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The water quality of Nador Canal (Merja Zerga, Morocco): Parameters Physicochemical and Metal trace elements.

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ABSTRACT

The study of the Merja Zerga, which undergoes human activities such as pollution and intensification of agriculture, is part of the assessment of the attributes of this important wetland. In order to better understand the impact of the contributions of the Nador Canal's permanent surface waters to Merja Zerga, we evaluated the physicochemical quality and the trace metallic elements as a function of time to determine the degree of toxicity that this zone undergoes. Generally it has been found that temperature, pH, dissolved oxygen, nitrates allow the waters of Nador Canal to be placed at the excellent to average class. by contrast, BOD, electrical conductivity, salinity and iron place them at the wrong to very poor class.
Keywords : Water, Quality, Merja Zerga, Physicochemical, Metallic elements.

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INTRODUCTION

Merja Zerga or the lagoon of Moulay bouselhame is the most important wetland in Morocco and one of the four sites selected by RAMSAR according to the Convention of Wetlands of International Importance, but Merja Zerga is exposed to human activities (Pollution, intensification of agriculture, overexploitation, poaching), therefore a risk of pollution especially agricultural pollution, since more than 6000 Hectares of irrigated perimeter discharge their drainage waters through the Canal Nador.

The aim of this study is to better understand the impact of the contributions of the surface waters of Canal Nador on the Merja Zerga, from which studies of physicochemical parameters and trace elements were made to evaluate the impact of its parameters on The MerjaZerga.

MATERIALS AND METHODS

Location of the study area

Merja Zerga is located at the north-western end of the Gharb plain, in the immediate south of the seaside village of Moulay Bouselham, 70 km north of the town of Kénitra and 35 km south of that of Larache. It is part of the territory of the province of Kenitra (circle of Lalla Mimouna), it depends on the communes of Moulay Bouselham and Sidi Mohamed Lahmer. The local population of Merja Zerga has more than 16 000 inhabitants including 1000 inhabitants in the urban center of Moulay Bouselham [1].

