Assessment of Pollution Sources on Rosetta Branch, Egypt

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Abstract: The purpose of the present paper is to assessment of pollution sources on Rosetta Branch, Egypt. Water quality studies on Rosetta Branch were performed through the analyses of twenty three geographical station water samples collected periodically through February and June months to represent the two seasons of year 2012. For understanding the sources of river water pollution, assessing the water resources and establish long-term water quality data for controlling the polluted segments of the river, the program of water quality monitoring has been conducted for eight variables were employed, which are: dissolved oxygen (DO, mg L^{-1}), fecal coli form (MPN), pH, (BOD5, mg L^{-1}), ammonia nitrogen (NH_3-N, mg L^{-1}), temperature (deviation from 20°C), and total dissolved solids (TDS, mg L^{-1}). Water Quality Index (WQI) along Rosetta Branch was determined. The worth case was found along El–Rahawy drain at the area between Abu Rawash City and Nekla Village. Physiochemical Parameters and biological characteristics Correlation Matrix were computed and the result of correlation matrix for the data shows some clear hydro-chemical relationships can be readily inferred.

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Introduction:

The River Nile is one of the most remarkable geographic features of Africa. Its catchment's area covers 2,900,000 km²; it extends from latitude 4° S to latitude 31° N.

In general, the Nile basin can be divided into four main sub-basins; The White Nile, the Atbara River, the Blue Nile and the Main Nile flow northward to Mediterranean Sea. A few km to the north of Cairo begins the Delta or Lower Egypt, which composed of three parts; The Delta proper and the two branches of the Nile. The two branches are the Rosetta arm on the west and the Damietta on the east.

Egypt is an arid country where water is a scare precious resource. Agriculture depends on irrigation from the River Nile. Closing food gap exasperated by population growth compels the country to use unconventional marginal water, such as drainage water, brackish ground water and treated sewage water for expanding irrigated agriculture.

Rosetta branch of River Nile has a greatest vital importance as an important source of water for municipal, industrial, agricultural, navigational and feeding fish farms. Rosetta branch subjects to two main sources of pollution which, potentially affects and deteriorates the water quality of the branch.

Results anddiscussion:

The first source is El-Rahwaydrain (Fig.1), which disposes its wastes into the branch. Its wastes are mixture of agricultural and domestic waste and sanitary drainage from large area of Great Cairo. It is thought that the impact of this source on the water quality of the branch is extended to long distance from the source.

The second source of pollution is several small agricultural drains that Discharge their waters into the branch in addition to sewage discharged from several cities and its neighboring villages that are distributed along the two banks of the Rosetta branch (Mancy and Hafez, 1979 a & b).

The policy of the Egyptian Government is to use drainage water with salinity up to 4.5 ds/m and blend it with fresh Nile water to form blended water of a salinity equivalent to 1.0 ds/m. (Rhoades, et. al 1992). To avoid problems associated with using poor quality water there must be sound planning to ensure minimal negative impact and maximum sustainable use of the water. The first step in planning for sustainable use of marginal quality water is to measure and evaluate pollutant levels in the water source at the proposed abstraction point.

The measuring of a specific physicochemical agent in the contaminated aquatic environment is important in a determining the potential toxicity and health effects of those agents on living organisms utilizing that environment (Wrona, et. al 1996).

For understanding the sources of river water pollution, assessing the water resources and establish long-term water quality data for controlling the polluted segments of the river, the program of water quality monitoring has been conducted for eight variables were employed, which are: dissolved oxygen

(DO, mg L^{-1}), fecal coliform (MPN), pH, (BOD5, mg L^{-1}), ammonia nitrogen (NH_3-N, mg L^{-1}), temperature (deviation from 20°C) and total solids (TDS, mg L^{-1}). In surface water quality, DO, BOD5, NH_3-N, faecal coliforms, turbidity and TDS are potential contaminants contributed by microbial communities and human activities.

Horton (1965) proposed the first water quality index (WQI), the weighted averaging methods of Brown et al. (1970), Ross et al. (1977), Ball et al. (1980), House and Ellis (1987), Stanbuk-Giljanovic (1999), Pesce and Wunderlin (2000) and Jonnalagadda and Mehere (2001).

House and Newsome (1989) state House and Newsome (1989 that the use of a Water Quality Index (WQI) allows 'good' and 'bad' water quality to be quantified by reducing a large quantity of data on a range of physicochemical and biological variables to be a single number in a simple, objective and reproducible manner.

