	01/15/04	Partanna	37.670531	12.896699	162	Carbonatic	Rock pool	T	nd	nd
TP029	Pozza 2 di Monte Inici	01/01/05	Castellammare del Golfo	37.981577	12.871179	672	Carbonatic	Ground pool	T	nd	nd
TP036	Pozza dello Svincolo Soria	03/13/05	Paceco	37.974349	12.596256	50	Carbonatic	Ground pool	T	20.2	1600
TP038	Pozza di Contrada Quasale	03/18/05	Calatafimi Segesta	37.900098	12.788271	387	Carbonatic	Ground pool	T	8.8	355
TP039	Kamenitza 1 di S. Vito	03/05/05	San Vito lo Capo	38.183054	12.732773	60	Carbonatic	Rock pool	T	11.6	222
TP042	Stagno 2 di Contrada Celso	01/06/07	Castellammare del Golfo	38.043121	12.748685	360	Sedimentary siliceous	Pond	T	13.3	266
TP044	Vasca in roccia di Contrada Celso	01/06/07	Castellammare del Golfo	38.042713	12.750862	360	Sedimentary siliceous	Rock pool	T	12.0	872
TP048	Gorgo di Monte Gibele	04/12/04	Pantelleria	36.776428	12.011791	606	Volcanic	Pond	T	13.1	230
TP061	Pantano Maria Stella	02/14/04	Trapani	37.997245	12.536558	2	Carbonatic	Swamp	T	18.1	5312
TP065	Pantano Calcara	05/27/05	Trapani	37.988633	12.500424	1	Carbonatic	Pond	T	22.6	22700
		02/20/06								15.3	11540
TP068	Abbeveratoio della galleria	03/14/04	Favignana	37.922223	12.300667	21	Artificial (concrete)	Reservoir	T	nd	nd
TP069	Bevaio di Ulisse	03/14/04	Favignana	37.927547	12.285342	19	Artificial (concrete)	Reservoir	T	17.0	608
TP072	Pozze dell'Uccerìa	01/22/05	Favignana	37.949642	12.301438	2	Carbonatic	Ground pool	T	19.3	920
TP074	Pozza 1 di Punta Fanfalo	12/10/05	Favignana	37.908551	12.357268	16	Carbonatic	Rock pool	T	16.4	574
TP076	Gebbia di Favignana	12/10/05	Favignana	37.914545	12.358942	15	Artificial (concrete)	Reservoir	P	14.6	1013
TP078	Gorgo Medio	01/30/14	Mazara del Vallo	37.610939	12.650079	3	Carbonatic	Pond	P	nd	nd
		06/17/16								27.6	3200
TP079	Gorgo Basso	01/30/14	Mazara del Vallo	37.608351	12.654544	6	Carbonatic	Pond	P	13.0	4190
TP080	Lago di Murana (sito A)	10/30/05	Mazara del Vallo	37.625452	12.633646	4	Carbonatic	Pond	T	nd	nd
		01/30/14								12.2	1960
		06/17/16								27.0	2427
		01/30/14								nd	nd
		06/17/16								nd	nd
TP093	Stagno 1 di Isola Longa	02/25/05	Marsala	37.856102	12.447186	2	Carbonatic	Pond	T	13.8	>3990
TP094	Stagno 2 di Isola Longa	02/25/05	Marsala	37.863327	12.446664	2	Carbonatic	Swamp	T	13.8	3630
TP095	Stagno 3 di Isola Longa	02/25/05	Marsala	37.867496	12.447770	2	Carbonatic	Pond	T	15.0	1228
TP096	Stagno 4 di Isola Longa	02/25/05	Marsala	37.874158	12.447495	2	Carbonatic	Pond	T	13.7	>3990
TP097	Stagno 5 di Isola Longa	02/25/05	Marsala	37.877495	12.445549	2	Carbonatic	Pond	T	16.1	1190
TP098	Stagno 6 di Isola Longa	02/25/05	Marsala	37.879441	12.443891	2	Carbonatic	Pond	T	14.8	>3990
TP099	Stagno 7 di Isola Longa	02/25/05	Marsala	37.878279	12.443860	2	Carbonatic	Pond	T	15.0	>3990
TP100	Abbeveratoio di Pietre Varate	03/18/05	Favignana	37.992767	12.327901	70	Carbonatic	Rock pool	T	16.7	516
TP109	Margio Spanò	05/16/07	Petrosino	37.678119	12.498980	3	Carbonatic	Swamp	T	28.9	118300

(*Continued*)

Table I. (Continued).

Code	Site name	Sampling date	Municipality	Latitude	Longitude	Height a.s.l. (m)	Prevalent lithology	Habitat	Hydroperiod	Water temperature (°C)	Conductivity (µS cm^{-1})
		12/23/11								13.3	78800
		03/07/12								12.8	52500
TP111	Pantano di Birgi Novo	12/15/07	Marsala	37.902620	12.471962	2	Carbonatic	Swamp	T	19.8	22000
		12/23/11								12.5	38490
TP113	Pantano del Villaggio San Teodoro	03/07/12	Marsala	37.915704	12.469444	2	Carbonatic	Swamp	T	12.5	38490
TP114	Margio Spanò 2	03/07/12	Petrosino	37.678516	12.500282	3	Carbonatic	Swamp	T	nd	nd
		01/30/14								15.2	49700
TP117	Pantano Leone	12/15/07	Campobello di Mazara	37.614864	12.721563	49	Carbonatic	Pond	T	12.8	1520
TP118	Gorgo Frascia	12/15/07	Castelvetrano	37.593762	12.778437	29	Carbonatic	Pond	P	12.2	3750
TP120	Pozzo di Pietre Varate	03/18/05	Favignana	37.992765	12.327898	70	Carbonatic	Well	P	nd	nd
TP124	Margio di Gallitello-Anguillara	04/02/11	Calatafimi Segesta	37.858466	12.920817	205	Sedimentary siliceous	Swamp	T	nd	nd
		01/16/12								nd	nd
		02/17/12								12.3	1905
		03/25/12								nd	nd
		04/15/12								nd	nd
		12/21/12								nd	nd
		01/30/14								11.0	1380
		01/31/14								nd	nd
		03/02/14								nd	nd
		01/24/15								nd	nd
		03/20/15								nd	nd
TP136	Margio Nespolilla 1	12/23/11	Petrosino	37.689284	12.493888	4	Carbonatic	Marsh	T	12.2	48420
		03/07/12								12.7	28800
TP139	Pozza 2 di Gallitello-Anguillara	04/02/11	Calatafimi Segesta	37.857876	12.919526	205	Sedimentary siliceous	Pond	T	nd	nd
		04/15/12								14.0	990
TP143	Pantano di Contrada Critazzu	02/18/09	Mazara del Vallo	37.685468	12.617532	63	Carbonatic	Swamp	T	12.9	2690
		02/26/13								nd	nd
		03/20/15								nd	nd
TP144	Vigneto allagato di Contrada Critazzu	03/20/15	Mazara del Vallo	37.688198	12.621062	63	Carbonatic	Flooded field	T	nd	nd
		02/20/11								nd	nd
		02/20/13								nd	1500
		02/18/09								13.0	1160
TP153	Vasca in cemento Hotel Cossyra	10/16/10	Pantelleria	36.815617	11.927343	9	Artificial (concrete)	Reservoir	T	nd	nd

(*Continued*)

Table I. (Continued).

