Taxonomic diversity of benthic stands of the Tataw source(ImouzerMarmoucha,Middle Atlas - Morocco)

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Abstract- This work is a development of the knowledge of the fauna of invertebrates of aquatic ecosystems of the source Tataw (Middle Atlas, Morocco). It aims on the one hand, to identify and inventory the communities of its benthic macrofauna, lifting the originality of this fauna and on the other hand, to identify the main factors responsible for its distribution and dynamics.Samples were taken monthly year 2013 using a Surber NET with a width of mesh 400µm. the waters of the resurgence are weakly mineralized their temperature is established around an average of 11 ° C, heavily infested with bacteria of fecal origin.Results from a synthesis of faunal data are 7513 individuals identified at source scale. 29 species belonging to 21 families and 24 genera.This ecosystem is mostly dominated by the Amphipod genus Gammarus (84.85%), followed by the insect TrichopteraAgapitusincertilus (5.62%), Diptera genus Simulium (1.82%) and very minority the rest of taxa.the source is shocked by two important phenomena, floods and anthropogenic activity. Special attention must be given to this wetland that it hosts exclusive crustacean Amphipod GammarusmarmouchensisFadil 2006.

Key words: macrofauna, quality water source, Middle Atlas

Introduction

Many functions important hydrological are associated with freshwater sources. They play an essential role in the regulation of flows and reloading of subsurface flows [1]. It is the most stable component of surface flows.In arid and semi-arid zones, where aquifers are not always directly communicate with the surface hydrographic network and where surface waters are rare and unevenly distributed, underground springs can be a source of supply. They are typically used inventory buffers that allow to fend off the seasonal precipitation deficits. They are typically used inventory buffers that allow to fend off the seasonal precipitation deficits [2]. Their socio-economic interest is more demonstrated as a rich and varied natural resources areas. Their waters are used in irrigation and drinking water supply, since the dawn of time several human civilizations are articulated around these water points. In addition to their socio-economic value, it is our responsibility to consider the ecological importance of sources in so far as these are biotopes which usually contain a variety of life forms [3].

All the links uniting these different groups is a food chain, in which benthic macro-invertebrates form a corner piece. They participate in the transformation of organic matter and constitute the largest share of the food of fish. These are also good bio-indicators which reflect particularly well the ecological state of the rivers. To narrow

ecological niche species respond very quickly to changes in their environment. Their presence, or on the contrary their disappearance after a proven presence, or a significant change in their frequency, shows if the watercourse State is satisfactory or not.

The sources of the Middle Atlas (Morocco) are home to a rich and diverse biocoenosis that is remained marginalized for a long time, because these resources were considered much more for their water resources as to their ecological value [4]. In this context, the study of the biodiversity of invertebrates macro specific sources, appears as an essential aid in the decision for the definition of management and conservation plans. Studies that are conducted in pairs with physiochemical analysis of the conditions of these ecosystems, in order to have precisely the evolution of these parameters over time, control their timing with the dynamics of benthic macrofauna of the environment, as well as their involvement in the determination of morphological and demographic of the population parameters alienated to the crenal.

Tataw is a unique source of its kind in the Middle Atlas because it hosts exclusively a freshwater crustacean *Gammarus marmouchensis* that is found nowhere else [5]. It is also an important reserve of water sweet goshawks of the what focuses the life of a population of over 15000 inhabitants. These waters are used for irrigation, drinking water and livestock watering. This rich wetland that vulnerable, is strongly subjected to anthropogenic pressure. The very strong occupation of space and the continued operation of their resource, constitute a real danger this heritage [6].

This study has for objectives, identifying benthic stands specific to source and their distribution and their interaction with the abiotic parameters of the environment. Such reflections may help decision-makers to the outlet or the strengthening of measures for the conservation of the wetland has a value ecological, and socioeconomic, as old as the history of the Morocco.

