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COMPARATIVE STUDY BETWEEN ENTRY AND EXIT AT THE LEVEL OF THE LACUSTRE "DAYET AOUA" MIDDLE ATLAS MOROCCO

Kenza Bouayad [1]*, Khalid Derraz [1], Nouha El Allaoui[2], Zineb Idrissi [1], Laila El Hanafi [1], Tlemcani Imane[1] Ismail Mansouri[1] and Saad Rachiq[1]

1Laboratory of Environment and Functional Ecology (EFE), Department of Life Sciences, Faculty of Technical Sciences, University Sidi Mohammed Ben Abdellah - B.P.: 2202, Fez 30000-Morocco.

2Laboratory of Electrochemistry, Engineering, Modeling and Environment (LIEME), Department chemistry, Faculty of Sciences Dhar El Mahraz, University Sidi Mohammed Ben Abdellah - B.P.: 2202, Fez 30000-Morocco

Abstract

The objective of our study is the determination of the physico-chemical quality of the waters of the lake and for that we will be interested in the two important points it is the entry and the exit of this last one. Sampling was conducted bi-monthly during the 2015-2016 period.

The parameters measured in situ (T °, pH, conductivity and dissolved oxygen) during this study the lake has basic waters (average values E = 9.06, S = 9.26), the water is very well oxygenated (average values E = 11.43 mg / l, S = 10.01mg / l), the conductivity varies from the input to the output, the average values are respectively 624.4 µs / cm and 441.8µs / cm and the water temperature varies according to the months, it generally follows the ambient temperature which prevails in the medium, average values recorded at the entry and at the exit are respectively (average values E = 16.67 ° C, S = 17, 6 ° C)

In addition, the parameters measured in the laboratory are the nitrogen compounds (nitrates, ammonium and total nitrogen) and the phosphorus compounds (orthophosphate and total phosphorus) have shown that these nutrients are very weak or even trace.

The physicochemical study of the annual cycle carried out at the lake level shows that the latter is in an unpolluted state of equilibrium and with an oligo-mesotrophic trophic state.

Keywords: Dayet Aoua, Entry, Exit, Lake, natural environment, oligo-mesotrophic and physicochemical.

Introduction

Population growth is increasing year by year and therefore water scarcity becomes increasingly horrified.

That is why great importance is attributed to the wet as they have a great interest in maintaining biodiversity.

The Morocco after its location is classified among the most diverse countries in North Africa[1] more it is spread by inland waters involving classified RAMSAR wetlands namely estuaries, lagoons, merjas, dayas, lakes and streams [2].

The Moroccan land where its water resources will accentuate this is the way atlas that has natural, forest and varied hydrogeological reserves which promote the growth of fauna and diverse flora.

Lake Dayet Aoua which is the subject of our study is one of the most important wetlands of the Middle Atlas Moroccan .It a lake system that is known for its sports activities (fishing, hunting ...) [3] for its accessibility, it is an environment threatened by drought because it has already seen several drying period during the past two decades, the lake has experienced three periods of drying: in 1995, 2002 and 2006 [4] following the fluctuation of climatic conditions on the one hand and anarchy of using his other hand waters.

To investigate this lake environment must first of all interested in the quality of the water to get we studied the physicochemical characteristics at the entrance and exit of the lake to make a comparison between the elements physical and chemical to the inlet and the outlet of Lake Dayet Aoua and to know the buffer role playing lake in routing parameters that are influenced by the biological activity of living beings that inhabit it to carry balance in this natural ecosystem.

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I. Materials and Methods

1. Study site

Lake Dayet Aoua is located in the eastern part of the Middle Atlas. Its coordinates are 32 ° 58'N and 05 ° 27'W (topographic map Ifrane) at 49km from the city of Fez, 6 km from the town of Imouzzer Kandar, 18km of Ifrane, 36 Km of Azrou and 75 km from the city of Meknes.

The lake is located to 1460 m with an area of 140 ha, a width of 1255 m, a radius of 3400 m and a maximum depth of 5 m [1].

