Assiut University Center for Environmental Studies-Egypt

The 9th Int. Conf. for Develop. and the Env . in the Arab world, April, 15-17, 2018

ASSESSMENT OF SOME PROPERTIES AS INDICATOR FOR WATER QUALITY INDEX (WQI) OF THE RIVER NILE, EGYPT AND COMPARING WITH SOME DIFFERENT WATERWAYS

Mohamed M. Shahata

Environmental affairs Department, Assiut University Hospitals, Assiut University, Assiut, Egypt. http://www.aun.edu.eg , E.mail: mohamedshahata67@hotmail.com

ABSTRACT

Quality of water in Egypt is determined by a periodic monitoring program where natural, chemical and microbiological indicators are measured. The River Nile monitoring points are examined periodically every four months. Monitoring the impact of various sources of drainage especially industrial drainage on waterways, as well as monitoring hot spots on the river banks can be a true criterion for judging quality of fresh water of the River Nile. Most results through my researching years on the Nile water quality show the validity of that water for all uses. Comparing the acquired outcome and criteria of a wide range of streams on the world was carried out.

Keywords: *Egypt, River Nile, Monitoring, Streams, Water Quality Index (WQI).*

INTRODUCTION

Water is an elixir of life, it is the source of energy, govern the evaluation life on the earth. Water is a unique natural resource, essential for life and it constantly cycles between the earth and the atmosphere. The same water used for crop and animal production can also be shared with the public, aquatic and terrestrial ecosystems (Cooper *et al*., 1998). Water quality index (WQI) is a valuable and unique rating to depict the overall water quality in a single term, it is helpful for the selecting the appropriate treatment technique needed for such issues. Attempts have been made to review the WQI criteria for the appropriateness of drinking water sources (Shweta *et al*., 2013). WQI utilizes the water quality data and helps in the modifying water policies, which are formulated by various environmental monitoring agencies. It has been realized that the use of an individual water quality variable in order to describe the water quality for common public is not easy to understand (Bharti *et al.*, 2011; Akoteyon *et al.*, 2011). The WQI is a mathematical tool, which is used to simplify the information about analytical water quality variables; a single number represents the water quality level. The WQI is widely used in land use planning and water resources management (Giljanovic, 1999). It is an important indicator of the water quality, which is used by the competent authorities to manage the resources based on various purposes. For example, the WQI developed in New Zealand for the management of water resources has been applied for more than two decades to four classes waters intended for bathing, water supply, spawning of fish and general uses, considering, above all, the protection of the aquatic life (Smith, 1990). Traditional water quality index method was developed by paying great rigor in

selecting parameters, developing a common scale and assigning weights. The attempt was supported by the National Sanitation Foundation (NSF) and therefore as NSFWQI in order to calculate WQI of various water bodies critically polluted (National Sanitation Foundation Water Quality Index, NSFWQI). A water quality index provides a single number that expresses overall water quality in a certain location and at time, based on several water quality parameters. The indices are among the most effective ways to communicate the information on water quality trends for the water quality management (Jagadeeswari ***et al.***, 2012). Few studies assess long-term trends in water quality indicators at single gauging stations or detect alterations in the spatial patterns, chiefly because of data fragmentation and sampling discontinuity (Levi *et al*., 2015).**

The Nile Basin area is estimated at 3.3 million square kilometers sharing among ten countries known as the Nile basin countries. In view of the limited water resources in the Arab Republic of Egypt, and as a result of the steady increase in the population and the increasing demand for water, especially for industrial, agricultural and tourist development, it became necessary to ensure the sustainability of these resources by rationalizing consumption and saving available water resources from pollution (Rifaat *et al.*, 2004). Artificial neural networks (ANNs) have been successfully applied in a number of studies focusing on water quality prediction in rivers (Niroobakhsh *et al.*, 2012), lakes (Stefan *et al.*, 1995), reservoirs (Kuo *et al.*, 2007; Rankovic *et al.*, 2010) and waste water treatment plants (Elhatip *et al.*, 2008; Abyaneh 2014) modeled the water quality parameters.

METHODS AND MATERIALS

1.1.Chemicals and Reagents

All chemicals in this study were purchased from Sigma, Aldrich (Germany), Merck (USA), Kanto Chemical CO. (Japan), and Egypt. The atomic absorption spectroscopic standard solutions (1.0 g/L) for the elements were purchased from (Merck) which is traceable to Standard Reference Material (SRM) from National Institute of Standards and Technology (NIST). Working standard solutions were prepared by diluting the stock solution using deionized water. Argon and acetylene gas with 99.99% purity, used in Atomic Absorption Spectrophotometer (Shimadzu Corporation) Model: (AA-6800).

1.2.Analytical Procedures

The various parameters were determined using standard procedures (APHA 2005). The temperature, pH, electrical conductivity, turbidity and DO of each water sample were measured at the sampling points by water quality analyzer (HORIBA- LtD) Model U-10-2M. Turbidity, was measured on site by Ultra meter (Myron L company) Model: 6P. TDS was determined gravimetrically at 105-110 ^{O}C.

Water Sampling

A total number of 214 water samples from monitoring points four times periodically every three months in different four seasons per year at studied area in River Nile. Each water sample was taken in three 500 mL capacity polyethylene and glass bottles. These bottles were immediately transported to the laboratory under low temperature conditions in iceboxes. The samples were stored in the laboratory at 4^{o}C until processed/analyzed.

For the determination of trace elements a 500 mL polyethylene bottle which are good tighted were used instead of glass bottles. This reduces the leaching of the trace element from the wall containers. Also, the storage of water samples into plastic bottles eliminates the adsorption of trace elements. The samples usually acidified with concentrated nitric acid to prevent the hydrolysis of these elements. The bottles were completely filled with water samples for protection and isolation from air. Finally, they were stored in a refrigerator. pH, electrical conductivity (EC), temperature, turbidity, dissolved oxygen (DO) and oxidation reduction potential (ORP) were determined in the site. All parameter were determined using the standard procedures (APHA, 2005).

*1.3.**Studied Area***

The area that the study covers in Egypt (Fig,1) is the River Nile starting at north from Al Wasta city (29˚ 23′ 38.3″ N , 31˚ 13′ 23.5″ E), Bani Suef governorate, far about 100 km from Cairo, passing by Minya and Assiut governorates and reaching Gerga city (26˚ 17′ 25.3″ N , 31˚ 54′ 53.2″ E), Sohag governorate.

3. RESULTS

Within a periodic monitoring for the Nile water quality, samples (214 samples) at a length of 460 km were taken for the Nile along a period of 7 years. The samples were taken at different points in special containers. Field parameters were measured (pH, temperature, electrical conductivity, etc.). The analysis included measuring: Some physical properties such as: temperature, electric conductivity, solid matter, etc., according to the American and Egyptian standard methods.

- Analysis of water quality (Q- Value), including: Color, taste, smell, pH, electrical conductivity, turbidity, suspended solids, dissolved solids (chlorides, sulphates, ...).

- Analyzes of contamination indications include: Concentrations of dissolved oxygen, chemically oxygen demand, total dissolved solids and Nitrate.

