ENVIRONMENTAL STUDY ON WATER QUALITY ASSESSMENT AND PREDICTION IN LAKE NASSER BY USING MONITORING NETWORKS

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ABSTRACT

This paper deals with studying water quality assessment and prediction in Lake Nasser (Egypt) by using monitoring networks, in which development of water quality modeling techniques for Nile water management is very important A mathematical model was created to estimate daily all parameters of water quality by constructing a fixed laboratoury at the entrance of the lake using the available data from 1977 to 2001. A physical, chemical and bilogical analysis was made on water quality on 25 sections distributed along the lake about 500 km from El Daka to the High Dam at Aswan were studied. Also the water evaporation losses at the lake from the relation between evaporation losses and dissolved oxygen amount are estimated at the water layers. The number of the regression equations of water quality parameters along the lake reach 33000 equations approximately .

PREDICTION PROCEDURES

The regression analysis equations of water quality parameters between sections were estimated from the available data from 1977 to 2001. These regression equations were calculated along the Lake, twenty-five sections, through seven layers depth, three-direction routes width, and two time periods.

The statistical figures of hydrological, physical, chemical and microbiological parameters were calculated at the north and south part of the Lake.

By constructing a fixed laboratory at the entrance of the Lake, we can estimate daily water quality parameters along the Lake using the mathematical model. Therefore, we can predict the water quality parameters along the Lake for 35 to 90 days before reaching to the High Dam.

The hydrological, physical, chemical and microbiological parameters were estimated along the Lake using the Three-Dimensional Mathematical Model with variable times (April 2000 and August 2001). And the estimated errors were calculated using measured and estimated data of the two years (April 2000 and August 2001).

DISCUSSION Of THE RESULTS

This paper collects all the relations between water quality parameters along the lake during two different periods, so we can estimate the results as well as discussing the relationship between parameters during the two periods using four different analysis as follows:

A- Hydrological characteristics relationships
B- Physical characteristics relationships
C- Chemical and trace element characteristics relationships
D- Microbiological characteristics relationships

1. During Flood Period

The flood period begins every year At Aswan differently but at most times from August till October. This short period brings about 85 % of arriving water at lake Nasser every year, which come from high mountains in Ethiopia, with high energy of velocity through the Blue Nile. The flood season indicates the water quality at Blue Nile, with all minerals of water coming from Ethiopia within a short time with high velocity. It has no chance to make self purification till it comes to lake Nasser. Before flood season water quality is affected by the characteristics of the White Nile, which comes from Uganda. It has a long distance with a long period till it reaches to lake Nasser, so it can make self-purification. It is very important to know that the rainwater flows leache the materials in agriculture lands like clay or silt… etc, which affects the water quality till it reaches to the surface water (River) .

1.1. The Hydrological Characteristic Relationships

Using the regression analysis carried out the mathematical model. It has three-dimensional grids with variable time. These grids are twenty-five sections, seven layers depth, three routes width and two different time periods. This model illustrates the following results

Water Velocity, Turbidity and Total Suspended Solids (TSS)
Water velocity decreases from the south part to the north part of the lake. The average figure at the south part is about 0.328 m/sec. However at the north part the average is about 0.00762 m/sec. From data records of the long period study the average turbidity at the south part is more than twelve times at the south part of the lake, at the same time the average turbidity during flood season is more than five times at before flood season as shown in Figs. 4 and 15. There are proportional relationships between velocity, turbidity and total suspended solids, e.g. at the north part the lowest values of velocity, turbidity and total suspended solids are zero m/sec, zero N.T.U. and 2.899 mg/l respectively, while at the south part the highest values of 0.75 m/sec, 168 N.T.U. and 254.7 mg/l respectively, as shown in Fig. 1.

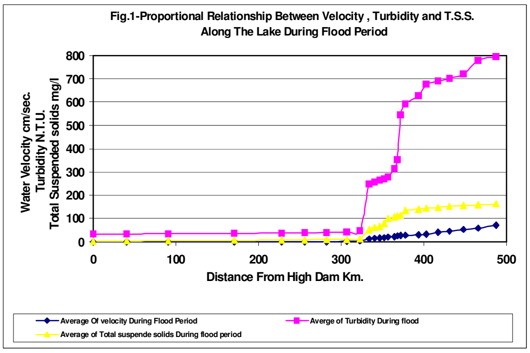


Fig.1-Proportional Relationship Between Velocity , Turbidity and T.S.S. Along The Lake During Flood Period

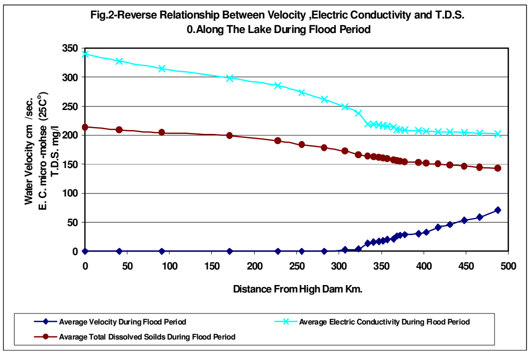


Fig.2-Reverse Relationship Between Velocity ,Electric Conductivity and T.D.S. 0.Along The Lake During Flood Period