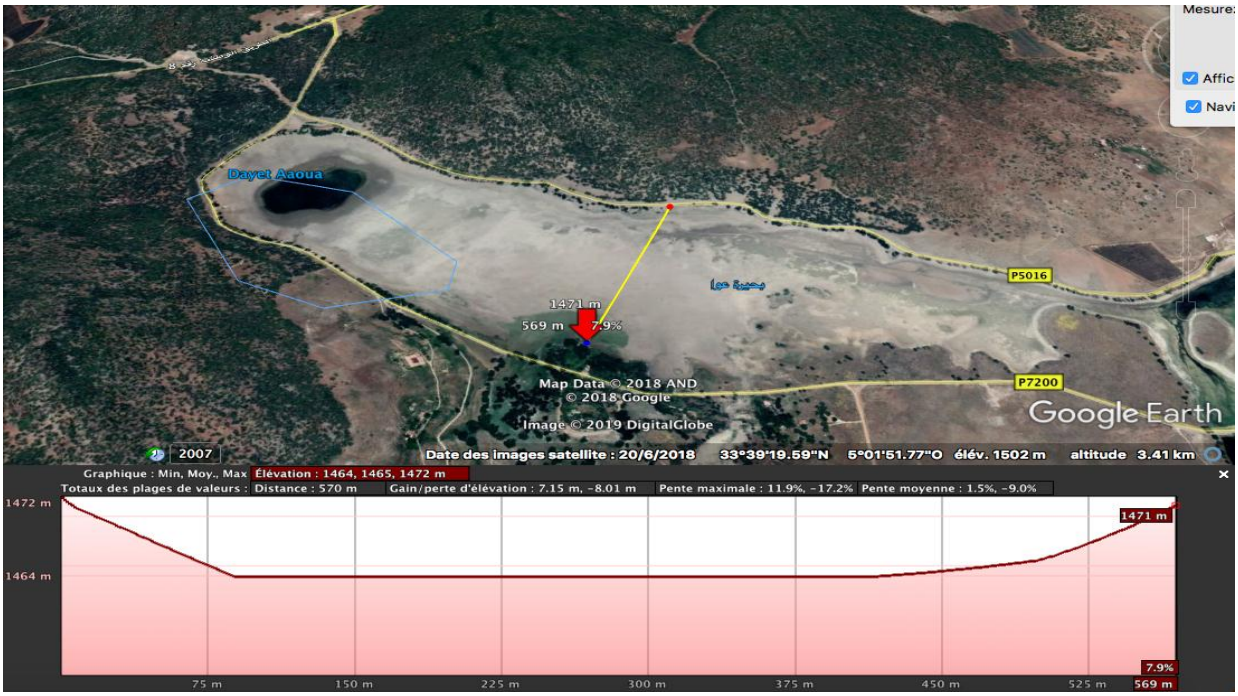

Figure 1: Satellite Location Lake Dayet Aoua (Middle Atlas).

2. withdrawals

The samples were collected between March 2015 and February 2016 ie two samples per month at the entry and exit side of the dike.

The selected sample is of composite type defined as an instantaneous sampling taken biweekly after good agitation of the sample to ensure homogeneity and then store in vials resistant to temperature and humidity, plastic, opaque with a refrigeration system 4C °.

The physicochemical parameters are measured in situ temperature, conductivity, pH and dissolved oxygen (thermometer, pH meter, conductivity meter and oximeter). Ammonium ions, nitrate, nitrite, orthophosphate, total nitrogen and total phosphorus are determined according to standard methods described in RODIER[5].

II. Results and Discussion

1. Temperature

The water temperature varied from 8.9 ° C to 27.4 ° C at the inlet of the lake and 9.1 ° C to 27.4 ° C at the outlet (Figure 2). This temperature generally follows the ambient temperature prevailing in the area of the lake as it is for input or for output over temperature is a factor affecting the kinetics of chemical and biological elements[6] The found results show that there is a range of variation between the cold season and the hot season.

