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A CHECKLIST OF THE BENTHIC MACROINVERTEBRATES OF THE NEGRO RIVER BASIN, PATAGONIA, ARGENTINA, INCLUDING AN APPROACH TO THEIR FUNCTIONAL FEEDING GROUPS

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RESUMO - LISTA DOS MACROINVERTEBRADOS BENTÔNICOS DA BACIA DO RIO NEGRO, PATAGÔNIA, ARGENTINA, INCLUINDO OBSERVAÇÕES SOBRE SEUS GRUPOS TRÓFICOS

A estrutura das comunidades de invertebrados e a composição de seus grupos tróficos muda dentro de uma mesma bacia hidrográfica, sendo diferente em pequenos rios de cabeceira e em rios maiores. Ambas as situações já foram observadas, quando foram estudadas em detalhes as bacias hidrográficas norte americanas, européias e australianas principalmente. No sistema hidrográfico sul americano, as comunidades de macroinvertebrados bentônicos têm sido muito pouco estudadas, e os conhecimentos até a última década se limitavam a estudos parciais em algumas localidades ou a certos grupos taxonômicos. Por outro lado, muitas das espécies neotropicais, particularmente as da Patagônia, são diferentes das de outras regiões. No entanto, os mesmos grupos alimentares devem estar presentes. O objetivo deste estudo é avaliar a composição dos macroinvertebrados bentônicos da bacia do Rio Negro, Patagônia, Argentina, e testar com observações iniciais se os grupos alimentares descritos para outras bacias são os mesmos para esta. Macroinvertebrados bentônicos de 50 estações foram

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coletados de 1977 a 1981, e de 1983 a 1984. 63 famílias, com pelo menos 129 espécies foram encontradas (38 famílias de insetos, 8 de ácaros, 5 de moluscos, 4 de crustáceos e 8 de outros invertebrados). Ainda que alguns poucos elementos fossem cosmopolitas, a maioria dos animais aquáticos da Patagônia apresentou um elevado grau de endemismo e diferenças biogeográficas marcantes. No entanto, os mesmos grupos tróficos descritos para outras bacias foram encontrados. Deve-se ressaltar que o número total de espécies diminuiu em direção ao leste da bacia hidrográfica, desde os riachos da Cordilheira dos Andes até os rios da meseta patagônica.

ABSTRACT - A CHECKLIST OF THE BENTHIC MACROINVERTEBRATES OF THE NEGRO RIVER BASIN, PATAGONIA, ARGENTINA, INCLUDING AN APPROACH TO THEIR FUNCTIONAL FEEDING GROUPS

The structure of invertebrate communities and the composition of the functional feeding groups change within a basin from headwaters to a large river. Both hypotheses were proved by studying in detail North American, European and Australian basins mainly. In the Andean South American hydrographic systems, benthic macroinvertebrate communities have been poorly studied and knowledge of them was limited until the last decade to partial research at some localities or on certain taxonomic groups. Many neotropical species, particularly in Patagonia, are different from those of other regions of the world. Even so, the same general functional feeding groups should be present. The objective of this paper is to report the composition of the benthic macroinvertebrates of the Negro River basin, Patagonia, Argentina, and to test with a preliminary approach if the functional feeding groups described for other basins are the same. Thus, benthic macroinvertebrates from 50 sampling stations of the Negro River Basin were collected from 1977 to 1981 and from 1983 to 1984. 63 families, with at least 129 species were recorded (38 families of insects, 8 of water mites, 5 of mollusks, 4 of crustaveans and 8 of miscellaneous invertebrates). Though some few elements are cosmopolitan, most of the Patagonian aquatic animals have a high degree of endemism and remarkable biogeographic differences. However, the same functional feeding groups of other basins of the world are present. It is interesting that the total number of species decreases eastward in this basin from the Andean Range streams to the Patagonian Plateau rivers.

INTRODUCTION

The structure of invertebrate communities and the composition of the functional feeding groups change within a basin from headwaters to a large river. Both hupotheses were proved by studying in detail North American, European and Australian basins mainly (ILLIES, 1953; SCHMITZ, 1957; MAINTLAND, 1966; VANNOTE et alii, 1980; WILLIAMS, 1981; MINSHALL et alii, 1985).

