

Article

Linking the Community and Metacommunity Perspectives: Biotic Relationships Are Key in Benthic Diatom Ecology

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Study Sites And More Details About Material And Methods

Study sites. The Cuenca mountain range (Serranía de Cuenca) is located in central-eastern Spain. It encompasses areas of different altitudes, which are mostly drained by two large basins: the Tajo basin, which drains to the Atlantic Ocean, and the Júcar basin, which drains to the Mediterranean Sea.

Underlying bedrocks are mostly Mesozoic limestones with karst landscapes prevailing. Tufa barrages are very common in streams. Rainfall amounts to 950–1110 mm/y, and average air temperature is within the range of 9.6–11.2 °C for the 1980–2014 period, the area thus being a Mediterranean cold climate which entails both a *Dsb* climate (cold with temperate dry summer) in upper areas and a *Csb* climate (temperate with dry or temperate summer) in lower altitudes, sensu the Köppen classification [1]. Most soils are mollisols, following the classification by [2].

The role of groundwater is important at headwater sites because it largely feeds streams, purely rainfall input being lower. Groundwater permeability is mostly due to karstification, but groundwater quantitative data, other than location and some chemical analyses [3], are lacking. Furthermore, no study on its quantitative effects for water availability exists. Stream discharge experiences a strong seasonality, and many small streams dry in summer, but very few are gauged. Discharge of permanent streams ranged between 0.01– $\ddot{\text{l}}$ and 2.6 m³/seg in August (Álvarez-Cobelas, unpublished data).

Landscapes are largely primary forests in most studied watersheds, consisting of *Pinus* spp., with *Quercus faginea* and *Juniperus* spp. in high-altitude areas and oaks (*Quercus ilex*) in areas of lower altitude. Croplands were important surrounding towns and villages until the 1960s but have become rangelands since then, mostly covered by herbs and shrubs (*Rosa* spp.). Crops are nowadays almost negligible throughout. Urban and agricultural pollution is also negligible. Other land uses (e.g., industry) are almost absent. Ovine cattle flocks are highly scattered and not very numerous. Therefore, the territory could be considered as largely pristine, with the exception of four reservoirs built in the 1950s and 1960s for different water use purposes (e.g., irrigation, hydropower) in the Guadiela, Cuervo and Júcar rivers. Moreover, two small dams were built in the upper Guadiela river in the 1940s to harbor enough water for a pipeline to supply a 1.52 MW hydropower plant, and another small dam harbors a small artificial beach upstream Cañizares town in the Escabas river.

The area is largely depopulated (3.5 inhabitants/km² mostly living in small towns and villages) due to migration to eastern Spanish cities in the 1960s and 1970s, resulting in a negative population growth down to -66% between 1950 and 1991 [4]. These trends have not changed recently. Tourism is still scarce and mostly related to summer visitors who live in big Spanish cities and whose relatives were raised in the area long ago.

A compilation of scattered limnological studies in the area was reported by [5]. Water monitoring data on the Tajo and Júcar catchments are available from CHT (Confederación

Hidrográfica del Tajo) and CHJ (Confederación Hidrográfica del Júcar) Water Authorities (www.chtajo.es, www.chjucar.es). Further information on the area can be found in [4], [5] and [6]. There is no recent information on fish; the latest data we have used are those taken from [7]. We know that there have been no introductions of new fish because the area has been steadily depopulated since those years. The only report on diatoms is an old one by [8].

Diatoms observation. All diatom samples were treated in the lab following [9], and at least three aliquots of a given sample were mounted on Naphrax (Brunel Microscopes Ltd., Chippenham, U.K.) in glass slides for microscopic observation, identification and counting at 400x and 1000x magnification. Between 400 and 1200 diatom valves were identified to the lowest taxonomical entity possible and later counted. The main guides for identification were those by [10] in the Süsswasserflora. The Omnidia 6.0 package (<https://omnidia.fr/>; accessed on 21 October 2022) was followed for diatom nomenclature. In some stagnant water sites, *Cyclotella* taxa (mostly *C. radiosa*) were excluded from the final counts because of their overwhelming dominance through settling from the planktonic environment. All recorded taxa were employed for alpha and beta diversity assessments to be used in subsequent statistical analyses. Only those taxa with more than 3% of relative abundance in more than one sample were included in other quantitative calculations.