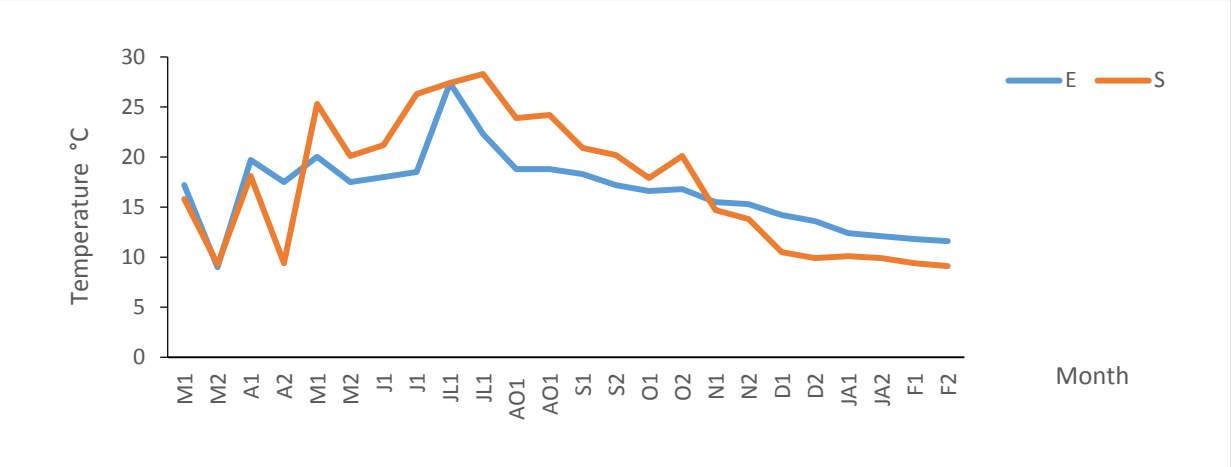

Figure 2: Temporal variation in water temperature at the inlet and outlet of Lake Dayet Aoua during the year 2015-2016.

2. Hydrogen potential

The pH ranges from 7.83 to 10.7 at the entrance and 8.03 to 10.3 to the dam .L'expression results mounts that the pH of the water tends to alkalinity as the vast majority of lakes of the middle atlas, where the lake Ifrah[7] and Iffer [8]This is due to the nature of calcium and magnesium carbanoto- bedrock [9] the similar results were found in the lake by ourselves [10] and previous work [11] [12].

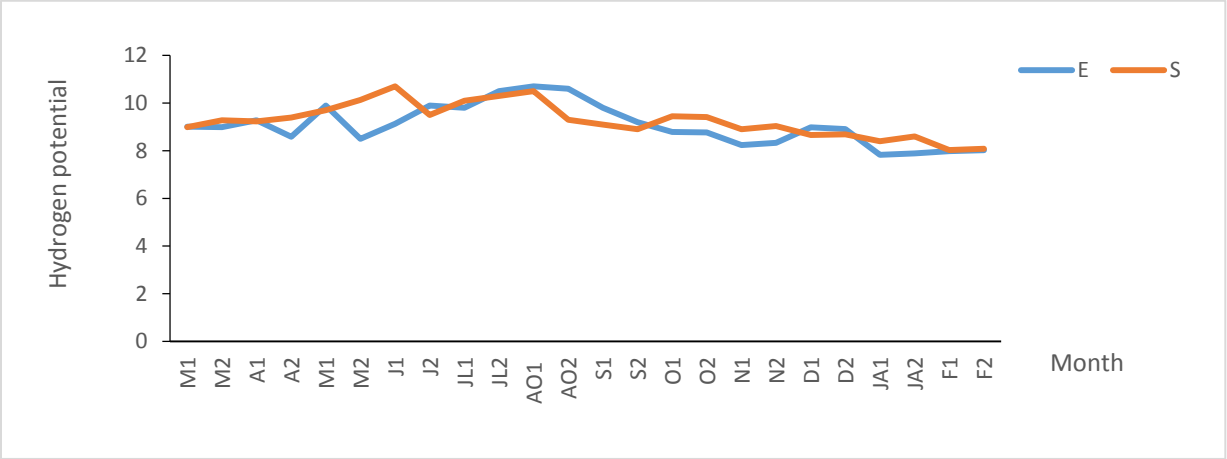

Figure 3: Temporal variation in the pH at the entrance and exit of the lake Dayet Aoua during the year 2015-2016.