Code	Site name	Sampling date	Municipality	Latitude	Longitude	Height a. s.l. (m)	Prevalent lithology	Habitat	Hydroperiod	Water temperature (°C)	Conductivity (µS cm^{-1})
TP161	Cava allagata di Contrada Luppino	SRL	Trapani	38.089075	12.713538	307	Carbonatic	Pool	T	nd	nd
TP164	Pietra Collina	12/04/11	Trapani	38.036071	12.698235	159	Sedimentary siliceous	Rock pool	T	14.0	302
TP166	Pozza di Roccolino	12/21/12	Castelvetrano	37.712900	12.715420	132	Carbonatic	Pond	T	12.9	1613
TP170	Stagno artificiale di Contrada Aquilotto	12/21/12	Castelvetrano	37.756230	12.743796	107	Carbonatic	Reservoir	P	12.0	3500
TP171	Sorgente della Madonna	04/20/13	Favignana	37.978792	12.063190	14	Carbonatic	Spring	P	nd	nd
TP172	Fiume Guidaloca	04/18/13	Castellammare del Golfo	38.056399	12.839562	2	Carbonatic	River	P	nd	nd
TP173	Abbeveratoio di Scopello	04/18/13	Castellammare del Golfo	38.070127	12.817882	106	Artificial (concrete)	Through	P	nd	nd
TP174	Vasche della Acropoli di Pantelleria	SRL	Pantelleria	36.822371	11.950959	106	Artificial (concrete)	Reservoir	T	nd	582
TP175	Stagno 4 di Gallitello-Anguillara	03/02/14	Calatafimi Segesta	37.856828	12.921546	198	Sedimentary siliceous	Swamp	T	nd	nd
TP176	Grotta di Santa Ninfa	07/08/14	Santa Ninfa	37.779803	12.897771	393	Clayey - gypseous	Stream	P	17.2	3050
TP177	Pantano 2 di Critazzu	03/20/15	Mazara del Vallo	37.686340	12.616628	62	Carbonatic	Pond	T	nd	nd
TP178	Carrareccia di Contrada Critazzu	02/15/15	Mazara del Vallo	37.691602	12.621837	64	Carbonatic	Ground pool	T	nd	nd
TP179	Pozzo di Gallitello-Anguillara	02/21/15	Calatafimi Segesta	37.859657	12.911366	208	Sedimentary siliceous	Well	P	nd	nd
TP180	Stagno 5 di Gallitello-Anguillara	02/21/15	Calatafimi Segesta	37.858851	12.910977	210	Sedimentary siliceous	Pond	T	nd	nd
		03/20/15								nd	nd
TP181	Stagno 6 di Gallitello-Anguillara	02/21/15	Calatafimi Segesta	37.857264	12.915297	203	Sedimentary siliceous	Pond	T	nd	nd
		03/20/15								nd	nd

Table II. Updated checklist of Recent non-marine ostracod species from Sicily and surrounding islands and their occurrence in the sampling sites considered in this study ([§]: new record for the study area; [#]: new record for the Italian fauna). The list also includes species, designated with an asterisk, previously reported for Sicily by other authors (Moniez 1889; Pieri et al. 2015 and references therein; Curry et al. 2016; Troia et al. 2016; Mazzini et al. 2017) but not found in the frame of the present study. Site codes are as in Table I.

Class Ostracoda Latreille, 1802
Subclass Podocopa G.O. Sars, 1866
Order Podocopida G.O. Sars, 1866
Suborder Cypridocopina Baird, 1845
Superfamily Cypridoidea Baird, 1845
Family Cyprididae Baird, 1845
Subfamily Cypridinae Baird, 1845
Genus *Cypris* O.F. Müller, 1776
Cypris bispinosa Lucas, 1849
EN008, EN027, ME042, PA029, RG006, TP124, TP143, TP166, TP177
Cypris pubera O.F. Müller, 1776
ME030, PA036, TP124
Subfamily Cypridopsinae Kaufmann, 1900
Genus *Cypridopsis* Brady, 1867
Cypridopsis elongata (Kaufmann, 1900)
AG094, SR059, TP011, TP079, TP124, TP139, TP175, TP180, TP181
Cypridopsis hartwigi G. W. Müller, 1900
PA029, PA079, PA121
Cypridopsis vidua (O.F. Müller, 1776)
AG089, AG092, AG093, AG094, CL020, ME010, ME012, ME035, PA097, PA119, PA153, RG013, SR026, SR043, SR052, SR053, TP011, TP076, TP078, TP079, TP080, TP118, TP153
Genus *Plesiocypridopsis* Rome, 1965
Plesiocypridopsis newtoni (Brady and Robertson, 1870) (Figure S12 A, B)
AG010, AG012, AG025, AG059, AG067, PA014, PA028, PA065, PA068, PA069, PA110, PA118, PA119, PA171,PA199, RG004, SR055A, SR055B, TP039, TP068, TP069, TP074, TP100, TP120, TP171, TP173, TP176
Genus *Potamocypris* Brady, 1870
Potamocypris arcuata (Sars, 1903) (Figure S12 G-J)
AG010, AG013, AG018, AG025, AG035, AG037, AG068, PA036, PA068, RG004, TP004, TP039, TP068
Potamocypris villosa (Jurine, 1820)
AG092, CT014, PA028, TP036
Genus *Sarscypridopsis* McKenzie, 1977
Sarscypridopsis aculeata (Costa, 1847) (Figure S12 C-F)
AG032, AG035, AG036, AG037, AG038, AG039, AG040, AG041, AG043, AG056, AG058, AG059, AG060, AG062, AG064, AG084, AG089, AG107, CL002, CL008, CL014, CL022, EN001, EN027, ME009, PA005, RG004, RG006, RG013, TP011, TP065, TP095, TP118, TP170, TP178
Subfamily Cyprinotinae Bronshtein, 1947
Genus *Heterocypris* Claus, 1892
**Heterocypris barbara* (Gauthier and Brehm, 1928)
Heterocypris incongruens (Ramdohr, 1808) (Figures S13 and S14 A, B)
AG009, AG018, AG021, AG024, AG025, AG027, AG033, AG043, AG057, AG059, AG063, AG089, AG094, AG095, AG096, AG097, AG098, AG108, AG110, AG111, AG112, CL013, CL022, ME009, ME032, PA031, PA051, PA068, PA073, PA171, PA173, PA176, PA199, PA200, RG004, SR039, SR055A, SR056A, SR056B, TP004, TP007, TP011, TP039, TP044, TP068, TP072, TP093, TP100, TP144, TP161, TP172, TP174, TP177, TP178
Heterocypris reptans (Kaufmann, 1900)
CL012, CL013
Heterocypris salina (Brady, 1868)
AG032, AG040, AG043, AG052, AG061, AG063, AG068, AG085, AG108, AG112, RG014, SR020, TP080, TP111
Subfamily Eucypridinae Bronshtein, 1947
Genus *Eucypris* Vávra, 1891
Eucypris kerkyrensis Stephanides, 1937 (Figure S16)
AG041, CL008, TP111, TP113, TP124, TP139, TP143, TP144, TP177, TP181
[#]*Eucypris mareotica* (Fischer, 1855) (Figure 5)
RG004, SR010, SR018, TP065, TP095, TP096, TP098, TP099, TP109, TP114, TP136
Eucypris virens (Jurine, 1820) (Figure S17)
AG009, AG013, AG023, AG032, AG033, AG034, AG035, AG037, AG038, AG041, AG064, AG068, AG070, AG091, AG092, AG093, AG094, CL008, CL012, CL013, CL014, CL015, CT003, CT004, CT007, CT011, CT014, CT020, EN009, EN027, ME001, ME033, ME036, ME039, ME042, ME044, PA004, PA013, PA021, PA022, PA023, PA029, PA032, PA034, PA036, PA053, PA073, PA079, PA079, PA084, PA085, PA111, PA114, PA116, PA121, PA171, PA196, PA197, RG006, TP004, TP006, TP011, TP036, TP038, TP042, TP048, TP061, TP065, TP072, TP074, TP094, TP097, TP098, TP113, TP118, TP124, TP139, TP143, TP144, TP170, TP175, TP177, TP179, TP180, TP181