3.1. Physicochemical Properties

3.1.1. Temperature (T °C)

Temperature is one of the most important indicators for its effect on chemical reactions and their velocity, for its effect on aquatic life and the extent of water suitability for all uses. For example, high temperature may lead to differences in fish species found in the aquatic environment that may receive water affected by temperature. The results conclude that, (the minimum – the maximum) temperature degrees through the years 2010, 2011, 2012, 201013,2014,2015,2016, are as follows: (17.5 - 30 °C) , (18 - 28.7 °C) , (16 - 25.1 °C) , (23.4 - 26.6 ° C) , (23.4 - 30.5 °C) , (16 - 29.5 °C) and (15.5 - 29.4 °C), respectively .

The average temperature (°C) *vs.* years of study is shown in (Fig.2).

3.1.2. Electrical Conductivity (EC ms/cm)

Electrical conductivity expresses abut the percentage of total salts soluble in water. Greater electrical conductivity of water due to it's higher salinity. The amount of salts in water can divided into two main parts. First, salts found in water naturally as marine water and groundwater or salts accompanied with dissolved elements in water during rainfall. The second kind is saline water caused by human actions as sewage and

industrial drainage on natural water bodies. The results conclude that the (the minimum – the maximum) values of electrical conductivity during the years 2010, 2011, 2012, 2013, 2014, 2015, 2016, are: (0.25 - 1.4), (0.256 - 3.12), (0.224 - 0.387), 0.298 - 0.344), (0.3 - 0.475), (0.257 - 0.402) and (0.309 - 0.554) ms / cm, respectively. Figure (3) shows the average electrical conductivity.

3.1.3. Turbidity (NTU)

The turbidity is a good term for the extent and degree of fresh water purity. Turbidity in surface water results from decaying substances and from organic or inorganic substances such as clay, iron oxides, hydrolysis, algae and bacteria. In a physical view, turbidity is a visible property that causes light scattering and absorption instead of its passing through it without no change in the direction or level of its flow during the sample. The results show that the (the minimum – the maximum) values of turbidity during the years 2010, 2011, 2012, 201013, 2014, 2015, 2016, are: (1.2 - 11), (2.2 - 24), (3.0 - 6.5), (3.0 - 16) , (2.41 - 11), (0.55 - 11.6) and (1.25 - 20.4) NTU, respectively. While the average values are plotted in Fig.4.

Results of water quality (Q- Value) calculated based on turbidity are in (Fig. 5).

3.1.4. Hydrogen Number (pH)

It is the negative logarithm of the effective concentration of hydrogen ions it expresses about the level of effective acidity or alkalinity of water. The value of the pH is essential in the assessment of water and its validity for drinking and other uses. The results conclude that the values of the average pH concentration along the River Nile during the years 2010, 2011, 2012, 201013,2014,2015,2016, are shown in figure (6). The water quality (Q- Value) based on pH are shown in (Fig.7).

3.1.5. Dissolved Oxygen (DO)

The importance of dissolved oxygen in water is due to its necessity for the survival of aquatic organisms and its role in enabling them to carry out their biological processes. Also, oxygen dissolved in water is helpful for decaying organic pollutants, while its shortage leads to an anaerobic degradation of pollutants in water. And this results in harmful gases such as methane, hydrogen sulfide and others gases. Dissolved oxygen is the most important environmental factor for the health and growth of fish. While decreasing oxygen concentration below recommended limits lead to fish exhaustion, lack of immunity and low growth rates of fish. If oxygen is greatly decreased in water reaching critical levels, this leads to fish choking and death. Needs of dissolved oxygen are varying according to kind, liveliness and density of fish. Also, according to water temperature oxygen deficiency indicators in water are as follows:

- **Fish are accumulated on the surface of water with open mouths. They also move to get oxygen from water surface, they reel while swimming slowly.**
- **Fish are accumulated at irrigation gates and openings, which have some water leakage.**
- **Death of fish especially during the night.**

The abundance of oxygen in water depends on concentration of salts and organic matters in water. It also depends highly on the temperature of water and therefore there is a correlation between temperature and the amount of dissolved oxygen. The concentration of dissolved oxygen in water is considered an evidence for

water quality. Much can be learned about the character of a water resource from the amount of oxygen dissolved in it.

The results indicated that the averages of concentrations for dissolved oxygen concentration (DO mg/L) during 2010, 2011, 2012, 2013, 2014, 2015 and 2016 were (the minimum – the maximum): (4.0 - 8.7), (5 - 10.2), (5.5 - 7.8)), (6 - 8.3), (6 - 8.3), (3.26 - 6.9), and (3.89 – 8.46) mg /L, respectively.

The results of average values of dissolved oxygen (DO mg/L) were shown in Fig.8. The average values of dissolved oxygen saturation (DO %) were calculated and the shown in Fig.9. Water quality (Q-Value) was calculated based on dissolved oxygen saturation (DO %) and the results were plotted in (Fig. 10).

3.2. Chemical properties (indicators of organic components)

Organic substances consist of a mixture of carbon, hydrogen, oxygen and sometimes nitrogen, in addition to other important elements such as sulfur, phosphorus, iron and organic components.

3.2.1. Chemically Oxygen Demand (COD)

It is the quantity of oxygen demand chemically estimated in mg/L and necessary for oxidation of organic matter into in organic substances within specific conditions such as temperature, certain time and oxidizing factor presence. Where, the oxidizing factor would oxidize the organic matter and convert it to CO, SO_2, CO_2, NO, NO_2, P_2O_5. Therefore, we can study these components and determine their amounts only through oxidizing reactions.

Another test for COD is the use of permanganate as an oxidizing agent, but this test gives low results that are not directly related to the standards of COD tests. Water quality results showed that the concentration of COD in 2010, 2011, 2012, 2013, 2014, 2015 and 2016 were (the minimum – the maximum): (5 - 15), (4 - 48) (10 - 23), (4.5 - 12), (4.5 - 10), (3.2 - 32) and (3.2 - 81) mg / L, respectively. The values of COD averages along the River Nile are shown in Fig.11.

3.2.2. Total Dissolved Solids (TDS)

Total dissolved solids in water are scientifically defined as all materials that remain after evaporation at a temperature of 103 ° C to 105 ° C. Materials with high vapor pressure will be lost in the evaporation process at this degree and therefore not considered solids. Solids can be further divided according to their degree of volatilization at 55 °C ± 5 °C, where the organic part is oxidized at this degree to convert into gas while inorganic fraction remains as ash. Thus, the terms volatile matter and suspended matter can be applied to organic and inorganic suspended substances content. The TDS values during 2011, 2012, 2013, 2013, 2014, 2015 and 2016 were (the minimum – the maximum): (172 - 768), (194 - 342), (166 - 287), (215 - 257) (500), (183 - 297) and (208 - 402) ppm respectively. The results of TDS average values for these years are plotted and shown in Fig.12. Water quality (Q-value) was calculated based on Total Dissolved Solids (TDS) are shown in Fig.13.