3. Conductivity

The electrical conductivity recorded during the study period ranged from 560-658 microseconds / cm at the inlet and 312-584 microseconds / cm to the output, we see a large amplitude between the results recorded at the entrance and the output as the input conductivity is influenced by changes in the river flow of the main tributary (wadi El Kantra) besides the lake as buffer medium plays its role when declining mineralization the output.

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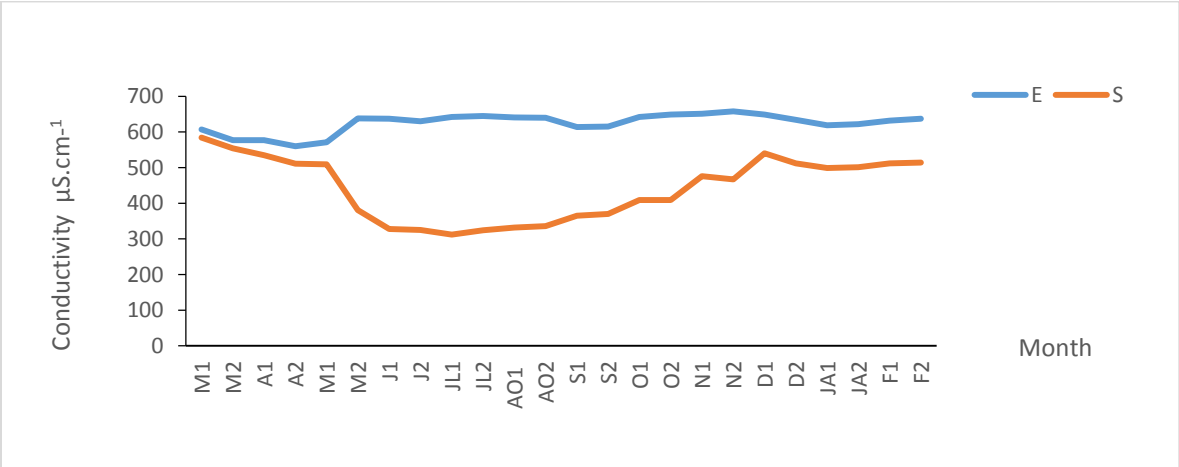

Figure 4: Temporal variation in conductivity at the inlet and the outlet of Lake Dayet Aoua during the year 2015-2016.

4. dissolved oxygen

Dissolved oxygen is considered as the main component because it determines the status of several mineral salts, degradation of organic matter and the lives of aquatic animals. [11] Moreover it is a key factor that is considered of excellence in water quality indicator. Its content provides information on the degree of pollution and consequently on the degree of self-purification of rivers.

Dissolved oxygen ranged from 7.3 mg / L to 20.02 mg / l at the input the minimum value is recorded in months of August and 4.8 mg / L to 15.77 mg / l at the output.

The difference observed between the inlet and the outlet is due the photosynthetic activity of aquatic plants and the wildlife that inhabits the lake.