(*Continued*)

Table II. (*Continued*).

Genus _Prionocypris_ Brady and Norman, 1896
Prionocypris zenkeri (Chyzer and Toth, 1858)
RG013, SR053
Genus _Tonnacypris_ Diebel and Pietrzeniuk, 1975
Tonnacypris lutaria (Koch, 1838)
AG059, AG070, CT007, EN009, ME039, PA073, PA111, PA112, PA196, PA197, TP072, TP144
Genus _Trajancypris_ Martens, 1989
Trajancypris clavata (Baird, 1838)
TP004, TP042
Subfamily Herpetocypridinae Kaufmann, 1900
Tribe Herpetocypridini Kaufmann, 1900
Genus _Candonocypris_ Sars, 1894
§_Candonocypris novaezelandiae_ (Baird, 1843)
TP011, TP080
Genus _Herpetocypris_ Brady and Norman, 1889
Herpetocypris brevicaudata Kaufmann, 1900
AG098, PA014, RG013
Herpetocypris chevreuxi (Sars, 1896)
AG109, PA177, PA199, SR026, TP117
*_Herpetocypris helenae_ G.W. Müller, 1908
Tribe Psychrodromini Martens, 2001
Genus _Psychrodromus_ Danielopol and McKenzie, 1977
*_Psychrodromus fontinalis_ (Wolf, 1920)
Subfamily Isocypridinae Hartmann and Puri, 1974
Genus _Isocypris_ G.W. Müller, 1908
Isocypris beauchampi (Paris, 1920)
PA036
Family Candonidae Kaufmann, 1900
Subfamily Candoninae Kaufmann, 1900
Tribe Candonini Kaufmann, 1900
Genus _Neglecandona_ Krstić, 2006
Neglecandona lindneri (Petkovski, 1969) (Figure S18 A-D)
ME030, ME044, PA010
Neglecandona neglecta (Sars, 1887)
CT011, SR055A, TP124
Genus _Fabaeformiscandona_ Krstić,1972
*_Fabaeformiscandona subacuta_ (Yang, 1982)
Genus _Mixtacandona_ Klie, 1938
*_Mixtacandona idrisi_ Mazzini and Rossetti, 2017
Genus _Pseudocandona_ Kaufmann, 1900
Pseudocandona albicans (Brady, 1864)
AG098, CL014, RG013
Subfamily Cyclocypridinae Kaufmann, 1900
Genus _Cyclocypris_ Brady and Norman, 1889
*_Cyclocypris laevis_ (O.F. Müller, 1776)
Cyclocypris ovum (Jurine, 1820)
EN008, ME001, ME032, ME033, ME036, ME056, PA087, PA103A
Genus _Cypria_ Zenker, 1854
Cypria ophtalmica (Jurine, 1820)
ME013, PA074, PA103B, PA176, PA201, PA202, SR038, TP120
#_Cypria subsalsa_ (Redeke, 1936) (Figure 4 A, B)
TP011, TP080
Genus _Physocypria_ Vávra, 1897
#_Physocypria kerkyrensis_ Klie, 1936 (Figure 4 C-E)
TP011, TP079, TP080
Family Ilyocyprididae Kaufmann, 1900
Subfamily Ilyocypridinae Kaufmann, 1900
Genus _Ilyocypris_ Brady and Norman, 1889
Ilyocypris bradyi Sars, 1890 (Figure S19 A, B)
AG098, AG112
Ilyocypris decipiens Masi, 1905 (Figure S19 C-F)
AG033, AG059, AG064, AG111, CL013, PA121, TP072, TP176, TP178
Ilyocypris getica Masi, 1906 (Figure S20)

(*Continued*)

Table II. (*Continued*).

CL023, PA073, TP036
Ilyocypris gibba (Ramdohr, 1808) (Figure S19 G, H)
AG039, AG089, AG091, CL008, CL022, PA179, TP007
§*Ilyocypris inermis* Kaufmann, 1900
CL023
Family Notodromadidae Kaufmann, 1900
Subfamily Notodromadinae Kaufmann, 1900
Genus *Notodromas* Lilljeborg, 1853
**Notodromas persica* Gurney, 1921
Superfamily Darwinuloidea Brady and Robertson, 1885
Family Darwinulidae Brady and Robertson, 1885
Genus *Darwinula* Brady and Robertson, 1885
Darwinula stevensoni (Brady and Robertson, 1870)
RG013, TP078, TP079, TP171
Genus *Vestalenula* Rossetti and Martens, 1998
#*Vestalenula boteai* (Danielopol, 1970) (Figures 6 and 7)
TP011, TP078
Superfamily Cytheroidea Baird, 1850
Family Cytherideidae Sars, 1925
Subfamily Cytherideinae
Genus *Cyprideis* Jones, 1857
Cyprideis torosa (Jones, 1850)
SR021
Family Limnocytheridae Klie, 1938
Subfamily Limnocytherinae Klie, 1938
Genus *Limnocythere* Brady, 1867
Limnocythere inopinata (Baird, 1843)
AG036, AG039, TP011
Family Hemicytheridae Puri, 1953
Genus *Tyrrhenocythere* Ruggieri, 1955
Tyrrhenocythere amnicola (Sars, 1887) (Figure S21)
RG013, SR042, SR052, SR053

level (Table III). Four species (*Cypria subsalsa, Eucypris mareotica, Physocypria kerkyrensis, Vestalenula boteai*) (Figures 4–7) and one genus (*Vestalenula*) are reported here for the first time for the whole Italian fauna, while *Candonopsis novaezelandiae* and the genera *Candonopsis* and *Physocypria* are also new for Sicily. Seven species (*Cyclocypris laevis, Fabaeformiscandona subacuta, Herpetocypris helenae, Heterocypris barbara, Mixtacandona idrisi, Notodromas persica, Psychrodromus fontinalis*) were already known from the study area (Pieri et al. 2015; Mazzini et al., 2017) but were not found again during the present survey (Table II).