3.2.3. *Nitrates*

Nitrates are found at low concentrations in water and at higher concentrations in groundwater. These high concentrations in indicates an old organic contamination in the groundwater because nitrates are the

last stage in the bio-oxidation of organic nitrogen compounds (total nitrogen). When nitrates enter the human body with large quantities, they are reduced in the human digestion system into nitrite, which binds with hemoglobin instead of oxygen and causes blood diseases, especially in children. Therefore, the permissible limit of nitrate in the Nile water and drinking water doesn't exceed 2 mg / L. Nitrates are found in small amounts in domestic wastewater and in large quantities, which may reach hundreds of milligrams per liter in industrial wastewater. The quantities of leaked nitrate from the nitrogen fertilizers that are used in farm lands are dangerous because they lead to a high concentration of nitrates in groundwater.

The values of nitrate concentration during 2010, 2011, 2012, 2013, 2014, 2015 and 2016 were (the minimum – the maximum): (0.13 - 17), (0.36 - 4.5), (0.5 - 1.7), (0.03 - 0.37) 0.1 - 1.3), (0.058 - 1.77) and (0.2 - 3.07), ppm respectively. While, the allowed limit is 2 ppm. Figure 14 shows a comparison between the average concentrations of nitrates. It also indicates a notable rise in nitrate concentration during 2010. While, Values of water quality (Q-values) based on nitrate concentration were plotted in Fig.15.

3.3. Water Quality Index (WQI)

In Water Quality Index (WQI) several properties were measured. Some of them are Physical such as: Temperature (T °C), Electrical Conductivity (EC ms/cm), Turbidity (NTU), Hydrogen Number (pH), and Dissolved Oxygen (DO). Others are Chemical such as: Chemically Oxygen Demand (COD), Total Dissolved Solids (TDS), and Nitrate concentration.

In using Water Quality Index (WQI), I used the program: The Dos Moines River Water Quality Network (DMRWQN), conduced by IOWA state university, Department of Civil, Construction and Environmental Engineering. Under contract with the Rock Island District of the U. S. Army corps of engineering. The results of study during 2010, 2011, 2012, 2013, 2014, 2015, and 2016, are plotted in Fig.16.

4. DISCUSSIONS

4.1. Temperature: **The effect of temperature on the proportion of oxygen in water, there is an inverse relationship between high temperature and amount of oxygen dissolved in water. The higher the temperature, the less oxygen dissolved in water. Also with temperature increase, the metabolic rate of aquatic animals increases significantly, and this increases the consumption of existing oxygen and also increases emissions of unwanted carbon dioxide. Also, with temperature increase, the degradation rates in the water are increased, resulting in rapid oxygen consumption. These serious effects may increase with the in the amount of hot water draining into water bodies. Noting that with any sudden change in temperature it may result in a high mortality rate in aquatic life. As well as, the abnormal rise in temperature may lead to an increase in the growth of some unwanted aquatic plants and fungus. The values shown in Fig.2 are normal and within the allowed limits. It is also clear that the difference between the highest temperature of a sample is 30.5 which was taken in July 2014 and the lowest temperature is 15.5 of a sample was taken in January 2016. This indicates that the difference in temperature is due to the difference in the time of taking samples. This assures that the River Nile was not affected by any activities around it. The convergence in the average temperature is an evidence for that.**

4.2. ***Electrical Conductivity:*** **The electrical conductivity of the water depends on the total dissolved solids, the temperature of the water, and the concentration and reward of ions.**

4.3. ***Turbidity (NTU):*** **In general there is no relationship between the degree of turbidity and concentration of suspended substances in untreated water. The degree of turbidity depends on the amount of suspended material, its type, its color and accuracy of its granules. The most causes of turbidity are the particles of silt and organic matter resulting from the decomposition of plants or animals. Also, water turbidity may result from soil particles and suspended substances such as sand and dust particles that stick to living organisms. Figure 5, show that results of water quality during study years which rating from 77 to 88, and according to the table (1) these values are in the range (70 - 90), indicate (good) quality.**

4.4. ***Hydrogen Number (pH):*** **The values shown in Fig.6, are within the allowed limits (6.5 - 8.5), and they also indicate that the River Nile was not affected by any activities around it. These values are normal for all water uses. Water quality (Fig.7), through study years is about (72-87). According to table (1) most values were (good) quality (70 – 90), except for the value during 2011 that was (average) quality (50 - 70). This due to the high value pH at the meeting point of Mohit drain with river Nile, at may 2011, reached to value of pH 8.9.**

4.5. ***Dissolved Oxygen (DO):*** **DO is one of the most commonly used parameters for assessing ecosystem conditions, and it also influences solubility of potentially harmful metals (Chapman, 1996). The results concluded that some values were below the allowed limits (DO > 6). The results of average values of dissolved oxygen (DO mg/L) were shown in Fig.8. The average values of dissolved oxygen saturation (DO %) were calculated and the shown in Fig.9 as follow: The values of water quality during 2013 and 2014 were 93 and 97 respectively. These are considered (excellent) quality (90-100). The values calculated during 2010, 2011, 2012 and 2016 were 80,89, 84 and 81 respectively. These are considered (good) quality (70 - 90). While the value calculated in 2015 is 68 and that considered (average) quality (50 - 70).**

4.6. ***Chemically Oxygen Demand (COD):*** **All organic matters in a water sample can be oxidized by sulfuric acid fermented with sulfuric acid in the presence of silver sulphate as a catalyst for reaction and mercury sulfate to remove chlorine effect if any. COD test is used to measure organic matters in industrial wastewater, which contains toxic compounds for biological life. It is oxidize reduced compounds in wastewater through reaction with a mixture of sulfuric acid and chromic at high temperature. Figure 11, shows a significant increase in the averages of COD, and these values are not valid for all water uses. As shown in this figure, the average of COD exceeds the allowed limits. This indicates that the river has affected by surrounding activities and that has an evident effect upon quality and validity of its water.**

4.7. ***Total Dissolved Solids (TDS):*** **The results of TDS average values for these years are plotted and shown in Fig.12. These values are below the allowed limits (500 ppm). Values of water quality during 2012 and 2015 are 70 and it is (good) quality (70 - 90). While, water quality values during 2010, 2011, 2013, 2014 and 2016 are extents of 62, 67, 68, 68 and 66, respectively and it is (average) quality (50 - 70). Hence, the outcomes conclude with the validity of water for all uses.**

4.8. ***Nitrates:*** **It also indicates a notable rise in nitrate concentration during 2010. While, values of other years are still within the allowed limit. This concludes with the fact that the Nile wasn't influenced by any surrounding activities. Values of water quality (Q-values) based on nitrate concentration were shown in Fig.15. It is evident that water quality in all years has (excellent) quality (90-100). The results show the validity of water for all uses.**

4.9. ***Water Quality Index (WQI):*** **Results shown in Fig.16, are evident that, water of the Nile is (good) quality (70 - 90). This assures the validity of the Nile water for all uses.**

Comparing the criteria of water quality index (WQI) for the River Nile, Good, and water quality of some different waterways in the world, (table 2), it is cleared that:

- **Ciambulawung River has been categorized as good. This condition showed that the activities of the people and micro-hydro had no negative effect on the water quality of upper part of Ciambulawung River (Hefni *et al*, 2015).**
- **Based on grab sampling on 5 stations in River Cihideung, River Ciapus, and Lake of PPLH, all water quality parameters met water quality standard (good) for fisheries and animal husbandry as stipulated in Government (Hefni, 2015).**
- **The efficacy of the WQI and statistical instruments used to evaluate the water quality of the Arapiranga and Murucupi rivers was confirmed. The Murucupi River was more affected by anthropogenic activities due the proximity to the Barcarena City, where the urban influence was more evident, whereas the Arapiranga River (Background) was less influenced by such activities. It is indicates that there is an increasing need to generate information about the water quality in the Amazon Region because the riverside population uses untreated water (Adaelson Campelo Medeirosa 2017).**

5. CONCOLUSION

To determine water quality, I measured some chemical and physical water properties. It became clear that the varying in water temperature are due to the difference of time taking samples and this assures that the River Nile water temperature wasn't affected by surrounding activities. Water electrical conductivity depend on the amount of total dissolved solids, water temperature and ions concentration. As for turbidity degree, the study indicated that the Nile water is (good). Also, the study concluded that, COD exceeds the allowed limits and this show that the COD in water Nile affected by surrounding activities. As for Total Dissolved Solids (TDS), Water quality results assured the validity of water for all uses. Values of Nitrate concentrations showed that Nile water is of (excellent) quality. This also assures the validity of water for all uses.

Consequently, The total Water Quality Index (WQI) through years of study indicates that the Nile water is of (good) quality and its results assures the validity of the Nile water for all uses. To sum up, Water Quality Index (WQI) with its various parameters can be considered as a significant method for monitoring and determination water quality.

6. AKCNOWLEDGMENT

The author would like to thanks Dr. Khalid M. Fahmy, the Minister of Environment, for his real supporting and encouragement.

7. REFERENCES

Abyaneh, H.Z.(2014). Evaluation of multivariate linear regression and artificial neural networks in prediction of water quality parameters. J. Environ. Health Sci. Eng. 12 (40), 1–8.

Adaelson Campelo Medeirosa,c,□, Kleber Raimundo Freitas Faiala, Kelson do Carmo Freitas Faiala, Iris Danielly da Silva Lopesa, Marcelo de Oliveira Limaa, Raphael Mendonça Guimarãesb, Neyson Martins Mendonçac, 2017. Quality index of the surface water of Amazonian rivers in industrial areas in Pará, Brazil. Marine Pollution Bulletin 123, 156–164.

Akoteyon, I.S., Omotayo, A.O., Soladoye, O. and Olaoye, H.O. (2011). Determination of water quality index and suitability of urban river for municipal water supply in Lagos-Nigeria. Europ. J. Scientific Res, 54(2), 263-271.

APHA (American public Health Association). (2005). Standard Methods for The Examination of water and Wastewater (21th Ed.). Washington, D.C.

Bharti, N. and Katyal, D. (2011). Water quality indices used for surface water vulnerability assessment. Int. J. Environ. Sci., 2(1), 154-173.

Chapman, D.V., 1996. World Health Organization, Water Quality Assessments: A Guide to the Use of Biota, Sediments, and Water in Environmental Monitoring. Unesco\ World Health Organization\United Nations Environment Programme.

Cooper ,J., Rediske, R., Northup ,M., Thogerson, M. and Van Denend, J. (1998). Agricultural water quality index. Scientific Technical Report. paper 11.

Elhatip, H., and Ko¨mu¨ r, M.A. (2008). Evaluation of water quality parameters for the Mamasin Dam in Aksaray city in the central Anatolian part of Turkey by means of artificial neural networks. Environ. Geol. 53, 1157–1164.

Giljanovic, N.S., 1999. Water quality evaluation by index in Dalmatia. Water Res. 3 (16), 3423–3440.

Hefni Effendia, Romantob, Yusli Wardiatnob, 2015. Water quality status of Ciambulawung River, Banten Province, based on pollution index and NSF-WQI, Procedia Environmental Sciences 24, 228 – 237.

Jagadeeswari P. B. and K. Ramesh. (2012). Water Quality Index for Assessment of Water Quality in South Chennai Coastal Aquifer, Tamil Nadu, India. International Journal of Chem. Tech Research, 4 (4), 1582-1588.

Kuo, J.T., Hsieh, M.H., Lung, W.S., and She, N. (2007). Using artificial neural network for reservoir eutrophication prediction. Ecol. Model. 200, 171–177.

Levi, L., Jaramillo, F., Andričević, R., Destouni, G., 2015. Hydroclimatic changes and drivers in the Sava River catchment and comparison with Swedish catchments. Ambio 44(7), 624–634.

National Sanitation Foundation Water Quality Index (NSFWQI).

Niroobakhsh, M.S.H., Musavi-Jahromi, S.H., Manshouri, M., and Sedghi, S. (2012). Prediction of water quality parameter in Jajrood River basin: Application of multi-layer perceptron (MLP) perceptron and radial basis function networks of artificial neural networks (ANNs). African Journal of Agricultural Research, 7 (29), 4131– 4139.

Rankovic, V., Radulovi, J., Radojevic, I., Ostojic, A., and Comic, L. (2010). Neural network modeling of dissolved oxygen in the Gruza reservoir, Serbia. Ecol. Model. 221, 1239–1244.

Rifaat A. Wahaab and Mohamed I. Badawy. (2004). Water Quality Assessment of the River Nile System: An Overview. Biomedical and Environmental Sciences, 17, 87-100.

Shweta Tyagi, Bhavtosh Sharma, Prashant Singh, and Rajendra Dobhal. (2013). Water Quality Assessment in Terms of Water Quality Index. American Journal of Water Resources, Vol. 1, No. 3, 34-38.

Smith, D.G., 1990. A better water quality indexing system for rivers and streams. J. Braz. Wat. Res. 24 (10), 1237–1244.

Stefan, H.G., Fang, X., Wright, D., Eaton, J.G., and McCormick, J.H. (1995). Simulation of dissolved oxygen profiles in a transparent, Dimictic Lake, Limnol. Oceanogr. 40, 105 –118.