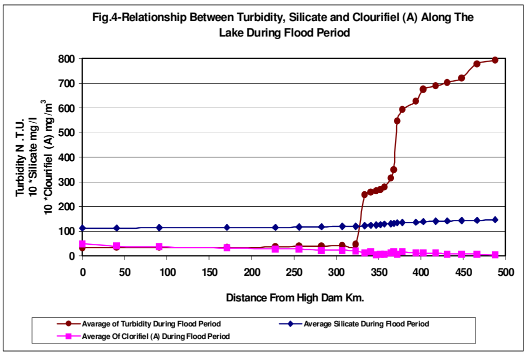


Fig.4-Relationship Between Turbidity, Silicate and Clourifiel (A) Along The Lake During Flood Period

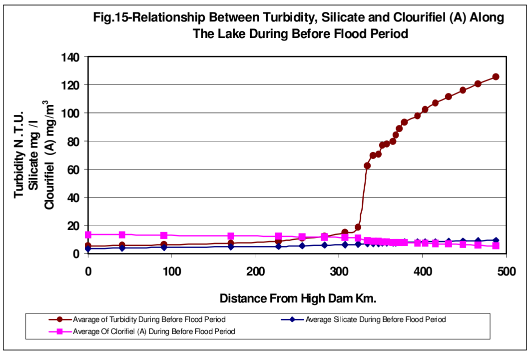


Fig.15-Relationship Between Turbidity, Silicate and Clourifiel (A) Along The Lake During Before Flood Period

Water Velocity, Electric Conductivity and Total Dissolved Solids (TDS)

Water velocity has reverse relationships with electric conductivity, total dissolved solids, and algae in the transparence water, e.g. at the north part with minimum velocity the highest values of electric conductivity, total dissolved solids and clorifiel-A are 374.33 micro-mhos (25 ^{o}C), 243.95 mg/l and 36.8 mg/m^3 respectively, while at the south part the lowest values are 193.92 micro-mhos (25 ^{o}C), 128.03 mg/l and 4.3 mg/m^3 respectively, as shown in Fig. 2.

Wind Speed, Temperature and Dissolved Oxygen (DO)

There is a marked difference (about 25 %) of dissolved oxygen between south and north part of the lake. This difference is due to the increase of temperature and the decrease of wind speed at the High Dam.

Wind Speed (WS) and Water Velocity (WV)

Here, we have a proportional relationship between wind speed and water velocity. i.e. decreasing 20 percent of wind speed from south to north , will decrease 50 percent of water velocity at the High Dam.

1.2. Physical Characteristic Relationships

Temperature, Dissolved Oxygen (DO) and Hydrogen Ion Concentration (pH)

Temperature has a reverse relationship with dissolved oxygen in water and proportional relationship with hydrogen ion concentration. When the temperature decreases the dissolved oxygen increases especially at the south part of the lake with low hydrogen ion concentration. For example at the south part with average temperature about 20.67°C the average dissolved oxygen is 6.309 mg/l with an average hydrogen ion concentration 8.034 units. More over at the north part with average temperature 22.64°C the average dissolved oxygen is 5.08 mg/l with an average hydrogen ion concentration 8.38 unit. So the dissolved oxygen increased at the south part due to low hydrogen ion concentration and low temperatures. Also at the north part due to high temperature the change of bicarbonate to carbonate takes place and also the hydrogen ion increased, as well as the dissolved oxygen decreases, due to the respiration of large number of microorganisms at north part, as shown in Fig. 3.

Turbidity, Silicate (SiO_2) and Clorifiel (A)

The turbidity (contains suspend matter of sand, clay and microorganisms), decreases at the north part with low velocity. Then high amount of clay and sand are settled at the south part. At the same time, the water has high degree transparence and good environment for growth of the algae at the north part, which is atrophic field. i.e. the turbidity decreases from 506.9 N.T.U. at south to 38.45 N.T.U. at north. Meanwhile, silicate decreases from 13.49 mg/l at south to 11.65 mg/l at north. On the other side clorifiel –A increases from 5.76 mg/m^3 at south to 22.4 mg/m^3 at the north, as shown in Fig. 4.

Total Dissolved Solids (TDS) and Electric Conductivity (EC)

Total dissolved solids have a proportional relationship with electric conductivity, as shown in Fig. 2. By analyzing the data records of T.D.S. and E.C. We conclude that there is a good proportional relationship between them.

The equation is T.D.S. = 0.67 E.C. Also the T.D.S. and E.C. increase from south to the north direction of the lake. Especially during flood period, there are marked differences between south and north part of the lake for T.D.S. and E.C. are about 36 mg/l and 77 micro-mhos (25°C) respectively. they increase from the south part to the north part of the lake, due to the increasing of negative charge anions like (carbonate, bicarbonate and chloride) and positive charge cations like (calcium, magnesium, sodium and potassium) as dissolved solids.