About 44% of studied sites contained only a single species; the highest diversity (11 taxa: *Cypria subsalsa, Candonocypris novaezelandiae, Cypridopsis elongata, Cypridopsis vidua, Eucypris virens, Heterocypris incongruens, Heterocypris salina, Limnocythere inopinata, Physocypria kerkyrensis, Sarscypridopsis aculeata* and *Vestalenula boteai*) was found in Lago Preola (TP011), an astatic swamp (Figure 3). Three species (*Cyprideis torosa, Ilyocypris inermis, Isocypris beauchampi*) were found only in one site, seven species (*Candonocypris novaezelandiae, Cypria subsalsa, Heterocypris reptans, Ilyocypris bradyi, Prionocypris zenkeri, Trajancypris clavata, Vestalenula boteai*) in two sites; the most common species were *Eucypris virens* (85 sites, Figure S5), *Heterocypris incongruens* (54 sites, Figure S3), *Sarscypridopsis aculeata* (34 sites, Figure S1), *Plesiocypridopsis newtoni* (27 sites, Figure S1), and *Cypridopsis vidua* (23 sites) (Table II). All taxa encountered on small islands and archipelagos were also found on mainland Sicily, except for *Potamocypris* cf. *arcuata* which was present exclusively in three sites on the Egadi Islands.

Plesiocypridopsis newtoni (Figure S12 A, B) was found in the north-western part of the study area, except for an isolated record in the province of Siracusa (Figure S1). This species occurred in several different habitats, mostly rock pools but also in drinking troughs, springs and occasionally in a well and in a stream, at elevations up to 500 m a.s.l. and with salinity usually not exceeding 3 mS cm^{-1}.

Two species of *Potamocypris* were present: *Potamocypris arcuata* (Figure S12 G-J) and *Potamocypris villosa*. The first species, which is

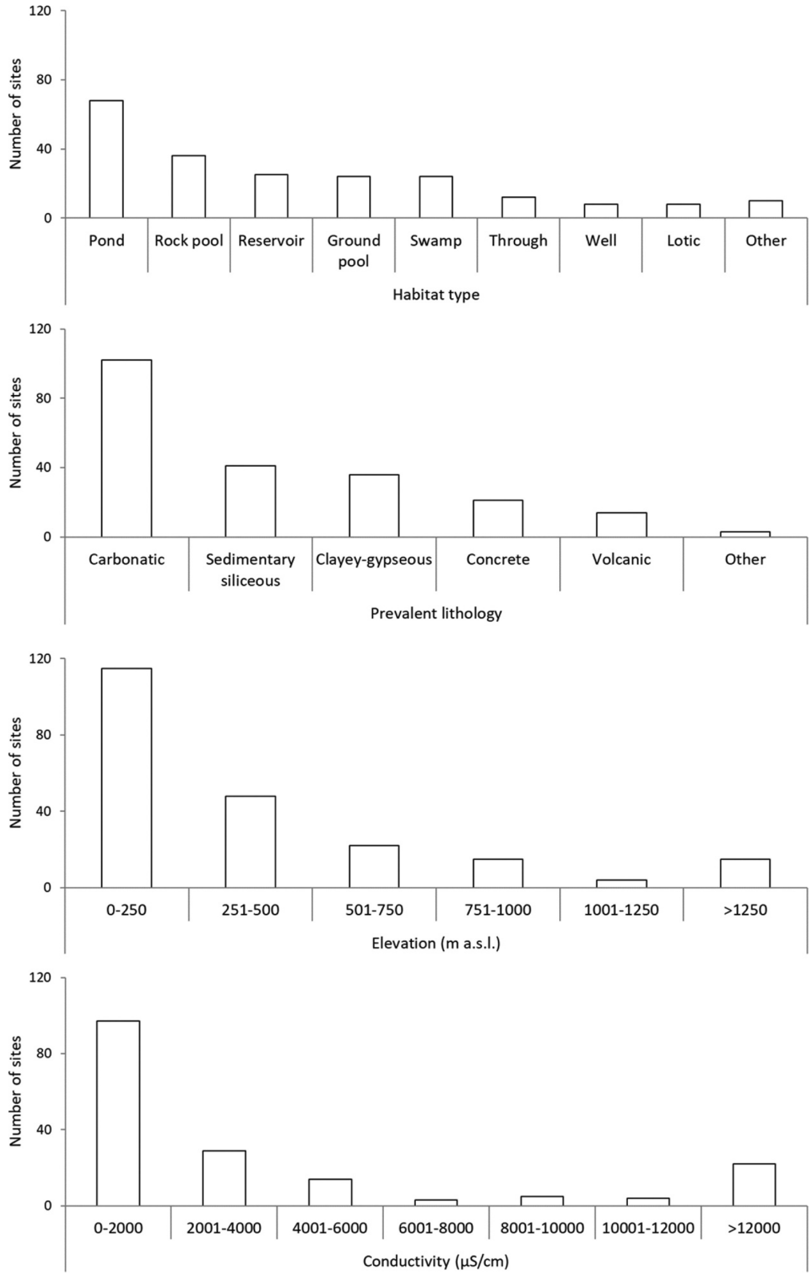

Figure 2. Distribution of sampling sites by habitat type, prevalent lithology, altitude and electrical conductivity.

absent in the central and eastern parts of Sicily, preferred small-sized habitats with a maximum conductivity of up to 2–3 mS cm^{-1}; the second one occurred in only three scattered, temporary sites (Figure S2).

Sarscypridopsis aculeata (Figure S21 C-F) was retrieved from both temporary and permanent lentic water bodies, and sporadically in a river and in a well. It was absent from the north-eastern part of the study area, except for a population recorded in a temporary pool of Vulcano Island (Eolie archipelago) (Figure S1).

Heterocypris incongruens displayed a variable morphology (Figures S13 and S14 A, B). It was present between 0 and 1500 m a.s.l., usually in temporary waters, and with salinity values of up to 14 mS cm^{-1} (Figure S3). *Heterocypris reptans* was recovered from two temporary pools in the central

Table III. Taxa with uncertain identification and their occurrence in sampling sites. Site codes as in Table I.