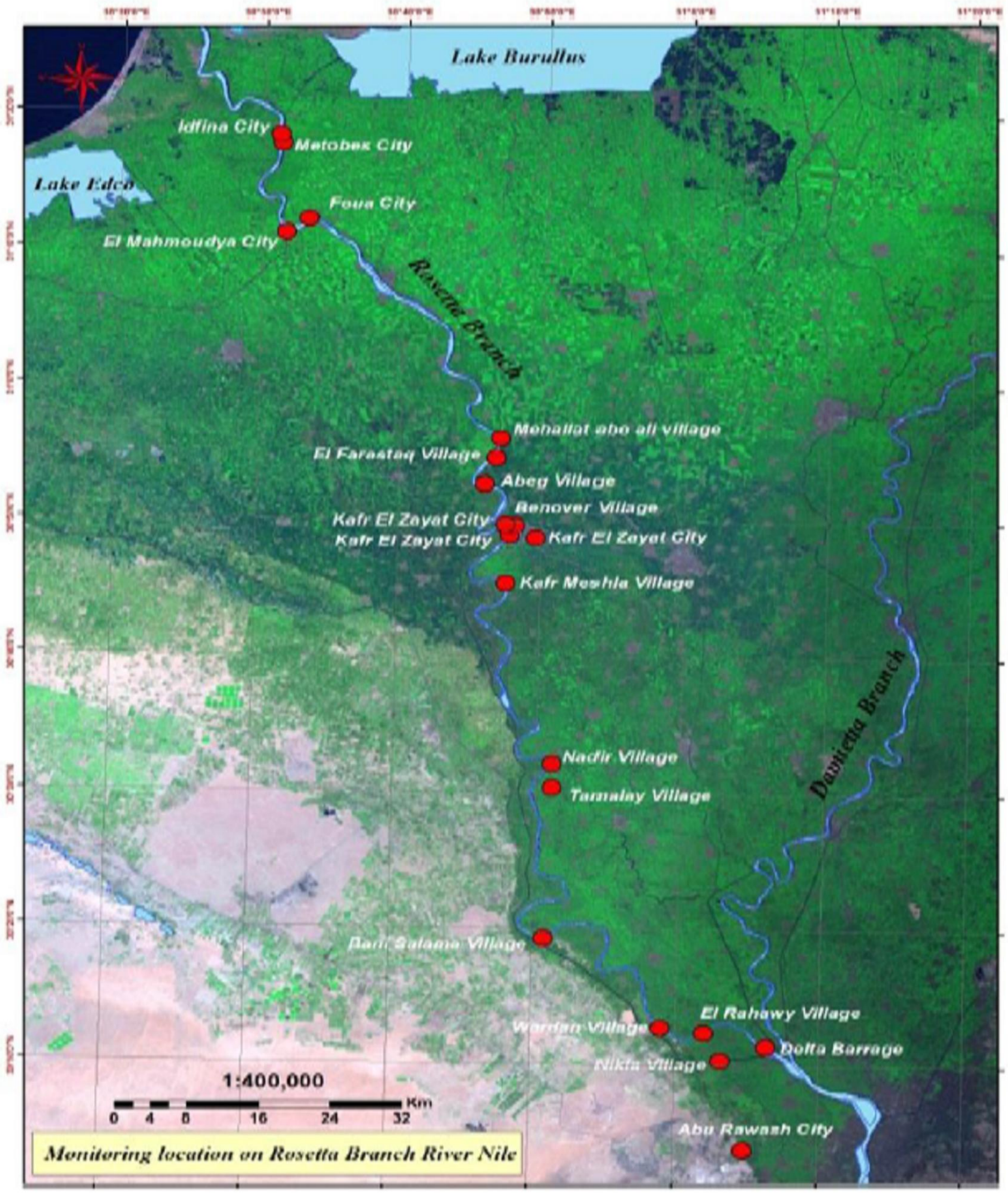


Figure (1): Monitoring location on Rosetta Branch River Nile

Table (1) Classification Ranks of Water Quality Index (WQI). (After House and Newsome 1989).

ITEM	Very bad water	Bad water	Medium	Good	Excellent
RANK	0---- 25	26----50	51----70	71----90	91---100

Table (2): Rosetta Branch physiochemical Parameters and Escolar (Drains and Nile Feb. 2012).

	Location	Physiochemical Parameters							Cation
		pH	DO	TDS	S.W.T	BOD	COD	E. Coli	NH_3
Drains	Abu Rawash City (Rahawy drain)	7.92	1.55	980	19.5	82	133	12000	34.43
	Nekla Village (Rahawy drain)	7.83	2.73	975	19	89	143	15000	30.33
	Rahawy Drain outfall	7.75	0.23	880	17	83	141	14000	27.87
	Tamalay Village (Sabal drain)	7.56	4.59	790	21	16	28	200	22.13
	Nadir Village (Sabal drain)	7.69	2.1	865	22	27	55	150	21.31
	Ganoub El Tahrir drain	7.7	3.6	775	23	19	45	450	13.93
	Zawieyt El-bahr drain	7.5	2.8	970	21	17	27	485	10.66
	Kafr El Zayat City at km 35 from Tala drain	7.77	2.4	977	19	17.7	22	750	4.74
	Kafr El Zayat City (outlet of Tala drain)	8.11	2.3	740	22	17	33	90	1.07
	Average	7.76	2.48	883.56	20.39	40.86	69.67	4791.67	18.49
Nile	Delta Barrage first of Rosetta branch	8.23	7.5	250	20	5.2	10	8	0.20
	Wardan Village	7.51	2.7	480	20	17	31	3700	9.02
	Bani Salama Village	7.94	2.9	490	21	17	29	3500	1.15
	Kafr Meshla Village	7.32	3.6	370	20	18	27	55	0.76
	Kafr -El Zayat City at Maliya Factories	8.32	3.8	425	23	20	36	55	9.46
	Benover Village After Maliya Factories 1 km	7.8	4.4	421	22	21	33	1800	9.51
	Abig Village	7.9	4.1	370	22	15	27	100	8.20
	El Farastaq Village	7.8	3.8	390	21	14.7	26	100	7.95
	Mehallat apo Ali Village	8.1	3.6	388	20	15	29	90	6.89
	Fuoa City	7.8	4.6	420	21	12	19	100	5.90
	El Mahmoudya City	8.2	4.5	415	23	11	17	70	4.43
	Motubis City	8.9	4.3	407	22	9	15	10	6.23
	Edfina Barrage end of Rosetta branch	8	4.2	405	22	10	16	15	5.41
	Average	7.99	4.15	402.38	21.31	14.22	24.23	738.69	5.777

N.B: *Biological Oxygen demand (BOD)*Chemical Oxygen demand (COD) *Total dissolved solid (TDS) *Dissolved Oxygen (DO) *Hydrogen Ion (pH) *Fecal Coliform (E.Coli)

Water quality studies on Rosetta Branch were performed through the analyses of twenty three geographical station water samples.

(Tables 2:5) collected periodically through February, April, June and October months to represent the four seasons of year, 2012 (tables2-5).

The results of WQI calculations (table 6), according to House and Newsome 1989, showed that; the worth case was found along El–Rahawy drain at the area between Abu Rawash City and Nekla Village, which recorded values of WQI ranged from 22 to 25 and their water are classified as very bad water quality level. However, the water discharging from El-Rahawy (outfall) classified as bad water quality (WQI=27).

It is worth to mention that, the water quality of Wardan Village, Bani Salama Village, Tamalay Village, Nadir Village, Ganoub El Tahrir drain, Zawieyt El-bahr drain and Kafr Meshla Village are classified as bad water quality level. However, the water quality of Kafr El Zayat City at km 35, Kafr El Zayat City (outlet of Tala drain), Kafr -El Zayat City at Maliya Factories, Benover Village after Maliya Factories, Abig Villageand Fuoa City El Mahmoudya City are classified as medium water quality level, which lies in the numerical ranges of 51- 70.

On the other hand, the water quality at Delta Barrage, El Farastaq Village, Mehallat Abo- Ali Village, Motubis City, Edfina Barrage end of Rosetta branch are classified as good water quality level, which lies in the numerical ranges of 71- 90 Table (6).

Physiochemical Parameters and biological characteristics

Correlation Matrix:

The changes in Physiochemical Parameters of the water are followed by significant changes in structure of the biota. Therefore, the quality of Rosetta Branch water should be assessed on the basis of Physiochemical Parameters and biological characteristics in order to provide complete spectrum of information for proper water management.

The data obtained (tables2-5) were statistically treated whereas, the correlation Matrix was calculated. Correlation coefficient and probable error were calculated between all the variables detected in Rosetta Branch tables (7- 9) and figures (2-9).

Values of unity or zero are very rarely found and typical figures usually of the order of 0.6 to 0.9. if (r) is greater than 0.40, but less than 0.60, there will be fair degree of correlation between the two variables. If (r) is less than 0.35; there will be limited degree of correlation between the two variables.

The employed variables reveal that; Comparative Correlation Matrix for Rosetta Nile and Drain Rosetta water during February and June months show that the value of pH is ranging narrowly, so does the measurement of temperature. The values of temperature (s.w.t) among the studied samples are uniform and thus the correlation with other variables could not be evaluated.

The result of correlation matrix for the data shows some clear hydro-chemical relationships can be readily inferred.

The dissolved oxygen (DO) is strongly and negative correlated with total dissolved salts (TDS), during February and June Nilewater (r = - 0.85) and vice versa for Rosetta Drain water. The dissolved oxygen (DO) is strongly and negative correlated with biological Oxygen demand (BOD), during June month, Rosetta Drain water (r = - 0.84) and vice versa for Rosetta Nile water and vice versa for Rosetta Nile water.

The dissolved oxygen (DO) is strongly and negative correlated with chemical Oxygen demand (COD), during February and June months, Rosetta Drain water (r = - 0.87) and vice versa for Rosetta Nile water.

The dissolved oxygen (DO) is strongly and negative correlated with fecal coliform (E.Coli) during February and June months, Rosetta Drain water (r = - 0.88) and vice versa for Rosetta Nile water.