2. Material and methods

2.1. Study site

Located in the part Eastern Middle Atlas and bordered to the East by the average Moulouya Valley, ImmouzerMarmoucha is a hinge zone between the Middle Atlas and the Eastern Morocco (figure 1). Despite its high altitude (1710 m) and its exposure to the wind, the station is little watered, because it is in fact, partially sheltered from the Tichoukt chain (2400 m to 2700 m) which blocks a large part the masses of moist air that crossed the dominant landforms Azrou and Ifrane [7].On the other hand, the commune belongs to alluvial groundwater which is characterized by the outcrop of limestones and dolostones of the Jurassic enabling a storage of groundwater, from which flow the emergences of Tataw.The waters of the main source (flow 430 l/s), as well as those of secondary outbreaks that are scattered on a surface of approximately 700 m^2 flowing to the OuedSebou and regulate, as well as its flow regime.Its waters are a source of drinking water supply and irrigation of an area of more 1170 ha. The massive presence of the inhabitants of the local towns, cattle, pumping,

derivations and measures capture at the level of the source,are the risks that threaten the quality of its waters by compromising its various uses and thus reduce the chances of a socio-economic progress of the region. Regardless already climate change.

Figure 1: Location of the source Tataw

Figure 1: Location of the source Tataw

2.2 Sampling of the macro invertebrate benthic

2.2.1. Sampling Schedule

Seasonal variability in the structure of the community is high because the life cycle of several benthic macro invertebrates species is annual or shorter and it culminates with an adult phase. Thus, the presence of mature larvae, nymphs or adults may be short. So it is better to collect samples, a monthly frequency in a year, and it is the schedule called for this study. We conducted monthly samplings from the month of January 2013 until December 2013.

2.2.2. Sampling method

For a general sampling, we opted for a surber NET to a width of mesh 400µm. This technique can be used on rocky, Sandy, gravelly and muddy, good that it is difficult on the very organic substrates. In order to collect the maximum of Macroinvertebrates colonizing the site, we should spend 30-45 minutes on the rocky beaches to return stones and search for invertebrates. On detached bodies of stones with pliers and keep them in a jar. The collected samples are fixed at 40% formalin, then stored in water from source to 10%. The sorting of samples is done using the loupe. Zoological groups are separated in vials containing 70% alcohol [8]. Species in each group are sorted, identified, counted, and classified among functional feeding groups according to [9].

In addition to these biological surveys, samples of water samples for chemical and bacteriological analysis was made during the year of study in the same places of sampling to have precisely the evolution of these parameters in local time and monitor their synchronism with benthic stands of sources.

2.3 Analysis of physico-chemical parameters of the water

In order to assess the physicochemical quality of the underground water masses of the station, a monthly survey of water samples was conducted during a year every 4 weeks, for a total of 12 months of sampling between January 2013 and December 2013. According to the who recommendations, a volume of 1, 5 litres of water is collected each month in bottles, polyethylene from the main resurgence. And kept at 4 ° C

during transport to the laboratory to be analysed within 24 hours following. The methods of analysis are those recommended by the standards [10; 11]. Measurements of temperature, pH and electrical conductivity were conducted in the field using a multi-parameter pH/conductivity Analyzer / temperature CyberScan PC10. The methods used are: volumetric measurement for dissolved oxygen, bicarbonates, chlorides, calcium and magnesium and sulfates and ortho molecular absorption spectrophotometry phosphates (table 1).

Table 1: Chemical component analysis method

Parametres	Unité	Measuring equipment and method of analysis
Temperature	° C	Analyzer multi parameters Cyber Scan
Conductivity	µS/cm	Analyzer multi parameters Cyber Scan
pH		Analyzer multi parameters Cyber Scan
Dissolved O_2	mg/l	Winklermethod
Total hardness	mg/l	EDTA Complexometry of with eriochrome black
Calcium hardness	mg/l	EDTA Complexometry of with calcone
Magnesiumhardness	mg/l	Difference between total and calcium hardness
Alkalinity	meq/l	Volumetric dosing with sulfuric acid and methyl orange
Organicmatter	mg/l	Oxidizability of hot potassium permanganate
Chlorides	mg/l	Metering,withMohrmethod
sulphates	mg/l	absorption spectrometryat 650 nm
Orthophosphates	mg/l	absorption spectrometry at 750 nm

2.4 Microbiological analyses.

Microbiological water characterization, is part of the commonly practiced analyses. Indeed, the purpose of a bacteriological study is to identify the presence or not of fecal contamination, sought microorganisms are the FMAT, fecal coliforms, total coliforms and faecal streptococci. The sampling of water made in situ in sterile bottles. Filtration and seeding, petri dish, were made the same day. The methods used in this follow-up meet Moroccan drinking water standards (NM.03.7.002.2011). Different culture media recommended for the bacteriological analysis of water are explained in **table 2**. After incubation, the colony forming units (CFU)