Family Cyprididae Baird, 1845
Subfamily Cypridopsinae Kaufmann, 1900
Genus *Cypridopsis* Brady, 1867
Cypridopsis cf. *elongata*
CL015
Genus *Potamocypris* Brady, 1870
Potamocypris cf. *arcuata*
TP069, TP100, TP120
Potamocypris cf. *villosa*
ME007
Subfamily Cyprinotinae Bronshtein, 1947
Genus *Heterocypris* Claus, 1892
Heterocypris cf. *incongruens*
SR054
Heterocypris cf. *rotundata*
PA057, PA112
Heterocypris sp. 1 (Figure S15)
AG024, AG025, AG096, AG100, AG101, AG102, AG103, SR055A, SR055B
Heterocypris spp. (Figure S14 C-H)
AG010, AG091, AG100, AG101, AG102, AG103, PA025, SR039, SR055B, TP029, TP164
Family Candonidae Kaufmann, 1900
Subfamily Candoninae Kaufmann, 1900
Tribe Candonini Kaufmann, 1900
Genus *Fabaeformiscandona* Krstić, 1972
Fabaeformiscandona cf. *holzkampfi* (Figure S18 E)
TP079
Genus *Neglecandona* Krstić, 2006
Neglecandona gr. *neglecta*
AG084, CL023, CT020, ME001, ME056, PA103A, TP038
Genus *Pseudocandona* Kaufmann, 1900
Pseudocandona sp.
ME070, TP078
Family Ilyocyprididae Kaufmann, 1900
Subfamily Ilyocypridinae Kaufmann, 1900
Genus *Ilyocypris* Brady and Norman, 1889
Ilyocypris sp.
AG036, AG058, AG084, TP038
Ilyocypris cf. *decipiens*
AG034

part of Sicily. *Heterocypris salina* was present only in the southern part of the island and in the Pelagie Islands, in ponds on carbonate and clay-gypsum deposits and in sites with variable, but still high salinities (Figure S4). In some cases, the specific allocations of *Heterocypris* specimens were not possible, because of marked differences in valve morphology from those of the described species of this genus (Figure S14 C-H). In particular, specimens reported here as *Heterocypris* sp. 1 show some affinities with *H. salina*, from which they differ nevertheless by a more rounded dorsal margin and a pronounced bend at the postero-dorsal margin of the carapace (Figure S15).

Apart from three permanent (but astatic) water bodies, *Eucypris virens* (Figure S17) was exclusively found in temporary waters. It occurred mostly in low mineralized waters, but also at higher conductivity values, up to 38 mS cm^{-1}. This species showed high morphological variability in valve shape and size. *Eucypris mareotica* (Figure 5) was collected from low altitude sites along the southern and western coast of the island, always on carbonate rocks (Figure S6). It was usually found alone in temporary sites with high salinity, rarely associated with *Eucypris virens* and *Sarscypridopsis aculeata*. Also, *Eucypris kerkyrensis* (Figures S6 and S16) was found exclusively in temporary habitats with varying salinity and lithological characteristics, and often co-occurring with *Eucypris virens*.

Tonnacypris lutaria was mainly found at intermediate altitudes in the internal parts of Sicily, but it was also reported from Favignana (Egadi Islands) and Ustica. It typically inhabits temporary environments

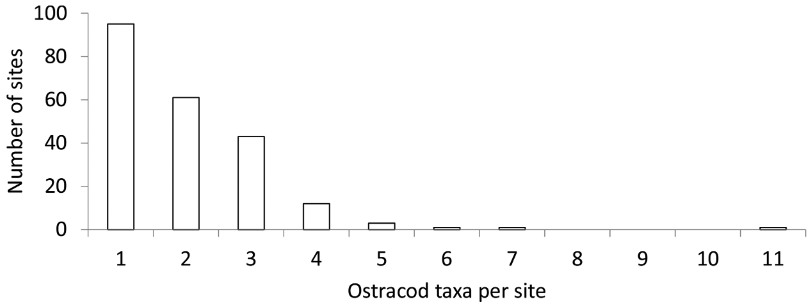

Figure 3. Ostracod taxa diversity found in studied sites.

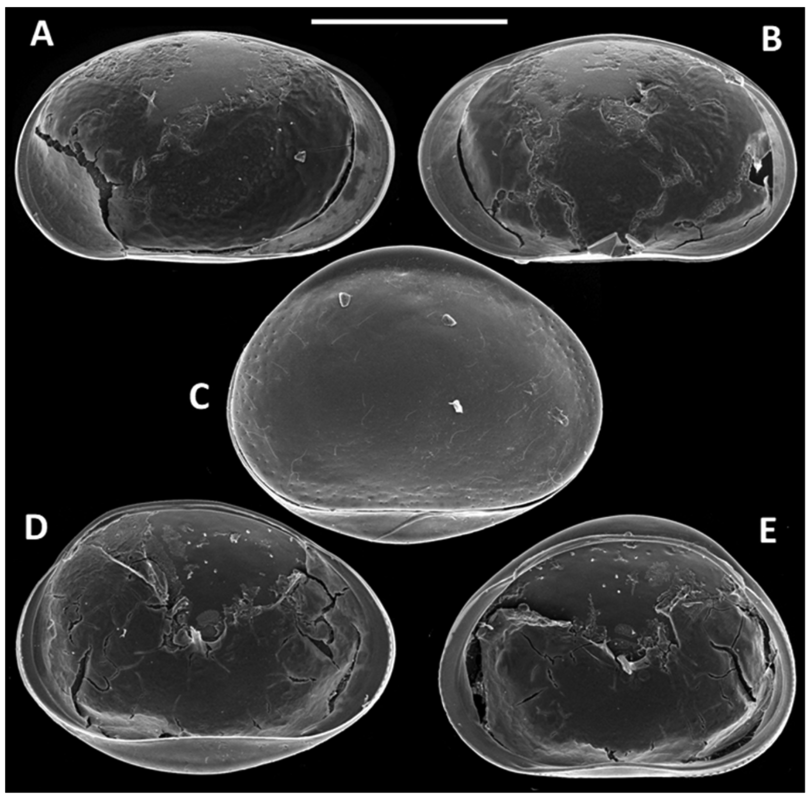

Figure 4. A, B: *Cypria subsalsa*; C-E: *Physocypria kerkyrensis* A: VP1752, ad ♀, LViv; B: VP1752, ad ♀, RViv; C: VP1757, ad ♀, CpRlv; D: VP1751, ad ♀, LViv; E: VP1751, ad ♀, RViv. Scale bar: 300 μm for A, B; 318 μm for C-E.

with low to medium electric conductivity, usually <1 mS cm^{-1} (Figure S7).

The genus *Neglecandona* had a distribution restricted to the northern part and inner areas of mainland Sicily, usually at medium-high elevation. *Neglecandona lindneri* (Figure S18 A-D) occurred in three temporary sites with very low conductivity (ranging from 40 to 193 μS cm^{-1}) and between 787 and 1312 m a.s.l. and in a rather restricted area of northern Sicily. *Neglecandona neglecta* showed a more scattered distribution in temporary sites with different lithological characteristics (Figure S8).