Table (3): Rosetta Branch Physiochemical Parameters and E.coli (Drains and Nile Apr. 2012).

	Locations	Physiochemical Parameters							Cation
		pH	DO	TDS	S.W.T	BOD	COD	E.coli	NH_3
Drains	Abu Rawash City (Rahawy drain)	7.8	1.8	680	21	75	119	7000	28.69
	Nekla Village (Rahawy drain)	7.6	1.9	720	20	65	95	5000	27.05
	Rahawy Drain outfall	7.5	0.43	670	22	83	115	5500	25.41
	Tamalay Village (Sabal drain)	7.8	2.2	670	21	33	55	1500	22.13
	Nadir Village (Sabal drain)	7.8	0.33	820	23	30	50	3000	18.85
	Ganoub El Tahrir drain	7.7	0.53	680	25	17	32	1900	10.66
	Zawieyt El-bahr drain	7.8	1.34	720	21	17	35	750	12.30
	Kafr El Zayat City at km 35 from Tala drain	7.8	1.92	660	22	31	57	1600	4.67
	Kafr El Zayat City (outlet of Tala drain)	7.7	2.21	670	26	21	33	1800	6.31
	Average	7.72	1.41	698.89	22.33	41.33	65.67	3116.67	17.34
Nile	Delta Barrage firest of Rosetta branch	8.5	8.2	235	20	5	11	0	0.27
	Wardan Village	7.8	5.5	320	21	15	35	3000	3.85
	Bani Salama Village	7.3	4.8	300	22	12	25	3500	0.98
	Kafr Meshla Village	7.7	6.5	320	21	12	27	22	0.62
	Kafr -El Zayat City at Maliya Factories	8.5	3.45	370	20	17	29	52	4.43
	Benover Village After Maliya Factories 1 km	8.3	5.32	480	21	15	27	30	3.44
	Abig Village	7.8	4.6	420	21	17	22	12	2.62
	El Farastaq Village	7.6	5.4	475	20	15	25	22	1.97
	Mehallat apo Ali Village	7.7	5.7	420	20	13	27	35	1.97
	Fuoa City	7.7	6.4	450	22	16	23	17	1.80
	El Mahmoudya City	7.4	5.7	520	21	14	24	13	2.21
	Motubis City	7.6	6.3	540	23	13	21	11	1.80
	Edfina Barrage end of Rosetta branch	7.7	6.1	530	21	15	24	10	1.56
	Average	7.82	5.69	413.85	21.00	13.77	24.62	517.23	2.118

Table (4): Rosetta Branch Physiochemical Parameters and E.coli (Drains and Nile Jun. 2012).

	Locations	Physiochemical Parameters							Cation
		pH	DO	TDS	S.W.T	BOD	COD	Ecoli	NH_3
Drains	Abu Rawash City (Rahawy drain)	7.96	0.33	652	32	88.74	132	7500	10.77
	Nekla Village (Rahawy drain)	7.85	0.21	617	31.4	92.32	123	5600	8.87
	Rahawy Drain outfall	8.12	0.35	631	31	81.11	110	5500	7.17
	Tamalay Village (Sabal drain)	7.74	1.25	569	31.8	33.8	45	3000	7.67
	Nadir Village (Sabal drain)	7.68	1.14	632	29	34.62	44	3500	6.45
	Ganoub El Tahrir drain	7.86	0.96	647	28	37.98	47	1900	3.80
	Zawieyt El-bahr drain	7.39	0.85	582	31	29.52	36	1700	4.80
	Kafr El Zayat City at km 35 from Tala drain	7.44	1.11	611	31.1	36.11	45	500	4.07
	Kafr El Zayat City (outlet of Tala drain)	7.55	0.95	623	27	38.14	55	580	4.41
	Average	7.73	0.79	620.44	30.26	52.48	70.78	3308.89	6.447
Nile	Delta Barrage firest of Rosetta branch	7.52	7.89	252	31.2	5	14	6	0.11
	Wardan Village	7.32	4.56	321	33.3	17.32	27	300	1.93
	Bani Salama Village	7.41	5.89	296	33.5	15.21	22	180	1.79
	Kafr Meshla Village	7.14	5.21	352	33.6	16.32	21	70	1.93
	Kafr -El Zayat City at Maliya Factories	7.32	4.48	423	26	16.38	27	20	2.80
	Benover Village After Maliya Factories 1 km	7.85	4.68	412	29.9	14.25	22	12	2.27
	Abig Village	8.32	5.69	386	31.6	17.58	23	11	0.80
	El Farastaq Village	7.96	6.14	296	31.8	9.21	17	8	0.61
	Mehallat apo Ali Village	7.78	6.38	286	33	11.72	24	7	0.91
	Fuoa City	7.74	6.17	275	31.7	8.64	17	14	1.25
	El Mahmoudya City	7.12	5.87	295	29.7	10.1	23	22	1.40
	Motubis City	7.32	5.98	288	28.5	7.85	22	19	2.22
	Edfina Barrage end of Rosetta branch	7.52	6.11	267	33.1	6.52	24	44	1.91
	Average	7.56	5.77	319.15	31.30	12.01	21.77	54.85	1.534

Table (5): Rosetta Branch Physiochemical Parameters and E.coli (Drains and Nile Oct. 2012).

	Locations	Physiochemical Parameters							Cation
		pH	DO	TDS	S.W.T	BOD	COD	E.coli	NH_3
Drains	Abu Rawash City (Rahawy drain)	7.9	0.97	630	28	65.23	177	10000	28.6
	Nekla Village (Rahawy drain)	7.6	1.23	670	27.5	77.85	156	9500	27.0
	Rahawy Drain outfall	7.5	0.78	654	26	62.5	145	8500	31.1
	Tamalay Village (Sabal drain)	7.7	1.89	785	25.8	13.8	39	1000	11.1
	Nadir Village (Sabal drain)	7.8	1.76	720	27	25.87	36	1500	9.80
	Ganoub El Tahrir drain	7.4	1.89	580	31	17.25	29	750	7.80
	Zawieyt El-bahr drain	7.5	2.56	690	32	19.6	31	650	9.71
	Kafr El Zayat City at km 35 from Tala drain	7.9	2.32	730	27	22	43	1500	10.3
	Kafr El Zayat City (outlet of Tala drain)	7.8	1.89	710	27	26	47	1300	9.13
	Average	7.68	1.70	685.44	27.92	36.68	78.11	3855.56	16.0
Nile	Delta Barrage firest of Rosetta branch	7.7	7.7	230	27	5	7	2	0.12
	Wardan Village	7.8	3.56	370	29	13	15	500	2.55
	Bani Salama Village	7.4	4.23	355	26	9	17	650	2.14
	Kafr Meshla Village	8.1	5.12	320	26.7	10.8	27	70	2.14
	Kafr -El Zayat City at Maliya Factories	7.8	4.45	440	29	17	27	80	2.75
	Benover Village After Maliya Factories 1 km	7.5	5.12	515	28.7	15	22	70	1.73
	Abig Village	7.7	5.56	490	28.4	13	27	20	0.52
	El Farastaq Village	7.6	4.44	356	28.12	16.6	31	17	0.70
	Mehallat apo Ali Village	7.2	4.89	330	27.4	14.3	29	12	0.80
	Fuoa City	7.7	5.12	365	26	17	22	13	0.78
	El Mahmoudya City	7.6	4.96	345	28.9	11	21	8	0.92
	Motubis City	7.8	5.11	370	27	12.3	23	15	0.91
	Edfina Barrage end of Rosetta branch	7.7	4,87	410	27	11	21	5	1.34
	Average	7.66	5.02	376.62	27.63	12.69	22.23	112.46	1.33

Table (6): Water Quality Index (WQI) along Rosetta Branch.