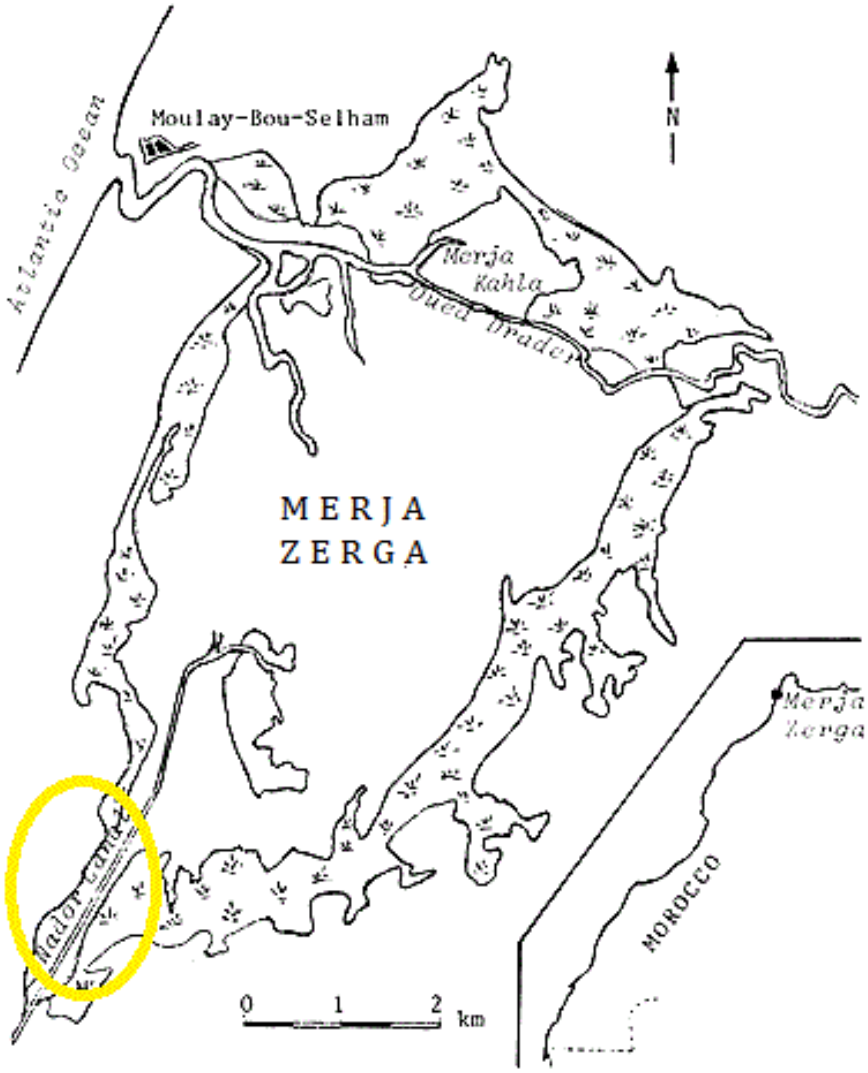

Figure 1 Location of the study area

Climate and Water Resources of the study area.

The climate in this region is of Mediterranean type with Atlantic influence. Merja Zerga receives continental waters and is regularly influenced by the ocean tide. Fresh water arrives in this ecosystem through the Nador Canal to the south and the Wadi Drader to the east. Fresh water also comes from a shallow water table fed by the infiltration of rainwater and runoff. Communication with the sea takes place via a gully whose width can reach a hundred meters and has alternated openings and closures since 1928, the last closure dating from 1991 [2].

Agriculture

Agriculture is practiced by about 90% of households. More than 92% of farms have areas of less than 5 ha, and 50% of farmers own only 20% of total agricultural land. The average area per household is 3.24 ha, and the average number of plots per farmer is 1.89. These lands are 91% of the collective and private land and the rest is domanial.

Mechanical plowing, fertilization and the purchase of selected seed are encountered in the majority of farmers. More than 70% of farms use artificial fertilizers, and more than 50% of farmers use natural fertilizers (manure). The number of cattle and sheep is 23.6 small livestock units on average per household. However, more than two-thirds of owners own only flocks below the observed average. The majority of cattle are of local breed, and live all year round in swamps, just like equines. On the other hand, sheep in Merja only 10 months out of 12.

Pick-up stations

At the Nador Canal and during each of the four sampling years (June 2015, August 2015, November 2015 and January 2016), water temperature, pH and conductivity were measured in situ and A water sampling was carried out. This was analyzed within 24 hours of laboratory sampling. The following elements were measured:

- Major ions: Chlorides (Cl^-), Sulfates ($SO4^{2-}$), Calcium ($Ca2^+$), Magnesium (Mg^{2+}), Sodium (Na^+), Potassium (K^+);
- Suspended solids (TSS);
- Metals: Iron (Fe), Copper (Cu), Zinc (Zn), Lead (Pb), Chromium (Cr).

Sampling techniques

During this study 2 types of sampling at each site, depending on the analyzes to be made (Physicochemical analyzes, Analyzes of heavy metals)

- For physicochemical analyzes, water samples were collected and stored in fully filled and hermetically sealed 2 liter polyethylene bottles, the samples were made under very favorable conditions and then placed in a cooler at room temperature. 4C and transported to the laboratory.
- Samples for heavy metal analyzes were collected in 50mL polypropylene tubes, chemically inert with closure caps, previously washed and rinsed with water from the oued and containing 1% nitric acid (HNO3) 65% ISO, Merck, in order to avoid any degradation of the sample during its storage before the analysis. The tubes are placed in a cooler and transported to the laboratory for analysis by Atomic Absorption Spectroscopy (SAA).

However, to avoid a change in some parameters, there were those that were analyzed on the spot, such as temperature, pH and conductivity [3].

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RESULTS

The study of the physico-chemical parameters allowed us to have the results which appear in the following figure.