Total Suspended Solids (TSS), Electric Conductivity (EC) and Velocity

The total suspended solids contain sand and clay where they are maximum at the south part of the lake, with high velocity and narrow width . Large width at the north part of the lake with low velocity settling of total suspended solids took place. So the suspend solids decreased from south to north direction and are about zero at High Dam section. The dissolved solids and electric conductivity have reverse relation with suspended solids, as shown in Fig. 1.

1.3. Chemical Characteristic Relationships

Dissolved Oxygen (DO), Hydrogen Ion Concentration (pH) and Temperature

A precipitation of high dissolved oxygen and low hydrogen ion concentration cause high scouring of the soil. With high temperature the dissolved oxygen decrease. The floodwater has more scouring at tropical region (Ethiopian plateau), as shown in Fig. 3.

Carbonate (CO_3), Bicarbonate (HCO_3), Temperature, Total hardness and Total Alkalinity

Carbonate has a proportional relationship with the temperatures, while bicarbonate has a reverse relationship with temperature. Because at the north part of the lake with high temperature the bicarbonate changes to carbonate. So the carbonate concentration at north part is more than at south part of the lake, as shown in Fig. 5.

Total hardness and total alkalinity have proportional relationships with carbonate and hydrogen ion concentration .So the increase of anion groups of carbonate from south to north part of the lake, the alkalinity, total hardness and hydrogen ion concentration increased, as shown in Fig. 5.

Hydrogen Ion Concentration (pH.), Carbonate (CO_3) and Total Alkalinity

Hydrogen ion concentration has a proportional relationship with carbonate and alkalinity. The north part of the lake has average pH. about 8.38 more alkalinity than at the south part pH. about 8.034, as shown in Fig. 6.

Sulfate (SO_4), Total Alkalinity and Total Dissolved Solids

Sulfate has a proportional relationships with alkalinity and total dissolved solids. Because total dissolved solids contains sulfate and increasing it at the north part of the lake, the sulfate increases, as shown in Fig. 7.

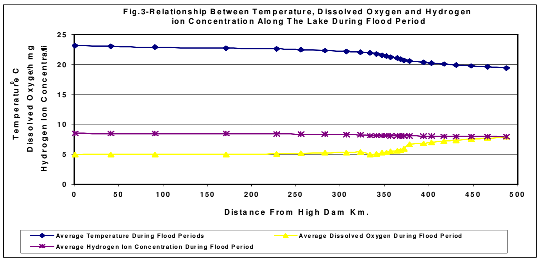


Fig.3-Relationship Between Temperature, Dissolved Oxygen and Hydrogen ion Concentration Along The Lake During Flood Period

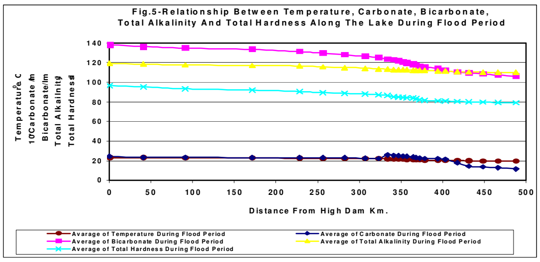


Fig.5-Relationship Between Temperature, Carbonate, Bicarbonate, Total Alkalinity And Total Hardness Along The Lake During Flood Period

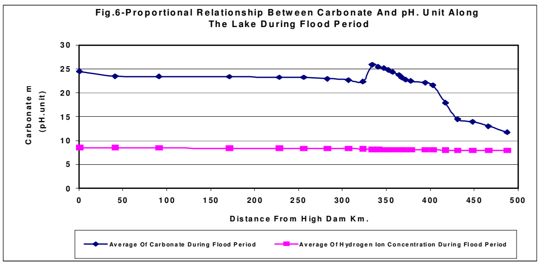


Fig.6-Proportional Relationship Between Carbonate And pH. Unit Along The Lake During Flood Period

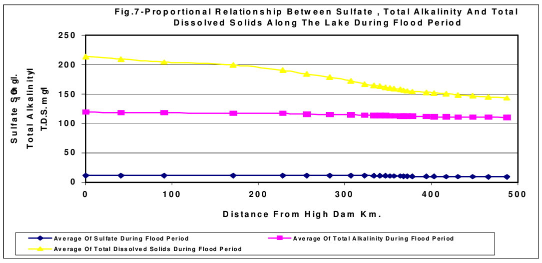


Fig.7-Proportional Relationship Between Sulfate , Total Alkalinity And Total Dissolved Solids Along The Lake During Flood Period

Nitrite (NO_2), Nitrate (NO_3), Ammonia (NH_3) and Algae

Nitrite concentration has a proportional relationship with algae and reverse with nitrate and ammonia. Algae redact nitrate-No_3 to nitrite No_2 and oxygen, so nitrite increased at the north part. Also algae redact ammonia to nitrogen and hydrogen. Nitrogen can be a good nutrient for microorganisms, which increase at the north part. So the concentration of nitrite increased, while the concentration of nitrate decrease from south to north part of the lake, as shown in Fig. 8.