Site Name	WQIg	Classification
Abu Rawash City (Rahawy Drain)	22.0	very bad water
Nekla Village (Rahawy Drain)	25.0	very bad water
Rahawy Drain outfall	27.0	bad water
Tamalay Village (Sabal Drain)	27.0	bad water
Nadir Village (Sabal Drain)	29.0	bad water
Ganoub El Tahrir drain	27.0	bad water
Zawieyt El-bahr drain	33.0	bad water
Kafr El Zayat City at km 35 (Tala drain)	56.0	Medium
Kafr El Zayat City (outlet of Tala drain)	57.0	Medium
Delta Barrage	75	Good
Wardan Village	31.0	bad water
Bani Salama Village	35.0	bad water
Kafr Meshla Village	45.0	bad water
Kafr-El Zayat City at Maliya Factories	66.0	Medium
Benover Village After Maliya Factories 1 km	69.0	Medium
Abig Village	68.0	Medium
El Farastaq Village	71.0	Good
Mehallat apo Ali Village	73.0	Good
Fuoa City	69.0	Medium
El Mahmoudya City	68.0	Medium
Motubis City	73.0	Good
Edfina Barrage end of Rosetta branch	71.0	Good

Table (7): Correlation Matrix for Rosetta Biological Element analyses (February Month. 2012).

	Ph		D.O		TDS		Temp		B.O.D		C.O.D		E. Coli		NH_3		No_3	
	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N	D	N
pH	*1.00*	*1.00*																
DO	-0.39	0.07	*1.00*	*1.00*														
TDS	0.47	-0.05	0.39	*-0.85*	*1.00*	*1.00*												
Temp	-0.07	0.01	0.46	-0.25	-0.52	0.46	*1.00*	*1.00*										
B.O.D	0.29	-0.07	*-0.84*	-0.55	-0.39	0.56	-0.26	0.33	*1.00*	*1.00*								
C.O.D	0.29	-0.04	*-0.87*	-0.42	-0.38	0.42	-0.29	0.18	*0.96*	*0.72*	*1.00*	*1.00*						
E. Coli	0.27	-0.13	*-0.88*	-0.52	-0.39	-0.03	-0.29	-0.09	*0.97*	-0.20	*0.99*	-0.36	*1.00*	*1.00*				
NH_3	-0.02	0.27	*-0.89*	-0.66	-0.34	0.29	-0.33	0.22	*0.94*	0.20	*0.97*	0.04	*0.97*	0.60	*1.00*	*1.00*		
NO_3	-0.1	0.12	*-0.72*	-0.45	-0.07	0.77	0.36	0.47	0.52	0.63	0.53	0.43	0.55	0.05	0.63	0.64	*1.00*	*1.00*

Table (8): Correlation Matrix for Rosetta Biological Elements Analysis (June Month. 2012).

	D.O				TDS			Temp		B.O.D				C.O.D		E. Coli		NH_3		NO_3	
	FEB.		JUNE		FEB.		JUNE	FEB.	JUNE	FEB.		JUNE		FEB.	JUNE	FEB.	JUNE	FEB.	JUNE	FEB.	JUNE
	N	D	D	N	N	D	D	D	D	N	D	D	N	D	D	D	D	D	D	D	D
DO	1.00	1.00	1.00	1.00																	
TDS	-0.85	-0.34	0.39	-0.85	1.00	1.00	1.00														
Temp	0.01	0.46	0.46	-0.25	0.24	-0.59	-0.52	1.00	1.00												
B.O.D	-0.68	-0.59	-0.84	-0.55	0.57	0.48	-0.26	-0.76	-0.76	1.00	1.00	1.00	1.00								
C.O.D	-0.70	-0.87	-0.87	-0.42	0.55	0.40	-0.29	-0.66	-0.66	0.96	0.99	0.96	0.72	1.00	1.00						
E. Coli	-0.52	-0.88	-0.88	-0.52	0.69	0.48	-0.29	0.96	0.99	0.96	0.72	0.97	-0.20	0.97	0.99	1.00	1.00				
NH_3	-0.35	-0.26	0.89	-0.66	0.39	0.35	-0.34	-0.46	-0.33	0.45	0.82	0.94	0.20	0.83	0.97	0.77	0.97	1.00	1.00		
NO_3	-0.80	-0.58	-0.72	-0.45	0.72	0.35	-0.07	-0.63	0.36	0.96	0.95	0.52	0.63	0.97	0.53	0.92	0.55	0.63	0.64	1.00	1.00

Table (9): Comparative Correlation Matrix for Rosetta Biological Element Analyses (February and June Months, 2012).

	D.O				TDS			Temp		B.O.D				C.O.D		E. Coli		NH_3		NO_3	
	FEB.		JUNE		FEB.		JUNE	FEB.	JUNE	FEB.		JUNE		FEB.	JUNE	FEB.	JUNE	FEB.	JUNE	FEB.	JUNE
	N	D	D	N	N	D	D	D	D	N	D	D	N	D	D	D	D	D	D	D	D
DO	1.00	1.00	1.00	1.00																	
TDS	-0.85	-0.34	0.39	-0.85	1.00	1.00	1.00														
Temp	0.01	0.46	0.46	-0.25	0.24	-0.59	-0.52	1.00	1.00												
B.O.D	-0.68	-0.59	-0.84	-0.55	0.57	0.48	-0.26	-0.76	-0.76	1.00	1.00	1.00	1.00								
C.O.D	-0.70	-0.87	-0.87	-0.42	0.55	0.40	-0.29	-0.66	-0.66	0.96	0.99	0.96	0.72	1.00	1.00						
E. Coli	-0.52	-0.88	-0.88	-0.52	0.69	0.48	-0.29	0.96	0.99	0.96	0.72	0.97	-0.20	0.97	0.99	1.00	1.00				
NH_3	-0.35	-0.26	0.89	-0.66	0.39	0.35	-0.34	-0.46	-0.33	0.45	0.82	0.94	0.20	0.83	0.97	0.77	0.97	1.00	1.00		
NO_3	-0.80	-0.58	-0.72	-0.45	0.72	0.35	-0.07	-0.63	0.36	0.96	0.95	0.52	0.63	0.97	0.53	0.92	0.55	0.63	0.64	1.00	1.00

