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ECOLOGICAL STUDIES OF THREE WEST ALGERIAN RIVERS: THE RIVER TAFNA AND ITS TRIBUTARY THE RIVER REMSHY

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Abstract:

Limnological studies of Tafna Watershed were carried out on aquatic bodies of the coastal north-west Algeria. Tafna Watershed near the Morrocan boarder was chosen, two sampling sites were appointed out in this investigation, on Beni-Saf, the River Tafna, a river of 110Km long and one of its tributaries, on Telemssan, the River Remshy. Samples were taken monthly during 2 years (1986-1988), during which the phisco-chemical were studied. The lowest air (15°C) and water temperatures (10°C) were recorded in January and the highest (30°C) in September for both air and water temperatures. The hydrogen ion concentration investigation samples were slightly alkaline lying between (pH7.5 and 8.6). Electrical conductivity (EC) values ranged between 56 and 4,960 µS cm^{-2}; being higher in the River Tafna than in the River Remshy. Dissolved oxygen (DO) values showed that the River Tafna and River Remshy were both well oxygenated (7.5-13.6mg l^{-1}). The minimum biological oxygen demand (BOD) value was recorded (2mg l^{-1}) in September and maximum (7.8mg l^{-1}) in May. Dissolved Organic Matter (DOM) values ranged from 5.09 mg l^{-1} in July and 11.78 mg l^{-1} in March. Suspended solids (SS) were high during the warm months and low in the cold months with a negative correlation with water turbidity WT. Average values of total residue (TR), fixed total residue (FTR), volatile matter (VM), total hardness (TH), calcium hardness (CaH) and silica (SiO3-Si) were higher at the River Tafna than at the Tributary River Remshy. While the average values current velocity (CV), water turbidity (WT), dissolved oxygen (DO), oxygen percentage saturation (OPS), biochemical demand (BOD), magnesium hardness (MgH), chloride, inorganic nitrogen contents and phosphorus were more at the tributary than at the river. Increase the chloride was coincided with increase of EC and DO at River Tafna. Total, calcium and magnesium hardness had a negative correlation with TR, FTR and VM. The contents of the three later parameters, DO, OPS, BOD, SS, and DOM were high during the cold months and low during the hot months at the study period. Fluctuations were likely to be more at river rather than at the tributary.

INTRODUCTION

An initial study was carried out to determine limnological conditions in the three main watersheds in western Algeria, which occupy the cultivated lowlands near the Mediterranean Sea, and which had not been studied before.

Gagneur and Kara (2001) mentioned in their limnological review in Algeria the following statement: "Needless to say that very few physicochemical or physiographical indications were collected. Physicochemical investigations in water composition are ancient, scarce, incomplete, and rarely exhaustive". Samraoui et al (1998) studied on fauna from coastal wetlands in northeast Algeria. More details of other northwest Algerian investigations were achieved by (Al-Asadi, 1991; Al-Asadi, *et al.* 2006a and b).

This paper deals with the environmental factors of the Tafna Watershed (the Tafna River its tributary, the Remshy River). This Watershed is near the Moroccan boarder to the west of the Habra Watershed (the Habra Reservoir and the Mactaa Canal).

STUDY AREA

Algeria is one of the second largest countries in the continent of Africa, having an area of 2,381,745 Km2. Most of the area is desert (Great Western Desert), but the coastal belt of the north, (12%), which is formed of tells and plains, so it is a country on the north coast of Africa (1200 Km) with the Mediterranean seaboard.

West Algeria is a plain extending from the Tassala Mountains in the west to the Dhahra Mountains in the east. The area is a round (1.6 Million hectares) irrigated by three main water sources; The River Shelif, the Mactaa (Habra) Reservoir and River Tafna (Ayoun, 1985).

The River Tafna is located to the far west of Algeria near the Moroccan boarder. It is of 100 Km, long with 14 tributaries, the most important of which are: Esser, Moayleh and Remshy Wadies.

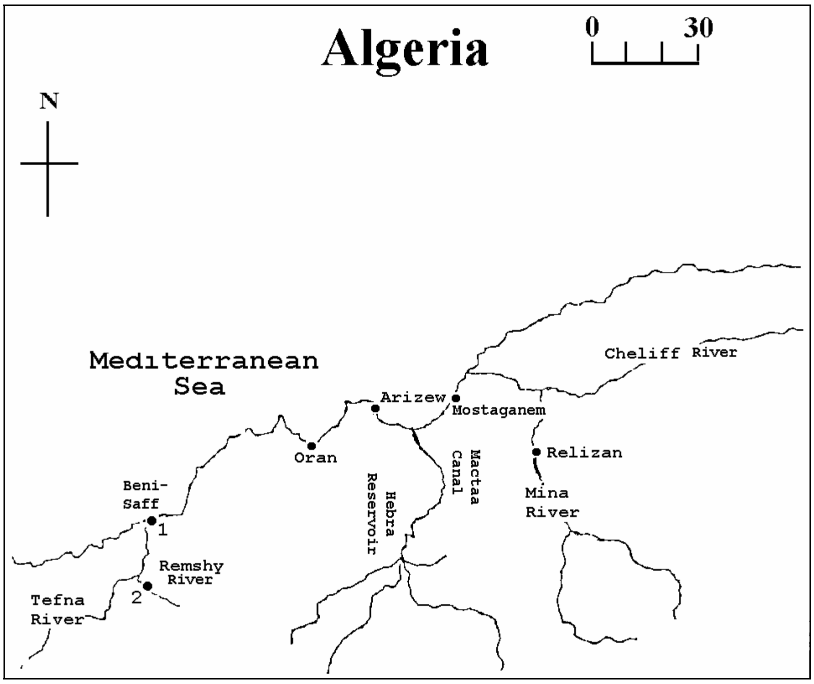

Figure 1: Map of the study area on the River Tafna (1) and the River Remshy (2).

