First data on the macroinvertebrates structure of the Atrous source (sector of ribaa) (the plain of sais, Morocco)

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Abstract

Macroinvertebrates of the source Atrous(Sector of ribaa) were studied using samples taken seasonally between October 2015 and August 2016. The fauna listed in this work is made up of 3584 individuals corresponding to 21 species belonging to 5 classes (Gastropods, Bivalvia, Arachnids, Malacostraceae and Insects). These classes are divided into 10 orders. The size of the benthic population has shown that those are the Malacostraca taxon is the most representative (2849 individuals) followed respectively by insects (558 individuals), Gastropods (121 individuals), Arachnids (50 individuals) and Bivalvia (6 individuals). the taxon Gammarus gauthieri is numerically the most inventoried while the remaining species are represented in small percentage. The values of the specific diversity index H and the specific fairness index revealed that the specific diversity of macroinvertebrates populating this source is is relatively low. The results obtained in this study highlight an alarming state of the ecological state of the source Atrous(Sector of ribaa).

 keywords: Macroinvertebrates, The source of Atrous(Sector ribaa), species, faunistic, the specific diversity index, the specific fairness index.

Introduction

Thanks to its geographical position, Morocco represents a contact area between several regions such as the South of Europe and Africa. Its importance, as a compulsory passage zoned for a large part of the fauna, between the Palearctic and Afrotropical regions, gives it a particular interest for faunistic, ecological and biogeographical studies [1]. En effet,de nombreux écosystèmes aquatiques ont fait objet pendant la dernière décennie d'études spécifiques à la faune benthique [2 ;3 ;4 ;5 ;6 ;7 ;8 ;9 ;10 ;11 ;12]. However, although these studies allowed a first vision of the biological diversity of quite a few sources in Morocco, a large part of fauna remained unknown and marginalized since several sources were not prospected or that they were considered strictly for their water resources by omitting their ecological values and their biodiversity. It is in the context of filling this vacuum, that we conducted this pilot study which main objective is to describe the biological state of the waters of the Atrous source (ribaa sector) and detect the surrounding factors that govern their structure, abundance and distribution, within the framework of sustainable development.

2. Material and methods

2.1 Study area

This source is located nearly 18km northeast of the city of El Hajeb. It is part of the Fez-Meknes hydrogeological unit. The aquifer formations are lacustrine limestones, alluviums and sandstones. The average flow of this ecosystem is 300 l / s. The spring water is used for the supply of drinking water to neighboring douars as well as for irrigation [13] (**Figure1**).

Figure1 : Situation géographique de la station Atrous(secteur ribaa)

2.2 Sampling of the macro-invertebrate benthic

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 **[14].** Species in each group are sorted, identified, counted, and classified among functional feeding groups according to **[15].**

2.3 Calculation of statistical descriptors of data

2.3.1 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: $H' = -\sum (n_i/N) . \log_2 (n_i/N)$ H': diversity specific N: total number of individuals n_i: 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.

2.3.2 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.

2.3.3 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.

2.3.4 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% .

3. Results and discussion

3.1 Study of benthic macrofauna

3.3.1. Inventory of the benthic community

3584 individuals were collected during this study. These specimens belong to five classes. The Malacostraca taxon is the most representative (2849 individuals) followed respectively by insects (558 individuals), Gastropods (121 individuals), Arachnids (50 individuals) and Bivalvia (6 individuals)(**Figure2**).
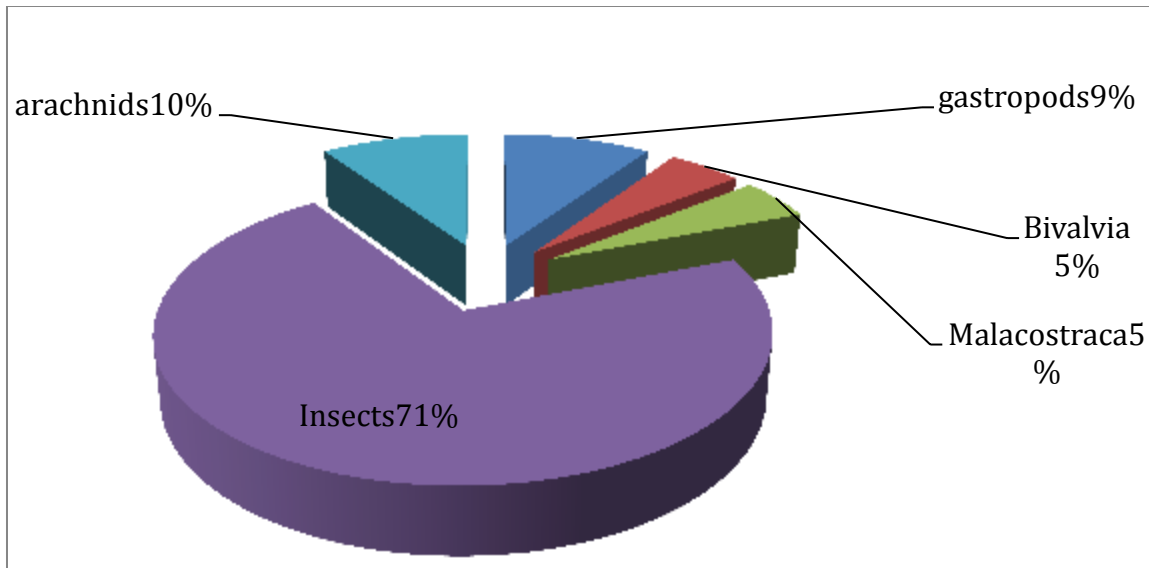
Figure 2 : Percentage of species not taxonomic class in the Atrous station (ribaa sector).

