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Study of phytoplankton in the lake reservoir EL Kansera (Khémisset- Morocco)

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Abstract:- This study focuses on a deep aquatic ecosystem, the lake dam EL Kansera which is taken a lot of water for irrigation and drinking water supply (AEP) and two cities Kemisset Tiflet. It aims to study the evolution of the phytoplankton community to understand the eutrophication in this Moroccan lake ecosystem. Phytoplankton was followed for two consecutive years 2008 and 2009 marked by climatic variations.
During the first year of study, the algal peak is in autumn-winter (110,214mg / l in September) and is dominated by biomass Closterium aciculare Var.Subpronum. Chlorophyll has reached a maximum of 9 mg / l. The following year the algal population is more diverse, following environmental enrichment in nutrients: diatoms (Cyclotella sp and Melosira granulata).
Environmental variables (climate, water physical chemistry and exogenous inputs Wadi Beht particular) seem to govern nearly phytoplankton succession in the reservoir El Kansera.
Depending on the model of O.C.D.E (1982), the restraint moves from one stage hypereutrophic in 2008 to a eutrophic stage in 2009.

Key Words: Phytoplankton, diatoms, Chlorophyceae, biomass, chlorophyll, Lake reservoir, eutrophication, EL Kansera Morocco.

I. INTRODUCTION

The development of algal populations is governed by chemical, biological (predation, competition ...) and physical [1,2]. These parameters play a more or less important role depending on the time of year, resulting from fluctuations in the composition and abundance of the algal flora. Good management of a reservoir-lake so requires, among other things, knowledge of the seasonal distribution of phytoplankton [3]; it was studied in the dam retaining El Kansera (northwestern Morocco), in conjunction with other approaches [4, 5, 6, 7]. In this work are presented and analyzed seasonal variation in density and algal biomass (wet weight) of phytoplankton; This in connection with certain abiotic parameters such as climate, nutrient availability and contributions of immigrants Wadi Beht upstream of the reservoir. In conclusion, these results are used to determine the trophic status of the restraint during the study period.

II. DESCRIPTION OF THE SITE

El Kansera restraint, hot monomictique Lake (photo 1), located in the northwest of Morocco (34 ° OO'N, -555 'W) in the Beht basin 40 km from Meknes (Fig. 1), is a platform basin north to south. It presents a very contrasting hydrology with a corresponding capacity of 265.8 million m3 has an area of 18 km2 at the normal filling level. Its average depth is 16.5 m and the deepest point is 28.5 m. This basin, very low vegetation cover, is made up of marl Miocene hills crossed by a valley running north. At the point of narrowing of the valley on an anticlinal ridge of Jurassic limestone of prérifaine area, was built the dam in 1935 to ensure support of low water and clip the flood Wad Beht last tributary of the Sebou river. The importance of this work lies also in the supply of two cities (Khemisset and Tiflet) in drinking water (Fig. 1). The main features of the retainer are shown in Table I.

Photo 1: Lake Photography Reservoir EL Kansera.