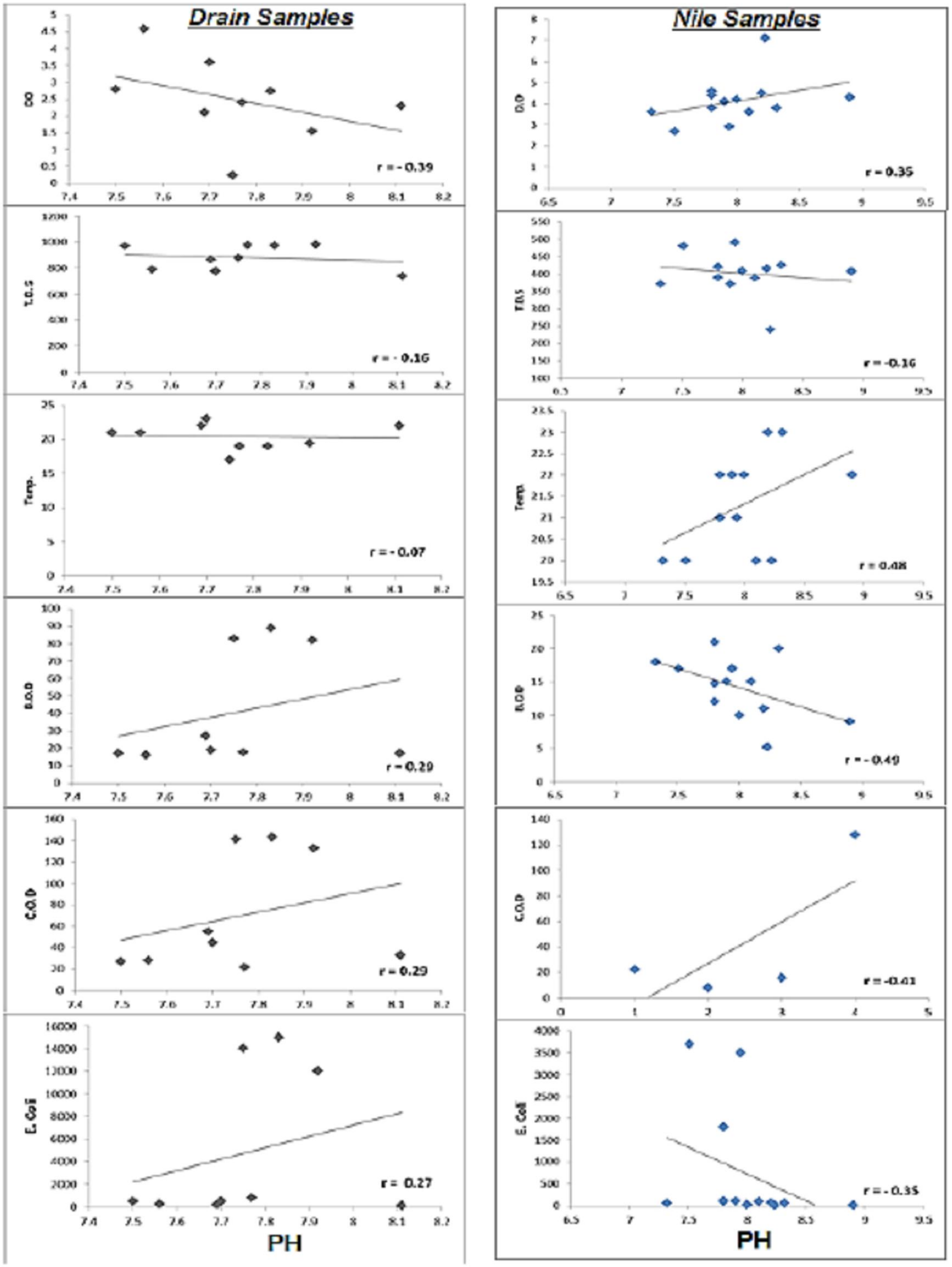
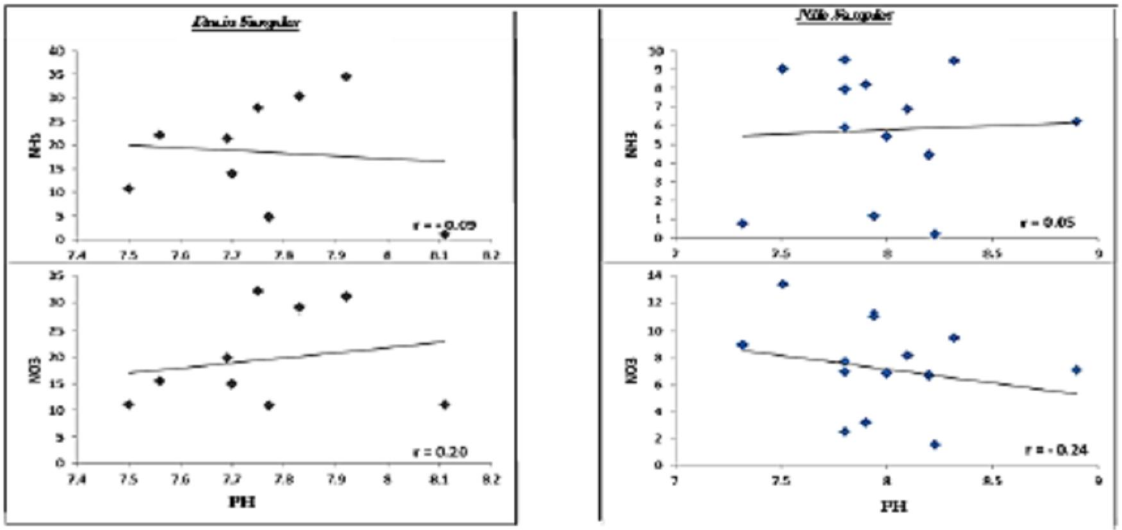


Figure (2): Rosetta Branch Physiochemical analysis (Drains and Nile during Feb. 2012).



Cont. Figure (2): Rosetta Branch Physiochemical analysis (Drains and Nile during Feb. 2012).