Table 1: **National Sanitation Foundation Water Quality Index (NSF-WQI) classification criteria**
(Hefni et.al., 2015)

NSF-WQI Score	0 - 25	26 – 50	51 - 70	71 – 90	91 - 100
Criteria	Very Bad	Bad	Medium	Good	Excellent

Table 2: Comparison between criteria of water quality of many different rivers:

River Name	**Criteria of water quality**	**Reference**
Ciambulawung	Good	Hefni et al 2015
Cihideung	Good	Hefni 2015
Ciapus	Good	Hefni 2015
Lake of PPLH	Good	Hefni 2015
Arapiranga	Good	Adaelson Campelo Medeirosa 2017
Murucupi	Good	Adaelson Campelo Medeirosa 2017
Nile	Good	This study

8. Figures

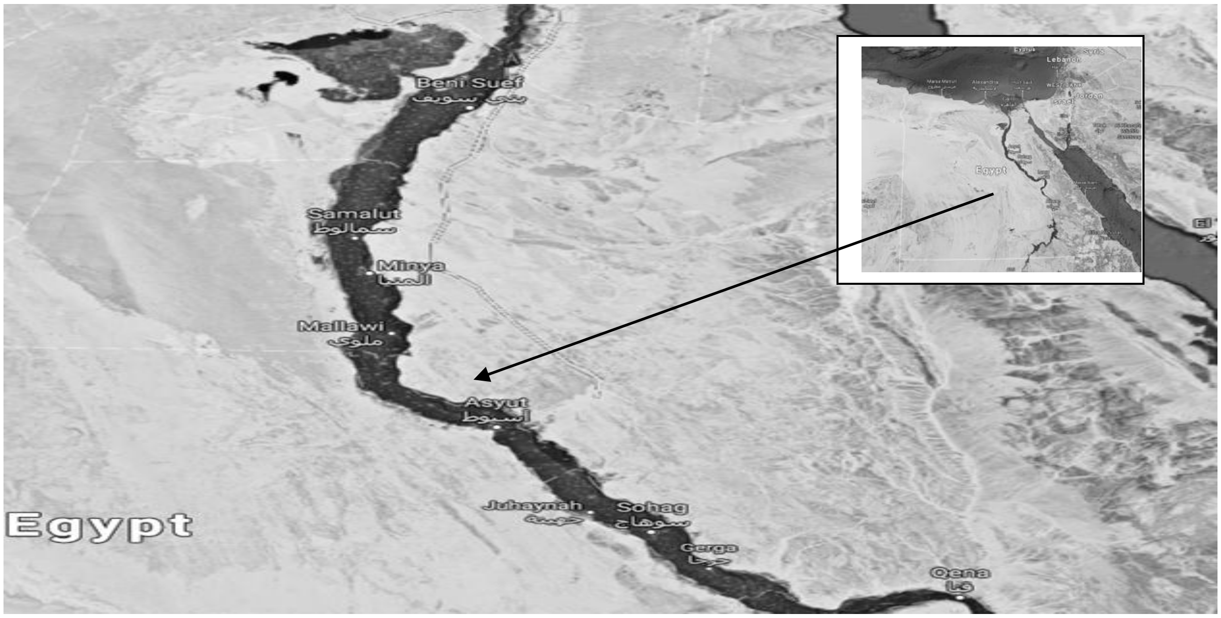

Fig. 1: Egypt map and the studied area from River Nile

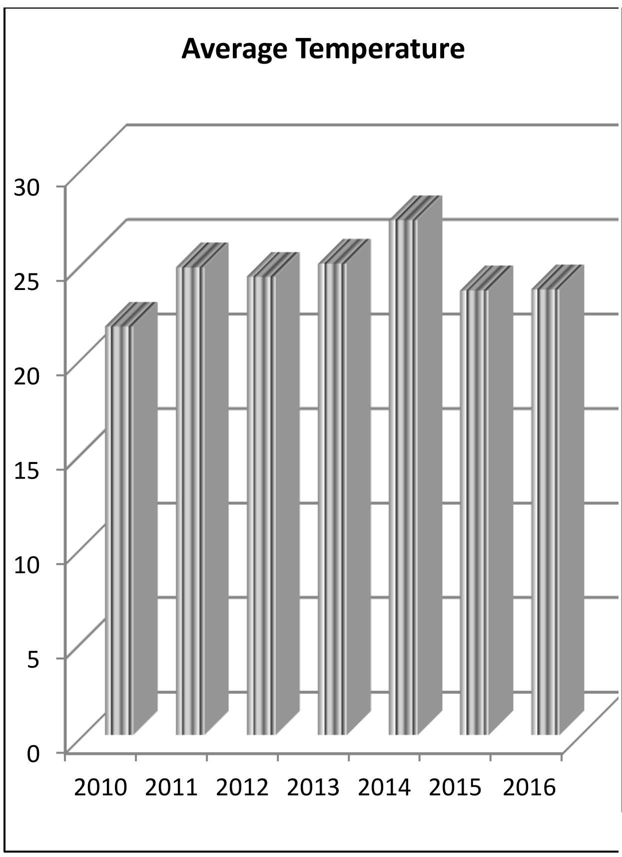