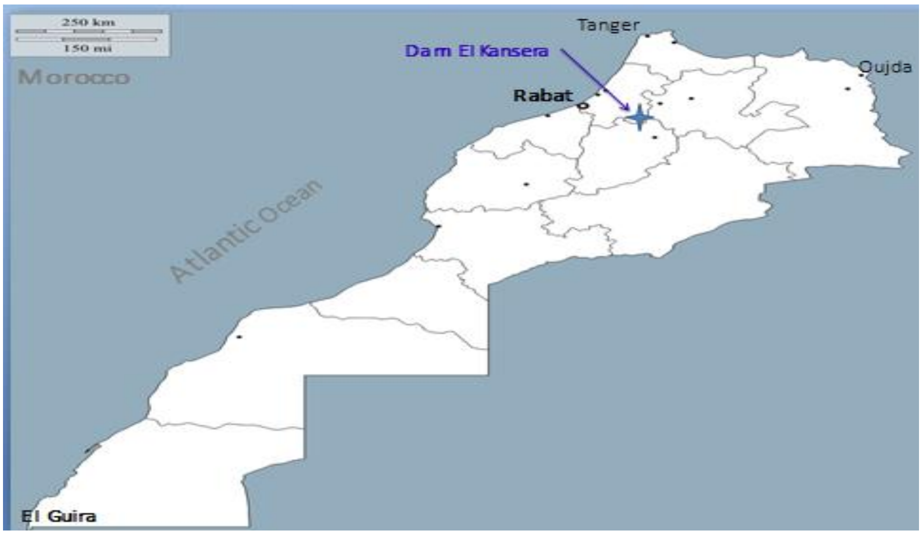

Figure 1: Location of the lake-reservoir El Kansera

III. METHODOLOGY

Samples were made between February 2008 and Septembre2009. These samples were collected using a vertical column type Van Dorn capacity of 5 liters. The attachment of algae was conducted in 5% neutral formalin and then the Lugol. The counting of algae was performed inverted microscope method. [8] Biomass is expressed as fresh weight. The physicochemical analyzes of water were performed according to the standards, the laboratory of the station. Transparency and photic zone were estimated from the disappearance of the Secchi disk. [9] Nitrates and ammonium ions were measured by colorimetry, respectively reduction of Cadmium column nitrites and indophenol blue. [9] Total phosphorus was measured on raw water after acid mineralization in, and the silica in the presence of ammonium molybdate [9].

Table 1: morphometric characteristics of the lake-reservoir El Kansera (according Derraz, 1995 and the National Directorate of Meteorology of Morocco).

Year of water in	**1935**
Drainage area	4500 km^2
Province	Khémisset
function	Electrical energy Potable water Irrigation
Type	Béton poids et contreforts
Concrete weight and foothills Crest length Height foundation Area of the water body	68 m 170 m 18 km2

Average length		14 Km
During the 2008-2009 period		**(min - max)**
changes:	the retention volume (Mm^3/months)	(67 - 267)
	Volume of inputs (Mm^3 /months)	(5 - 200)
	Restitution (Mm^3 /months)	(2 - 40)
	Water residence time (months)	(1,7 - 22)
	Maximum depth (m)	(5 - 23)

IV. RESULTS AND DISCUSSION

4.1. Physico-chemical characteristics of water

4.1.1. Level of the water body

The low rainfall in 2008 result in a reduction accused of fluid intake and consequently the volume of the reservoir (fig. 2); which indicates a net decrease in the level of the water. Conversely, in 2009, the heavy rainfall and flooding of Wadi Beht lead to a significant rise of the water level.

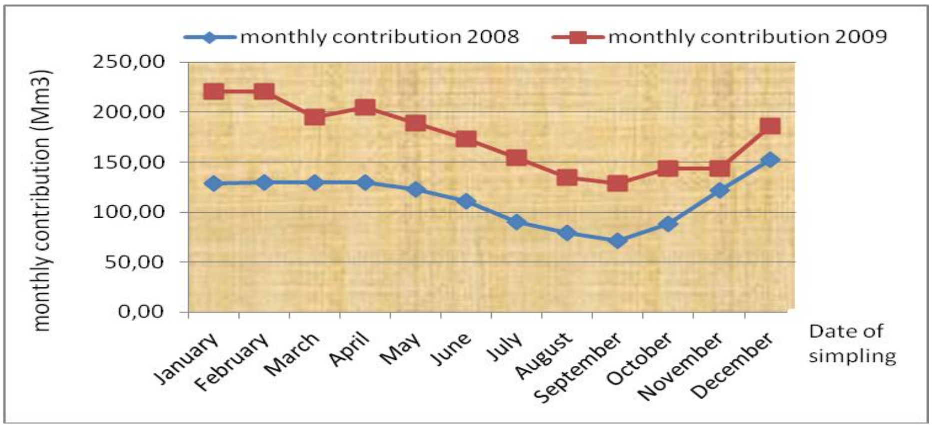

Figure 2: Seasonal Variations contributions for restraint El Kansera

4.1.2. Temperature, pH and Dissolved Oxygen

Lake Reservoir El Kansera is a hot monomictique lake, characterized by a single period automno-winter blend and a summer thermal stratification period; it starts right from the month of April and ends in September (Fig. 3). The maximum difference between the surface and the bottom of 13.1 ° C was recorded in June 2009, due to better retention filling in that year. This temperature difference is similar to that of other deductions Moroccan [10, 11], but is higher than that seen in some lakes in temperate climates [12] or hot (Lake Victoria year the equator, quoted by [11].