In the Andean South American hydrographic systems, benthic macroinvertebrate communities have been poorly studied and knowledge was limited until the last decade to partial research at some localities or on certain taxonomic groups. On the other hand, many neotropical species, especially the Patagonian ones, are different from those of the other regions of the world. Even so, the same functional feeding groups should be present.

The Negro River Basin in Patagonia was studied. For a more complete panorama of its macroinvertebrates concerning type of sampling sites, characteristics of the basin, identifications, epibiosis relationships, anatomical and behavioral adaptations and biogeographical problems, the papers of BONETTO et alii (1986), FARÍAS & WAIS (1986), WAIS (1981a, b; 1983; 1984a, b; 1985a, b; 1986; 1987), WAIS & BONETTO (1988), WAIS & CAMPOS (1984), WAIS & de CABO (in press), WAIS & VILA (1987), Wais et alii (1987) may be consulted. The objective of this paper is to report the composition of the benthic macroinvertebrates of the Negro River Basin, and to describe a preliminary approach to their functional feeding groups, to test whether they are the same as those described for other basins of the world.

METHODOLOGY

Benthic macroinvertebrates from 50 sampling stations (Fig. 1) of the Negro River Basin were cllected from 1977 to 1981 and from 1983 to 1984, as part of three different projects centered on sites located on the Southern Upper, Middle and Lower basin respectively. Sampling sites located on mountain creeks of Eastern Andean slopes were taken with a Surber sampler. In larger streams (rivers) a modified Allen & Macan net was used as well as to take samples from lakes, reservoirs and ponds, which were obtained only from shorelines.

Surber sampler was placed on the stones of fast flowing water creeks, removing all available substrata for benthic macroinvertebrates, including the remains of the riparian vegetation entering as allochthonous coarse particulate organic matter on the first-order streams of the system. A modified Allan & Macan net was placed directly on the bottom and among aquatic vegetation, which consisted primarily of *Myriophylum elatinoides*, *Ceratophylum demersum*, *Potamogeton pectinatus*, filamentous algae (*Spirogyra* sp., *Cladophora glomerata*, *Ulothrix zonata*, *Zygnema* sp.) and characeous algae (*Nitella clavata*) and submerged trees and shrubs in areas flooded by reservoirs. On the headwater streams, allochthonous vegetation inputs were