Table 2: Method of sampling and enumeration of bacteria

	Technique	Sampling	Culture medium	Incubation

		volume		temperature
FMAT	Incorporation in solid medium	1 ml	Yeastextract agar	20°C et 37°C
Total coliforms	Filtration	100ml	Agar lactose to the TTC	37°C
Fecalcoliform	Filtration	100ml	Agar lactose to the TTC	44°C
Faecalstreptococci	Filtration	100ml	Agar Slanetz	37°C

2.5 Calculation of statistical descriptors of data

2.5.1. Specific diversity index

The most used index and the Shannon-Weaver, it reflects the diversity of species that make up the stands in a medium and establishes the link between the number of species and the number of individuals of a same ecosystem or a community. Is calculated using the formula:

$$H' = -\sum (ni/N) . Log\ 2\ (ni/N)$$

H': diversity specific

N: total number of individuals

ni: number of species i

Index of species diversity is high, when the taxon richness is important and the distribution of individuals among the taxa is balanced.

2.5.2. Fairness Index

Knowledge of species diversity index is used to determine the fairness, equity is a second fundamental dimension of diversity. It is the ratio between the maximum diversity (Hmax). It varies between 0 and 1, tends towards 0 when almost all of the staff is focused on a species; It is 1 when all species have same abundance. Index of fairness determines, either reconciliation or even the remoteness between H' and Hmax. It is expressed by the formula

$$E = H' / Hmax$$

$$Hmax = Log2\ (S)$$

E = H' / Hmax

Hmax = Log2 (S)

S: Total number of species

2.5.3 Relative abundance

Relative abundance of a species is the percentage of the number of it compared to the total number of individuals collected from a station. It is expressed by the formula

Pi = Ab(a)*100/ Ab(t)

Where, Ab (a): total number of individuals of a species.

Ab (t): total number of individuals

2.5.4. The frequency

The frequency of a species is the ratio, expressed as a percentage, between the total number of

samples where this species is noted and the total number of all samples taken.

Fi = Pa * 100 /Pt

PA: number of samples where the species was collected,

Pt: total number of samples

A species is ubiquitous if its F is 100%, constant if the F is strictly between 75% and 100%, regular if the F is between 50 and 75%, accessory if the F is between 25 and 50% Finally, a species is accidental if F is less than 25%

2.6. Analysis of principal components (ACP)

On the other hand, to visualize and analyze existing correlations between the different variables through their behaviors and orientations, to identify the main factors responsible for the quality of the waters of the searched environment. We statistically processed all the data by component analysis main c.p.a. by the Unscrambler 9.2 software.

The Unscrambler 9.2 focuses on the interpretation rather than statistics to improve the decision-making process and the speed at which decisions can be taken.

3. Results and discussion

3.1. water chemistry

The Tataw source waters are weakly mineralized, the annual profile of electrical conductivity is marked by very small fluctuations which settle around an average of 353.2 (µS/cm). The potential of hydrogen is neutral to alkaline (8) and it is the underlying lithological substratum which would be responsible for. Calcium ion concentrations are pretty important the highest levels recorded during the summer months, the maximum is 121.7 (mg/l) in July so that the minimum that is 95.7 (mg/l) is reported in the month of October. Tataw is part of the Middle Atlas pleated consisting primarily of rocks limestone, and this is the reason why so important calcium concentrations are found. Levels low Mg2 + who settled goshawks from an average of 15.3 (mg/l), the same observation is made for ion Cl -, waters are weakly charged chloride and their annual average is 14.9 (mg/l) nature of crossing rocks which is in question. The orthophosphates are signage their concentration does not exceed 0.056 (mg/l) and this in the best of cases. Salient information, is that the concentrations of organic matter in permanganate index, which only ceases to rise from the month of may, marked by the installation of an important measure of capture that has induced the drying of all secondary outbreaks, and subsequently increased human activity at the level of the main source. The same consequences are reflected on the dissolved oxygen levels which declined synchronously with the increase of the permanganate index. It is from this diagnosis, that the spring waters are of good quality but in a perspective of sustainable development, it be protected from anthropogenic activities that endanger the health of the aquatic ecosystem.