Testing the metacommunity organizational level. The problem of defining metacommunities has usually been overlooked in the huge number of studies on any conceivable biological group of assemblages carried out over the last two decades. The authors in [11] did not consider it in their recent monograph on metacommunity ecology. The usual approach assumes that any group of communities with some present or past exchange of populations could constitute a metacommunity, regardless of the spatial extent involved. This is the case for environments such as the ones we are dealing with (i.e., two pristine, large catchments close to each other which share the same climate, geology and landscape features). We checked whether there were different clusters of communities, which would suggest the possibility of more than one metacommunity, a possibility that should have to be analyzed. This check was completed by performing a spatially contiguous sample-constrained cluster analysis on the relative abundances of taxa plus the bootstrap (Bray–Curtis index; [12,13]). Clusters restricted by contiguous sites did not show high bootstrap values for any group of contiguous assemblages, nor of taxa (Figure S1), suggesting that we are probably dealing with a single benthic diatom metacommunity.

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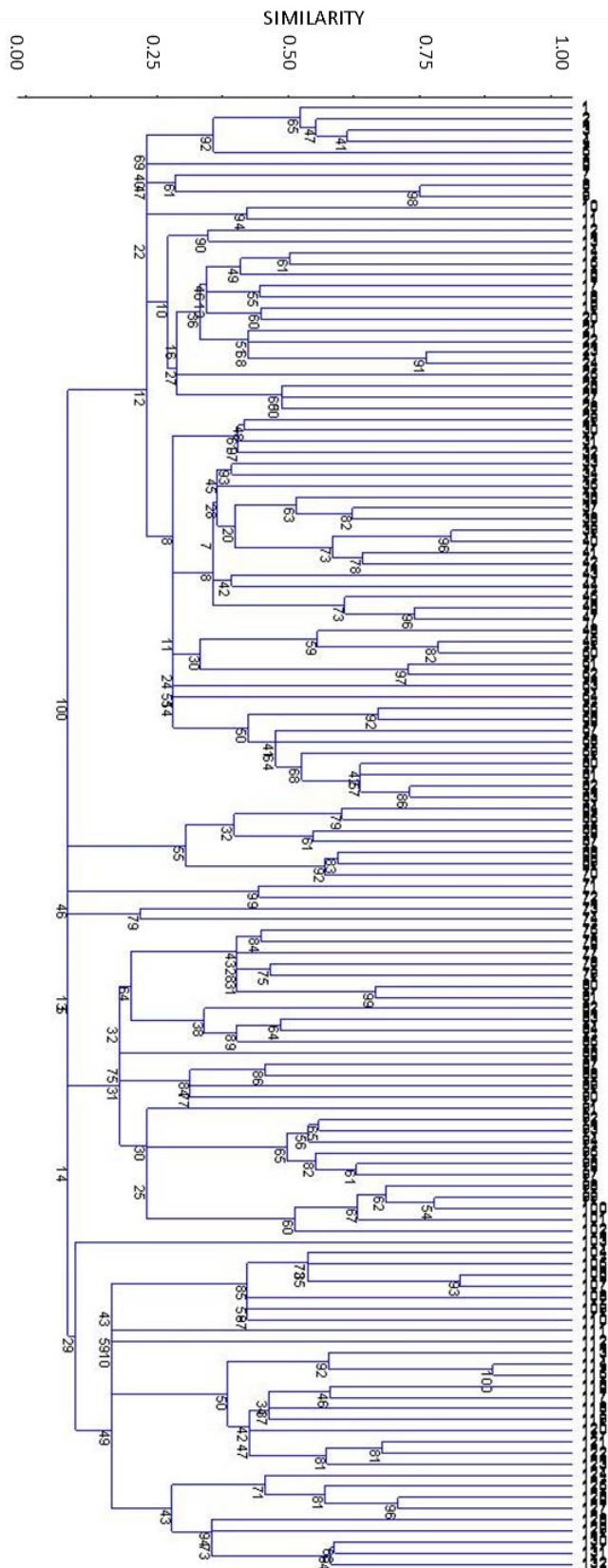


Figure S1. Cluster of contiguous sites (132 samples) on taxa of Serranía de Cuenca (Spain) benthic diatoms. The constrained dendrogram was obtained by using Bray–Curtis similarity and UPGMA

algorithm of agglomeration. A bootstrap of 999 cluster permutations for resampling was undertaken (values at nodes).