Climatic Conditions: North Algeria, or Tell, with a typical Mediterranean climate (Gagneur & Kara 2001). Algeria is an area with hot summers and warm winters with temperature from a minimum of 11.6 °C in winter (January) to a maximum of 22.7 °C in summer (August). It has a light seasonal rainfall, ranging from 5.8mm wettest in (November and December) to 0.1> driest in (July and August). the climate of studied area (west Algeria) is under the effect of the Mediterranean climates.

According to Mejrab (1988) the air temperature at Bani-Saf site (studied area) ranged between 12.95 °C in January and 26.05 °C in August, while the rainfall at the same area ranged between 1.0 mm in July and 68.0 mm in December. At Telemsan site, temperatures varied from 9.00 °C in January and 26.0 °C in August, while rainfall ranged between 2.0 mm in July and 91.0 mm in December.

The higher evaporation rates were recorded during June-October and the lower ones during November-April. The total evaporation and transpiration at this study area is ranged between 800-900 mm per year (Mejrab 1988).

Station 1 (River Tafna)**:** This station is about 5 km from Beni-saf Town (Ain Temoshent Wilaya). The River Tafna is of 15-20 meters width and 10-20 meters depth. The tides have no active affect on its bed, according to

Doodson & Warburg (1941), area of little tidal movement. The site is shadowed by large trees like: *Oleo*, *Quercus*, *Eucalyptus and Citrus*. Plenty of grasses (herbs) cover the shore and surround the station.

The bed of this river consists of sand and clay with some silt, small rocks and stones also. This site is less than 80 meters above the sea level.

Station 2 (River Remshy): The river's width is of 15-20 meters, but has shallow depth of only 2-4 meters. This Station is also shaded by the same trees as those found at the Tafna site. The bed of the river consists mostly of sand with silt and clay as well. Below this, the bottom was rocky and stony with different sizes of rocks and stones.

This station is 20 km from Telemsan Wilaya. The site is 110 meters above sea level.

MATERIAL AND METHODS

Surface water samples were collected at bimonthly intervals, from June 1986 to March 1988. Water collection was carried out at 20cm below the surface to avoid floating matter. Winkler bottles were filled for dissolved oxygen (DO) and biological oxygen demand (BOD) determinations. Samples for other determinations were kept in well-stopper polyethylene bottles and immediately treated with 0.5% chloroform, as a preservative (Aberg & Rodhe, 1942), except those for chloride determination.

Air and surface water temperatures were measured *in situ*, using a mercury thermometer, to the nearest 0.1°C. Current velocity was determined with a stop watch by timing a floating cork stopper over a 5-metre distance. Turbidity of water was estimated by the platinum wire method (McLean & Cook, 1946). Light intensity, in full daylight at the water surface, was measured using a SEKONIK model L-418 light meter. ElectRical conductivity (EC) was determined using a Jenway portable PCMI conductivity-meter and pH was measured using a Pye Unicam PW 9418 pH meter. Suspended solids (SS) were determined by dry weight estimations and total residue (TR), fixed total residue (FTR) and volatile matter (TM) were determined by drying and ignition, according to the APHA (1978).

DO and BOD were estimated according to a modification of the standard Winkler method (APHA, 1971). Percentage saturation of oxygen (OPS) was calculated using the table of Truesdale *et al.* (1955). Dissolved organic matter (DOM) was determined according to the method described by Golterman & Clymo (1969). Determinations of CO_2 and Bicarbonates were carried out titrimetrically using phenolphthalein and a mixture of methyl red and bromocresol indicators. Alkalinity was measured using methyl orange indicator, according to Golterman & Clymo (1969). Total, calcium and magnesium Hardness, and chlorides were determined as described in the APHA (1971).

Nutrients were determined spectrophotometrically, using the Greiss-Ilosvay method for NO_2-N (Mackereth *et al.*, 1978), sodium azide and phenoldisulphonic acid method for NO_3-N estimation (APHA, 1976), Nessler method for NH_4-N (APHA, 1971), stannous chloride reduction for PO_4-P (APHA, 1971) and SiO_2-Si was determined according to Golterman & Clymo (1969).

RESULTS

Seasonal changes in measured physico-chemical parameters are shown in Figures 2-5.

Water temperatures were closely related to air temperatures. The water temperature at both stations was less than that of air temperature.

The minimum water temperature was recorded at both stations (10°C) in January 1987 and the minimum air temperature was recorded (15°C) at those two stations in January1987-88 and March 1988. Maximum air and water temperature was recorded (30°C) in July and September 1987 (Figure 2).

The water velocity at Station 2 (River Remshy) is more than at Station 1(River Tafna) and had more fluctuations. The maximum value of current velocity (CV) was recorded (22.7 cm s^{-1}) at Station 2 in March 1988, while the minimum one was recorded (9cm s^{-1}) at Station 1 in January 1987.

Light intensity varies seasonally at both stations, with minima (2.0w/ m^2) in March 1988 at both stations and maxima (54 w/ m^2) in October 1986 at Station 2.

Water turbidity had the same trend at both stations. Maximum value was recorded (130mgl^{-1}) in March 1988 at both stations and minimum one (45mgl^{-1}) in July 1987 at Station1. The turbidity in hot weather was less than that of cold weather.

Electrical Conductivity (EC) values were generally higher at Station 1 (River Tafna) the highest values being in May 1987 (4.96 S/cm^2) and the lowest values occurped (0.56 S/cm^2) at Station 2 (River Remshy) in October 1986 (Figure 2).