Table 1: Results of physico-chemical analyses of the waters of the Tataw source

	Ca_2^+ (mg/l)	Mg_2^+ (mg/l)	TAC (meq/l)	Cl- (mg/l)	I.P (mg/l)	SO_2^- (mg/l)	PO_4^{3-} (mg/l)	Dissolved O2 (mg/l)	EC (µS/cm)	pH	T °C
J	100,9	19,8	0,6	16,0	1,3	15,4	0,052	5,4	339	7,9	10,8
F	115,5	12,5	0,7	10,7	1,3	20,3	0,055	8,2	340	8,2	11,0
M	124,8	11,4	0,6	14,2	2,1	19,3	0,058	7,4	344	8,1	10,9
Ap	118,6	9,4	0,5	12,4	1,0	22,0	0,041	7,5	353	8,1	11,2
M	112,3	13,5	0,6	16,0	1,9	20,7	0,056	6,6	364	8,0	11,3
J	121,7	12,5	0,7	17,8	2,3	17,0	0,014	6,01	373	7,9	12,0
JL	101,9	8,3	0,7	17,8	2,9	15,8	0,010	5,4	362	7,9	12,4
Ap	110,3	11,4	0,8	16,0	3,7	9,3	0,061	5,1	366	8,1	12,2
S	103,0	26,0	0,8	14,2	5,6	10,7	0,001	5,4	359	8,0	11,4
O	95,7	18,7	0,9	14,2	5,3	13,2	0,002	5,0	351	8,1	11,4
N	103,0	22,9	0,5	16,0	4,7	21,0	0,043	5,1	345	8,1	11,5
D	107,1	16,6	0,5	14,2	4,5	19,4	0,055	5,2	342	8,1	10,9

3.2 Microbiological water analysis

The results of microbiological analyses are recorded in table 7. Analyses showed the presence of the bacteria of fecal coliform types (Escherichia coli), total coliforms and faecal streptococci in water samples from the source Tataw.This shows that flows in the study area are subject to anthropogenic influence. Indeed, the indicative value for the bacteriological quality proposed by the world Organization of the health (who) is zero coliform per 100 ml of water,Discharges of domestic water at the level of the alluvial groundwater (septic) and watering of livestock have a definite impact on the quality of groundwater.

Table 3: Results of microbiological analyses at source SidiBouali year 2013

Microorganismes	(UFC)
FMAT at 37ºC/100ml	52
FMAT at 22ºC/100ml	48
Total coliforms (TC)/100 ml	80
Fecalcoliform (FC)/100 ml	50
Faecalstreptococci (FS)/100 ml	60
FC/FS rate	0,833

3.3 study of benthic macrofauna

3.3.1. Inventory of the benthic community

This monthly monitoring of benthic stands in the Jet source throughout a year is essentially intended to establish an inventory as complete as possible of different taxa that can be encountered in the waters of this aquatic system and thereby to enrich the list of Moroccan biodiversity.In total, 7531 individuals have been collected, divided 8 classes, 16 orders, 22 families and 24 genera. Table 4 gives us a first impression of the macrofauna collected then table 5 is an inventory detailed taxa collected during the twelve months of sampling.These are insects that predominate in terms of species (43%), followed by Oligochaetes (19%), of Turbellarians and Arachnids (10%) each and finally to Achaetes, bivalves, gastropods and amphipods (5%).

Table 4: List source Tataw fauna

Taxons				
Phylum	class	order	family	species
Molluscs	Gastropods	Architaenioglossa	Viviparidae	*Mélanopsispraemorsa*
	Bivalves	Eulamellibranche	Spharium	*Pisidiumpersonatum*
				Pisidiumcasertanum
Arthropods	malacostraca	Amphipoda	Gammaridea	*Gammarusmarmouchensis*
	Insects	Diptera	Simulidés	*Simuliumpseudoquinum*
				Simuliumornatum
				Simuliumsergenti
		Odonata	Calopterygidae	*Calopterixhemoroidalis*
				Calopterixsplendens
		Trichoptera	Glossosomatidae	*Agapitusincertilus*
		Heteroptera		*Gerris* sp.
		Megaloptera	Sialidae	*Sialis* sp.
		Hymenoptera	Agriotypidae	*Agriotypus*sp.
		Ephemeroptera	Baetidae	*Baetisrhodani*
				*Potamanthus*sp.
			Caenidae	*Caenispusilla*
				Caenisluctuosa
			Heptagenidae	*Ecdyonorusifranensis*
				*heptagenia*sp.
	Arachnids	Hydracariens	Pontarachnidae	*Hydrachnidia*sp.
			Pionidae	*Pionauncata*
Plathelmintes	Turbellarians	Triclades	Dugesiidae	*Dugesiagonocephala*
			Planariidae	*Phagocata*sp.
Annelids	Oligochaetes	Lumbriculida	Lumbriculidae	*Lumbricussp.*
		Haplotaxida	Tubificidae	*Tubifex tubifex*
			Haplotaxidae	*Haplotaxissp.*
		Opisthopoa	lumbricidae	*Eiseniella tetraedra*
	Achaetes	Rhynchobdellida	Glossiphonidae	*Glossiphonidae*sp.