Table S1. List of the 132 samples of benthic diatoms gathered on different substrates at the 36 sampling locations (Table 1) of Serranía de Cuenca (2017).

Location name	Mineral substrat e	Macrophytic algae and Cyanobacteri a	Mosses	Hornwort s	Plant substrate
El Tobar lake	Rock				
El Tobar lake	Cobble				
El Tobar lake spring	Mud				
El Tobar lake spring	Traverti ne				
El Tobar lake					<i>Nymphaea alba</i> L.
El Tobar lake					<i>Chiloscyph us</i>
El Tobar lake					<i>polyanthos</i>
El Tobar lake					(L.) Corda
El Tobar lake					<i>Myriophyllum cf. verticillatum</i> L.;
El Tobar lake					<i>Typha</i> sp.
Beteta wetland					<i>Sparganium</i> sp.
Uña lake					<i>Phragmites</i>
Uña lake					<i>australis</i> (Cav.)
Uña lake					Trin. ex Steudel
El Tobar lake spring	Traverti ne				<i>Hippuris vulgaris</i>
El Tobar lake spring	Cobble				L.
La Toba reservoir	Mud				
La Toba reservoir					<i>Myriophyllum</i>
La Toba reservoir					<i>verticillatum</i> L.
La Tosca reservoir	Mud				
La Ruidera reservoir	Mud				
La Ruidera reservoir					Stem piece
La Ruidera reservoir		<i>Chara hispida</i>			
La Ruidera reservoir		var. <i>major</i>			
La Ruidera reservoir		R.D. Wood			
Molino de Chincha reservoir					<i>Polygonum</i>
Molino de Chincha reservoir					<i>amphibium</i> L.
Marquesado lake					<i>Typha</i> sp.
Marquesado lake					Roots
Marquesado lake					<i>Utricularia</i>
Marquesado lake					<i>australis</i> R. Br.

Marquesado lake		<i>Potamogeton natans</i> L.
Cuervo river at the spring	Traverti ne	
Cuervo river at the spring	Cobble	
Cuervo river at the spring		<i>Spirogyra</i> sp.
Cuervo river at the spring		<i>Cratoneuron filicinum</i> (Hedw.) Spruce
Location name	Mineral substrat e	Plant substrate
	Macrophytic algae and Cyanobacteri a	Mosses Hornwort s Higher plants
Cuervo river at the spring	<i>Chara vulgaris</i> var. <i>crassicaulis</i> (Schleicher ex A. Braun) Kützing	
Cuervo river at the spring		<i>Cladophora</i> sp.
Cuervo river at the spring		Roots
Marquesado lake		<i>Sparganium natans</i> L.
Cuervo river at Vega del Codorno	Cobble	
Cuervo river at Vega del Codorno		<i>Platyhypnidium riparioides</i> (Hedw.) Dixon
Cuervo river at Vega del Codorno		<i>Ranunculus cf. peltatus</i> Schrank
Cuervo river upstream Santa María	Cobble	
Cuervo river upstream Santa María		<i>Hymenostylium recurvirostrum</i> (Hedw.) Dixon
Cuervo river upstream Santa María		<i>Chara vulgaris</i> var. <i>crassicaulis</i>

		(Schleicher ex A. Braun) Kützing and <i>Chara vulgaris</i> var. <i>longibracteata</i> (Kützing) Kützing
Cuervo river at Solán de Cabras	Cobble	
Cuervo river at Solán de Cabras		<i>Petalonema</i> sp.
Cuervo river at Solán de Cabras		
Escabas river at Tejadillos	Cobble	
		<i>Bulbochaete</i> sp. and <i>Calothrix</i>
Escabas river at Tejadillos		<i>parietina</i> Thuret ex Bornet et Flah.
Escabas river at Tejadillos		<i>Spyrogyra</i> sp. and <i>Zygnema</i> sp.
Escabas river at Tejadillos		Unidentified green algae
<hr/>		
Location name.	Mineral substrat e	Plant substrate
	Macrophytic algae and Cyanobacteri a	Mosses Hornwort s Higher plants
Escabas river at Tejadillos		Poplar leaf
Escabas river at Tejadillos		<i>Aneura</i> <i>maxima</i> (Schiffn.) Steph.
Escabas river at Tejadillos		<i>Potamogeton</i> cf. <i>coloratus</i> Hornem. and <i>Groenlandia</i> <i>densa</i> (L.) Fourr.
Escabas river at Tejadillos		<i>Palustriella</i> <i>commutata</i> (Hedw.) <i>Ochyra</i> , <i>Cratoneuron</i>