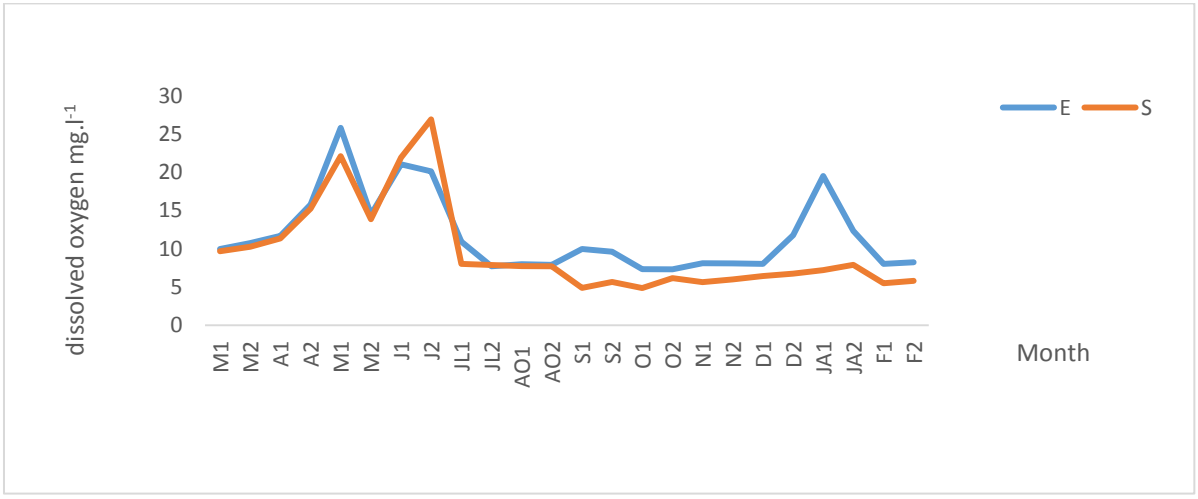

Figure 5: Temporal variation of dissolved oxygen in the inlet and the outlet of Lake Dayet Aoua during the year 2015-2016.

5. nitrogen elements

The average values recorded for nitrites, nitrates, ammonium and total nitrogen to the inlet during the sampling campaign are respectively (0.008 mg.l-1: 0.436 mg.l-1, 0.0128 mg l-1; 0.076 mg.l-1) and for outputting the stored values are respectively

(0.034 mg.l-1; 0.276 mg.l-1; 0.016 mg.l-1; 0.103 mg.l-1).

In general the levels of nitrogen element are low or even in trace amounts as reported by[13] We see that there is an amplitude between the data recorded in the levels of the input compared to stored data to the output this is due to the degradation process of organic matter by vegetation and environment around the lake, and that living home in this natural ecosystem ie microorganisms, phytoplankton community and the zooplankton community.