				*Helobdella*sp.

Table 5: Monthly changes in the abundance of benthic macrofauna in the Tataw during the year 2013 station

Species	J	F	M	Ap	M	J	JI	A	S	O	N	D
Pisidiumpersonatum	1	2	2	6	1	1		9	3		3	
Pisidiumcasertanum	-	-	-	1	-	-	-	-	-	1	1	-
MélanopsisPraemorsa	-	1	-	-	-	-	-	1	-	-	-	-
Gammarusmarmouchensis	319	371	564	686	635	742	670	589	486	540	437	306
SimuliumPseudoquinum	5	2	5		8	6	7	13	8	10	2	5
Simuliumornatum	3	4	6	6	3	10	13	7	3	6	1	
Simuliumsergenti	-	-	-	-	1	-	1	-	1	1	-	-
Calopterixhemoroidalis	-	-	-	3	7	-	4	1	1	1	-	-

Calopterixsplendens	-	-	-	2	2	2	2	1	-	-	-	-
Agapitusincertilus	-	-	4	21	62	80	71	53	126	5		
Gerris sp.	-	1	3	-	3	2	3	4	3	2	3	-
*Agriotypus*sp.	-	-	-	1	2	1	1	-	1	2	1	-
Sialis sp.	-	-	-	1	-	-	-	-	-	-	-	-
Baetisrhodani	-	-	8	9	9	8	27	9	6	3		
*Potamanthus*sp.	-	-	-	13	12	9	3	1	1	-	-	-
Caenispusilla	-	-	1	1	-	1	1	3	2	1	-	-
Caenisluctuosa	-	-	5	3	-	12	22	4	3	2	-	-
Ecdyonorusifranensis	-	-	3	4	6	18	15	2	1	1	-	-
*heptagenia*sp.	-	-	2	2	9	5	-	-	7		-	-
*Hydrachnidia*sp.	2	1	2	2	2	1	2	1	3	1	1	-
Pionauncata	1	1	1	-	2	-	3	-	1	-	1	-
Dugesiagonocephala	2	4	3	1	-	1	-	3	1	3	-	12
*phagocata*sp.	4	6	2	2	6	1	-	1	2	7	2	4
*Lumbricus*sp.	6	8	5	1	9	3	2	2		4	1	2
Tubifex tubifex	7	6	1	3	-	-	4	1	1	2		6
*Haplotaxis*sp.	3	3	4	-	-	-	-	1	1	-	3	3
Eiseniella tetraedra	-	-	-	-	-	-	-	-	6	-	-	-
*Glossiphonidae*sp.	2	5	3	-	3	-	-	1	-	-	10	5
*Helobdella*sp.	9	3	-	-	-	2	6	2	4	-	9	5

- Absence

3.3.2 Total abundance

The profile of this station recorded a marked dominance of the insects followed Amphipod crustaceans all order confused with annual collections of 873 specimens and finally the rest of the file marked by the presence of the Annelida, Platyhelminthes and bivalve molluscs, gastropods molluscs are the least abundant group with only two individuals for the total annual. Macrobenthic spectrum shown in figure 2, is converged with the data of dominance. These are amphipods that are first rank with a percentage of 84.45% of the total fauna followed by Trichoptera representative 5.62% of the benthos of Tataw, followed by mayflies with 3.38% and finally the rest of the cohabitants minority with percentages that exceed not the 0.5%.