The genus *Ilyocypris* had the highest number of identified species. It was not found in the north-eastern part of the study area (Figures S9 and S10). The most common species were *Ilyocypris decipiens* (Figure S19 C, F) and *Ilyocypris gibba* (Figure

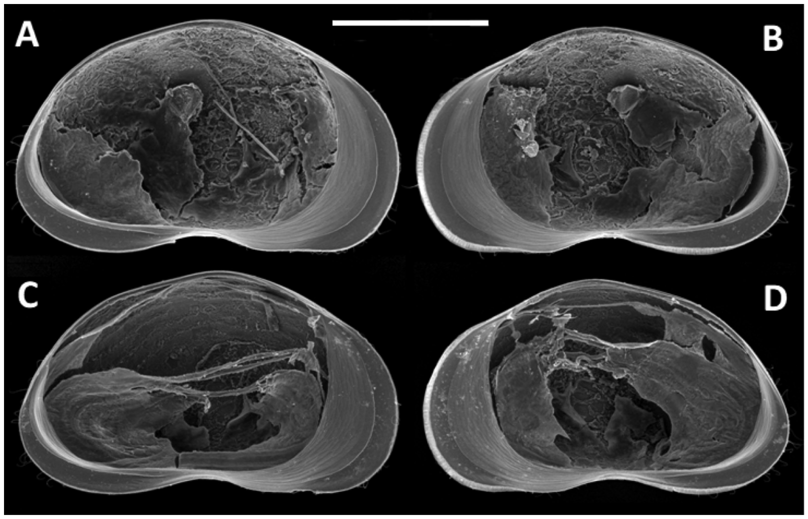

Figure 5. *Eucypris mareotica*. A: VP1796, ad ♀, LViv; B: VP1796, ad ♀, RViv; C: VP1797, ad ♂, LViv; D: VP1797, ad ♂, RViv. Scale bar: 438 μm.

S19 G-H), occurring in nine and seven sites, respectively, whilst *Ilyocypris bradyi* (Figure S19 A, B), *Ilyocypris getica* (Figure S20) and *Ilyocypris inermis* (Figure S10) had a rather sporadic distribution. *Ilyocypris decipiens* was collected in sites with medium-high salinity, often with species of the genus *Eucypris* and/or *Heterocypris incongruens*, but showed no clear preferences for habitat types or lithological conditions. *Ilyocypris gibba*, on the other hand, was recorded in areas with carbonate rocks or clay-gypsum deposits.

Tyrrhenocythere amnicola (Figure S21) was found in four sites located in two lotic systems in the south-eastern part of Sicily (Figure S11).

Discussion

The Recent non-marine ostracod fauna of Sicily comprises at least 46 (morpho) species and 28 genera (Tables II and III). This already remarkable diversity, which is the result of extensive surveys in several different inland water ecosystems, is likely to be further increased for several reasons. Some taxa were not identified at species level when samples contained only damaged material or female specimens for species whose identification relies on male sexual characters. For other taxa, which are characterized by large morphological plasticity and/or by the presence of "cryptic" or "pseudo-cryptic" species (e.g. Bode et al. 2009; Lajus et al. 2015), the achievement of higher taxonomic resolution inevitably also requires a molecular approach. It is also known that valve morphology in some non-marine ostracod species may be influenced by environmental conditions or reproductive strategies (Yin et al. 1999; Bellavere et al. 2002; Ramos et al. 2017). In the case of the genera *Eucypris* and *Heterocypris*, we have often found morphotypes whose valves differed considerably from the typical form of described species and which could potentially be erected as new species. The criterion that we followed was to conservatively accommodate, whenever it seemed applicable, the specimens within existing species and, for *Heterocypris*, also at higher taxonomic ranks when doubts about identification still remained. Martens et al. (2002) already indicated that hybridisation between circum-Mediterranean *Heterocypris* species in which males occur can lead to various hybrid strains with aberrant or intermediate morphologies.

In addition, hypogean habitats were marginally represented in this and previous studies, although in Sicily about 20% of the land area consists of carbonates and evaporites, primarily gypsum, with complex karst systems and a wide variety of groundwater environments (Di Maggio et al. 2012) that presumably host rare or even potentially endemic ostracod species, as reported for other freshwater crustacean groups (Cottarelli et al. 2012; Bruno et al. 2018). It must also be considered that most of the sites of this study were sampled on a single occasion each; therefore, we might have underestimated their actual diversity, which could vary on a seasonal basis, especially in those water bodies with a longer hydroperiod (see, for example, Martens et al. (1992) on Mamilla Pool in Israel). Furthermore, in temporary Mediterranean ecosystems, the interannual variability in inundation conditions may favour the emergence of different species of aquatic invertebrates over time (Florencio et al. 2020).

Candona angulata and *Limnocythere stationis* were found in Holocene deposits of Lago Preola (TP011) and Gorgo Basso (TP079) (Curry et al. 2016), but so far never as living ostracods in Sicily.

The absence of detailed data on water quality and other characteristics of the sampled sites do not allow us to thoroughly investigate potential relationships between ostracod species occurrence and environmental variables. As expected, the most common and tolerant species with a circum-Mediterranean to Palearctic or Holarctic distribution (e.g., *Eucypris virens, Heterocypris incongruens, Tonnacypris lutaria*) did not show definite distributional patterns (Figures S3, S5 and S7). Conversely, other species seemed to be more restricted in their distribution range within the study area in relation to habitat duration, lithology or conductivity (e.g., *Heterocypris reptans, Plesiocypridopsis newtoni, Potamocypris arcuata*). In some cases, species showed a marked distributional differences: for example, *Eucypris kerkyrensis, Eucypris mareotica*, and *Heterocypris salina* occurred in the southern part of the study area (Figures S4 and S6); *Sarscypridopsis aculeata, Plesiocypridopsis newtoni* and species of the genera *Ilyocypris* and *Potamocypris* were found in the south-western part, and the genus *Neglecandona* in the north-central part of mainland Sicily (Figures S1, S2, S8, S9 and S10). This localized distribution of ostracod species may be explained by different local climatic conditions of Sicily, which can be roughly divided into northern, southern and eastern distinct macro-areas based on their climate and physiography. The northern one, mostly characterized by humid to temperate-humid conditions, has significantly higher values of annual average precipitation and lower annual average temperatures. Similar climatic conditions are also locally found in different mountainous areas, for example in the Iblei and Sicani mountains, respectively in south-eastern and central-western parts of the island. The climate of the remaining areas ranges from warm-temperate to semi-arid conditions (Duro et al. 1997; Liuzzo et al. 2015). In addition, the orography shows marked differences between the northern portion, which is mainly mountainous, the central-southern and south-western ones, which are essentially hilly, the plateau in the south-eastern area, and the volcanic area in eastern Sicily (Drago 2005).

Different barycentres in the distribution areas of the Sicilian non-malacostracan crustacean fauna are determined by a marked ecological segregation but are also the result of repeated colonization and extinction events driven by climatic fluctuations from the Plio-Pleistocene to Recent (Marrone et al. 2009).