Phosphate (PO_4), Phosphorous (P) and Clorifiel (A)

Phosphate and phosphorous are represented as a nutrient, so they decrease at the north part with high microorganism and water haycent plant, as shown in Fig. 9.

Iron (Fe) and Copper (Cu)

Iron and copper increase from the south part to the north part of the lake. Because, geological mountains around the lake are volcanic rocks and Nubian sand, which have heavy metal like iron and copper. They increase at the north part of the lake due to melting and scouring the volcanic rocks and Nubian sand along the lake, as shown in Fig. 10.

1.4. Microbilogical Characteristic Relationships

Total Coliform, Faecal Coliform, Total Suspended Solids (TSS) and Velocity

Microbiological analysis, total coliform and faecal coliform are decreasing from south to the north part of the lake. So we can say that the Blue Nile water quality has high concentration of microbiological at the entrance of the lake and decreasing, due to more water release during flood season, which purify the water quality at the north part of the lake. So microbiological concentration has a proportional relationship with the velocity and total suspended solids, as shown in Fig.11.

Clorifiel (A) and Turbidity

Clorifiel (A) has a reverse relationship with turbidity. So at the entrance of the lake with high turbidity the clorifiel (A) concentration is low.

By low turbidity at the north part of the lake with high water transparent is a good atrophic field for microorganisms and water hyacinth plant as shown in Fig. 4.

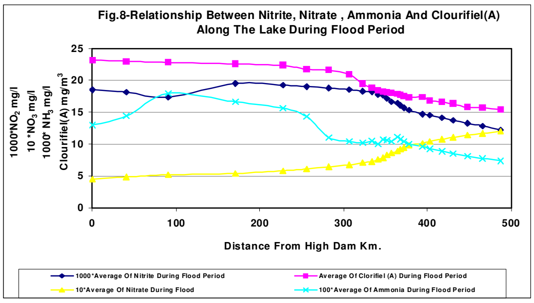


Fig.8-Relationship Between Nitrite, Nitrate , Ammonia And Clourifiel(A) Along The Lake During Flood Period

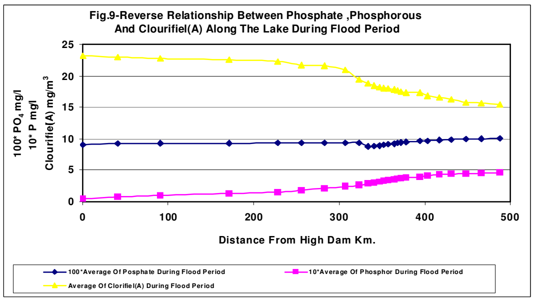


Fig.9-Reverse Relationship Between Phosphate ,Phosphorous And Clourifiel(A) Along The Lake During Flood Period

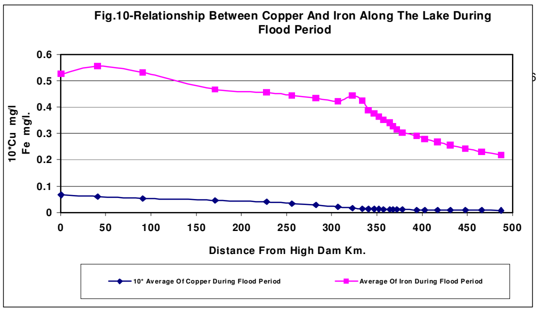


Fig.10-Relationship Between Copper And Iron Along The Lake During Flood Period

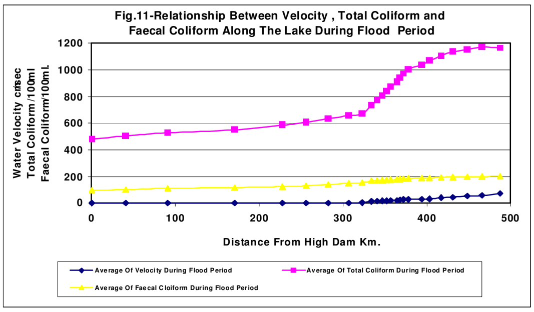


Fig.11-Relationship Between Velocity , Total Coliform and Faecal Coliform Along The Lake During Flood Period

2. Before Flood Period

Before flood period which begins every year from November till June. This long period has only about 15 % of arriving water at Lake Nasser every year, which comes from Lake Victoria, with constant low energy of velocity through White Nile. Before flood season indicates the water quality of White Nile, with all minerals of water coming from different countries lie around Victoria Lake, with a long time period, long journey distance and low velocity, so it a good chance to make self purification till it comes to Lake Nasser.