The hydrogen ion concentration (pH) values of the water samples had no much fluctuation at both stations, which ranged between 7.5(as a minimum) at both stations in September1987 and 8.6 (as a maximum) at Station 2

(River Remshy) in March 1987. At station 1 (River Tafna) the maximum value was recorded, 8.2 in Marches 1987-1988.

Irregular variations of dissolved oxygen (DO) values in the range of 7.5-13.6 mg l^{-1} occurred during the study period. In October 1986, a minimum value was recorded at Station 1 (River Tafna) while a maximum value was recorded in May 1987 at Station 2 (River Remshy). River Tafna showed higher DO values during the cold months and lower ones during the hot months, but this was not clear in case of the River Remshy. Oxygen Percentage Saturation showed a trend similar to that of DO, with values between (80% at Station 1 to 160% at Station2 in October 1986 and July 1987 respectively).

The biochemical oxygen demand (BOD) values were lying between 1.8 mg l^{-1} as a minimum at Station 1(the River Tafna) in September 1987 and 7.8 mg l^{-1} as a maximum at Station 2 (the River Remshy) in May 1987. At the later station, higher values of BOD during the cold months and lower during the hot months was recorded, but at the other station (the River Tafna), high values were Recorded during the hot months (May- September 1987) (Figure3).

Generally, the River Tafna (Station 1) showed greater suspended solids (SS) fluctuations. The maximum value was recorded 197.6 mg l^{-1} in July 1987 whereas, in the River Remshy (Station 2), the minimum value was 9.7 mg l^{-1} in January 1987.

The lowest value of dissolved organic matter (DOM) was recorded 5.09 PV(4h) mg l^{-1} at Station 1 (the River Tafna) in July 1987 and the highest was recorded at the same station 11.78 PV(4h) mg l^{-1} in March 1987. The maximum and minimum values at Station 2 were recorded in May and July 1987 (9.84 and 5.13 PV(4h) mg l-1, respectively). As a general, DOM values were higher during the cold months and lower in hot months and average values were higher at Station 1 than that at Station 2 (Figure 3).

The highest amount of total residue (TR) was recorded at Station 1 (9.53 mg l^{-1}) in July 1987, with the lowest at Station 2 (0.58 mg l^{-1}) in October 1986. TR values varied relatively little at Station 2. A similar pattern is shown at both stations for fixed total residue FTR (8.79 mg l^{-1} at Station 1 in July 1987 and 0.29 mg l^{-1} at Station 2 in October 1986). Values of VM were generally higher at Station 1 and more variable at Station 2.

In general, values of TR and FTR were lower at the tributary, River Remshy (Station 2) than at the main River Tafna (Station 1) and about the same in the case of VM. Also, in the warm months, values of TR, FTR and VM were higher than in the cold months (Figure4).

The maximum value of total hardness (TH) during the sampling period was 840 mg l^{-1} at Station 1 (River Tafna) in March 1988 and the minimum one 180 mg l^{-1} in October 1986 at Station 2 (River Remshy). At the same time of sampling period (October 1986), the minimum values of calcium hardness (CaH) and magnesium hardness (MgH) were recorded (70 and 90 mg l^{-1} respectively). The maxima were recorded in March 1987 (290 mg l^{-1}) and in May 1987 (510 mg l^{-1}) at the same station 1 respectively (Figure 4). The average values of total, calcium, and magnesium hardness were greater at Station 1 (44, 165.55 and 336.67 mg l^{-1}) than at Station 2 (315, 130.55 and 171.11 mg l^{-1} respectively)

The chloride content ranged between approximately 0.15 gm l^{-1} in October 1986 at Station 2 and 4.4 gm l^{-1} in March 1988 at Station 1. The last station values were greater than that of Station 2 (Figure 5).

Nitrite-Nitrogen (NO_2-N) values were high in warm months, and average values were relatively greater at Station 1 than at Station 2 (0.15-0.08 mg l^{-1} respectively).

The maximum value of nitrate nitrogen (NO_3 –N) was recorded at Station 1 in March 1987 (5.8 mg l^{-1}) and minimum one at Station 2 in November 1987 (2.1 mg l^{-1}). The average values were greater at Station 1 than at Station 2 (4.24-3.5 mg l^{-1} respectively).

Ammonia-Nitrogen NH_4-N values were about the same at both station, with maxima of 7.9 mg l^{-1} at Station 1 in July 1987 and minima of 4.3 mg l^{-1} at Station 2 in November 1987. The values of NH_4-N were higher during the hot months and lower in cold months (average values 5.7 and 0.65 mg l^{-1} at Station 1 and 2 respectively).

The minimum values of orthophosphate-phosphorus (PO_4-P) were recorded (0.9 mg l^{-1}) in October 1986 at both stations and the maximum (7.9 mg l^{-1}) in July 1987 at Station 1. Average values were greater at Station 1 (3.42 mg l^{-1}) than at Station 2 (2.96 mg l^{-1}). Fluctuations were more at Station 1 (Figure 5).

Values of Silicate-Silicon (SiO_2-Si) were consistently higher at Station 2 (10.8 mg l^{-1}) in May 1987 than at Station 1 (4.0 mg l^{-1}) in March 1988. The average values 7.94 and 4.7 mg l^{-1} respectively).