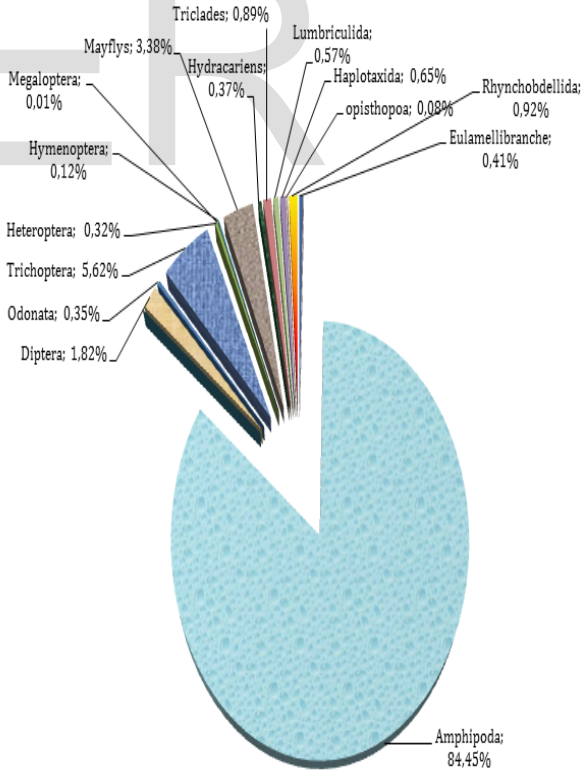

Figure 2: Abundance of different orders to Ain Tataw

3.3.3 Specific diversity index

Species diversity can be defined as a measure of species composition of an ecosystem, in terms of number of species and their relative abundance. The sourceTataw is marked by a low index of diversity, it is 1.2. The phenomenon of flooding suffered by frequently by this station has strongly influenced the diversity of this station thus inducing its deterioration. In addition, there are the anthropogenic pressure in addition to the looting of the benthic heritage of the station, it has prejudiced its natural landscape which has always been source of pride for the inhabitants of I. Marmoucha. Indeed, a disturbed streams may create unfavourable conditions for some organizations (polluted-sensitive) leaving thus more tolerant of other bodies (polluted-resistant).

3.3.4 Index of specific fairness

Fairness is also called regularity or equi-distribution, varies between 0 and 1, more a taxon is abundant, lower than we is fairness. Is the case for the Jet source or the fairness index is 0.25, data that will pair with those of the diversity index revealing the lowest taxonomic diversity in this station, it is the species *Gammarus marmouchensis* which dominates the rest of the taxa.

3.3.5 Relative abundance

As cited above, Jet, the source of high mountain is populated mostly by Gammarusmarmouchensisqui 84.45% of total population of the station, followed by the *Agapitus incertilus*(5,62 %) caddisfly and finally the rest of taxa (figure3) minority

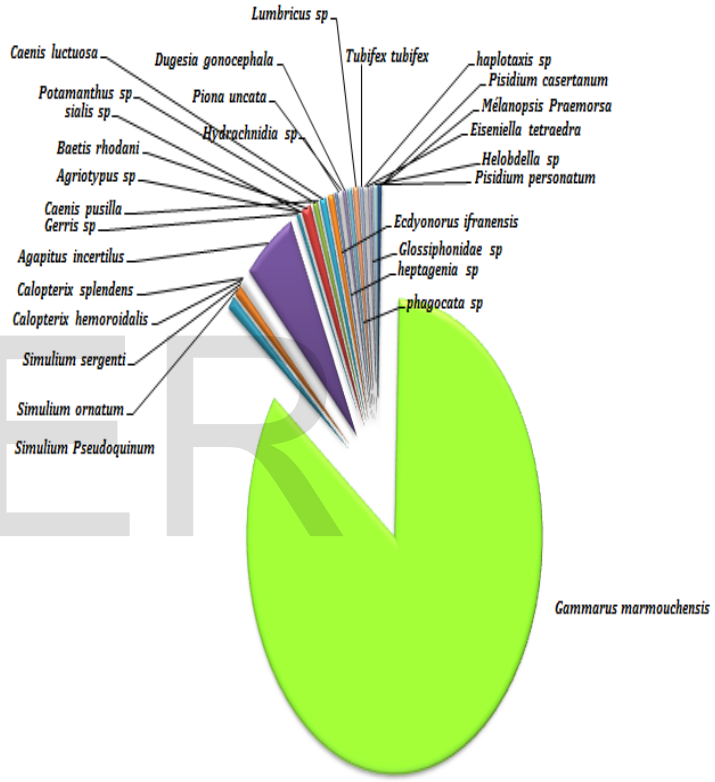

Figure 3: Relative abundance of taxa to Tataw

3.3.6 Frequency

Constant species that confined permanently source Tataw represent over three quarter (76%) of the benthic fauna total bycatch species are number 4, *Simulium sergenti*, , *Heptagenia* sp. and *Pisidium casertanum*. Accidental species whose presence is more than explained by the

flood and phenomenon of the derivative which follows are 3 (table 6).