2.1. The Hydrological Characteristic Relationships

Water Velocity, Turbidity and Total Suspended Solids (TSS)

Water velocity decreases from the south part to the north part of the lake. The average velocity at the south part is about 0.126 m/sec . However at the north part the average is about 0.0009 m/sec. There are proportional relationships between velocity, turbidity and total suspended solids, e.g. at the north part the lowest values of velocity, turbidity and total suspended solids are zero m/sec, 4.25 N.T.U. and 2.8 mg/l respectively. At the south part the highest values are 0.46 m/sec, 138.88 N.T.U. and 82.4 mg/l respectively, as shown in Fig. 12.

Water Velocity, Electric Conductivity And Total Dissolved Solids(TDS)

Water velocity has a reverse relationships with electric conductivity, total dissolved solids, and algae in the transparence water, e.g. at the north part with minimum velocity the highest values of electric conductivity, total dissolved solids and clorifiel - A are 417.18 micro-mhos (25^{o}C), 195.65 mg/l and 16.8 mg/m^3 respectively, while at the south part the lowest values are 187.089 micro-mhos (25^{o}C), 170.43 mg/l and 4.3 mg/m^3 respectively, as shown in Fig. 13.

Wind Speed, Temperature and Dissolved Oxygen (DO)

There is a marked difference (about 25 %) of dissolved oxygen between south and north part of the lake. This difference is due to the increasing of temperature and the decrease of wind speed at the High Dam.

Wind Speed (WS) And Water Velocity (WV)

There is a proportional relation ship between wind speed and water velocity. i.e. decreasing 20 percent of wind speed from south to north , will decrease 30 percent of water velocity at the High Dam.

2.2. Physical Characteristic Relationships

Temperature, Dissolved Oxygen (DO) and Hydrogen Ion Concentration (pH)

Temperature has a reverse relationship with dissolved oxygen in water and proportional relationship with hydrogen ion concentration. When the temperature decreases the dissolved oxygen increases especially at the south part of the lake with low hydrogen ion concentration and high wind speed. For example at the south part with average temperature 22.37°C the average dissolved oxygen is 6.475 mg/l with an average hydrogen ion concentration 8.236 unit. Moreover at the north part with average temperature 25.05°C the average dissolved oxygen is 4.56 mg/l with an average hydrogen ion concentration 8.54 unit. So the dissolved oxygen increased at the south part due to low hydrogen ion concentration and low temperatures.

So at the north part due to high temperature the change of bicarbonate to carbonate takes place and also the hydrogen ion increased as well as the dissolved oxygen decreases, due to the respiration of large number of microorganisms at north part, as shown in Fig. 14.

Turbidity, Silicate (SiO_2) and Clorifiel (A)

The turbidity (contains suspend matter of sand, clay and microorganisms), decreases at the north part with low velocity. Then high amount of clay and sand are settled at the south part. At the same time the water has high degree transparence and good environment for growth of the Algae at the north part, which is Atrophic field. For example: The turbidity decreases from 92.83 N.T.U. at south to 10.12 N.T.U. at north. Meanwhile silicate decreases from 8.115 mg/l at south to 5.1 mg/l at north. On the other side clorifiel –A increases from 7.26 mg/m^3 at south to 12.4 mg/m^3 at the north, as shown in Fig.15.

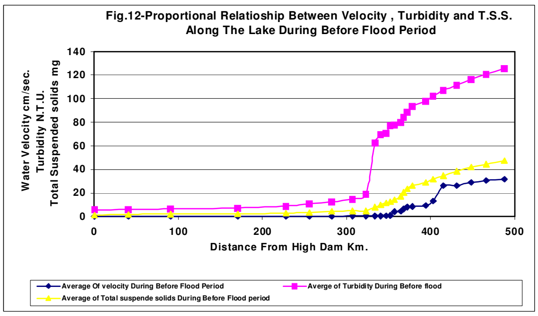


Fig.12-Proportional Relatioship Between Velocity , Turbidity and T.S.S. Along The Lake During Before Flood Period

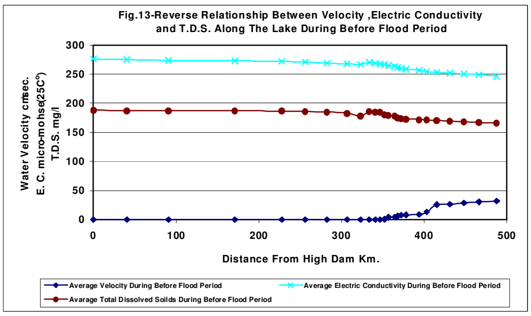


Fig.13-Reverse Relationship Between Velocity ,Electric Conductivity and T.D.S. Along The Lake During Before Flood Period