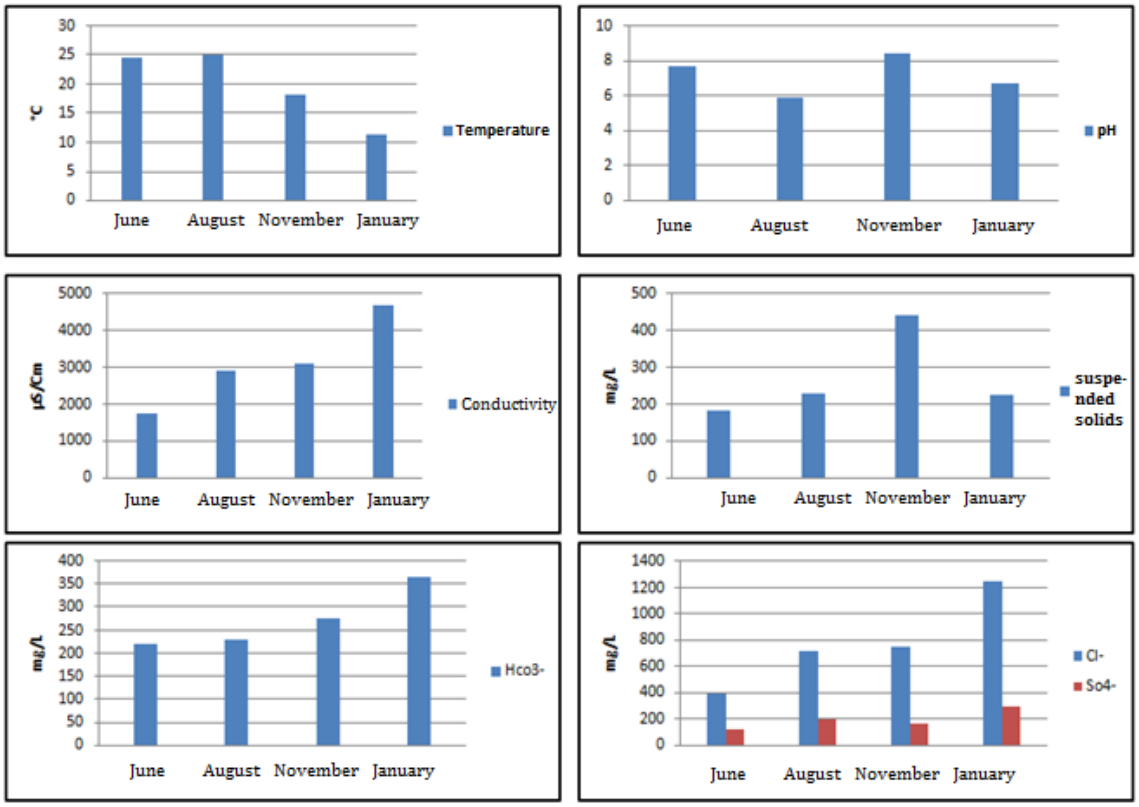

Figure 2 Evolution of physicochemical parameters

Temperature

Monitoring of temperature during the study period revealed a significant seasonal variation, ranging from 25°C during the dry period to 11°C during the cold season (Figure 2). This temperature difference is largely related to the climatic conditions of the region.

The water temperatures of the two wadis, place these waters in the excellent class to good, according to the draft Moroccan standards of the surface water quality grid [4].

The pH

The pH values are between 6 as the minimum value in summer and 8.44 as the maximum value during the cold season, this pH increase may be related to precipitation and runoff.
Nador canal water is favorable to irrigation (6.5 pH 8.5) [5].

Conductivity

Figure 2 shows that the electrical conductivity is very high, the measured values are very high with a maximum value of 4680 µS/cm during the winter season and a minimum value of 1757 µS/cm. This increase is largely due to drainage waters and upstream inputs loaded with nutrient salts.

The suspended solids

The analysis of the results in figure 2 shows that the suspended solids contents fluctuate during the period of study. This fluctuation is marked by high concentrations during the cold season with 440 mg/L at the Canal Nador.

The low suspended solids content was noted during the summer period, 184 mg/L.

The appearance of high levels of suspended matter is subject to high turbidity during the flood period.

It should be noted that the abundance of suspended solids in water reduces the luminosity and causes a drop in dissolved oxygen by slowing the photosynthesis phenomenon. It causes clogging of the soil which is the cause of both a significant decrease in permeability and destruction of the soil structure.

In rivers, TSS can also be responsible for the clogging of river beds and contribute to the siltation of flora and microfauna.

In the light of the results obtained, the Canal Nador water is classified as good to medium according to the draft Moroccan standards.