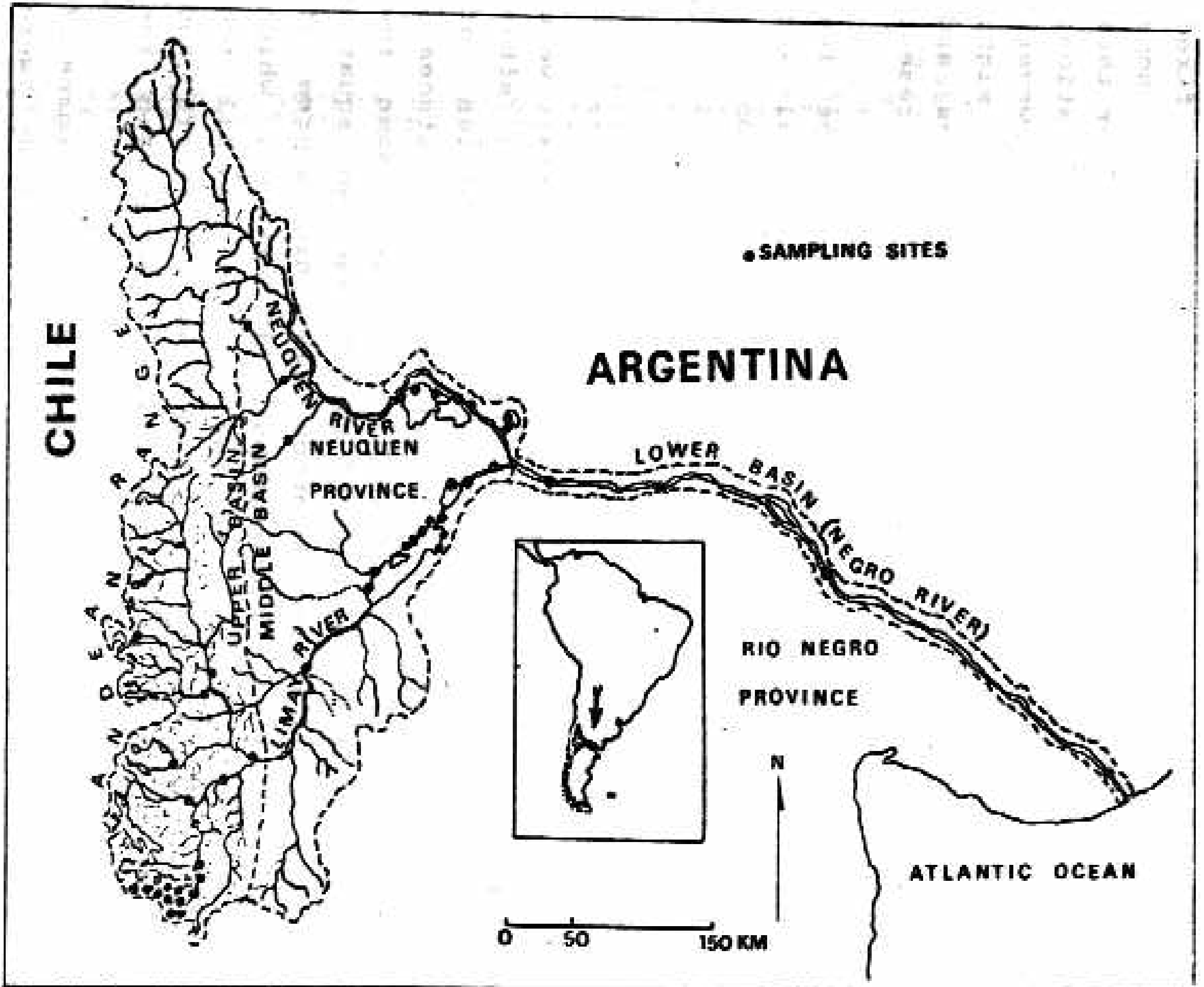

Figure I - Sampling sites at Negro River Basin, Patagonia, Argentina.

constituted of 21 plant species (WAIS & BONETTO, 1988).

Organisms adhering to vegetal substrata were removed in the laboratory by hand. The material was fixed with 5% formalin and preserved in 70% ethanol plus some drops of glycerine in the case of aquatic insects. For this first approach to study functional feeding classification, mouthparts as well as gut contents were analyzed. However, this study is only preliminary because some taxa might change their functional roles during different stages and instars, as noted in a few cases according to present knowledge (Tab. 1).

Taxonomic identifications were done using the few available keys for the area. Much doubtful material was sent to specialists for identification or confirmation.

RESULTS AND DISCUSSION

63 families with at least 129 species were recorded in the Negro River Basin at the sampling sites studied. These species correspond to 38 families of insects, 8 of water mites, 5 of mollusks, 4 of crustaceans and 8 of miscellaneous invertebrates. Though some few elements are cosmopolitan, most of the Patagonian aquatic invertebrates of the macrozoobenthos have a high degree of endemism and remarkable biogeographic differences, which reach the greatest degree in the stoneflies. All the Plecoptera species are endemic, as well as most genera and even a family (Diamphipnoidae), exclusively known from the Patagonian Andes.

The checklist (Tab. 1) shows a different degree of taxonomic identification of each group. Some were identified to species level; others, as Ostracoda or Hirudinea, could not be clarified even to family, according to present knowledge of the taxa in the area. However, it is possible to conclude that the total number of species

Table 1 - Checklist and functional feeding roles (FFR). References: Location: U. Upper Basin; M. Middle Basin; L. Lower Basin.
FFR: H. Herbivores, including detritivores (D) (sensu stricto), excluding shredders, only microparticulated debris feeders included; S. Shredders; G. Grazing-scrapers; P. Predators (including micropredators (Pm) and macropredators (PM)); C. Collectors (including filtering collectors (Cf) and gathering collectors (Cg)). Note. some microdetritivores are gathering collectors.