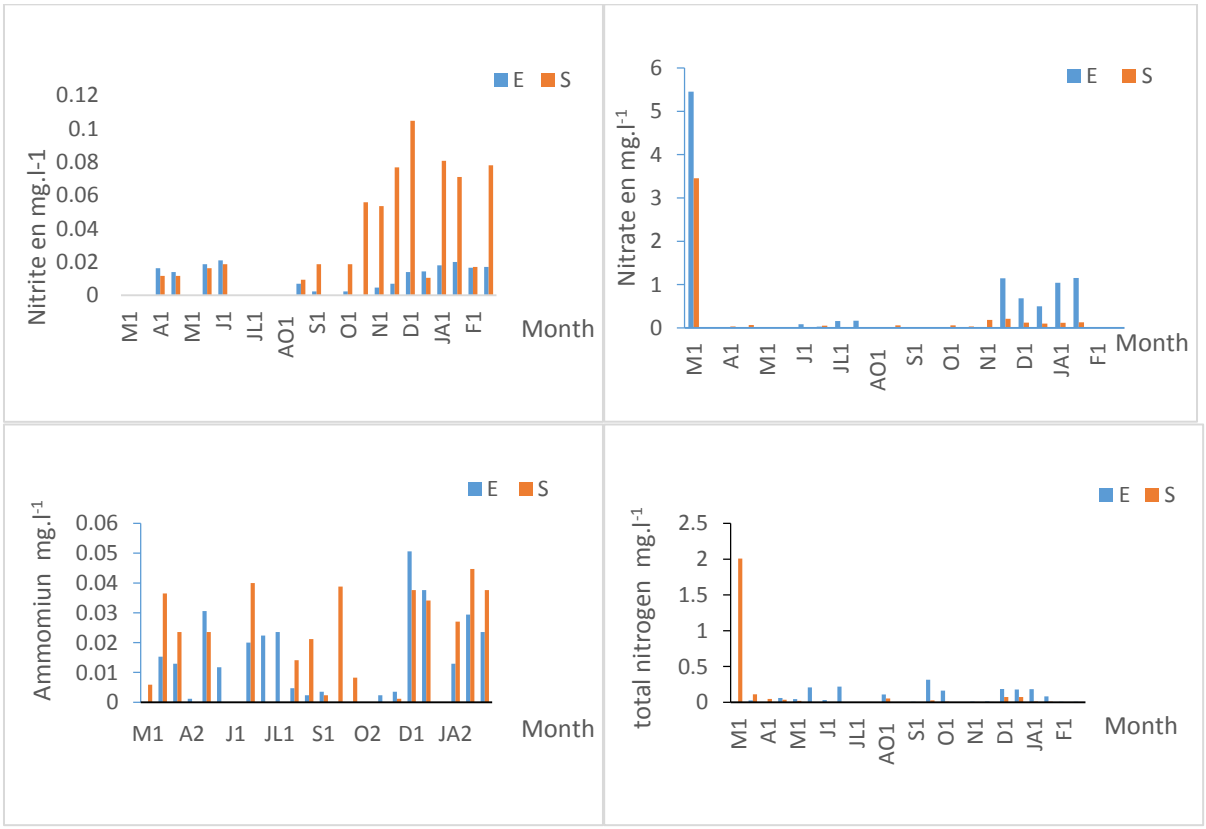

Figure 6: Temporal variation of the nitrogen levels in the inlet and the outlet of Lake Dayet Aoua during the year 2015-2016.

6. phosphorus elements

The concentration of orthophosphate average obtained at the input level is (Mg.l-1 0.02 ± 0.03) and the average recorded towards the outlet is (0.008 ± 0.01 mg.l-1).

For total nitrogen the average recorded at the entrance is (0.01 ± 0.02 mg.l-1) and the outlet (0.009 mg.l-1 ± 0.010).

The increase noted in the output during the month of July is due to washing practiced by the inhabitants of neighboring douars next to the dam in the summer season and the increased

orthophosphate value at entry compared to that of the output in the winter season is due to heavy rains in the Atlas area.

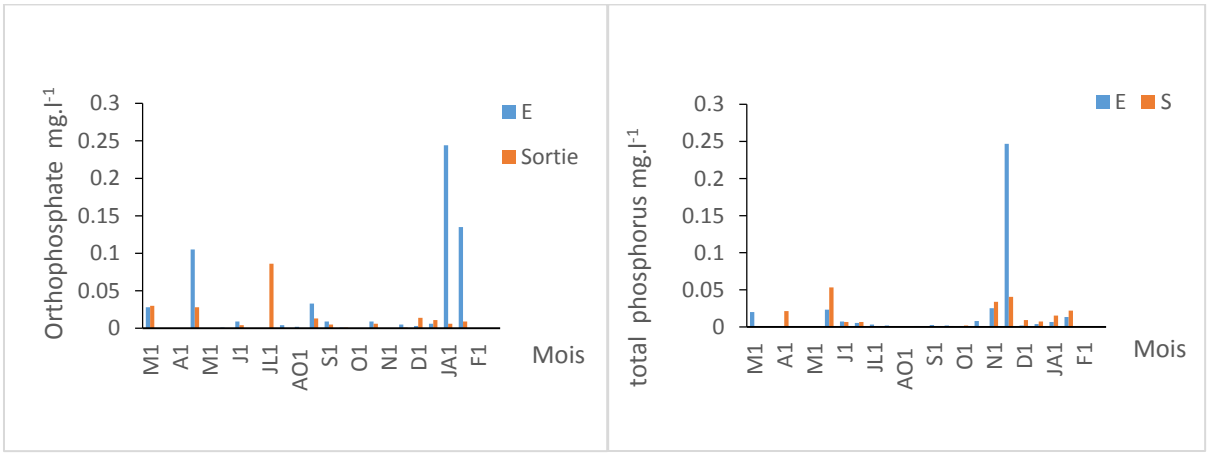

Figure 7: Temporal variation of phosphorus levels in the inlet and the outlet of Lake Dayet Aoua during the year 2015-2016.