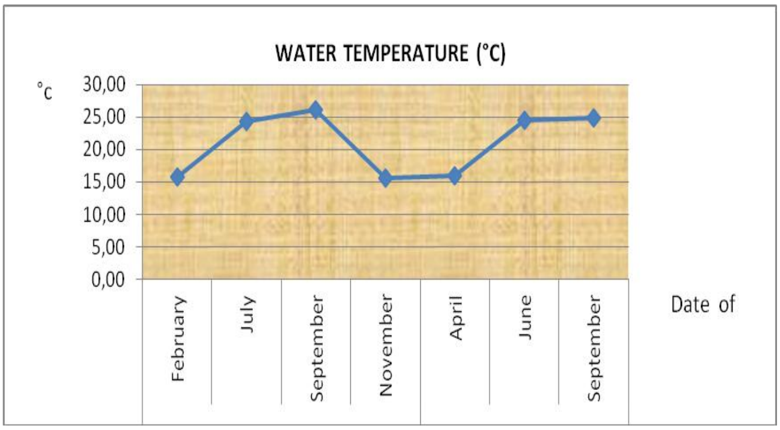

Figure 3: Vertical profile of temperature in the reservoir El Kansera during the study period.

The pH of water is alkaline and varies between 8 and 8.6 (Fig. 4). The maximum values are observed at printano-summer seasons, in surface waters where the photo-synthetic activity is more intense. Aquatic plants consume dissolved CO2 (respiration) and move the calco-carbonic balance. This phenomenon tends to reduce the concentrations of H ions and causes the pH increase. According to [13] the pH of the water is good indicator of photosynthetic activity.In general, the change in pH in this body of water has a basic trend. A seasonal variation was recorded, which may be due to different inputs from rainfall and leaching and the nature of the crossed [14, 15] often associate the pH to an assessment of the trophic status of water: an acid lake is oligotrophic, a neutral body of water is mesotrophic and an alkaline lake is eutrophic.

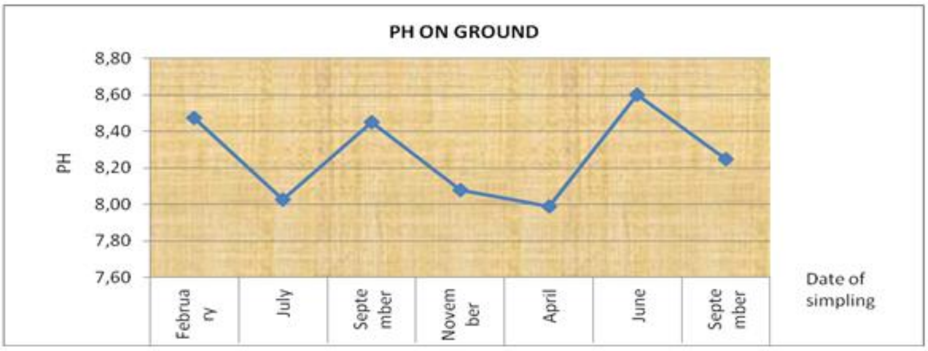

Figure 4: Seasonal Variations pH of the reservoir during the study period

The seasonal evolution of dissolved oxygen in mg / l (Fig. 5), indicating a supersaturation of the surface layers during spring and summer of each year, with a peak of 8.90 mg / l in June 2009 . This maximum is linked to intense photosynthetic activity in surface waters. Meanwhile, the bottom waters suffer gradual oxygenation, leading to the installation of a near-anoxic layer with a minimum of 3,17mg / l in September 2009. This désoxygénation is the result of intense bacterial activity in bottom waters. Such a profile is characteristic of eutrophic lakes. [16] The stirring period results in complete reoxygenation more or less of the whole mass of water.