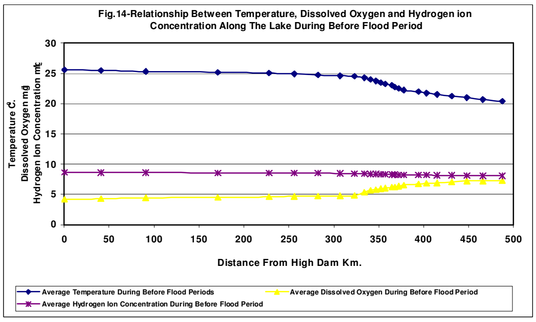


Fig.14-Relationship Between Temperature, Dissolved Oxygen and Hydrogen ion Concentration Along The Lake During Before Flood Period

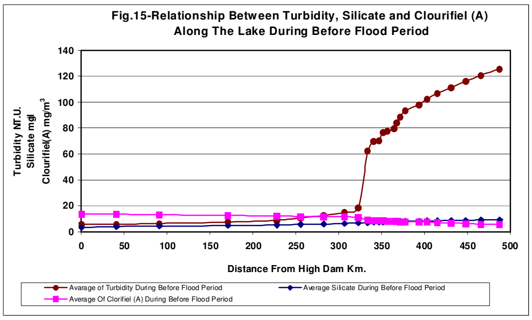


Fig.15-Relationship Between Turbidity, Silicate and Clourifiel (A) Along The Lake During Before Flood Period

Total Dissolved Solids(TDS) And Electric Conductivity(EC)

Total dissolved solids have a proportional relationship with electric conductivity, as shown in Fig.13. By analyzing the data records of T.D.S. and E.C. We conclude that there is a good proportional relationship between them.

The equation is T.D.S. = 0.68 E.C. Also the T.D.S. and E.C. increase from south to the north direction of the lake.

Before flood period the differences between average figure at south and north part of the lake for T.D.S. and E.C. are about 10 mg/l and 12 micro-mhos (25^oC) respectively. So they are increase at the north part of the lake, due to the decreasing of negative charge Anions like (carbonate, bicarbonate and chloride) and positive charge cations like (calcium, magnesium, sodium and potassium) as dissolved solids.

Total Suspended Solids, Electric Conductivity (EC) and Velocity

The total suspended solids contain sand and clay where they are maximum at water with high velocity and narrow width at the south part of lake . Large width at the north part of the lake with low velocity settling of total suspended solids took place. So the suspend solids decreased from south to north direction and are about zero at high dam section. The dissolved solids and electric conductivity have a reverse relation with suspended solids, as shown in Fig. 12.

2.3. Chemical Characteristic Relationships

Dissolved Oxygen (DO), Hydrogen ion Concentration (pH) and Temperature

The dissolved oxygen is decreasing by high temperature. Because by high temperature the density of water is increasing and moving to the deep layers, which has a low amount of dissolved oxygen, as shown in Fig.14.

Carbonate (CO_3), Bicarbonate (HCO_3), Temperature, Total hardness and Total Alkalinity

Carbonate has proportional relationship with the temperatures while Bicarbonate has a reverse relationship with temperature. Because at the north part of the lake with high temperature the bicarbonate changes to carbonate. So the carbonate concentration at north part is more than at south part of the lake, as shown in Fig. 16.

Total hardness and total alkalinity have proportional relationships with carbonate and hydrogen ion concentration. The increase of anion groups of carbonate from south to north part of the lake, the alkalinity, total hardness and hydrogen ion concentration increased, as shown in Fig. 16.

Hydrogen Ion Concentration (pH.), Carbonate (CO_3) And Total Alkalinity

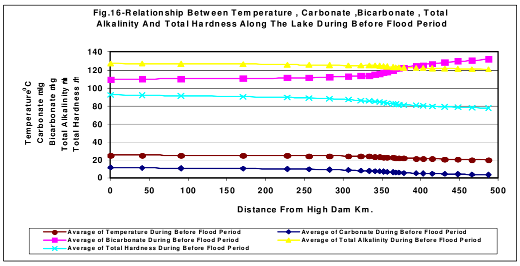
Hydrogen ion concentration has a proportional relationship with carbonate and alkalinity. The north part of the lake has average pH. about 8.54 more alkalinity than at the south part pH. about 8.236 mg/l, as shown in Fig. 17.

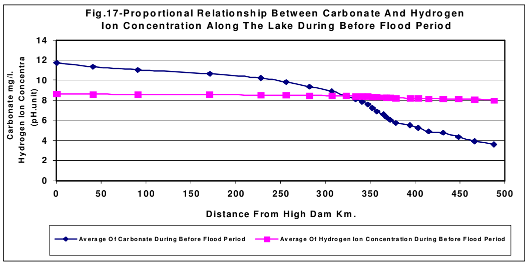
Sulfate (SO_4), Total Alkalinity and Total Dissolved Solids

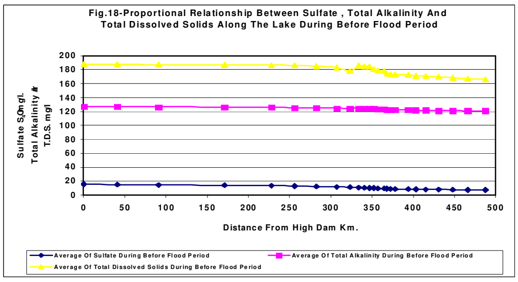
Sulfate has a proportional relationships with alkalinity and total dissolved solids. Because total dissolved solids contains sulfate and increasing it at the north part of the lake, the sulfate increases, as shown in Fig. 18.