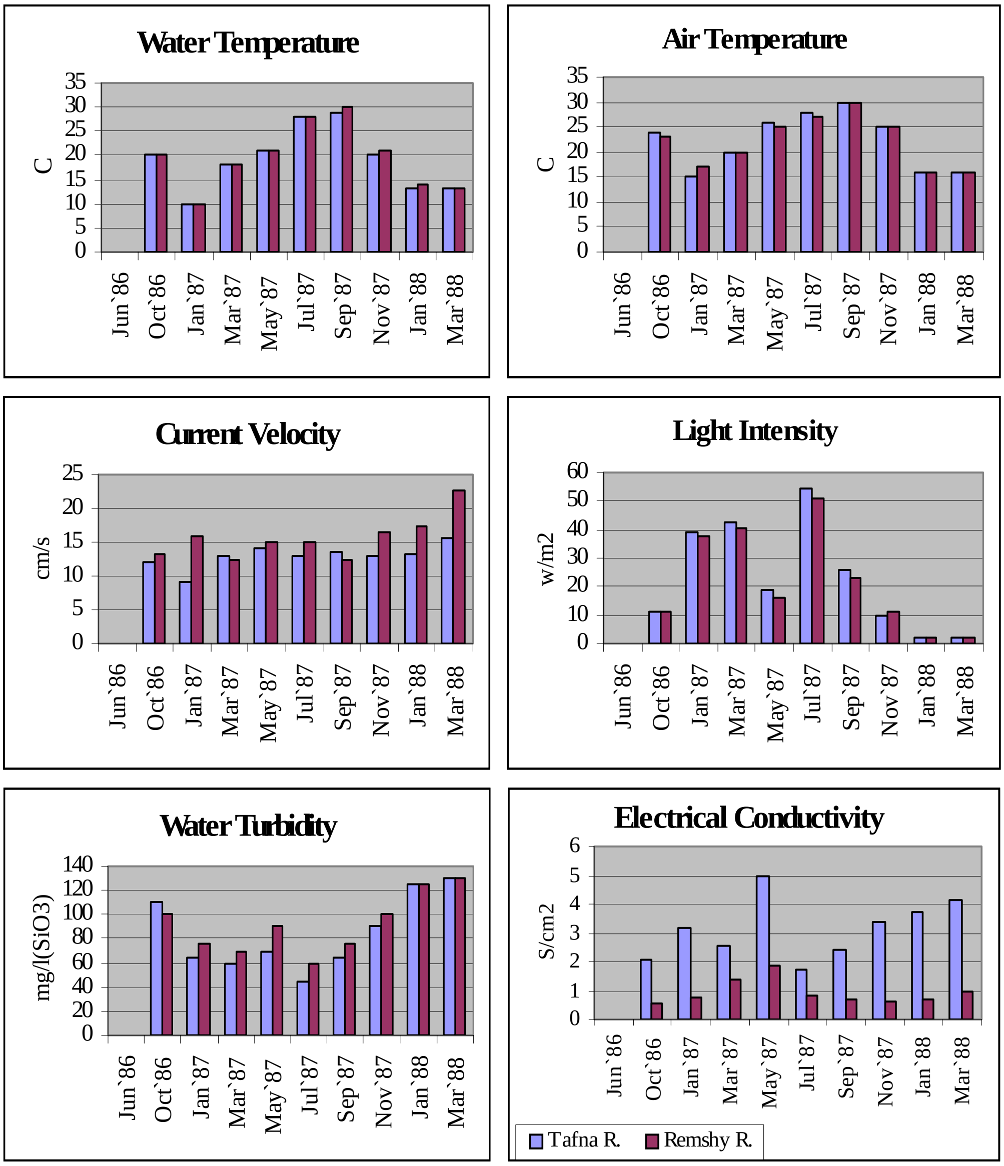

Figure 2: Monthly Variations of physical analysis at the River Tafna and its tributary River Remshy, during the sampling period (1986-1988).