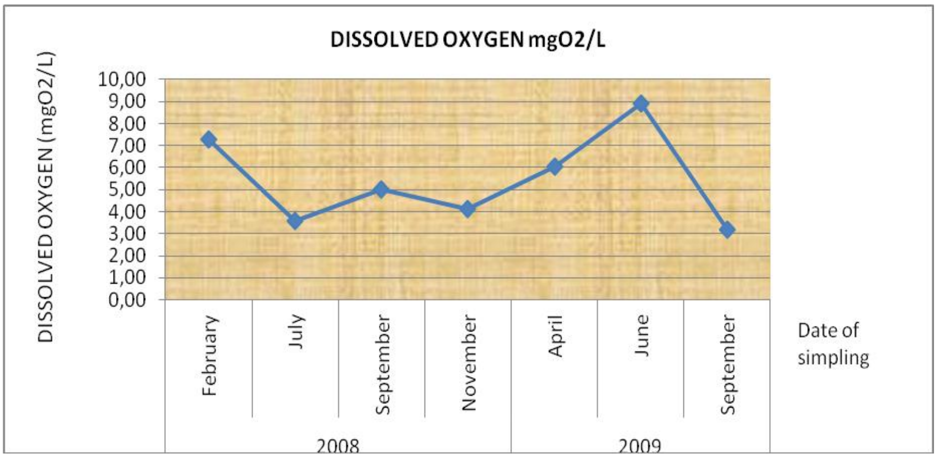

Figure 5 : Seasonal Variations of oxygen dissolved in the restraint during the period of "study

4.1.3 Nutrients

The levels of nitrogen and phosphorus nutrients have significant fluctuations in the reservoir. Concentrations of nitrate (N03), constituting the highest proportion of total nitrogen, vary with the seasons and the levels of the water column (Fig. 6).

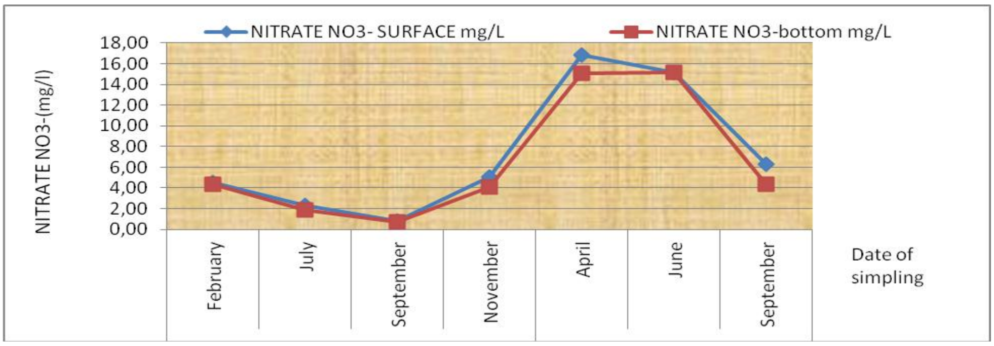

Figure 6: Seasonal variations of surface nitrate levels and the bottom of the retention during the study period.