					<i>filicinum</i> (Hedw.) Spruce
Escabas river at Tejadillos		<i>Chara vulgaris</i> var. <i>crassicaulis</i> (Schleicher ex A. Braun) Kützing			
Escabas river downstream Fuertescusa	Cobble				
Escabas river downstream Fuertescusa					<i>Phragmites</i> <i>australis</i> (Cav.) Trin. ex Steudel
Escabas river downstream Fuertescusa					<i>Palustriella</i> <i>commutata</i> (Hedw.) Ochyra
Escabas river downstream Cañamares	Cobble				
Escabas river downstream Cañamares	Cobble				
Escabas river downstream Cañamares					Roots
Escabas river upstream Guadiela junction		<i>Chara vulgaris</i> var. <i>longibracteata</i> (Kützing) Kützing and leaves			<i>Potamogeton</i> <i>crispus</i> L.
Escabas river upstream Guadiela junction		<i>Spirogyra</i> sp.			
Escabas river upstream Guadiela junction		<i>Chara vulgaris</i> var. <i>vulgaris</i> L.			
Escabas river upstream Guadiela junction		<i>Oedogonium</i> sp.			
Location name	Mineral substrat e	Plant substrate	Location name	Mineral substrate	Plant substrate
Guadiela river at Beteta	Traverti ne				
Guadiela river at Beteta				<i>Didymodon</i> <i>tophaceus</i>	

		(Brid.) Lisa var. <i>anatinus</i> Hamm.
Guadiela river at Beteta		<i>Cladophora</i> <i>glomerata</i> (L.) Kützing
Guadiela river upstream Puente Vadillos	Cobble	
Guadiela river upstream Puente Vadillos		<i>Bulbochaete</i> sp.
Guadiela river upstream Puente Vadillos		<i>Chara vulgaris</i> var. <i>longibracteata</i> (Kützing) Kützing and <i>Ch. vulgaris</i> var. <i>crassicaulis</i> (Schleicher ex A. Braun) Kützing
Guadiela river upstream La Ruidera reservoir		<i>Hymenostyliu</i> <i>m</i> <i>recurvirostru</i> <i>m</i> (Hedw.) Dixon
Guadiela river upstream La Ruidera reservoir		<i>Chara</i> sp.
Masegar creek at El Tobar	Cobble	
Masegar creek at El Tobar		Roots
Masegar creek at El Tobar		<i>Spirogyra</i> sp.
Mayor river upstream Cañete	Cobble	
Mayor river upstream Traverti Cañete	ne	
Mayor river upstream Cañete		<i>Chiloscyph</i> <i>us</i> <i>polyanthos</i> (L.) Corda
Vencherque river at Villar del Humo	Cobble	
Vencherque river at Villar del Humo		<i>Chiloscyph</i> <i>us</i>

		<i>polyanthos</i> (L.) Corda
Vencherque river at Villar del Humo		A piece of leaf. <i>Apium</i> sp.
	<i>Platyhypnidii</i>	
Vencherque river at Villar del Humo	<i>um</i> <i>ripariooides</i> (Hedw.) Dixon	
Location name	Mineral substrat e	Plant substrate
	Macrophytic algae and Cyanobacteri a	Mosses Hornwort s Higher plants
Vencherque river at Villar del Humo		<i>Drepanoclad us aduncus</i> (Hedw.) Warnst.; <i>Fissidens</i> <i>crassipes</i> <i>Bruch</i> and <i>Schimp.</i>
Vencherque river at Villar del Humo		<i>Aneura pinguis</i> (L.) Dumort.
Vencherque river at Villar del Humo		<i>Groenlandia densa</i> (L.) Fourr. and <i>Lemna minor</i> (L.) Griff.
Guadarrroyo river upstream Valdemoro Sierra	Cobble	
Guadarrroyo river upstream Valdemoro Sierra		<i>Spirogyra</i> sp.
Guadarrroyo river upstream Valdemoro Sierra		<i>Zygnema</i> sp.
Guadarrroyo river upstream Valdemoro Sierra		<i>Oedogonium</i> sp.
Algarra river at Algarra		<i>Batrachosperm um</i> sp.
Alcantud river downstream Alcantud		<i>Ch. vulgaris</i> var. <i>crassicaulis</i>