According to our results, the main colonization route for thermophilous species adapted to cope with dry and fluctuating conditions which are common in the southern part of Sicily, currently seems to originate from the temperate part of northern Africa. On the other hand, apart from few exceptions represented by relict taxa inhabiting mountainous areas (e.g., the genus *Neglecandona*), the absence of typically temperate ostracod species in the most humid and coolest parts of the island suggests that these did not behave as effective refugia for most "northern" ostracod taxa, which have likely colonised Sicily during the cooler (glacial) periods of the Pliocene and the Pleistocene, but later have gone extinct due to the climate changes linked with the current inter-glacial phase. Also, extremely euryecious ostracod species, e.g. *Cypridopsis vidua, Cyclocypris ovum*, and *Cypria ophtalmica*, which are widespread and very common in peninsular Italy and in other European regions (Meisch 2000; Pieri et al. 2015), occur in a relatively low number of Sicilian sites.

The above-described pattern is in sharp contrast with the evidence collected for other crustacean groups, e.g. copepods, whose Sicilian fauna is characterised by the presence of a significant quota of relict taxa with northern or north-eastern affinities (Marrone et al. 2009). However, this hypothesis needs to be substantiated further by a phylogeographic approach, also based on molecular data.

Also the absence of endemic ostracod taxa in epigean water bodies of Sicily can be related to its colonization history, which seems not to have allowed the long-term in *situ* persistence of pre-Quaternary inland water crustacean dwellers owing to Pleistocene climatic upheavals (Marrone et al. 2009; Vecchioni et al. 2017). An interesting species encountered in the study area is *Vestalenula boteai* (Figures 6 and 7), whose known extant distribution was so far restricted to Romania (Danielopol 1970) and Turkey (Külköylüoğlu et al. 2015, 2020). The genus *Vestalenula* is the most species-rich within the putative ancient asexual ostracod family Darwinulidae, which has representatives on all continents, except Antarctica (Schön et al. 2012; Pinto et al. 2013). The other

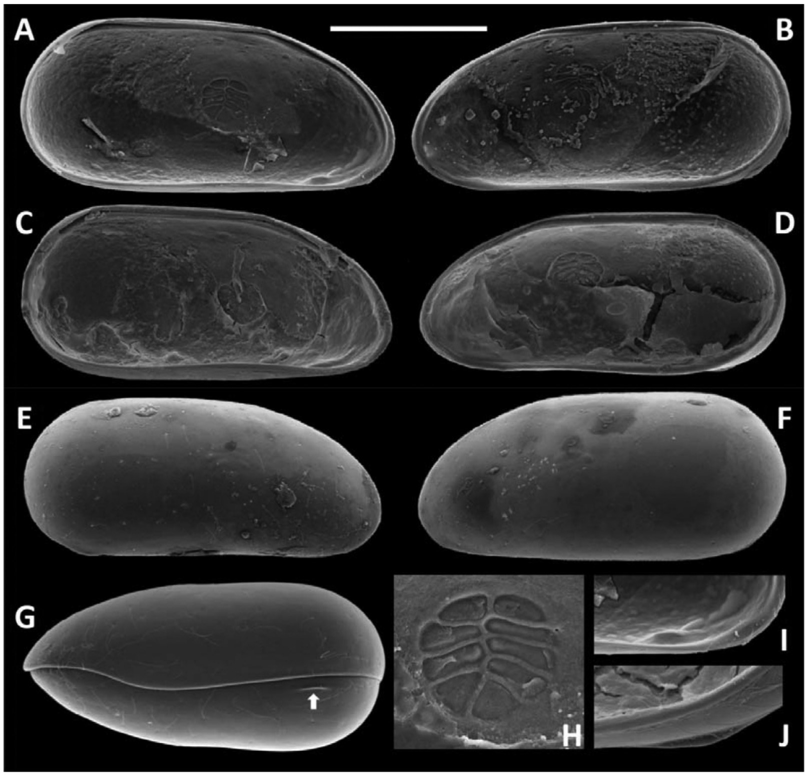

Figure 6. *Vestalenula boteai*. A: GR0785, ad ♀, LViv; B: GR0785, ad ♀, RViv; C: GR0791, ad ♀, LViv; D: GR0791, ad ♀, RViv; E: GR0791, ad ♀, RVev; F: GR0791, ad ♀, LVev; G: VP1753, ad ♀, CpVv (arrow indicates the position of the keel); H: GR0785, ad ♀, LViv, detail of central muscle scars; I: GR0785, ad ♀, LViv, detail of antero-ventral internal tooth; J: GR0783, ad ♀, RViv, detail of keel on posterior part of ventral margin. Scale bar: 200 μm for A-G; 70 μm for H; 49 μm for I; 29 μm for J.

Recent European species of this genus, *Vestalenula carveli*, was described from southern France (Artheau 2007). In the Mediterranean area, other two species, previously left in open nomenclature, were reported: *Vestalenula* sp. B from Tunisia (Danielopol 1980) and *Vestalenula* sp. C from Israel (Rossetti & Martens 1999). Fossil representatives of this genus were reported for Italy from the Neogene (e.g., Ligios et al. 2009; Spadi et al. 2019).

Eucypris mareotica, a widespread species typical of saline and hypersaline habitats, occurred in 11 sites. In previous surveys carried out in Italy and adjacent islands, this species was likely misidentified as *E. virens*. Marchegiano et al. (2018) recorded *Eucypris mareotica* in the Late Pleistocene sediment of Lake Trasimeno (central Italy). Also, *Eucypris kerkyrensis* was possibly confused with *E. virens* from which it differs mainly by the slightly beak-shaped anterior end of the carapace in ventral and dorsal view. Based on this character, we retained *E. kerkyrensis* as a valid species, although we fully agree with Meisch (2000) that *E. kerkyrensis* needs to be redescribed.

Cypria subsalsa is a Palearctic freshwater ostracod which tolerates oligohaline brackish water. It is known from inland and coastal localities in Belgium (Wouters 1984), Netherlands (Wouters 2018), Germany (Vopel & Arlt 1995; Scharf & Viehberg 2014) and Poland (Bąk & Szlauer-Łukaszewska 2012). Its occurrence in two sites of south-western part of Sicily may possibly be attributable to long-range dispersal through waterfowl (Horne & Smith 2004; Valls et al. 2017), although it is also possible that the currently known distribution range of the species is incomplete, and that further surveys will prove that the occurrence in Sicily is not disjunct from the currently known core distribution of the species. In the same sites, we also found *Physocypria kerkyrensis* and *Candonocypris novaezelandiae*. *Physocypria kerkyrensis* was first reported from Corfu (Klie 1936) and later from Skadar lake (Petkovski 1961). Available records suggest a circum-Mediterranean distribution of this species. *Candonocypris novaezelandiae* was first described for New Zealand and afterwards recorded, most likely as alien invasive species, in different