Fig.2 : The average temperature (°C) vs. years of studied

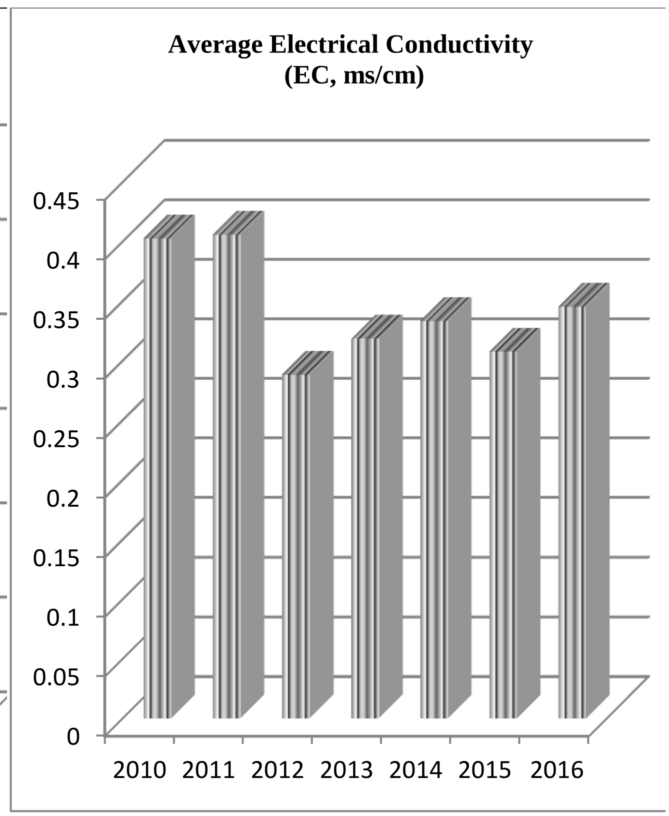

Fig.3: The average electrical conductivity (ms/cm) vs. years

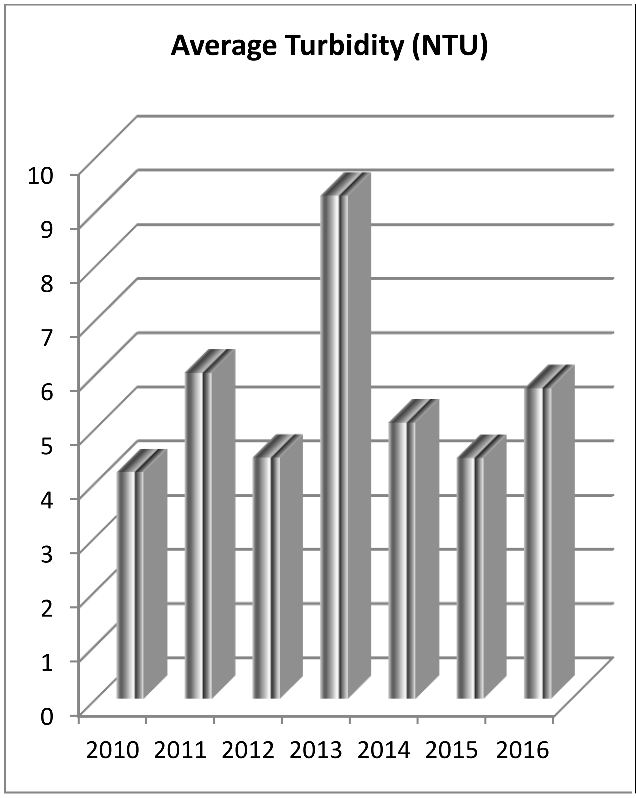

Fig.4: The average values of Turbidity (NTU) vs. years

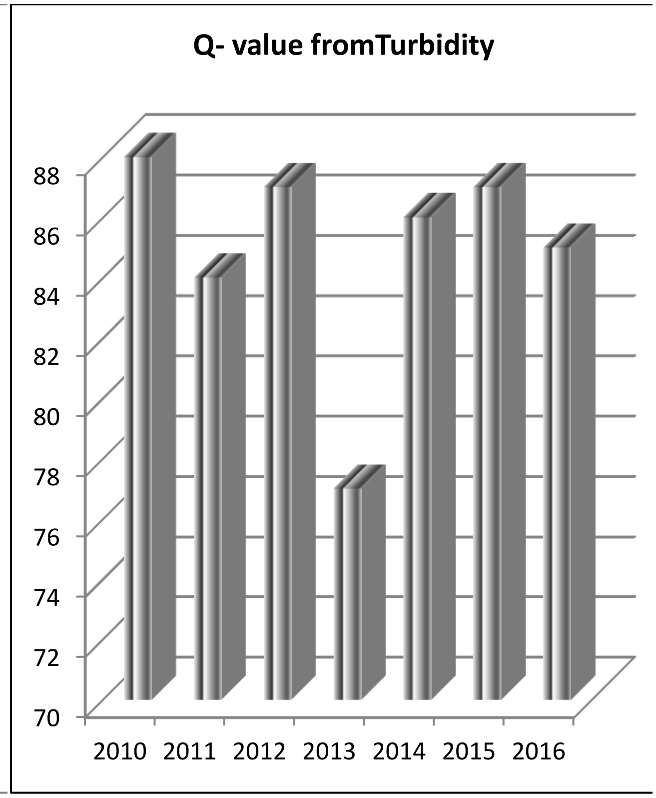

Fig.5: Water Quality (Q- Value) for turbidity vs. years

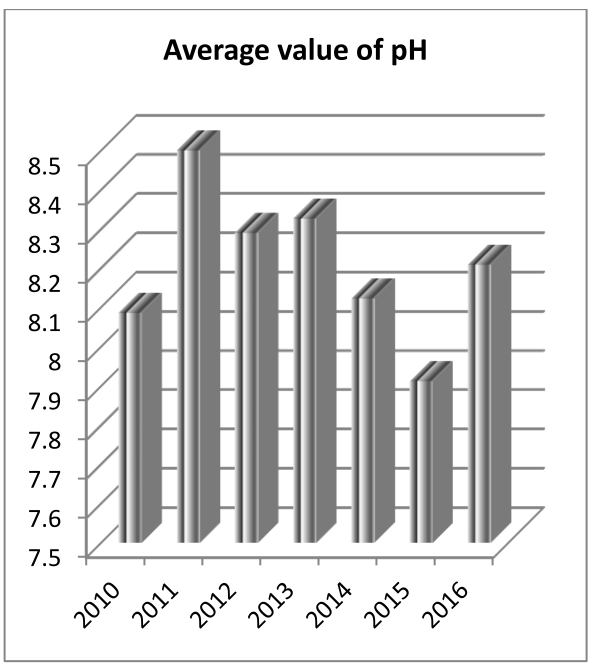

Fig.6: The average values of pH vs. years

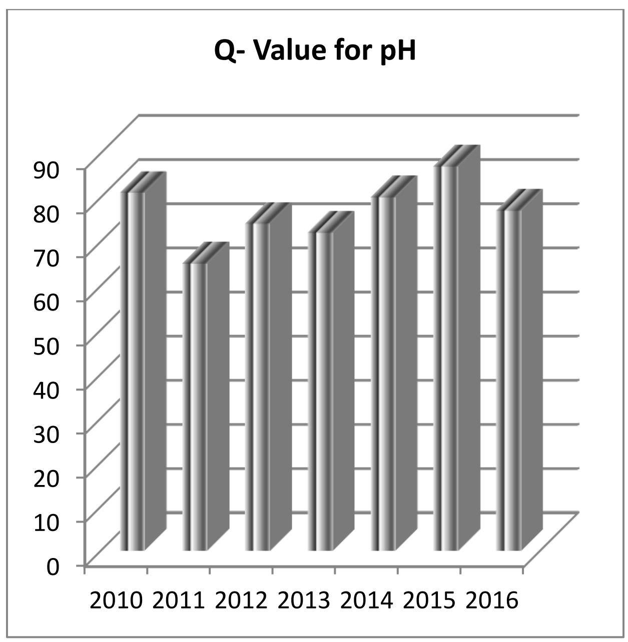

Fig.7: Water Quality (Q- Value) for turbidity vs. years

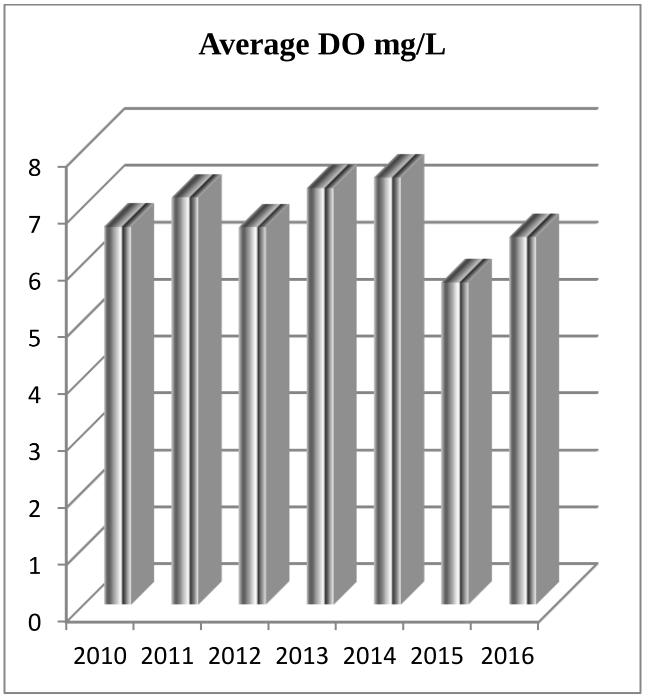

Fig.8: The average values of Dissolved Oxygen concentration (DO) mg/L vs. years

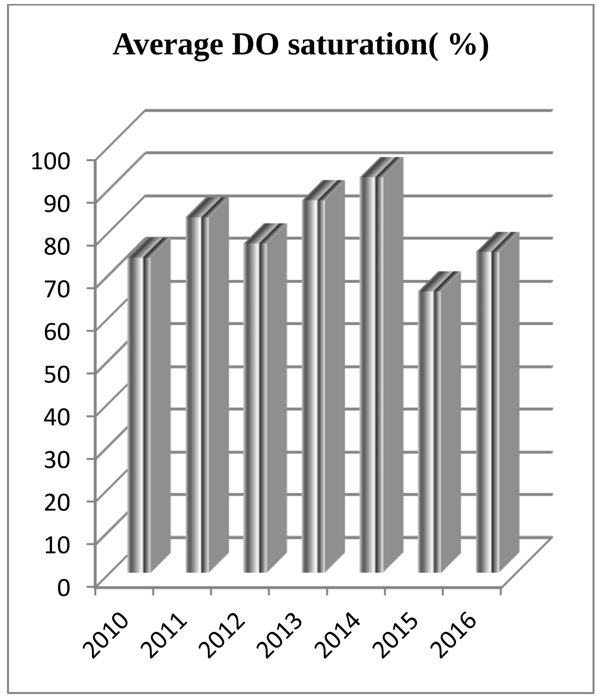