		(Schleicher ex A. Braun) Kützing
Laguna river downstream Laguna del Marquesado	Cobble	
Laguna river downstream Laguna del Marquesado		Stems
Laguna river downstream Laguna del Marquesado		Roots and bark
Laguna river downstream Laguna del Marquesado		<i>Apium</i> sp. and <i>Lemna minor</i> (L.) Griff.
Tejadillos river at Cañete	Cobble	
Tejadillos river at Cañete		Roots
Tejadillos river at Cañete		<i>Chiloscyphus</i> <i>us</i> <i>polyanthos</i> (L.) Corda
Tejadillos river at Cañete		<i>Cladophora</i> <i>glomerata</i> (L.) Kützing
Location name		Mineral substrat e
		Plant substrate
		Macrophytic algae and Cyanobacteri a
		Mosses
		Hornwort s
		Higher plants
Tejadillos river at Cañete		<i>Groenlandia densa</i> (L.) Fourr.
Júcar river close to its spring	Cobble	
Júcar river close to its spring		<i>Chaetophora</i> sp.
Júcar river close to its spring		<i>Platyhypnidium</i> <i>riparioides</i> (Hedw.)
Júcar river close to its spring		<i>Aneura pinguis</i> Dixon, <i>Fontinalis</i> <i>antipyretica</i> Dumort. Hedw.
Júcar river at Huélamo	Cobble	

Júcar river at Huélamo	Various minerals (cobble, mud)	
Júcar river at Huélamo	<i>Cladophora glomerata</i> (L.) Kützing	
Júcar river at Huélamo		Roots
Júcar river at Uña	Cobble	
Júcar river at Uña	<i>Spirogyra</i> sp.	
Cabriel river at Salvacañete	Cobble	
Cabriel river at Salvacañete		<i>Groenlandia densa</i> (L.) Fourr.
Cabriel river at Salvacañete		<i>Zannichellia</i> sp.
Cabriel river at Salvacañete		<i>Fontinalis antipyretica pinguis</i> (L.) Hedw. Dumort.
Cabriel river at Alcalá de la Vega	<i>Ch. vulgaris</i> var. <i>crassicaulis</i> (Schleicher ex A. Braun) Kützing	
Cabriel river at Alcalá de la Vega		Stem pieces
Cabriel river at Boniches	Cobble	
Cabriel river at Boniches	<i>Nostoc</i> sp.	
Cabriel river at Boniches	<i>Ch. vulgaris</i> var. <i>crassicaulis</i> (Schleicher ex A. Braun) Kützing	<i>Aneura maxima</i> (Schiffn.) Steph.
	Mineral substrat e	Plant substrate
	Macrophytic algae and Cyanobacteri a	Mosses Hornwort s Higher plants
Cabriel river at Boniches	<i>Ch. vulgaris</i> var. <i>crassicaulis</i> (Schleicher ex A. Braun) Kützing	<i>Aneura maxima</i> (Schiffn.) Steph.