	LOCATION	FFR
INSECTA		
DIPTERA		
Muscidae		
Limnophorinae sp.	M	PM
Athericidae		
Cf. *Atherix* sp.	U	P
Tabanidae		
Dasybasis albosignata	U	S-P
Dasybasis minor	M	S-P
Dasybasis argentina argentina	M	S-P
Tabanus claripennis	M	P
Stratiomyiidae sp.	U-M	Cg-Pm
Ceratopogonidae sp.	M	Cg-P
Chironomidae sp.		
Parachironomus longistilus	M	Cg-P
Parachironomus sp.	M	Cg-P
Cf. *Parachironomus* sp.	U-M-L	Cg-P
Cryptochironomus aff. *sorex*	M	PM
Chironomus (s.str.) sp.	M-L	Cg-P
Phaenopsectra (s.str.) sp.	U-M	Cg
Cf. *Phaenopsectra* sp.	U-M	Cg
Dicrotendipes aff. *californicus*	U-M	C
Dicrotendipes sp.1	M	C
Dicrotendipes sp.2	U-M	C
Dicrotendipes sp.3	M-L	C
Cricotopus (s.str.) sp.	M	Cg-S
Cricotopus sp.	M	Cg-S
Tanytarsus sp.	U-M	C
Paratanytarsus sp.	U-M	C?
Rheotanytarsys sp.	U-M	Cf
Ablabesmya cf. *peleensis*	U-M	Cg(1)-PM(2)
Ablabesmya cf. *monilis*	U-M	Cg(1)-PM(2)
Cf. *Syncricotopus* sp.	M	Cg?
Orthocladius sp.	U-M	Cg
Cf. *Orthocladius* sp.	U-M	Cg
Polypedilum sp.	M	Cg-PM-S
Polypedilum cf. *simulans*	U-M	Cg-PM-S
Cf. *Thienemannimya* sp.	M	P
Orthocladius (s.str.) sp.	M	Cg-S
Limnophyes sp.	U-M	

Table 1 (cont.)

	LOCATION	FFR
Eukiefferiella sp.1	M	Cg-PM
Eukiefferiella sp.2	U-M	Cg-PM
Procladius (s.str.) sp.	U	C
Cf. *Cardiocladius* sp.	U	Cg(1)-P(2)
Goeldichironomus sp.	M	Cg
Simulidae		
Simulium (*D.*) *bachmanni*	U-M	Cf
Simulium wolffhuegali	U-M	Cf
Simulium jujuyense	U-M	Cf
Simulium (*P.*) *nigristrigatus*	U-M	Cf
Culicidae sp.	M-L	C
Psychodidae sp.	M	Cg
Tipulidae		
Cf. *Ormosia* sp.	U-M	Cg(D)
Blepharoceridae		
Paltostoma nov. sp.	U	G
Edwardsina aff. *dispar*	U	G
COLEOPTERA		
Gyrinidae		
Andogyrus seriatopunctatus	M	P
Dytiscidae		
Laccophilus sp.	M-L	P?
Desmopachria sp.	M-L	P?
Lancetes varius	M-L	P?
Hydrophilidae		
Berosus sp.	M	H-Cg
Tropisternus (*P.*) *setiger*	M	PM(1)H-Cg(2)
Elmidae sp.	U-M	Cg-S
Eubridae		
Cf. *Ectopria* (*Chilectopr.*) *grandis*	U	G
TRICHOPTERA		
Hydropsychiidae		
Smicridea annulicornis	M	Cf
Smicridea sp.1	M	C
Sericostomatiidae		
Parasericostoma sp.	U	S
Hydroptilidae		
Oxyethira sp.	U-M	H-Cg
Hydroptila sp.	U-M	H-G
Leptoceridae		
Nectopsyche chilensis	U-M	S
Nectopsyche sp.1	U-M	Cg-S
Nectopsyche sp.2	U-M	Cg-S

(1) Early instars; (2) late instars.