Fig.9: The average values of Dissolved Oxygen saturation (DO) % vs. years

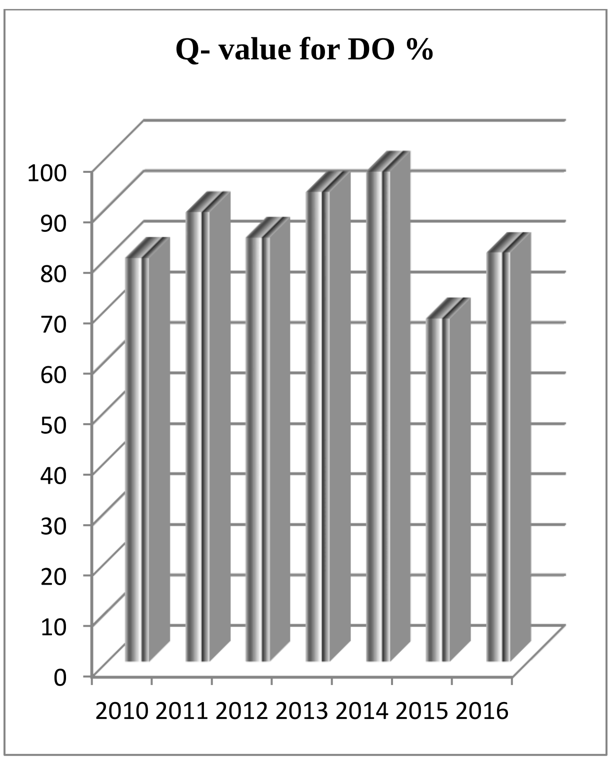

Fig.10: Water Quality (Q- Value) for Dissolved Oxygen (DO) vs. years

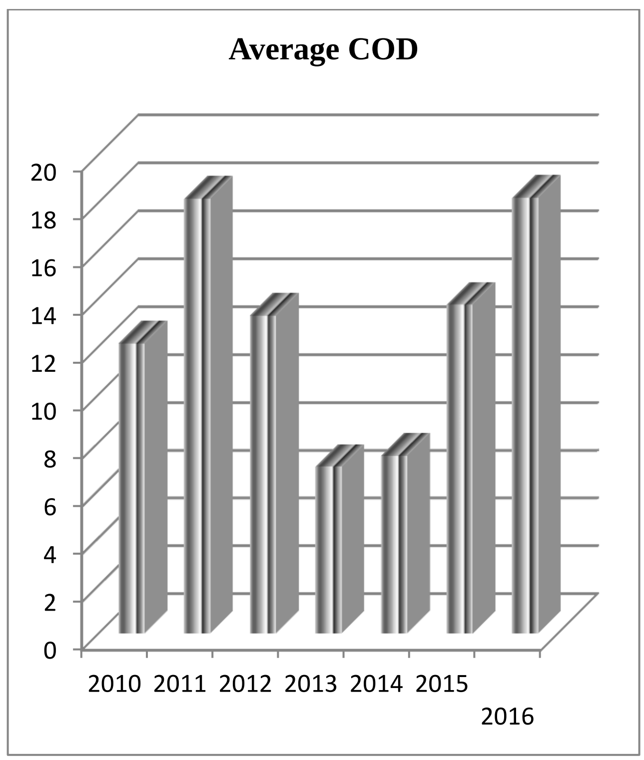

Fig.11: The average values of Chemically Oxygen Demand (COD)mg/L vs. years

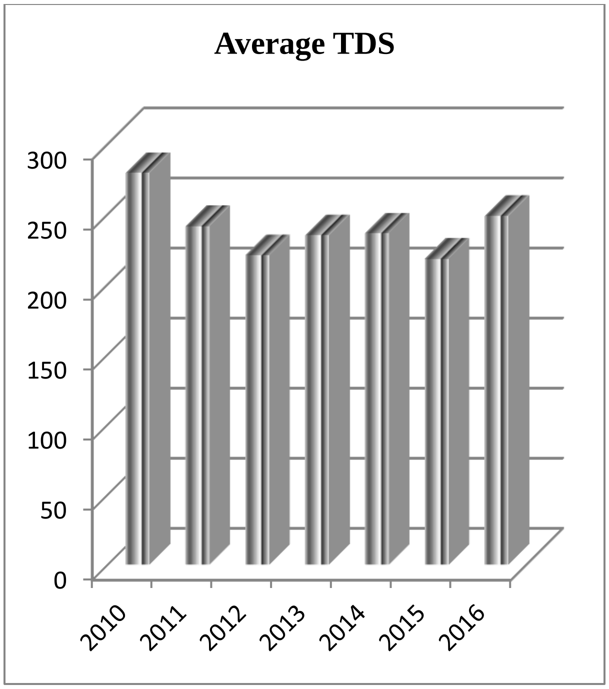

Fig.12: The average values of Total Dissolved Solids(TDS)ppm vs. years

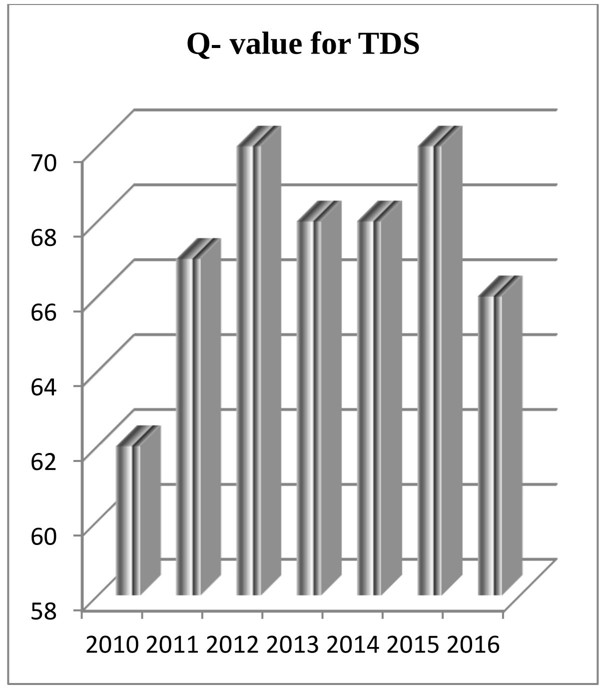

Fig.13: Water Quality (Q- Value) for Total Dissolved Solids (TDS) vs. years

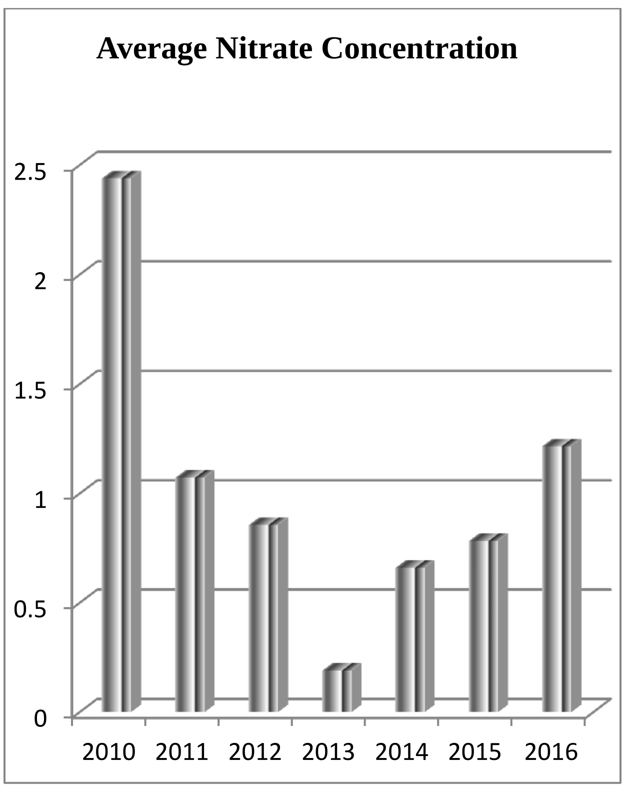

Fig.14: The average values of Nitrates concentrations, ppm vs. years

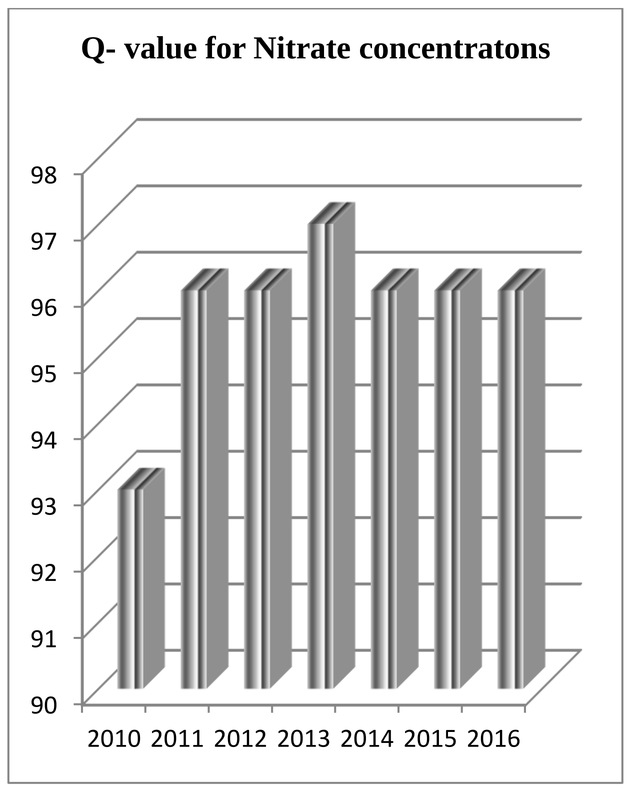

Fig.15: Water Quality (Q- Value) for Nitrates concentrations, vs. years