Cabriel river at Boniches	<i>Cladophora</i> sp.
Cabriel river at Boniches	<i>Chara vulgaris</i>
Cabriel river at Villar del Humo	Cobble
Cabriel river at Villar del Humo	<i>Calothrix</i> sp.
	<i>Hymenostylium</i>
Cabriel river at Villar del Humo	<i>recurvirostrum</i>
	<i>m</i> (Hedw.)
	Dixon
Cabriel river at Villar del Humo	<i>Chara hispida</i>
	L. and Ch.
	<i>vulgaris</i> L.
Mayor river downstream Cañete	Cobble
Mayor river downstream Cañete	<i>Chaetophora</i>
	sp.
Mayor river downstream Cañete	Unidentifed hornwort
Cabriel springs	Cobble
Cabriel springs	<i>Cladophora</i> sp., <i>Chaetophora</i> sp., <i>Mougeotia</i> sp.
Valdemoro Sierra spring and cascade	Cobble
Valdemoro Sierra spring and cascade	Travertine
Valdemoro Sierra spring and cascade	<i>Oedogonium</i> sp.
Valdemoro Sierra spring and cascade	<i>Mougeotia</i> sp.
Valdemoro Sierra spring and cascade	<i>Spirogyra</i> sp.
Valdemoro Sierra spring and cascade	<i>Phragmites</i> <i>australis</i> (Cav.) Trin. ex Steudel

Table S2. Identified benthic diatom taxa and their codes in the studied site of Serranía de Cuenca.

Code	Taxon name
ACON	<i>Achnanthes conspicua</i>
ADMI	<i>Achnanthidium minutissimum</i>
APEL	<i>Amphipleura pellucida</i>
ATHU	<i>Amphora cf. thumensis</i>
AOVA	<i>Amphora ovalis</i>
APED	<i>Amphora pediculus</i>
ANBR	<i>Anomoeoneis cf. brachysira</i>
BRE	<i>Brachysira cf. brebissonii</i>
BNEO	<i>Brachysira necexilis</i>
CBAC	<i>Caloneis bacillum</i>
CLTU	<i>Caloneis latiuscula</i>
CAL1	<i>Caloneis sp.</i>
CHIB	<i>Campylodiscus hibernicus</i>
CNRC	<i>Campylodiscus noricus</i>
CPED	<i>Cocconeis pediculus</i>
CPLA	<i>Cocconeis placentula</i>
CSCU	<i>Cocconeis scutellum</i>
CRAD	<i>Cyclotella radiosa</i>
CYC1	<i>Cyclotella sp. 1</i>
CYC2	<i>Cyclotella sp. 2</i>
CYC3	<i>Cyclotella sp. 3</i>
CSTE	<i>Cyclotella stelligera</i>
CELL	<i>Cymatopleura elliptica</i>
CSOL	<i>Cymatopleura solea</i>
CAFF	<i>Cymbella affinis</i>
CCAE	<i>Cymbella caespitosa</i>
CCES	<i>Cymbella cesatii</i>
CCIS	<i>Cymbella cf. cistula</i>
CFAL	<i>Cymbella cf. falaisensis</i>
CLAE	<i>Cymbella cf. laevis</i>
CLAT	<i>Cymbella cf. lata</i>
CLTS	<i>Cymbella cf. latens</i>
CNAV	<i>Cymbella cf. naviculiformis</i>
CDEL	<i>Cymbella delicatula</i>
CHEL	<i>Cymbella helvetica</i>
CMIN	<i>Cymbella minuta</i>
CPRO	<i>Cymbella prostrata</i>
CSLE	<i>Cymbella silesiaca</i>
CYM1	<i>Cymbella sp.</i>
CYM1	<i>Cymbella sp. 1</i>
CYM2	<i>Cymbella sp. 2</i>
CYM3	<i>Cymbella sp. 3</i>
CTUM	<i>Cymbella tumida</i>
CTMD	<i>Cymbella tumidula</i>
CTGL	<i>Cymbella turgidula</i>
CBAM	<i>Cymbopleura amphicephala</i>
DKUE	<i>Denticula kuetzingii</i>