Table 6: Frequency of occurrence of the species colonizing the Tataw source

Species	frequency (%)	Presence
Gammarusmarmouchensis	100	Constant (⩾50%)
*Hydrachnidia*sp.	92	
*Phagocata*sp.	92	
*Lumbricus*sp.	92	
Simuliumpseudoquinum	92	
Simuliumornatum	92	
Pisidiumpersonatum	75	
Gerris sp.	75	
Dugesiagonocephala	75	
Tubifex tubifex	75	
Agapitusincertilus	67	
Baetisrhodani	67	
Ecdyonorusifranensis	67	
*Helobdella*sp.	67	
Caenispusilla	58	
Caenisluctuosa	58	
Pionauncata	58	
*Agriotypus*sp.	58	
*Haplotaxis*sp.	58	
Glossiphonidaesp	58	
Calopteryxhemorrhoidalis	50	
*Potamanthus*sp.	50	
Simuliumsergenti	42	50< accessory
Calopteryxsplendens	42	
*Heptagenia*sp.	42	<25
Pisidiumcasertanum	25	
Mélanopsispraemorsa	17	Accidental ⩽25
Sialis sp.	8	
Eiseniella tetraedra	8	

3.4 Statistical studies of benthic stands by ACP

3.4.1. Studies of correlations between species

The graph of the correlations (figure 4) gives us a first impression of the existing associations between different species. It indicates that the presence of any species is almost identical in this source with the exception of two species: *Gammarus marmouchensis* and *Agapitus incertilus*. These results are confirmed by the dominance index, indicating that these two species are highest and outstrip by far all other small cohabitants.

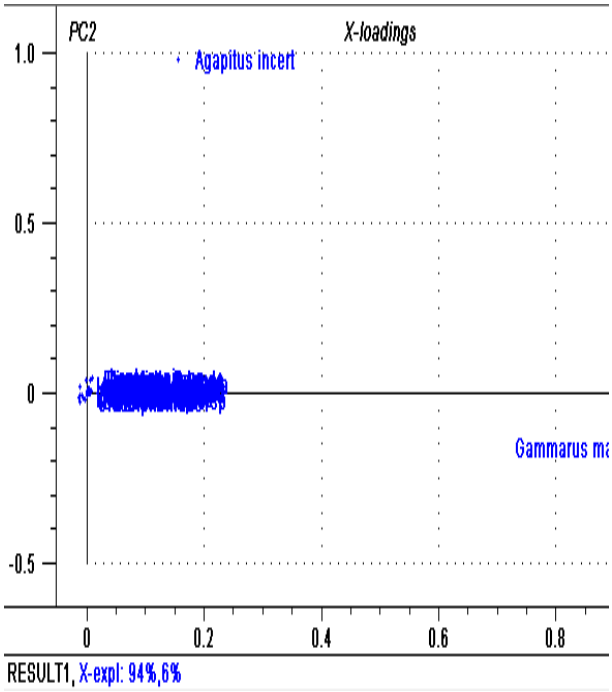

Figure 4: Analysis of possible associations between benthic invertebrate macro from the Tataw source

3.4.2 Studies of the impact of the factor "season"

the study principal component raises the involvement of the factor 'season' in the distribution of macrobenthic species in the Jet station. (Figure 5). Indeed, knowing that this resurgence hosts a total of 30 taxa, twenty-eight of these have a clear preference for the months temperate (spring-autumn). Only the month of September remains excluded from these gatherings. This unusual one month of the year separation could be the result of human disturbance suffered by the source at the end of the summer season, or more, yet the flood that disrupts the entire ecosystem crenal given that this resurgence is often subject to this phenomenon whose extent varies from once to another.