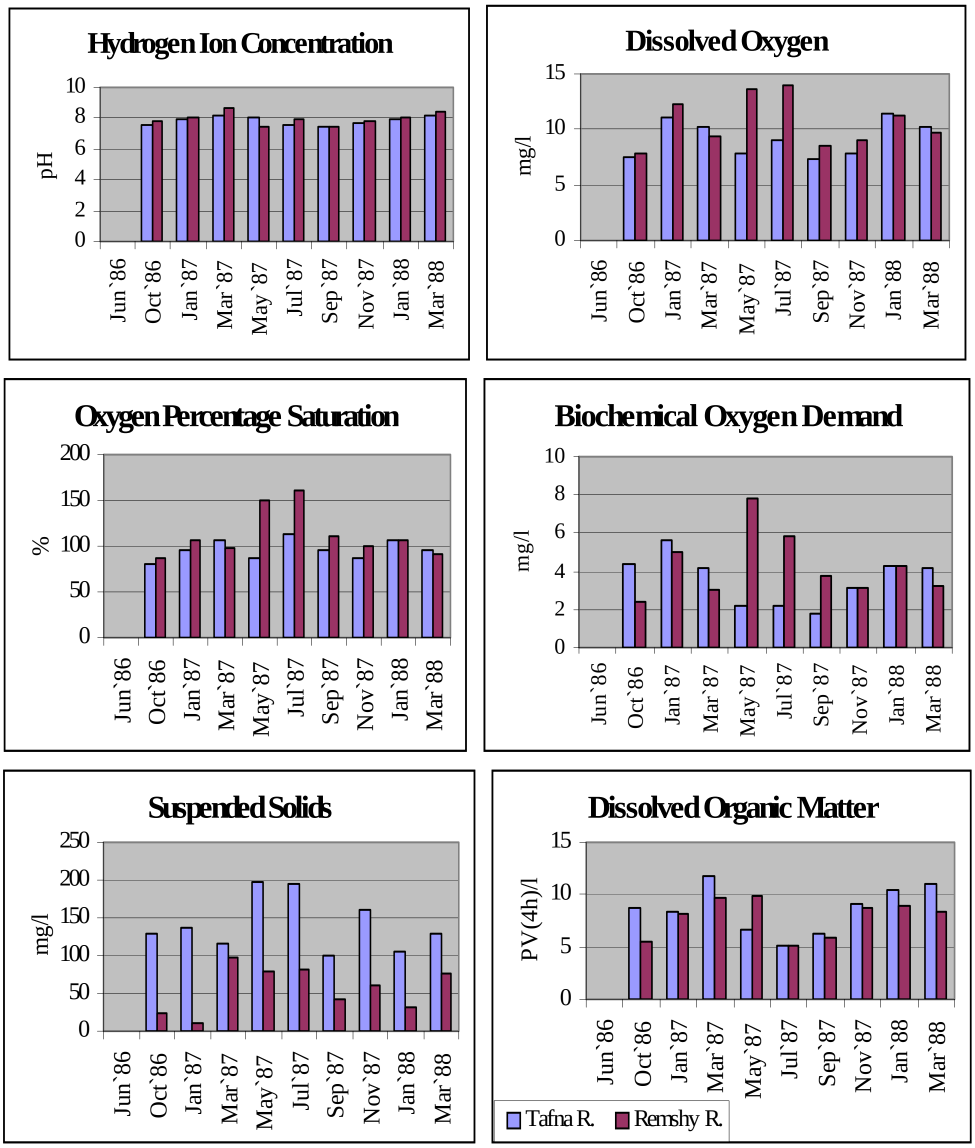

Figure 3: Monthly Variations of physical analysis at the River Tafna and its tributary River Remshy, during the sampling period (1986-1988).

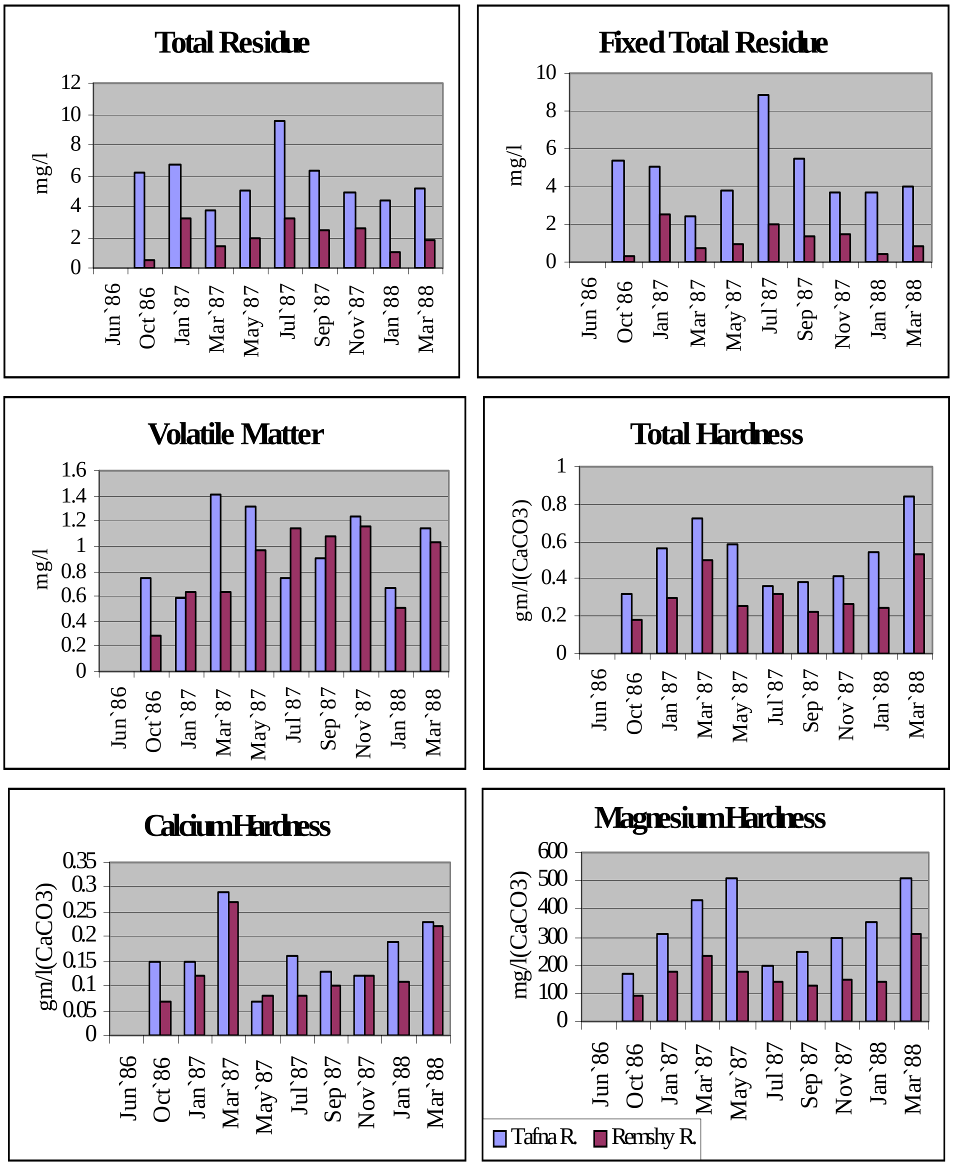

Figure 4: Monthky Variations of physical analysis at the River Tafna and its tributary River Remshy, during the sampling period (1986-1988).