Table 1: Seasonal evolution of the abundance of benthic macrofauna in the Atrous

station (Ribaa) during the year 2015-2016

species	Oct	Nov	Janv	Mars	Avr	Mai	Juil	Aout
Melanopsis sealaris	14	17	8	11	14	17	20	19
Pisidium personatun	0	0	0	0	1	1	3	1
Pseudomnicola sp.	0	0	0	0	0	0	1	0
Gammarus gauthieri	317	320	290	259	380	420	450	413

Simulium ornatum	5	9	4	6	9	11	10	14
Willenia quadriphilata	4	5	2	3	5	9	13	10
Simulium pseudoquinum	4	7	1	5	8	9	10	8
Gerris sp.	1	2	1	2	6	9	19	17
Naucoris sp.	0	1	0	1	5	8	14	12
Nepa sp.	2	5	1	5	8	7	5	4
Micronecta sp.	0	1	0	1	3	5	11	9
Baetis rhodani	2	4	1	4	6	11	16	13
Caenis luctuosa	1	2	1	2	4	3	12	10
Brachycerus sp.	1	3	2	3	4	5	9	7
Erochrus sp.	1	0	0	1	0	1	0	0
Gyrinus sp.	0	0	0	2	0	0	1	0
Calamoceras sp.	1	2	0	2	4	5	7	10
Glossosoma sp.	0	1	0	1	3	5	7	4
Psychonyia pusilla	0	1	0	1	4	7	11	14
Hydrachnidia sp.	4	9	1	3	5	4	5	2
Piona sp.	1	2	0	2	3	4	4	1

3.3.2 Total abundance

The five identified classes are represented by ten orders. In terms of abundance, these are the Amphipods which prevail (79.49%) followed by the Diptera (4.77%), the Heteroptera (4.6%), the Ephemeroptera (3.51%), the Caenogastropods (3.34%); The remaining groups (Trichoptera, Hydracarians, Beetles, Eulamellibranchs and

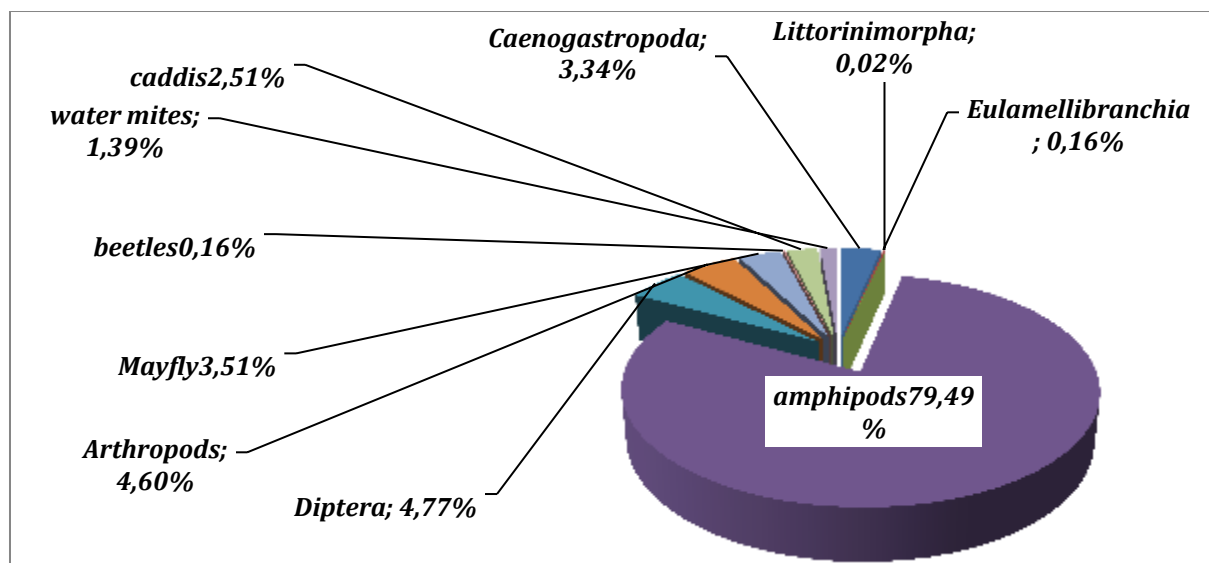Littorinimorpha) are only weakly represented on the study site with less than 3% (**Fig.3**).