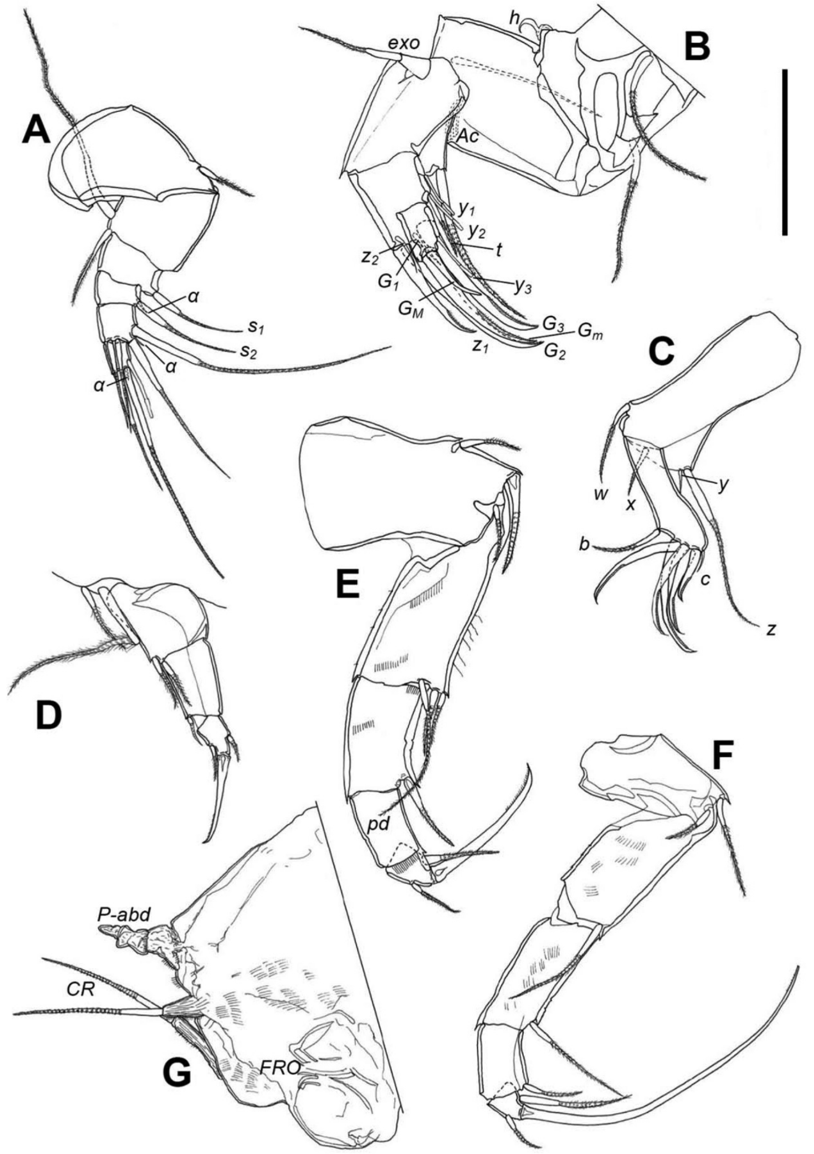

Figure 7. *Vestalenula boteai*, GR0791. A: A1; B: A2; C: mandibular palp; D: first thoracopod; E: second thoracopod; F: third thoracopod; G: end of body (h: hook-like process on A1; exo: exopodite on A2; Ac: ventral aesthetasc clump on A2; α, b, c, s1, s2, w, x, y, z, z1, G1-3, GM, Gm: specific setae on limbs; y1-3: aesthetascs on A2; pd: 'poil darwinuloïde'; CR: caudal rami; P-abd: post-abdomen; FRO: female reproductive organ). Scale bar: 50 μm.

biogeographic regions. The presence of this non-native species was recently reported for North Africa and Europe (Scharf et al. 2014).

Another non-native ostracod found in this study was *Isocypris beauchampi*; this species of Afrotropical origin was introduced in Canada, South America and several European countries, including Italy (Meisch 2000), and Sicily (Pieri et al. 2015). *Fabaeformiscandona subacuta*, a globally widespread species, in Europe was so far reported only from the Iberian Peninsula (Escrivà et al. 2012) and Sicily (Curry et al. 2016).

Naselli-Flores and Marrone (2019) hypothesised that Sicilian seasonal ponds and streams are nearly immune to invasions by alien species, whereas permanent natural waterbodies and reservoirs actually act as invasion hubs for freshwater invaders. This is corroborated by the presence of *Candonocypris novaezelandiae* and *Fabaeformiscandona subacuta* in permanent water bodies, and of *Isocypris beauchampi* in a highly disturbed pond, whose hydroperiod is regularly altered by the artificial immission of water for the cattle. However, the paucity of records of non-native ostracod species in Sicily does not allow, to date, to extrapolate a general pattern for this group. Our results demonstrate that the proportion of ostracod species originating from diverse biogeographical areas did not significantly differ from that recorded for Italy (Gherardi et al. 2008). Interestingly, in spite of the widespread presence of the non-native crayfish *Procambarus clarkii* (Faraone et al., 2017), to date, no entocytherid ostracods (common as commensals on decapod crustaceans) were collected from Sicily (Aguilar-Alberola et al. 2012).

Conclusions

The central position in the Mediterranean Sea and the complex geological events that caused repeated episodes of connection and isolation of Sicily with respect to the surrounding regions (Cazzolla Gatti et al. 2018) account for its interest from a biogeographical perspective.

Sicily hosts a very diverse invertebrate fauna and a large number of endemic taxa compared to its relatively small surface area (Stoch 2000). This is only partly true for inland water ostracods: Sicily and surrounding islands host about a quarter of the non-marine ostracod species known from Italy, but no endemic species were thus far observed in surface waters. However, it is possible that accurate morphological and molecular analyses will lead to the identification of endemisms within "problematic" genera, such as *Eucypris* and *Heterocypris*.

To date, only three non-native ostracod species are known to occur in Sicily, i.e. *Candonocypris novaezelandiae, Isocypris beauchampi* and *Fabaeformiscandona subacuta*; these species seem to have a limited distribution in the study area, thus not behaving as successful invasive taxa.

The new data from the present study provide a solid foundation for further comparative faunal studies aimed at investigating the affinities and origins of the central Mediterranean inland-water ostracods and allow us to generate preliminary hypotheses on biogeographic scenarios. The results of the present survey were also used to test some ecological factors that may influence the distribution of ostracod taxa.

Although traditional limnological investigations scarcely consider "marginal" aquatic habitats, such as temporary ponds, the present study confirms their importance for the conservation of non-marine ostracods and, more generally, of the invertebrate fauna (Rossetti et al. 2006; Boix et al. 2016). This is even more evident in predominantly arid areas such as Sicily, where temporary and man-made habitats are by far the most common type of aquatic ecosystems. The predicted increase of warm and dry periods in the Mediterranean climatic regions, and as a consequence a higher water withdrawal for agricultural use, will probably alter the hydrological regimes and will lead to the disappearance of many temporary aquatic systems and their faunal components (Fenoglio et al. 2010; Liuzzo et al. 2015). This calls for urgent actions and mitigation measures to ensure the persistence of these key ecosystems and their biotic communities in the face of multiple interacting stressors (Alvarez Cobelas et al. 2005).

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Disclosure statement

No potential conflict of interest was reported by the authors.

Supplemental data

Supplemental data for this article can be accessed here.

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