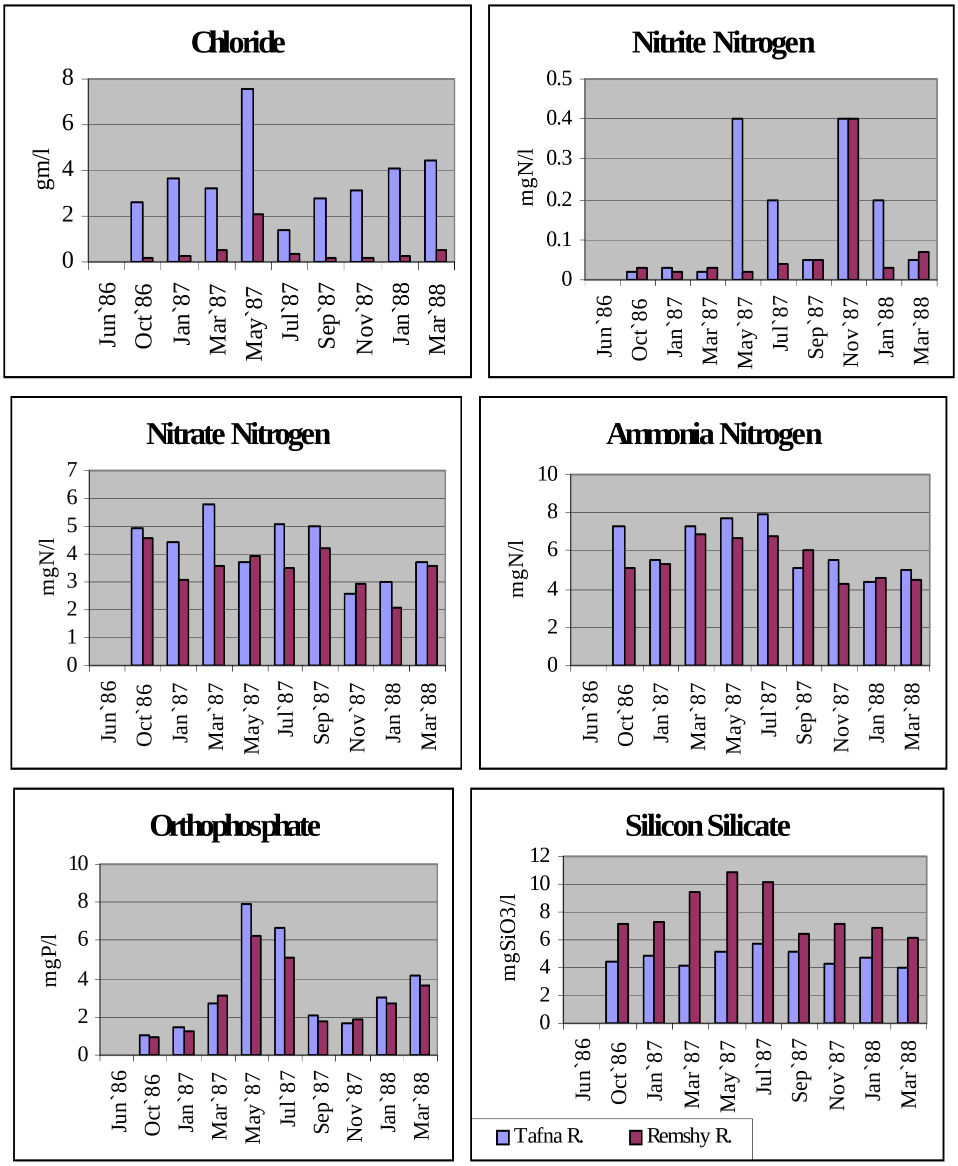

Figure 5: Monthly Variations of physical analysis at the River Tafna and its tributary River Remshy, during the sampling period (1986-1988).

Discussion:

The water temperatures were consistently lower at the two Stations than air temperatures. This may be due to the open nature of the sites. Seasonal fluctuations of air and water temperatures followed each other closely (Edington, 1966 and El-Sawy, 1988). Same observations were found by (Al-Asadi, *et al.* 2006a) with Cheliff Watershed (River Cheliff and its tributary River Mina) northwest ALgeria..

The rate of CV and WT values at the River Remshy were greater than at the River Tafna, may be due to the shallow depth of River Remshy. While this observation was not found in case the River Cheliff and its Tributary Mina, which found that turbidity was much higher at river than that of the tributary (Al-Asadi *et al.*2006a). On other hand found to be higher fluctuations at River Tafna than at the River Remshy which is normal because River Tafna has several tributaries and had effected by them. Higher turbidity was recorded during the cold months and low one during the hot months. This result were in contra to the results of Hussainy (1967), Timns (1970), Antoine & Benson-Evans (1988) and others who suggested that turbidity water are warmer than clearer ones under the same circumstances.

Low LI values were recorded in winter at Stations River Tafna and River Remshy. While the high LI values, were recorded in July 1987. Antoine (1984) and Antoine & Benson-Evans (1988) worked on the River Wye, Wales, U.K. and found that the low Light Intensity was in autumn and winter, and the high intensities were in spring and summer.

In general, the EC at the River Tafna was greater than at the River Remshy. This may be due to the fact that the River Tafna is downstream, same results were achieved at the River Cheliff and its tributary, River Mina (Al-Asadi *et al.*2006a). Kimbadi *et al.* (1999) referring this due to the rocky nature of the substratum of the river, while Odum (1971) refere it to the larger and more varied areas of land that drain into the water. Another factor may caused differences is closer the River Tafna to the sea.