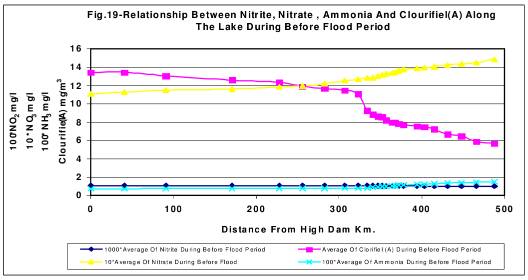
Nitrite (NO_2), Nitrate (NO_3), Ammonia (NH_3) and Algae

Nitrite concentration has a proportional relationship with algae and reverse with nitrate and ammonia. Algae redact nitrate-NO_3 to nitrite-NO_2 and oxygen, so nitrite increased at the north part. Also algae redact ammonia to nitrogen and hydrogen. Nitrogen can be a good nutrient for microorganisms, which increase at the north part. So the concentration of nitrite increased, while the concentration of nitrate decreases from south to north part of the lake, as shown in Fig. 19.









Phosphate (PO_4), Total Phosphorous (P) and Clorifiel (A)

Phosphate and total phosphorous are represented as a nutrient, so they decrease at the north part with high microorganism and water haycent plant, as shown in Fig. 20.

Iron (Fe) and Copper (Cu)

Iron and copper increase from the south part to the north part of the lake. Because, geological mountains around the lake are volcanic rocks and Nubian sand, which have heavy metal like iron and copper. Iron and copper increase at the north part of the lake due to melting and scouring the volcanic rocks and Nubian sand along the lake, as shown in Fig. 21.

2.4. Microbiological Characteristic Relationships

Total Coliform, Faecal Coliform, Total Suspended Solids (TSS) and Velocity

Microbiological analysis, total coliform and faecal coliform are increasing from south to the north part of the lake. So we can say that the White Nile water quality has low concentration of microbiological at the entrance of the lake and increasing due to low water release flow during before flood season and more evaporation at the north part of the lake. So microbiological concentration has reverse relationship with the velocity and total suspended solids, as shown in Fig. 22.

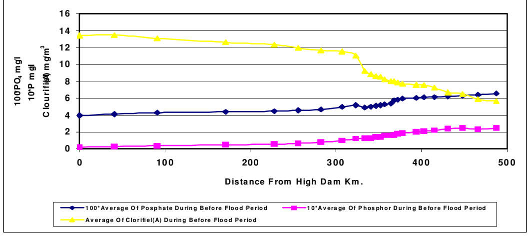


Fig.20-Reverse Relationship Between Phosphate ,Phosphorous And Clourifiel(A) Along The Lake During Before Flood Period

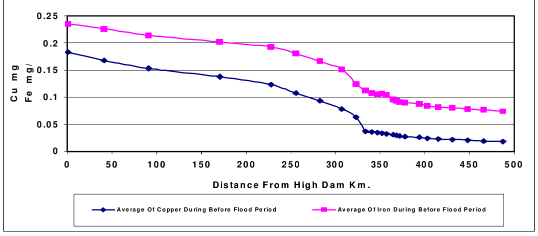


Fig.21-Relationship Between Copper And Iron Along The Lake During Before Flood Period

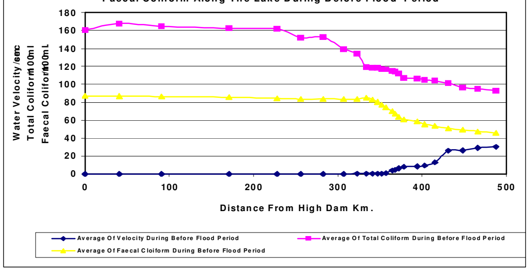


Fig.22-Relationship Between Velocity , Total Coliform and Faecal Coliform Along The Lake During Before Flood Period

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

By studying data record analysis of water quality at period from 1977 to 2001, and the measured data, we conclude the following:

1. In general, the average water quality results before flood are good (according to WHO standards).The average water quality results during flood are satisfactory except the turbidity (more 800 NTU) (according to WHO standards).

3. The statistical mathematical model is established based on the available data (from 1977 to 2001) and the record of the proposed origin laboratory at the entrance of the lake El Daka. Therefore the prediction of water quality parameters can be estimated with low cost, effort, and time.

4. The mathematical model achieves averages accuracy during flood about 4.3 % and before flood about 2.9 % between the measured and predicted values.

5. At the north part of the lake the temperature increased about ten percent and in the same time the average water velocity is greatly decreased, causing a decrease of the value of dissolved oxygen about 25%.