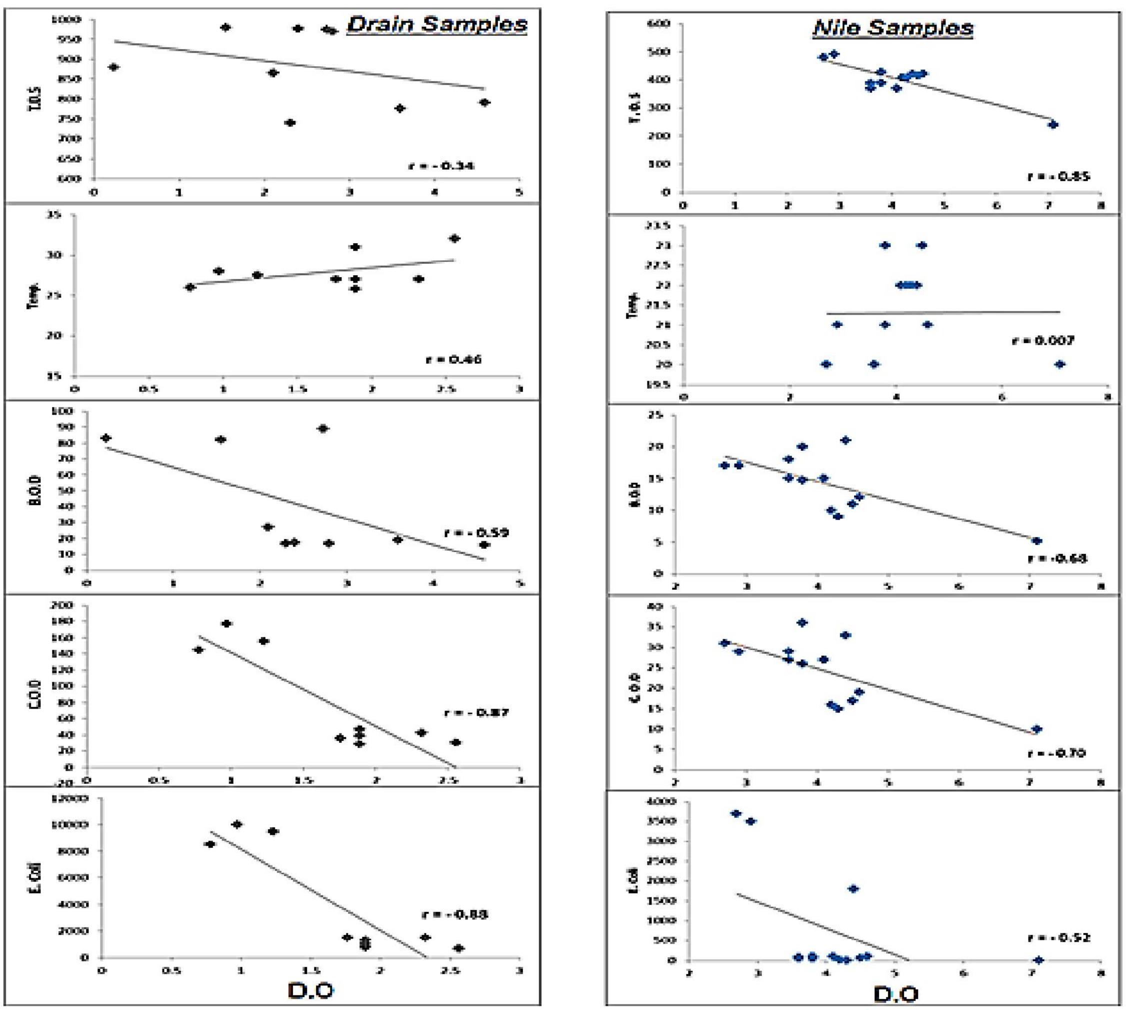
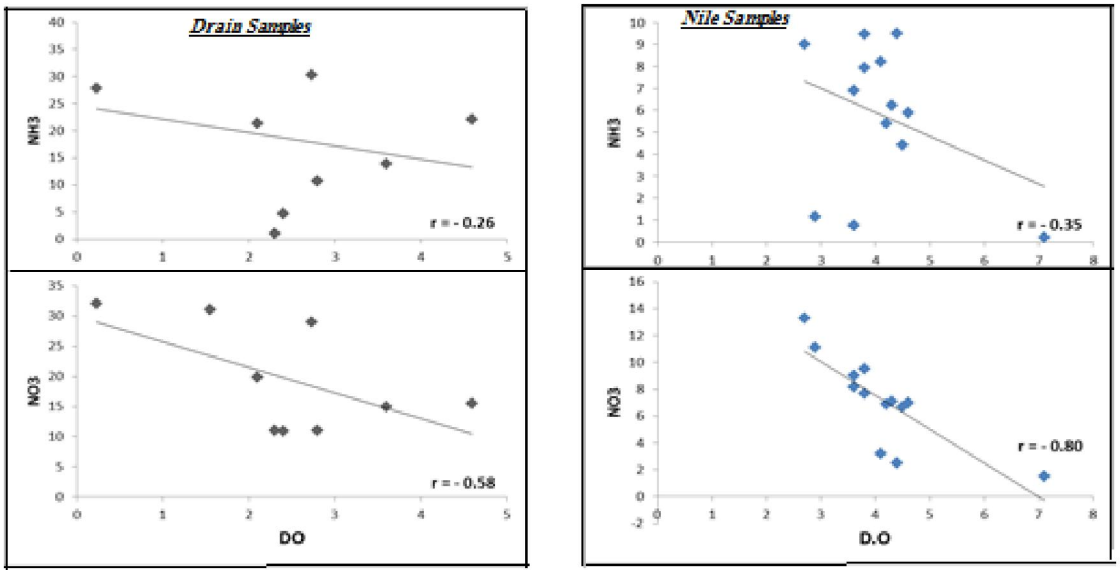


Figure (3): Rosetta Branch Physiochemical analysis (Drains and Nile during Feb. 2012).



Cont. Figure (3): Rosetta Branch Physiochemical analysis (Drains and Nile during Feb. 2012)

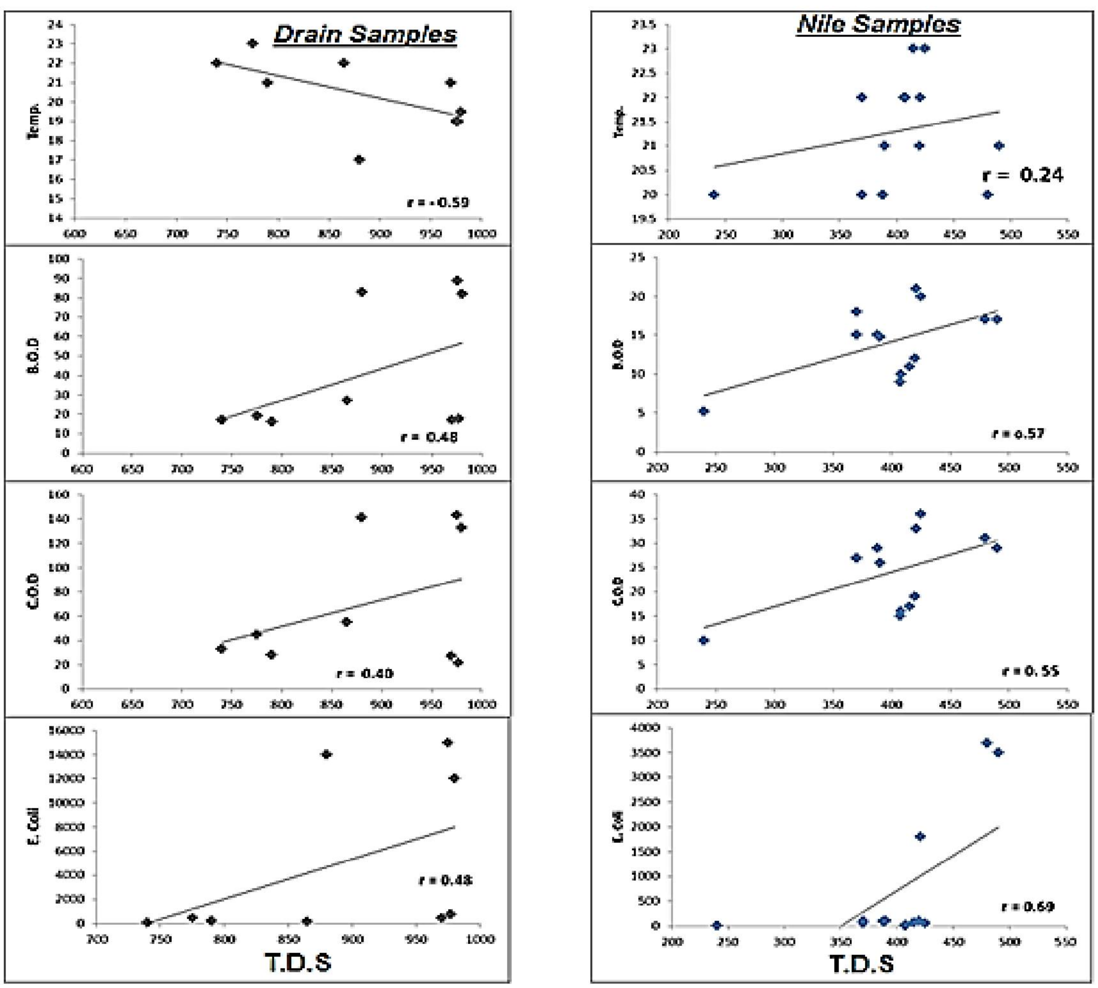
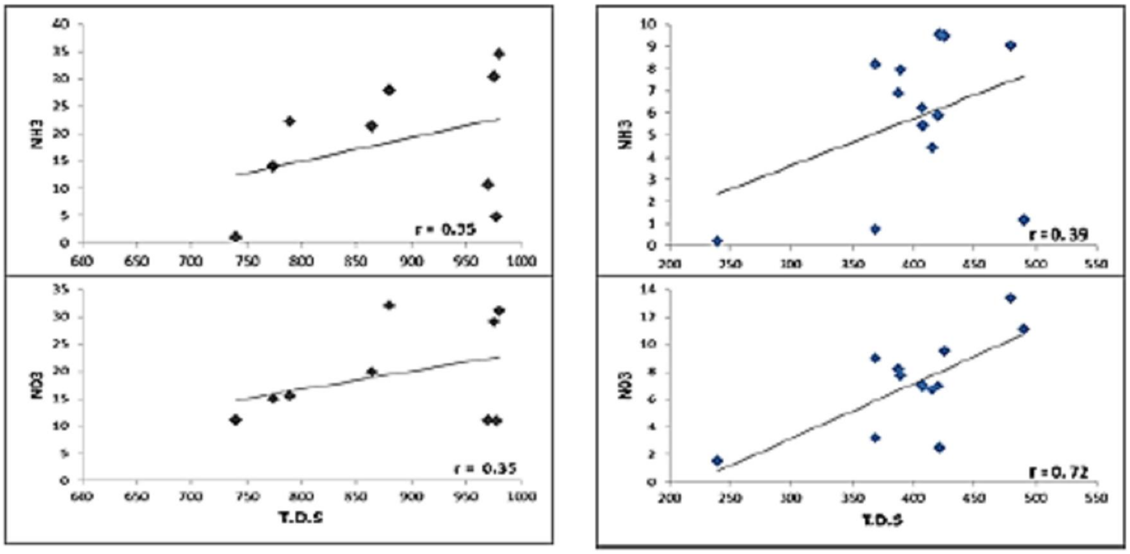