Figure39 : Abundance of different orders in Ain Atrous (ribaa sector)

3.3.3 Relative abundance

Gammarus gauthieri is the species that governs in the Atrous source (ribaa sector). It represents 79.4% of the total population while the other species are only poorly represented (**Fig.52**).
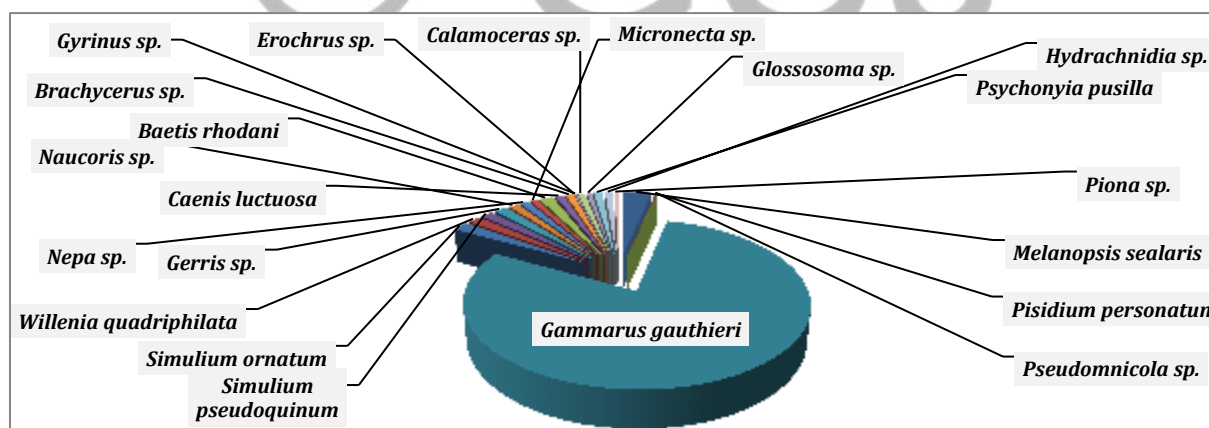

Figure 52 : Relative abundance of different taxa in Atrous (ribaa sector)

3.3.4 Specific diversity index

Analysis of the stands of macroinvertebrates collected during the study period revealed that the Atrous station (ribaa sector) has a relatively low specific diversity index. It is equal to 0.16. This is the result of a correlation of different biotic and abiotic parameters which have affected the existence of different species in this station such as the homogeneity of substrate, the overexploitation of water resources intended for drinking

water and l irrigation of neighboring agricultural land. Without forgetting the effects caused by ecotourists who frequent this aquatic ecosystem at all times of the year.

3.3.5 Specific fairness index

The fairness index found in this source is 0.037. This reflects that the species confined to this station do not have the same abundances. This alarming situation must prompt the authorities to formulate a legal arsenal within the framework of safeguarding this aquatic ecosystem**.**

3.3.6 Frequency

Out of a total of 21 species, we noted the presence of 17 constant species, one accessory species and 3 accidental species (**tab. 2**).

Table 2: frequency of occurrence of species colonizing the Ain Atrous source (Ribaa sector)

Species	Fréquency(%)	Présence
Melanopsis sealaris	100	
Pisidium personatun	50	
Gammarus gauthieri	100	
Simulium ornatum	100	
Willenia quadriphilata	100	
Simulium pseudoquinum	100	
Gerris sp.	100	
Naucoris sp.	75	
Nepa sp.	100	
Micronecta sp.	75	constants (≥50%)
Baetis rhodani	100	
Caenis luctuosa	100	

Brachycerus sp.	100	
Calamoceras sp.	87,5	
Glossosoma sp.	75	
Hydrachnidia sp.	100	
Piona sp.	87,5	
Erochrus sp.	37,5	25< accessory <50
Pseudomnicola sp.	12,5	accidental ≤25
Gyrinus sp.	25	
Psychonyia pusilla	25	

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Conclusion

The wildlife inventory carried out in this study constitutes a first important database. The fauna studied is characterized by a relatively low taxonomic diversity. Only a few stands are well diversified, the values of the biotic indices prove that this station has an undemanding ecological quality. The taxonomic structure of benthic stands shows that these stands are formed mainly of Amphipods. A taxon that tolerates organic pollution well. This alarming situation must prompt the authorities to establish a legal arsenal to safeguard this precious ecosystem within the framework of sustainable development.

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