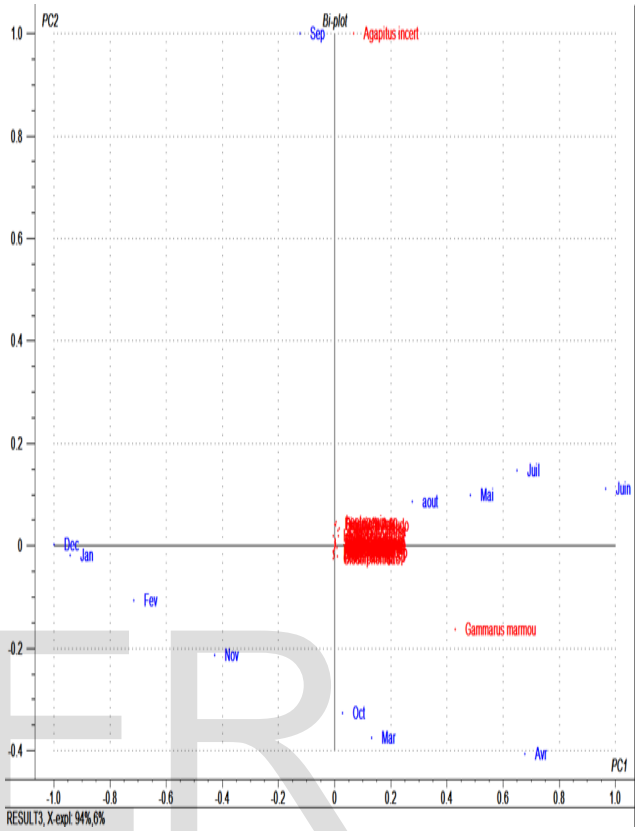

Figure 5: Principal component analysis of the distribution of the species in the Tatawource during the different months of the year 2013

3.4.3 Sudies of Correlations between species and the physico-chemical parameters of the environment

In the Tatw station, the temperature is the only physicochemical parameter that correlates with certain species. According to the ACP, *Caenis luctuosa*, *Simulium ornatum*, *Baetis rhodani*, *Ecdyonorus ifranensis*, *Gammarus marmouchensis*, *Calopterix splendens* and *Agapitus incertilus* are positively correlated to temperature. In other words, these species

tolerant of the temperature rise. In other words, these species tolerant of the temperature rise, however, Jet source is classified cold source because its waters do not exceed 12 ° C and despite the clarity of these data cannot move forward appointment of eurythermy, views that these changes in temperature do not exceed the 1.5ºC in where appropriate. However, *Haplotaxis* sp. And *Phagocata*sp. are negatively correlated to this parameter and do not tolerate temperature changes (Table7).

Table 7: Statistically significant correlations between the source Tataw macrobenthic species and temperature

Species	P.C parameters	r
Caenis luctuosa	T °C	0,746
Simulium ornatum	T °C	0,731
Baetis rhodani	T°C	0,709
Ecdyonorusifranensis	T °C	0,671
Gammarusmarmouchensis	T °C	0,642
Gerris sp	T °C	0,618
Haplotaxis sp.	T °C	-0,617
Phagocata sp.	T °C	-0,602
Calopterix splendens	T °C	0,583
Agapitus incertilus	T °C	0,582

Conclusion :

This study proposes a State of play of the benthic system source Tataw (Middle Atlas, Morocco) structural and functional perspective. It yielded a first database which contains both information on the environment (physicochemical and bacteriological water quality) and qualitative data (list of species) and quantitative (frequency, relative abundance, taxonomic diversity) concerning the associated benthic macrofauna.

At the national level, it fits in the current trend in aquatic ecology which aims to use the biotic indicators of the quality of the water. This study also provides a qualitative and quantitative description and location of the main units of benthic stands on the basis of the main environmental factors. It is therefore an element reference and reflection project (REBENT) benthic monitoring or as a follow-up of the temporal dynamics of the benthos.

The originality of the source Tataw is shown by *Gammarus marmouchensis* native and endemic species whose presence is an indicator of the biological diversity of this source. However the local population and their cattle, causing huge losses of habitats and could constitute an element of pressure and major disruption for this vulnerable species. A high priority in conservation approaches should be given to this source. The absence of plecoptera is a pressure indicator and these are the human activities that are plotted of the finger. This diagnosis should encourage the public authority to make recommendations to contribute to strategic thinking for biodiversity management and integration data in decision making, establishment of a biodiversity monitoring

network and promote consultation and communication between stakeholders.

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