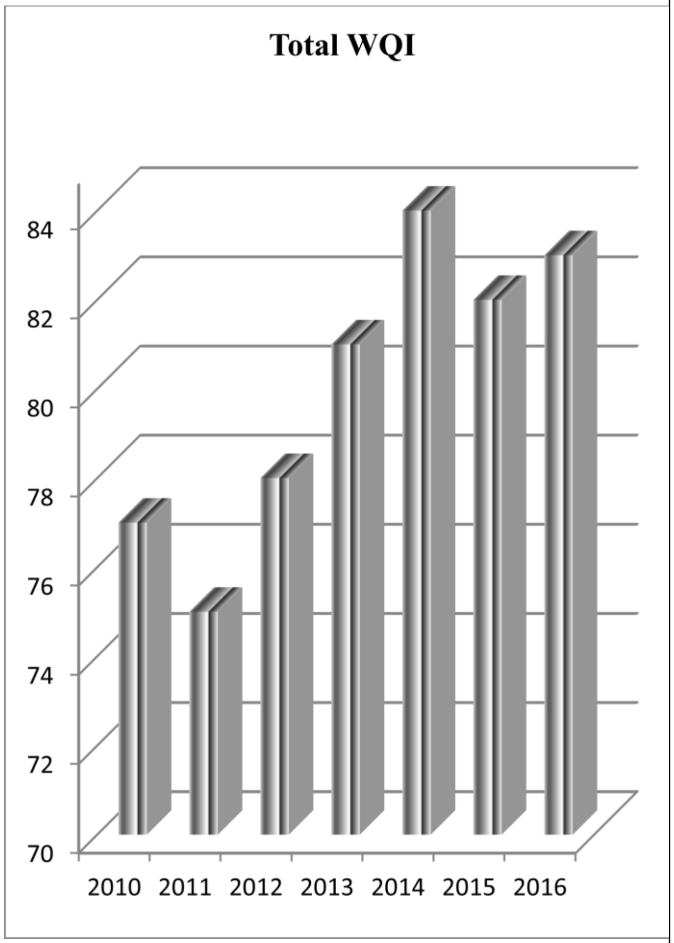

Fig.16: Water Quality Index (WQI) vs. years

□

قياس مؤشر جودة المياه لنهر النيل في صعيد مصر

محمد محمود شحاتة

شئون البيئة – مستشفيات جامعة أسيوط – جامعة أسيوط

E.mail: mohamedshahata67@hotmail.comhttp://www.aun.edu.eg

الملخص

يتم قياس نوعية المياه في مصر من خلال برنامج الرصد الدوري حيث يتم قياس المؤشرات الطبيعية والكيميائية والميكروبيولوجية. يتم فحص نقاط مراقبة نهر النيل بشكل دوري كل أربعة أشهر. ويمكن أن يكون القياس لرصد تأثير مختلف مصادر الصرف الصحي وخاصة الصرف الصناعي على الممرات المائية. بالإضافة لذلك رصد البقع الساخنة على ضفاف الأنهار لتعتبر معيارا حقيقيا للحكم على نوعية المياه العذبة لنهر النيل . وأظهرت معظم النتائج من خلال سنوات البحث على نوعية مياه النيل صحة تلك المياه لجميع الاستخدامات.