DTEN	<i>Denticula tenuis</i>
DANC	<i>Diatoma anceps</i>
DMES	<i>Diatoma mesodon</i>
DMON	<i>Diatoma moniliformis</i>
DVUL	<i>Diatoma vulgaris</i>
DELL	<i>Diploneis elliptica</i>
DOBL	<i>Diploneis oblongella</i>
DPAR	<i>Diploneis parma</i>
DPUE	<i>Diploneis puella</i>
EARE	<i>Ellerbeckia arenaria</i>
EADN	<i>Epithemia adnata</i>
EARG	<i>Epithemia argus</i>
EGOE	<i>Epithemia goeppertiana</i>
ESOR	<i>Epithemia sorex</i>
EUFL	<i>Eucocconeis flexella</i>
EARC	<i>Eunotia arcus</i>
FRAC	<i>Fragilaria acus</i>
FBCP	<i>Fragilaria biceps</i>
FBRE	<i>Fragilaria brevistriata</i>
FCAA	<i>Fragilaria capucina var. amphicephala</i>
FCCP	<i>Fragilaria capucina var. capitellata?</i>
FDEL	<i>Fragilaria cf. delicatissima</i>
FTEN	<i>Fragilaria cf. tenera</i>
FCON	<i>Fragilaria construens</i>
FDIL	<i>Fragilaria dilatata</i>
FLAP	<i>Fragilaria lapponica</i>
FLEP	<i>Fragilaria leptostauron</i>
FNAN	<i>Fragilaria nanana</i>
FPAR	<i>Fragilaria parasitica</i>
FPIN	<i>Fragilaria pinnata</i>
FRA1	<i>Fragilaria sp.</i>
FTEN	<i>Fragilaria tenera</i>
FVIR	<i>Fragilaria virescens</i>
FRU1	<i>Frustulia sp.</i>
FVUL	<i>Frustulia vulgaris</i>
GACU	<i>Gomphonema acuminatum</i>
GANG	<i>Gomphonema angustatum</i>
GANT	<i>Gomphonema cf. angustum</i>
GCLA	<i>Gomphonema cf. clavatum</i>
GOLI	<i>Gomphonema cf. olivaceum</i>
GPAR	<i>Gomphonema cf. parvulum</i>
GTER	<i>Gomphonema cf. tergestinum</i>
GCON	<i>Gomphonema constrictum</i>
GTRU	<i>Gomphonema truncatum</i>
GYAT	<i>Gyrosigma attenuatum</i>
GNOD	<i>Gyrosigma nodiferum</i>
GSCA	<i>Gyrosigma scalproides</i>
HAMP	<i>Hantzschia amphioxys</i>
MSMI	<i>Mastogloia smithii</i>
MVAR	<i>Melosira varians</i>
MCIR	<i>Meridion circulare</i>

NACO	<i>Navicula</i> cf. <i>acommoda</i>
NCPR	<i>Navicula</i> cf. <i>capitoradiata</i>
NCCT	<i>Navicula</i> cf. <i>concentrica</i>
NVIR	<i>Navicula</i> cf. <i>viridula</i>
NCIN	<i>Navicula</i> <i>cincta</i>
NCON	<i>Navicula</i> <i>contenta</i>
NCRY	<i>Navicula</i> <i>cryptocheopala</i>
NCTE	<i>Navicula</i> <i>cryptotenella</i>
NLAN	<i>Navicula</i> <i>lanceolata</i>
NLAT	<i>Navicula</i> <i>laterostrata</i>
NMUT	<i>Navicula</i> <i>mutica</i>
NRAD	<i>Navicula</i> <i>radiosa</i>
NSCH	<i>Navicula</i> <i>schoenfeldii</i>
NAV1	<i>Navicula</i> sp. 1
NAV10	<i>Navicula</i> sp. 10
NAV11	<i>Navicula</i> sp. 11
NAV2	<i>Navicula</i> sp. 2
NAV3	<i>Navicula</i> sp. 3
NAV4	<i>Navicula</i> sp. 4
NAV5	<i>Navicula</i> sp. 5
NAV6	<i>Navicula</i> sp. 6
NAV7	<i>Navicula</i> sp. 7
NAV8	<i>Navicula</i> sp. 8
NAV9	<i>Navicula</i> sp. 9
NSTR	<i>Navicula</i> <i>stroemii</i>
NSBM	<i>Navicula</i> <i>subminuscula</i>
NTPT	<i>Navicula</i> <i>tripunctata</i>
NEAM	<i>Neidium</i> <i>ampliatum</i>
NIRI	<i>Neidium</i> <i>iridis</i>
NAMP	<i>Nitzschia</i> <i>amphibia</i>
NIAN	<i>Nitzschia</i> <i>angustata</i>
NCPL	<i>Nitzschia</i> cf. <i>capitellata</i>
NIFR	<i>Nitzschia</i> cf. <i>frustulum</i>
NHEU	<i>Nitzschia</i> cf. <i>heufleriana</i>
NWUE	<i>Nitzschia</i> cf. <i>wuellerstorffii</i>
NDIS	<i>Nitzschia</i> <i>dissipata</i>
NFON	<i>Nitzschia</i> <i>fonticola</i>
NIHU	<i>Nitzschia</i> <i>hungarica</i>
NINT	<i>Nitzschia</i> <i>intermedia</i>
NLIN	<i>Nitzschia</i> <i>linearis</i>
NSCHO	<i>Nitzschia</i> <i>schoenfeldii</i>
NSIO	<i>Nitzschia</i> <i>sigmoidea</i>
NSIT	<i>Nitzschia</i> <i>sinuata</i> var. <i>tabellaria</i>
NIT1	<i>Nitzschia</i> sp. 1
NIT2	<i>Nitzschia</i> sp. 2
NIT3	<i>Nitzschia</i> sp. 3
PMIC	<i>Pinnularia</i> <i>microstauron</i>
PLCM	<i>Planothidium</i> <i>lanceolatum</i>
RCUR	<i>Rhoicosphenia</i> <i>curvata</i>
RGIB	<i>Rhopalodia</i> <i>gibba</i>
RPAR	<i>Rhopalodia</i> <i>parallela</i>