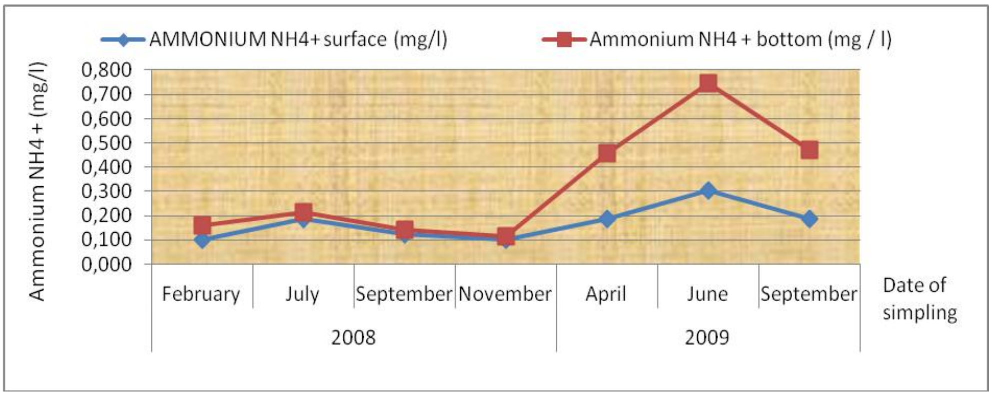

Figure 7: Ammonium NH4 Seasonal variations in surface and bottom of the reservoir during the study period.

In spring-summer 2009, the significant increase of nitrates in surface waters coincides with the development of diatoms particularly the two species Cyclotella sp & Melosira granulata, while low concentrations in bottom waters are due to their reduction. The synchronous appearance of a peak of ammonium ions (fig.7), mark this reduction in oxygenated hypolimnion. Meanwhile, a slight enrichment of total phosphorus in water is recorded (Fig. 8). Leaching of the watershed caused by torrential rains and flooding of Wadi Beht pour a significant amount of nitrogen and phosphorus nutrients in the lake; nitrate levels reach a maximum of 17 mg / l in April, while those of the phosphorus remain relatively low for most of the year. In fact, throughout the year, large amounts of phosphorus are stored in the sediment by precipitation and adsorption on hydroxyapatite particles in suspension [17]. But in summer anoxia prevailing in the end recess results in reduction of phosphorus and its release into the water column. This is the phenomenon of release, causing the peak PT in this season.

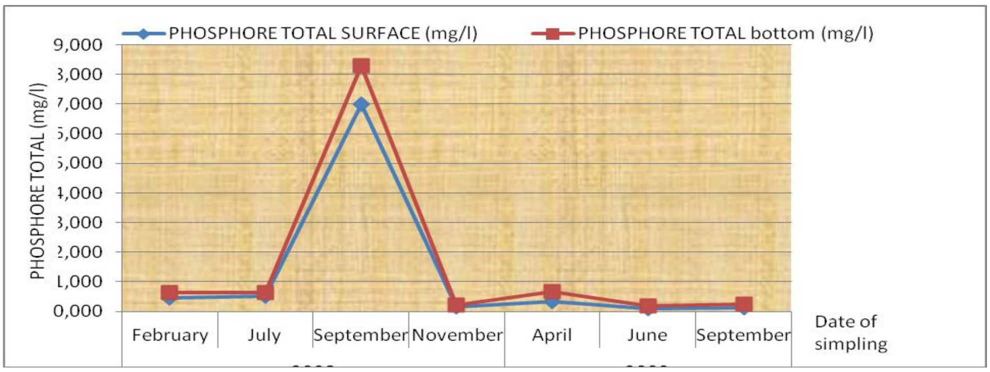

Figure 8: Seasonal variation of total phosphorus in surface and bottom of the reservoir during the study period.
The levels of silicate that oscillate between a minimum of 4 mg / l and a maximum of 12 mg / l,(Fig.9) show no significant seasonal variations; this element compared to other Moroccan reservoir lakes [18], would not be a limiting factor for the growth of algae (diatoms) in the reservoir.