III. Examination Statistics

1. analysis of variance (ANOVA)

ANOVA is a method used to evaluate the results of experiments carried out. The overall objective of this analysis is to test the significant differences between the averages of several independent groups. The ANOVA aims to analyze the total intra and intergroup variance to get an idea about the significance either separately or jointly[14].

Table 1 shows the results of the ANOVA test bi varied fixed pattern applied to each of 10 abiotic variables measured at the entrance and exit of the lake Dayet Aoua during the sampling campaign effect between March 2015 and February 2016.

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Table 1: Analysis of variance

parameters	**Season**		
	F	P value summary	significant
Temperature	7.048	0,000 P <0.0001 ***	*Yes*
pH	4,028	0,001***	Yes
Conductivity	63.01	0,000 P <0.0001 ***	Yes
Dissolved oxygen	6.264	0,000 P <0.0001 ***	Yes
total nitrogen	23.55	0,001***	Yes
Nitrite	1,233	0.309	No.
Nitrate	45.222	0,000 P <0.0001 ***	Yes
Ammonium	7.822	0.05*	Yes
orthophosphate	1,030	0.473	No.
total phosphorus	1,578	0.139	No.

p> a = 0.05 (ns) differences not significative

p <a = 0.05 (*) differences just significatives

p <a = 0.01 (**) differences highly significatives

p <a = 0.001 (***) very significant differences

F: F value of Fisher

The ANOVA results recorded show results that are meaningful through the season that is the time factor influences these last: temperature, pH, conductivity, dissolved oxygen, total nitrogen, ammonium nitrate and. Indeed the observed significant differences related to the metrological conditions that reign in the middle next month, by cons for nitrite, orthophosphate and total phosphorus do not vary significantly with time their variation is autonomous, ie independent of time this can be explained that nitrite is an unstable form that rapidly converts to nitrate and phosphorous elements are influenced by the laundry done by the inhabitants of neighboring douars.

2. main correspondence analysis (PCA)

The main correspondence analysis aims to visualize and analyze correlations between the different variables and concentrate the information linking the variables with the main

factors[15]We statistically processed all the data by the Principal Component Analysis (PCA) by SPSS software.

Figure 8 shows respectively the correlations between the measured parameters and the axes (F1 and F2). Both axes explain 44.45% of the information contained in the data matrix. Based on the criterion of Kaiser who said during an ACP this measure provides a comprehensive overview of the quality of inter correlations items, the KMO index was 0.3 (Table 2) then we can judge that correlations between the items is quite good as represent the correlation matrix for the sphericity test result is significant Bartlet(P <0.0005).We can conclude that correlations are not all equal to zero, the variables are dependent on each other.

Table 2: Index of KMO and Barlett test

sampling precision measuring Kaiser-Meyer-Olkin.		340
Bartlett's test of sphericity	Chi-square approximated	517.250
	dOF	190
	Meaning Bartlett	, 000

The variables involved in the formation of the axis F1 are the temperature at the inlet and the outlet and the pH at the inlet and the outlet and negatively and the nitrite at the inlet and the outlet . The results are respectively TS (0.94), TE (0.86), Phe (0.85) and pHS (0.84) and they oppose on the same axis nitrite (-0.80) nitriteE (-0.60) axis represents 27.18% of the inertia.

As against the S nitrate (0.95), nitrate E (0.91) and total nitrogen (0.95) more positively contribute to the formation of the second component, this axis represents 17.26% of the overall inertia.

Consolidation and positioning of the variables in the circles of correlations enables us to distinguish three groups of variables, on the plane of the first 2 factorial axes of the ACP of a matrix "Season-physicochemical characteristics' we observe that there is a strong correlation

between temperature and pH, and this is related to the climatic conditions prevailing in the environment and the relationship with nature calcium and magnesium carbonate-of rock. Component 2 is characterized by the variable nitrate and total nitrogen or coefficients are greater than of the order of 0.9 is unstable nitrogen which play a crucial role in the cycle of the fauna and flora which people Lake Dayet Aoua .