SPUP	<i>Sellaphora pupula</i> var. <i>capitata</i>
SSMI	<i>Stauroneis smithii</i>
SBIS	<i>Surirella biseriata</i>
SBRE	<i>Surirella brebissonii</i>
SUR1	<i>Surirella</i> sp.
SSPI	<i>Surirella spiralis</i>
UACU	<i>Ulnaria</i> cf. <i>acus</i>
UULN	<i>Ulnaria ulna</i>

Table S3. Benthic diatom taxa which contribute more to dissimilarities between stagnant and stream waters in two large catchments (Tajo and Júcar) of Serranía de Cuenca. SIMPER results of cumulative % and mean of their relative abundance in each habitat are given. Common taxa which are shared by both catchments in these analyses are represented in bold letters. Taxa abbreviations are given in Table S2.

	Cumulative (%)	Mean abund.	Mean abund.
	Stagnant waters	Streams	
<i>Taxa in Júcar</i>			
ADMI	17.3	30.9	11.3
CPLA	33.0	3.7	26.5
GANG	40.2	8.9	7.2
MSMI	46.0	9.5	0.0
CBAM	51.1	7.3	3.2
NCTE	55.1	0.1	6.4
MVAR	58.9	0.0	6.3
<i>Taxa in Tajo</i>			
ADMI	16.6	22.7	22.7
CBAM	27.8	18.6	8.5
GANG	35.4	5.2	10.4
CAFF	42.3	6.8	6.2
CCES	47.8	4.1	4.9
EGOE	52.9	7.2	1.2
CPLA	57.9	1.9	7.3

Table S4. Relative contribution of spatial and environmental components to the total explained variation (RDA) of BD taxa (presence matrix and relative abundance). Analysis performed with overall data (132 samples). Only statistically significant values ($p < 0.05$) are shown.

	Presence	Relative abundance
TWO INDEPENDENT MATRICES		
Spatialiced Environment	50	47
Pure Space	1	3
Pure Environm.	6	6
Unexplained	48	51
FOUR INDEPENDENT MATRICES		
Spatialiced Physico-chemical	44	42
Spatialiced Catchment	42	39
Spatialiced Biological	17	16
Pure Catchment	0	0
Pure Biological	5	6
Unexplained	50	52

Table S5. Spatial autocorrelograms based upon Moran's I of taxa (richness, presence and relative abundances) and environment. Eight distance geographical classes were selected to compute auto-correlations. Number of sites was 132 in all analysis. ns: not statistically significant values at $p > 0.05$.

Distance classes	Taxa			Environment
	km	Richness	Presence	
0-6	ns	0.028	0.060	0.051
6-12	ns	0.078	0.036	-0.030
12-18	ns	ns	-0.062	-0.058
18-24	ns	ns	-0.081	0.062
24-30	ns	ns	-0.044	ns
30-36	ns	ns	ns	ns
36-40	ns	ns	ns	ns
40-46	ns	ns	ns	ns