The pH values of the water samples were more alkalinity and more fluctuated at River Remshy (Station2) than at River Tafna (Station1), during the investigation period. These values were within the range 7.5-8.6, which would be expected for natural inland waters and which would support a normal flora (Sarker *et al*,1980; Antoine & Al-Saadi, 1982; Esho 1983). There was no clear seasonal trend, and little variation, during the sampling period. This might be due to the fact that the two stations were in low-lying agricultural land. Sreenivasan (1974) explained the pH as a reflection of many chemical and biological processes occurring in natural waters.

Irregular variations of DO appeared during the sampling period at the two stations, both of them, more or less, have same oxygenated trend, which is

similar to the Cheliff and Habra watersheds (Al-Asadi *et al.*2006a and b). Antoine (1984), Esho & Benson-Evans (1984) mentioned that a part of the DO content in the spring, autumn and summer could be related to the large algal population which was actively photosynthesising, this was not found clear with this study. On the other hand these DO values had no relations with periods of high Current Velocity and flow. In contra with the observations were made by Saad & Antoine (1978, 1983); Saad & Abbas (1985a); Esho & Benson-Evans (1984) in the rivers, Tigris (Iraq), Rossetta branch of Nile (Egypt) and Ely (U.K) respectively. Fluctuations and rate had slightly more at the River Remshy than at the River Tafna.
At Station 2 (River Remshy), the Dissolved Oxygen has negative correlation with (Air &Temperatures, Current Velocity, Water Turbidity and Light Intensity).

High values of BOD, as general, were observed in the cold months and low ones during the warm months, this for River Tafna site, irregular variations was observed at River Remshy site, which had relatively more fluctuations than at the formal site. Same observations were found with the Cheliff and Habra watersheds (Al-Asadi *et al.*2006a and b). Gocke & Rhemeimer (1988) worked on the Elbe & Trave Rivers of northern Germany and found that both gave the same seasonal variations in BOD, with high values during warmer months and relatively low ones during the colder months. At Station 2 (River Remshy) the average values of BOD were higher then at Station 1 (River Tafna).

Fluctuations of SS may be due to local conditions such as wind action and rainfall as observeD by several workers (Antoine 1977; Esho 1983; Saad & Abbas, 1985b) in other rivers. Higher values were recorded at River Tafna and lower one at River Remshy. Same results were found in the Cheliff Watershed, the SS values at River Cheliff were more than that at its tributary, the River Mina (Al-Asadi,*et al*. 2006a). The SS values were high in warm months at the two stations, and this may be due to the increase in biomass contrast with Hynes's (1970) results, which stated that most streams and rivers are normally clear at low water. They become turbid during floods when valuable amounts of suspended matter may be carried in. Meybeck *et al.* (1999) worked on the Seine Basin and found no significant trend in total suspended solids (TSS) at the river mouth from 1971-1997. Comparison with a previous daily survey from 1863-1866 showed a marked decrease of average TSS and TSS annual range attributed mostly to locks.

A dimodal or trimodal seasonal fluctuation of DOM was observed, may due to certain local factors such as changes in phytoplankton abundance, surface runoff, wind action and pollution, which tend to produce such local variations (Saad & Antoine, 1980, 1983). The maximum values could have been due to allochthonous (Liaw & MacCrimmon, 1977) autochthonous (Fogg, 1958; Nalewajko, 1962) or even due to autolytic processes especially in March, in this respect Brehm, 1967 and Weinmann, 1970 started that low molecular weight organic substances such as amino acid, monomeric sugars and organic acids can enter directly into the water e.g. as excretion from plankton.

There was a seasonal trend of TR, FTR and VM at the two Stations, increasing in values during the warm months and decreasing during the cold months. Al-Asadi, *et al.*(2006a and b) and Antoine (1977) found similar results, during their work on the Cheliff and Habra Watersheds, northern west Algeria and the Tigris River, Iraq respectively. Higher average values of TR and FTR were recorded at the River Tafna than at the Tributary Remshy, while the same average values were found in case of VM. Saad (1976) stated that TR and FTR represent mainly the total amounts of suspended matter and dissolved solids, while VM represents the organic lost due to the partial decompositions of solids, water of hydration and probably burning of carbonaceous matter (Saad (1976).

Higher values of total, calcium and magnesium Hardness were recorded at Station 1 (River Tafna) than at Station 2, the tributary (River Remshy). Reversed relation had been found by the River Cheliff and its tributary River Mina (Al-Asadi, *et al*. (2006a), while these results were agreed with the work of Antoine & Benson-Evans 1988, which showed a marked downstream increase in TH during their studies on the River Wye, Wales (UK). They attributed that the accumulation of calcium and magnesium carbonate from the catchment area. The present results also could be due to the geology of the land. In this respect, Antoine & Al-Saadi (1982) stated that CO2 which has resulted from the breakdown of organic matter, (both in the water column and the bottom sediments), reacts with both calcium and magnesium carbonate.

The chloride content at the River Tafna closely related EC of the same station. Also the chloride content of this station was higher than at the Tributary River Remshy, this may be due to the fact that River Tafna is affected by the Mediteranian Sea. The same observation was recorded in case of the River Cheliff and its tributary the River Mina (Al-Asadi, *et al*. 2006a). The maximum values were recorded at the two stations was in May 1987 coincided with high dissolved oxygen, the same observation was recorded in case of the Mactaa Canal and the Habra Reservoir (Al-Asadi, *et al*. 2006b).

Generally, the inorganic nitrogen values were found to be higher at Station 1(River Tafna) than at Station 2 (River Remshy). Similar observations were found in the River Cheliff ans its tributary the River Mina (Al-Asadi, *et al*. 2006a). Jarvinen *et al*. (1999) found that increasing the

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amount of ammonia-N had no effect on primary prodUctivity also Karjalainen *et al*. (1998) stated that the available nitrogen did not increase chlorophyll a concentration in any experiments compared with the controls, while Sawyer (1954) Vollenweider (1968) and Brye (1970) reported that a concentration of 0.3 $mg1^{-1}$ inorganic nitrogen is necessary to produce and maintain phytoplankton blooms.