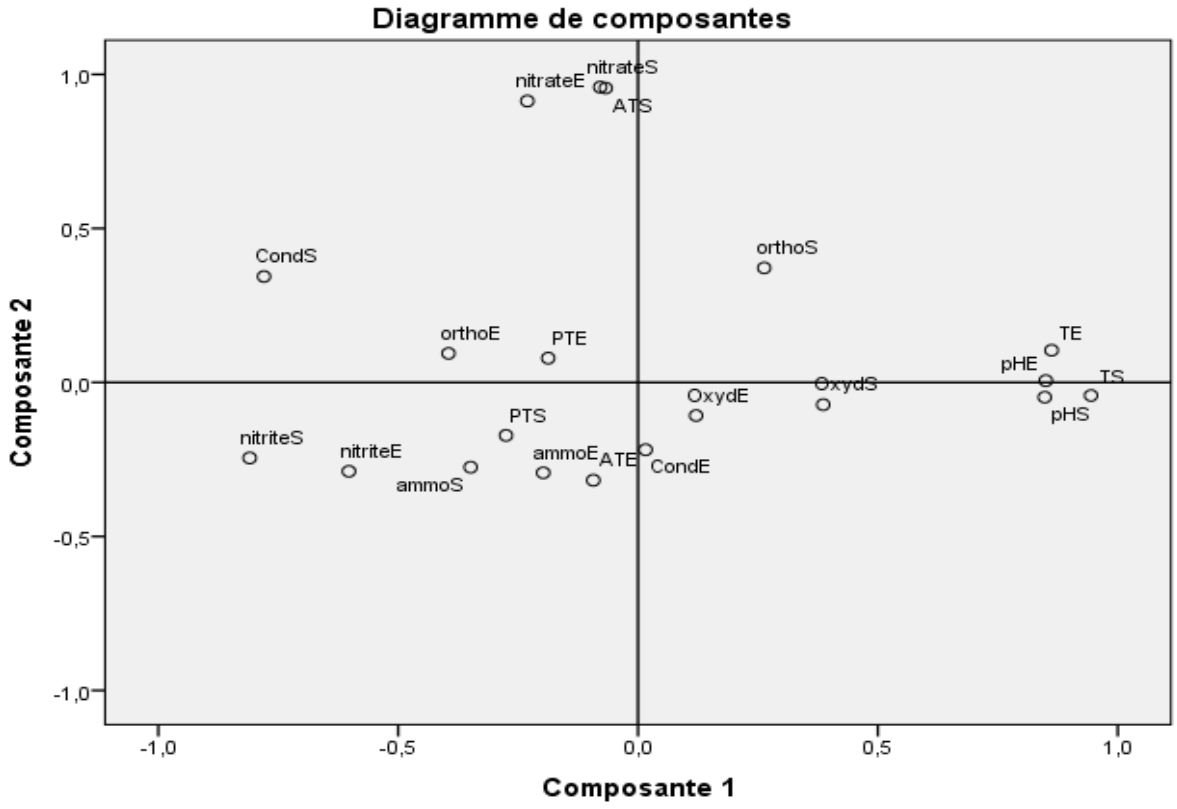

FIG: 8 Distribution of physicochemical parameters of the factorial design of the ACP (C1 x C2), E = input, output = S, T = temperature °, Cond. = Conductivity oxidised = dissolved oxygen, pH = potential hydrogen, ammo = ammonium nitra = nitrates, nitrites = nitrile, AT = Total nitrogen = ortho ortho phosphates, PT = total phosphorus.

Conclusion

This work therefore provides some interesting observations on a set of parameters measured it either in situ or laboratory confirming the serenity of the input source from Lake Dayet Aoua influenced by the main tributary Wadi el Kantra level of phosphorus and nitrogen elements there is low levels or even see a trace and this is confirmed even in the middle of the lake [16].

Furthermore this comparative study between the input and the output of lake system Dayet Aoua shows the essential importance of the buffer role that plays in the lake survival of aquatic communities and maintaining the balance of wetlands. But unfortunately this anarchy in use by pumping or irrigation leads to frequent drying up of this natural environment is an urgent call is for agencies responsible for legislation and good management.

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