Complete alkalimetric title (TAC)

These results show that the temporal evolution of total alkalinity (Figure 2) showed marked seasonal variation at the Canal Nador; The maximum concentration of bicarbonates (HCO_3^-) was obtained during the cold season with 366 mg/L and a minimum concentration during the summer with 219 mg/L. The results suggest that high concentrations are necessarily correlated with runoff in flood periods, which leads to an increase in the pH of the receiving medium waters favoring the dominance of bicarbonate ions.

Chlorides and sulphates

Concentrations of chloride ions vary between 390.5 and 1246 mg/L, sulphates are between 124.35 and 296.06 mg/L, this increase in ion content is due to agricultural activity, grazing and Phytosanitary products.

Sodium and potassium

At the Nador channel, the minimum values (Sodium: 215 mg/L, Potassium: 3 mg/L) were recorded in summer and the maximum values (Sodium: 680 mg/L, Potassium: 14 mg/L) Variation is due to the geological nature of the lands crossed by the rivers and to the erosion of the superficial rocks.

Calcium and Magnesium

The results obtained (figure 2) revealed a seasonal variation in calcium (Ca^{2+}) content at the various sites studied. The highest levels are found at Canal Nador, with a minimum value of 47.34 mg/L in summer and a maximum value of 216.43 recorded during cold periods.

At the Canal Nador, the variation in magnesium ion content is remarkable in summer, with a minimum value of 47.86 mg/L, towards winter with a maximum value of 92.42 mg/L.

In all the analyzes performed, it appears that Calcium is more important than Magnesium.

The total hardness, which is only the sum of two calcium and magnesium cations, has a natural character related to the leaching of the lands traversed. It is not easy to define a level between what constitutes hard water and fresh water. However, it can be considered that water with a content of less than 30 mg/L of calcium is soft water and that it is hard water.

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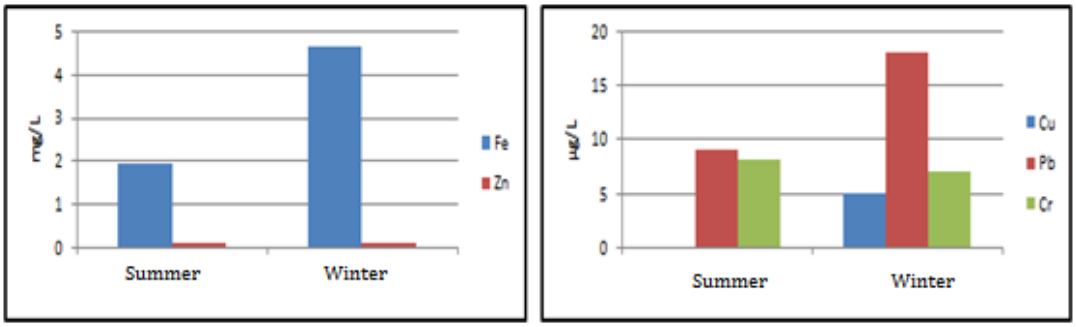

Figure 3 Evolution of the trace metal elements

Metal trace elements

According to the results of the analyzes of the trace metallic elements, it is noted that the contents are low and comply with the standard except for the contamination by iron with 4.63 mg / L in winter, so it can be seen that there is Has a recent contamination by iron.

The presence of these trace metallic elements which are non-biodegradable, even at very low values, poses toxicological risks to the ecosystem due to bioaccumulation.

CONCLUSION

The surface water quality studies of Canal Nador have revealed that the physicochemical quality (temperature, conductivity, suspended matter ...) respects the Moroccan standard, and for trace metallic elements, we have noticed a contamination by iron with 4.63mg/L in winter and also the presence of traces of metal that are non-biodegradable, even with very low values raises toxicological risks to the ecosystem due to bioaccumulation.

ACKNOWLEDGEMENTS

It is essential to deepen the study and gather more information on the quality of surfacewater and groundwater in Merja Zerga and particularly the level of contamination of these ecosystems by elements particularly traces the heavy metals and pesticides and to study the risks associated with their presence, because the population of the zone of study rely mainly on groundwater and surfacewater for their activities.

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