Figure (4): Rosetta Branch Physiochemical analysis (Drains and Nile during Feb. 2012).



Cont. Figure (4): Rosetta Branch Physiochemical analysis (Drains and Nile during Feb. 2012).

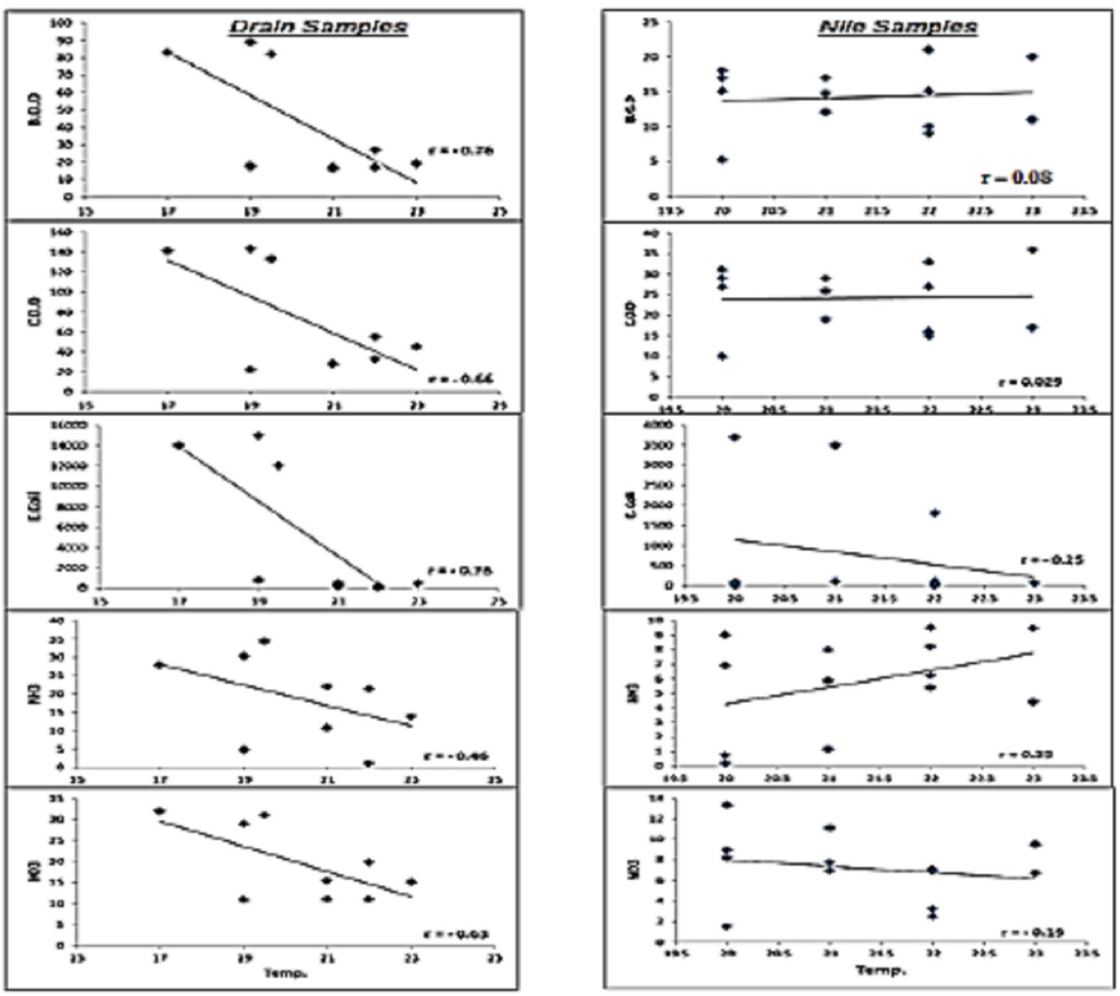


Figure (5): Rosetta Branch Physiochemical analysis (Drains and Nile during Feb. 2012).