6. Average turbidity at the south part is about five times of the turbidity at the north part. This is related to the marked decrease of the water velocity from the south to the north part.

7. There is a marked decrease in the average values of water velocity, turbidity and total suspended solids from the south to the north part of the lake.

8. According to decrease of water velocity from south to north part of the lake, the electric conductivity, T.D.S, and algae are increasing .There is an increase in the value of dissolved oxygen during flood season about 7% more than before flood season.

10. At the north part of the lake algae are very active especially before flood season, causing a marked decrease of the nutrients.

11. In general, the average bicarbonate increase from south to north during flood, but it decreases from south to north in the period before flood season due to increasing the algal activity.

12. Average ammonia during flood season is about nine times at before flood period and decreased from south to the north part of the lake.

13. Iron during flood season is about two times at before flood period and increased from south to the north part of the lake.The average value of iron at the north part of the lake is 50 % more than at the south part during flood season about two times more before flood season.

15. The average value of copper at the north part of the lake is four times more than at the south part during flood season about six times more before flood season.Faecal coliform during flood season is about three times at before flood period and decreased from south to the north part of the lake, due to self-purification.During summer, the Ultra Violet bathing through water in the north part of the lake causing a decay of bacteria and a decrease in the total coliform, in the same time photo plankton increased. At the north part of the lake algae are very active especially during summer season, in the same time nutrients are decrease.

19. According to this environmental study on hydrological Physical, Chemical and Microbiological Parameters for water quality parameters (the period from 1977 to 2001), it was found that the common average values of these parameters are characterized as follows:

Parameters		During Flood Periods		Before Flood Periods	
		Average of the South Part	Average of the North Part	Average of the South Part	Average of the North Part
Hydrological Parameters	Wind speed m/sec	3.69	3.67	2.92	2.68
	Water velocity m/sec	0.328	0.00762	0.1257	0.0009
	Evaporation Milliard m^3/year	3.004	8.338	3.2	8.92
Physical Parameters	Temperature ^{0}C	20.67	22.64	22.37	25.05
	Turbidity N.T.U.	506.9	38.45	92.83	10.12
	Electric Conductivity Micro-mhos (25^0C)	210.31	287.45	258.9	271.5
	Total dissolved solids mg/l	154.3	190.8	175.01	185.43
	Total suspended solids mg/l	118.34	7.845	25.68	3.09
Chemical Parameters	Dissolved oxygen mg/l	6.309	5.0825	6.475	4.56
	Carbonate mg/l	2.08	2.327	5.913	10.16
	Bicarbonate mg/l	115.177	131.3	122.64	111.245
	PH. unit	8.034	8.38	8.236	8.54
	Chloride mg/l	5.516	6.076	7.19	4.71
	Sulfate mg/l	9.95	11.16	9.05	13.6
	Nitrite mg/l	0.0154	0.0186	0.01047	0.0108
	Nitrat mg/l	0.965	0.58	1.37	1.185
	Ammonia mg/l	0.0914	0.055	0.011	0.0065
	Silicate mg/l	13.49	11.65	8.115	5.1
	Phosphate mg/l	0.0943	0.0927	0.0575	0.045
	Phosphorus mg/l	0.38	0.152	0.185	0.0611
	Calcium mg/l	23.21	16.345	18.28	17.95
	Magnesium mg/l	7.96	7.99	9.02	9.52
	Sodium mg/l	19.94	20.43	19.96	17.13
	Total Hardness mg/l	82.24	91.15	81.47	89.52
	Potassium mg/l	6.76	5.85	8.53	5.62
	Total Alkalinity mg/l	111.59	116.306	122.73	125.98
Trace Elements	Iron mg/l	0.311	0.475	0.092	0.188
	Copper mg/l	0.0011	0.0041	0.0279	0.123
Microbio-logical	Total Coliform /100ml	988	579	108	155
	Faecal Coliform/100ml	185	125	65	85
	Clourifiel-(A) mg/m^3	7.26	12.4	5.76	22.4

RECOMMENDATIONS

1- Lake Nasser represents as a central water bank of Egypt. It is very important to secure our resource (Lake Nasser) form the microbial sources, human or industry or agriculture uses. So the monitoring of water quality at lake Nasser should be daily measured and not one or two research every year by using the mathematical model.
2- Establishment of a fixed laboratory at the entrance of the Lake should be done to estimate all water quality parameters along the lake. By the new measured data, we can update the regression equations of the mathematical model.
3- Environmental Impact Assessment (EIA) should be done before the construction of any new project along the Lake. In addition, clean energy like electric or hydrogen should be used at the lake Nasser region.
4- It is very important to transport the sediment, which settled at the south part of the lake till 256 km from high dam down steam the high dam to solve the problem of aquatic weed, because at the south part the depths is lower as at the north part.
5- Lake Nasser should be protected from any pollution in the future and we treat it as natural protectorate to save the Flora and fauna in a good Environmental, because it represents as a semi-closed lake with arrive water more than release water.

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