Table 1 (cont.)

	LOCATION	FFR
Glossossomatidae		
Mastigoptila sp.	U	G-C
Limnephilidae sp.	U-M	S
Ryacophilidae		
Cf. *Metachorema* sp.	U-M	P
Calamoceratidae sp.	U	S
ODONATA		
Aeshnidae		
Aeshna sp.	M	PM
Libellulidae		
Pantala hymenaea	M	PM
Coenagrionidae		
Ischnura fluviatilis	M	PM
PLECOPTERA		
Gripopterygidae		H-S-D-G-C-P
Araucanioperla aff. *bullocki*	U	
Pelurgoperla personata	U	
Ceratoperla fazi	U	
Antarctoperla michaelseni	U-M	
Rhithroperla aff. *rossi*	U	
Limnoperla jaffueli	U-M	
Teutoperla aff. *auberti*	U	
Aubertoperla illiesi	U	
Potamoperla myrmidon	U	
Senzilloides sp.	U	
Notoperla archiplatae	U	P
Notoperlopsis femina	U	
Neopentura semifusca	U	
Austroperlidae		
Klapopteryx barilochensis	U	S?
Notonemouridae		
Austronemoura chilena	U	H-S?
Neonemura barrosi	U	H-S?
Udamocercia sp.	U	H-S?
Eusthenildae		
Neuroperla cf. *schedingi*	U	P
Perlidae		
Pictetoperla gayi	U	P
Kempnyella genualis	U	P
Diamphipnoidae		
Diamphipnoa sp.	U	H-P?
Diamphipnopsis sp.	U	H-P?
EPHEMEROPTERA		
Leptophlebiidae		
Meridialaris laminata	U-M-L	Cg
Meridialaris diguilina	U-M-L	Cg

Table 1 (cont.)

	LOCATION	FFR
Penaphlebia sp.	U-M	
Baetidae		
Baetis sp.	U-M	Cg-G
Siphlonuridae		
Chiloporter eatoni	U	Cg
HEMIPTERA		
Notonectidae sp.	M-L	PM
Corixidae sp.	M-L	H-PM
ACARI		
Hydrachnidae		P-D
Hydrachna sp.	U-M	
Eylaidae		
Eylais sp.	U-M	
Hydryphantidae		
Hydryphantes sp.	U-M	
Libertiidae		
Oxus sp.	U-M	
Limnesiidae		
Limnesia sp.	U-M	
Hygrobatidae		
Hygrobates sp.	U-M	
Pionidae		
Piona sp.	U-M	
Oribatidae sp.	U-M	
CRUSTACEA		
DECAPODA		
Parastacidae		
Samastacus spinifrons	U-M	S
Aeglidae		
Aegla neuquensis	U-M-L	P-S
Aegla riolimayana	U-M-L	P-S
AMPHIPODA		
Hyalellidae		
Hyalella curvispina	U-M-L	S-Cg
OSTRACODA sp.	M-L	D
TARDIGRADA		
Macrobiotidae		
Isohypsibius cf. *augusti*	M	H-Pm
MOLLUSCA		
Chilinidae		
Chilina puelcha	U-M-L	G
Chilina parchappei	U-M-L	G

Table 1 (cont.)

	LOCATION	FFR
Chilina tehuelcha	U-M-L	G
Planorbiidae		
Biomphalaria peregrina	U-M-L	G
Hydrobiidae		
Littoridina parchappei patag.	U-M-L	G
Littoridina hatcheri	U-M-L	G
Ancylidae		
Uncancylus concentricus	U-M	G
Hyriidae		
Diplodon patagonicus	U-M-L	Cf
ANNELIDA		
HIRUDINEA sp.	U-M-L	P
OLIGOCHAETA		
Naididae		
Chaetogaster limnaei	U-M-L	P
Aelostomatidae sp.	M-L	D-Pm
POLYCHAETA		
Histriobdellidae		
Stratriodrilus aeglaphilus	U-M-L	D?
NEMATODA sp.	U-M-L	H-Pm
PLATYHELMINTES		
TRICLADIDA sp.	U-M-L	P-D
TEMNOCEPHALIDA		
Temnocephalidae		
Temnocephala aff. chilensis	U-M-L	D?