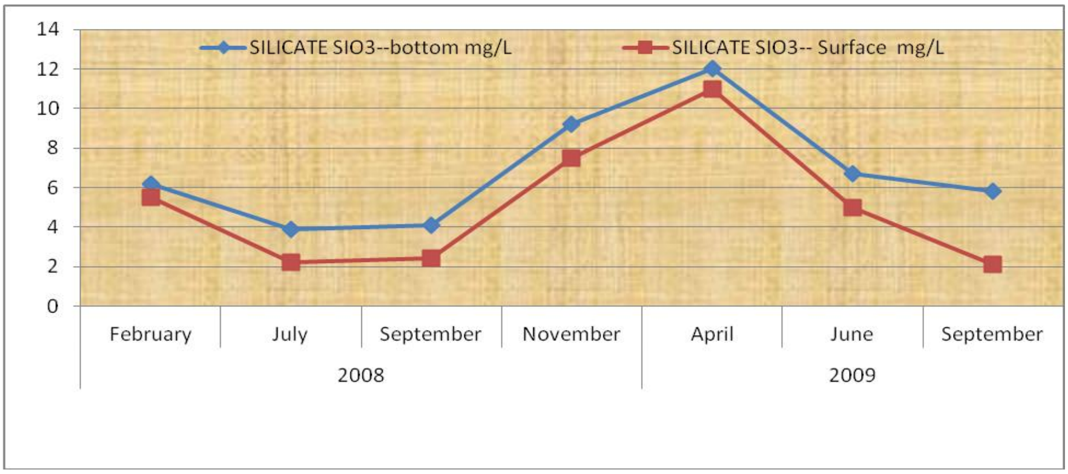

Figure 9: Seasonal variation of SiO3 silicate surface and bottom of the reservoir during the study period.

4.2 Evolution of the overall seasonal phytoplankton

4.2.1 Seasonality of algal biomass

The evolution of the algal biomass in the photic zone indicates significant temporal variations. The year 2008 was characterized by two algal outbreaks (163,28mg / l in July and 110.21 mg / l in September). They are mainly related to the development of diatoms and Chlorophyta (fig. 10). Dice the following spring (April), two new outbreaks algal apparaient Cyclotella sp (36112.512 mg / l) and Melosira granulata (6185,8mg / l) (fig. 10).

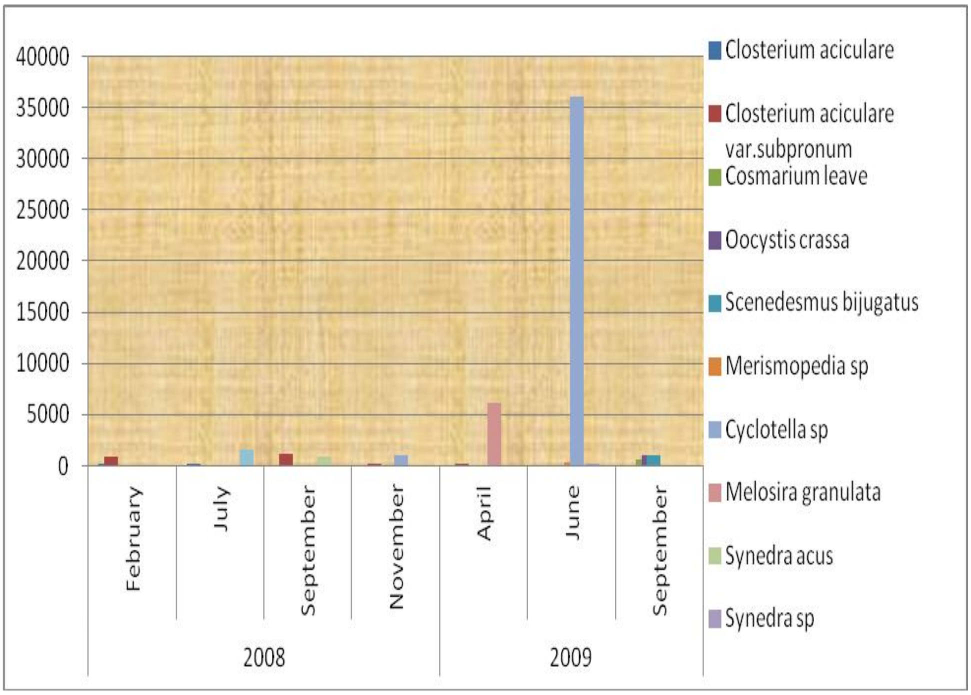

Figure 10 : Successions time major algal species (expressed as fresh weight) in the photic zone of the reservoir during the study period.

The increase in spring temperatures (Fig 3) and environmental enrichment in nutrients (fig.6.7.8) after heavy winter rains, this would stimulate algal development. In addition, the increase in water transparency in this season would promote the development of Cyclotella especially at sun-loving character recognition [18].