There is marked downstream increasing of PO_4-P values at these studied sites. The same observations were found regarding the River Cheliff and its Tributary the River Mina (Al-Asadi, *et al*. 2006a). This is to be agreed with several other workers (Antoine & Benson-Evans, 1988; Antoine, 1987; Hadi, 1981) which found during their studies in other rivers reported increase of PO_4-P values in downstream.

As general rule, high values of PO_4-P were recorded in warm months during the study period. Such high values can be attributed to the decay of the algal populations as found by Kramer *et al* 1972; Saad 1973; Soltero *et al* 1974 and others.

High values were recorded in worm months and low in cold months. Averages were recorded at River Remshy (7.94 mg 1^{-1}) was higher than that of the River Tafna (4.7 mg 1^{-1}). This indicates that there is downstream decrease during this study, similar to the Cheliff Watershed (Al-Asadi, *et al*.2006a). And that was contra with several workers, a downstream increase in most of their observations. Antoine & Benson-Evans (1988) showed downstream increases in silica content of the River Wye, Wales, U.K. they attributed this to the differences in geology of the area, and also to sediments replenishing a part of the silica content of the water as well, together with dissolution of diatom frustules.

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دراسة بيئية لثلاثة أنهار في غرب الجزائر: نهر تافنة ورافده الرامشي

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الخلاصة

هذه الدراسة هي جزء من برنامج دراسي بيئي لساحل شمال غـرب الجزائـر (شمال افريقيا). جمعت عينات شهرية خلال سنتين (1986-1987) حيث تـم تعيين محطتين في منطقة تافنه القريبة من الحدود المغربية. الأولى لنهر تافنـة الذي يبلغ طوله أكثر من 110 كيلومتر حيث يصب بالبحر الأبيض المتوسـط والمحطة المختارة هي قريب من مدينة بني صاف أما المحطـة الثانيـة فهـي لإحدى الروافد التي ترفد هذا النهر وهو رافد او نهر رامشي والمحطة المختارة تبعد عن المصب بخمسة وعشرين كيلومتر على مقربه مـن مدينـة تلمـسان. درجات الحرارة الصغرى للجو والماء كانت (10-15°C) على التـوالي فـي شهر كانون الثاني والعظمى خلال شهر أيلول لكلا القـراءتين. درجـة الأس الهيدروجيني خلال الدراسة مائل إلى القلوية ويتراوح بين 7.5 -8.6. سـرعة جريان الماء في نهر شلف أعلى منه في نهر مينا مع تغيرات متلاحقة خـلال شهر مارس وحتى انتهاء موسم الأمطار.

أقل شدة إضاءة سجلت خلال شهري كانون الثاني ومارس ومتزامنة مع ارتفاع عكرة المياه وزيادة الأجسام العالقة. أما درجة التوصيل الكهربائي فهي تتراوح بين ($56 - 4900\mu S\ cm^{-2}$) ولوحظ أن درجة التوصيل الكهربائي في نهر تافنة أعلى منه في نهر رمشي وذلك لقرب الأول من البحر وتأثيره بالمد والجـزر. بالنسبة للأوكسجين الذائب وجد بان المحطتين تتمتعـان بدرجـة جيـدة مـن الأوكسجين ($7.5\text{-}13.6mg\ \ l^{-1}$). سجلت أقل قيمة لمتطلب الأوكسجين الحيوي في شهر أيلول 1987 ($2mg\ \ l^{-1}$) وأعلى قيمة في شهر مايس من نفس الـسنة ($7.8mg\ \ l^{-1}$). أما قيم المـواد العـضوية الذائبـة (DOM) فتتـراوح بـين ($5.09\ mg\ l^{-1}$) في شهر تموز 1987 و ($11.78\ mg\ l^{-1}$) في شهر مـارس من نفس السنة. المواد الصلبة العالقة تكون عالية خلال اشهر الحـر وواطئـة خلال اشهر البرد ولها علاقة عكسية مع درجة العكورة. بينما معدلات المـواد الكلية (TR) والثابتة (FTR) والمتطايرة (VM) وكذلك العسرة الكليـة (TH) وعسرة الكالسيوم (CaH) والسليكا في نهر تافنة اكثر منها في نهر رمشي. من جانب آخر فان معدلات سرعة التيار(CV) وعكورة الماء(WT) والاوكسجين الذائب(DO) ونسبة التشبع الأوكسجيني(OPS) والمتطلب الاوكسجيني الحيوي (BOD) وعسرة المغنسيوم (MgH) والكلور ومحتويات كل من النتـروجين والفوسفور تكون اكثر في الرافد نهر رمشي منها النهر الأصلي (تافنة). زيادة في المحتوى آيون للكلور في نهر تلفنة يرافقها زيادة لدرجة التوصيل الكهربائي والأوكسجين الذائب. العسرة الكلية وعسرة الكالسيوم والمغنيسيوم لهـا علاقـة عكسية مع المواد الكلية والثابتة والمتطايرة. ينخفض محتوى المتغيرات الثلاثة المذكورة والأوكسجين الذائب ونسبة التشبع ومتطلـب الأوكـسجين الحيـوي والمواد العضوية الذائبة والمتعلقة خلال الأشهر الباردة ويرتفع خـلال اشـهر الصيف، يبدو إن نهر تافنة تتباين فيه القراءات أكثر من نهر رمشي.