decreases eastward in the basin from the Andean Range streams to the Patagonian Plateau rivers (91 species are present in the Upper Basin and only 29 in the Lower). A transitional area of maximum species richness (98) is observed in the Middle trends, especially at those sampling stations located next to the Upper Basin limits (WAIS, 1987). The explanation seems quite easy. Beside the fact that the Andean streams offer a variety of different possibilities for macroinvertebrates (altitudinal ranges, patches of microhabitats from riffles to pool zones, etc.). Upper reaches of the basin are located in a very humid area, populated by a rich riparian flora which provides large quantities of coarse particulate allochthonous organic matter (CPOM) to the system. This CPOM is rapidly divided by the action of some shredders but maily by meteorization due to the fast flowing waters and the abundance of falls and cascades characterizing the Upper basin. Finer particulate matter can be, thus, inmediately used by filtering and gathering collectors, very abundant in this basin.

The Middle, particularly in its final two-thirds, and the Lower trends are located in a semi-arid region. The rainfall decreases dramatically eastward from the mountains to the Atlantic Ocean. The area of the confluence of the Neuquen River with the Limay (Fig. 1) to form the Negro River has less than 10% of the rainfall of the Southern Upper basin. It is not surprising, thus, that the Negro River has not a single affluent in all its extent, due to the dryness of the area (Fig. 1).

A different degree of discrimination was also obtained for the functional feeding roles of the organisms, because the Patagonian macroinvertebrates have not been studied before from this point of view. Some of the organisms, such as water mites and gripopterygid stoneflies, were treated as a whole to evaluate their FFR, except in the case of *Notoperla archiplatae*, which is clearly a predator. In the case of the sister-group of Northern Hemisphere nemourids, the Notonemouridae, somewhat more is known. Ecologically they would act as herbivores, but actually the exact functional role they play is still doubtful (BAUMANN, 1982). CUMMINS & WILZBACH (1985) report that most of the chironomids are gathering collectors, except about 10%, which are predators. According to the checklist (Tab. 1), the predator species represent here more than that 10%, but comparison is difficult because CUMMINS & WILZBACH (1985) refer only to streams and many chironomids considered here live not only in lotic but also in lentic habitats (WAIS, 1987). However, the same functional feeding groups reported for other basins of the world are present in the Patagonian Negro system.

VANNOTE et alii (1980) postulate that along the river continuum downstream communities "capitalize" the "inefficiencies" of the upstream communities in terms of organic matter and energy. They support the shredders and some collectors (e.g. simulids) are much more abundant on the Upper reaches; on the Middle stretch grazers are those presenting the higher proportions and other collectors (e.g. freshwater mussels, oligochaetes) predominate on the Lower reaches. In the Patagonian Negro basin the collectors seem to be much more abundant along the whole system. However, the total relative proportions of each functional feeding group will be able to be evaluated when all the species with its associated functional feeding roles will be elucidated. In this direction, 29 are the species exclusive of the Upper basin, mostly stoneflies which functional feeding roles were not still clarified. 27 are the species living only in the Middle stretch and, surprisingly, there is not a single organism exclusive of the Lower reaches. Those sharing the Upper and Middle basin (but not the Lower) are 42; 10 live in Middle and Lower stretches (but not in the Upper) and none shares exclusively the Upper and Lower, obviously because of the very different environmental characteristics of both extreme reaches. About a 25% of the organisms living in Upper and Middle stretches were not identified in terms of functional feeding roles. From 19 species living along the whole basin, 16 are invertebrates non insects (21 in total) (Tab. 1). This fact allows to supose those groups have a wider ecological tolerance than the insects as to adapt to different kinds of substrata, discharge, water velocity, climat along the basin. These 16 species cover all the spectrum of functional feeding roles.

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