Thus the growth of the diatom Cyclotella sp seems to be governed by several factors in the reservoir El Kansera in particular the temperature, availability of nutrients (nitrogen).

4.2.2. Seasonal variation of chlorophyll a.

Seasonal changes in chlorophyll a in the photic zone follows more or less that of the algal biomass. A relatively high correlation was found between these two parameters. The printano-summer peaks of chlorophyll often coincide with particularly diatoms Synedra Ulna and Chlorophyceae particularly Closterium acicular Var. subpronum for example, the peak of 9mg / l of chlorophyll in September 2008 coincides with that of Closterium aciculare Var. Subpronum. Conversely, chlorophyll minima correspond to the decline of the algal community. However, some discrepancies appear, especially during 2009: in spring, for example (April), low levels of chlorophyll are recorded (3 mg / l), despite a significant algal outbreak. This discrepancy seems to be related to changes in the cellular chlorophyll content which depends particularly on the cell density [19, 20], cellular nutrient quotas [21, 22] and light conditions (high light results in reduced cellular chlorophyll content). A similar situation was observed in the 1st Hassan restraint in southern Morocco. [18]

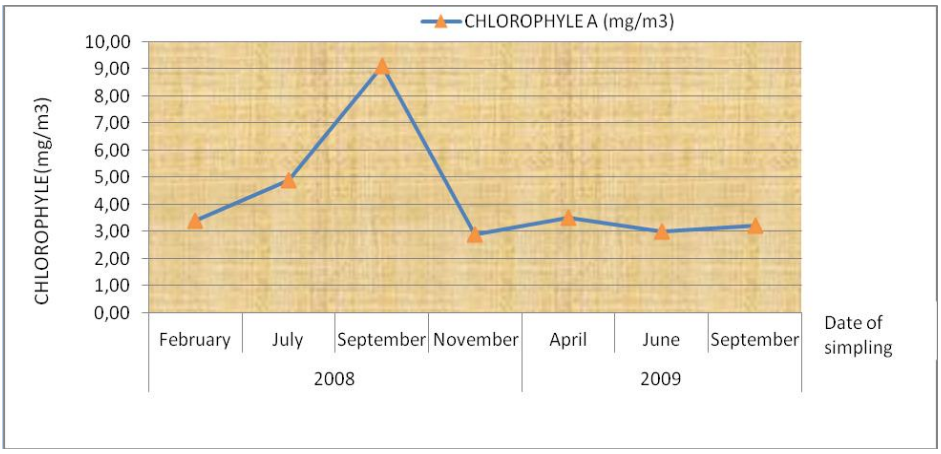

Figure 11. Seasonal Variations of chlorophyll a (mg / l) in the photic zone of the reservoir.

V. CONCLUSION

1. The study of some physicochemical parameters of the dam El Kansera it possible to characterize the overall state of water, for two consecutive years 2008 and 2009.
2. The results obtained in this study shows that the dam El Kansera is an ecosystem conducive to the proliferation of species that prefer environments rich in nitrogenous compounds (diatoms and chlorophyceae in our case) The succession of phytoplankton populations is largely conditioned by the physical and chemical parameters; this is so in many lakes and reservoirs [7].
3. Environmental enrichment in nitrates (rainy lessivage watershed and flood the river Beht) is the origin of a specific algal diversification and the emergence of new groups of phytoplankton, especially diatoms (Cyclotella sp and Melosira granulata).
4. Taking into account these résultats, the trophic status of the lake-reservoir El Kansera determined from phytoplankton associations [23, 24] and biomass parameters [25, 26] evolves from one year to the next; usually it is eutrophic. The climatique impact seems to play a role in the evolution majeur the water quality of this restraint.
5. Future studies should allow a more precise approach of existing interactions between phytoplankton compartment and adjacent levels of the food web and the impact of physical and chemical parameters. The rapid development of phytoplankton communities in response to environmental change reinforces the interest of their ecological monitoring because of the importance of this dam from the viewpoint of these plural uses.

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