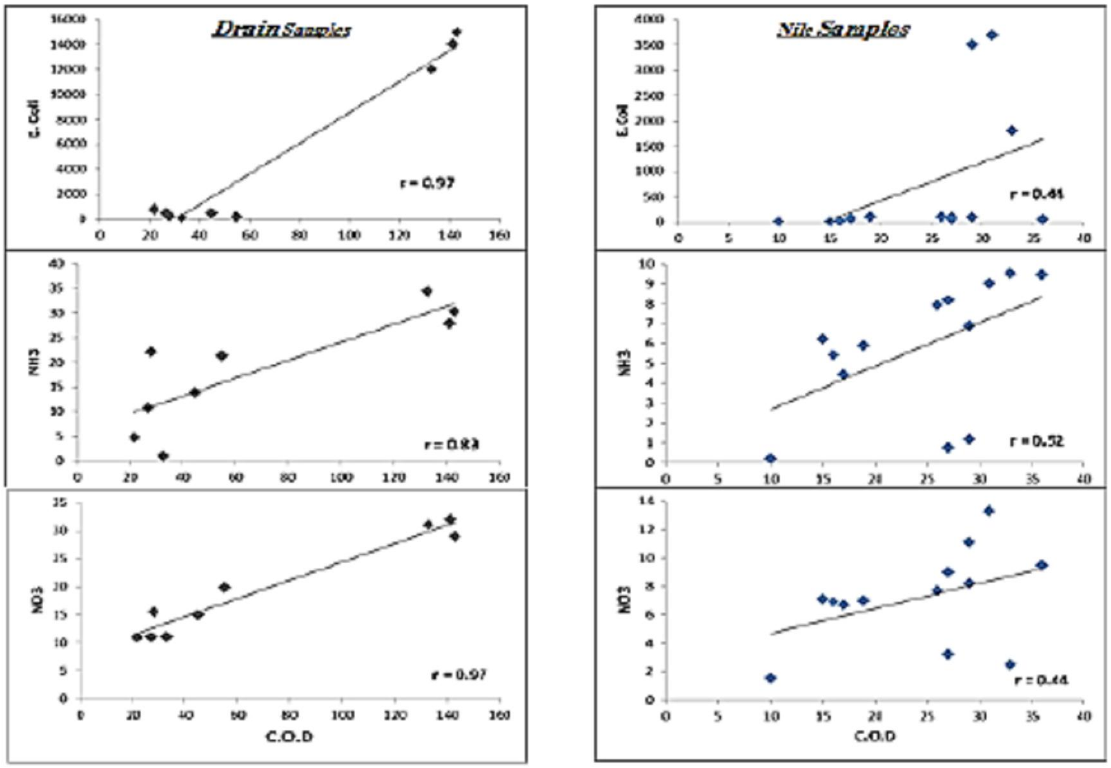


Figure (6): Rosetta Branch Physiochemical analysis (Drains and Nile during Feb. 2012).

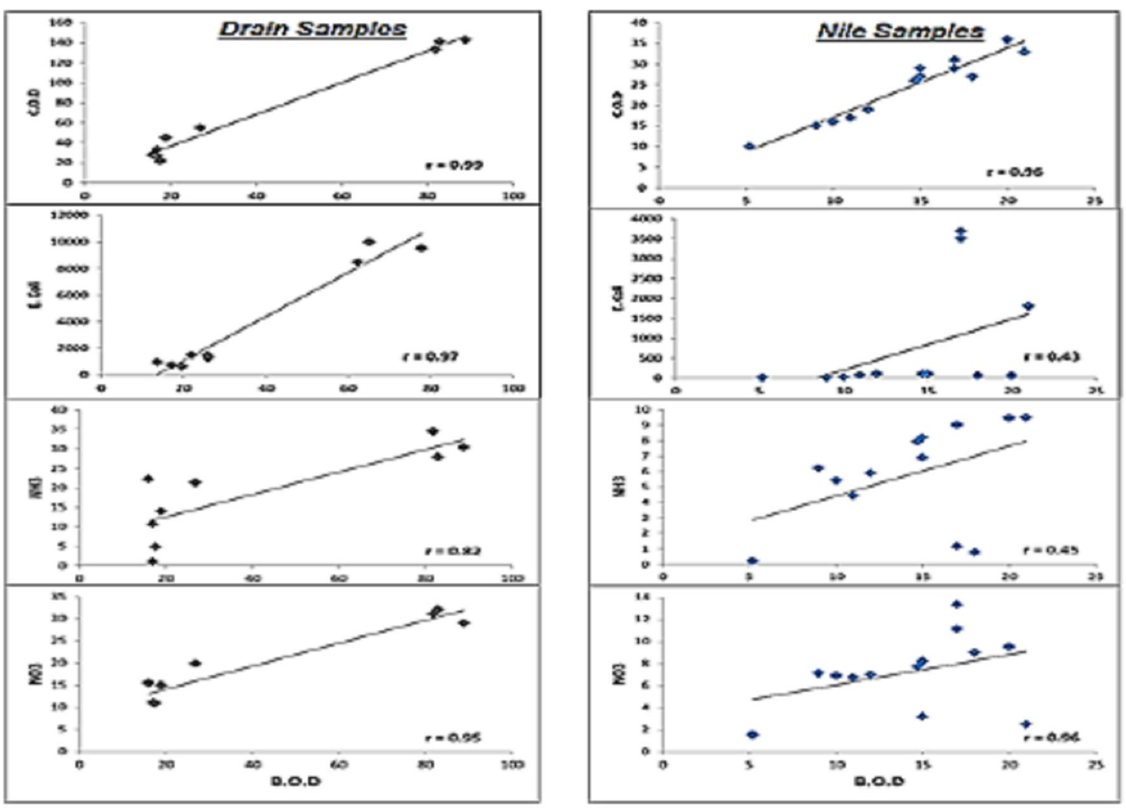


Figure (7): Rosetta Branch Physiochemical analysis (Drains and Nile during Feb. 2012).

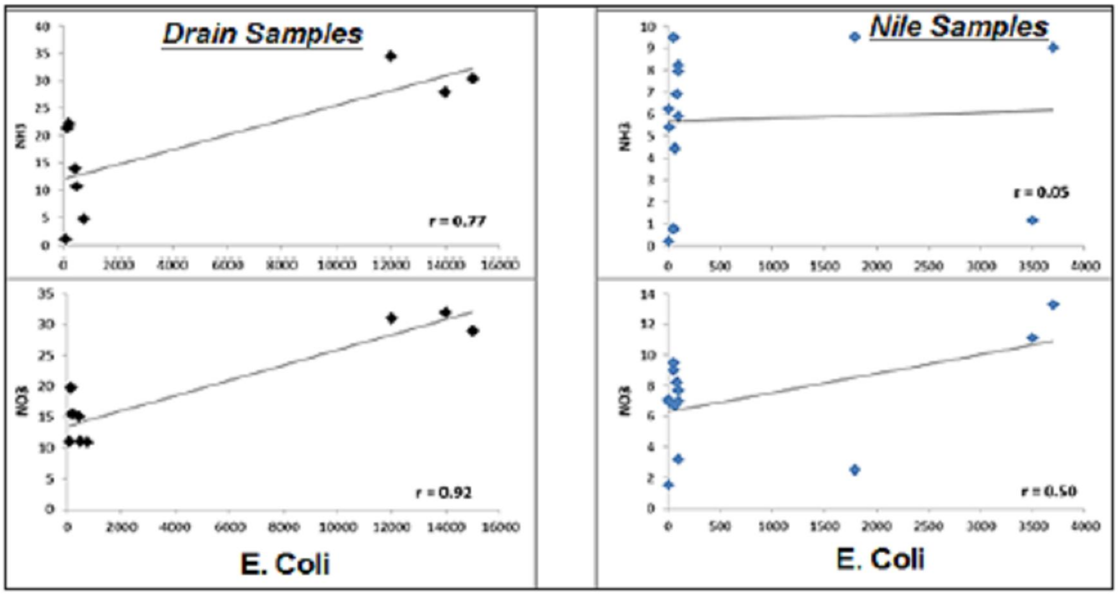


Figure (8): Rosetta Branch Physiochemical analysis (Drains and Nile during Feb. 2012).

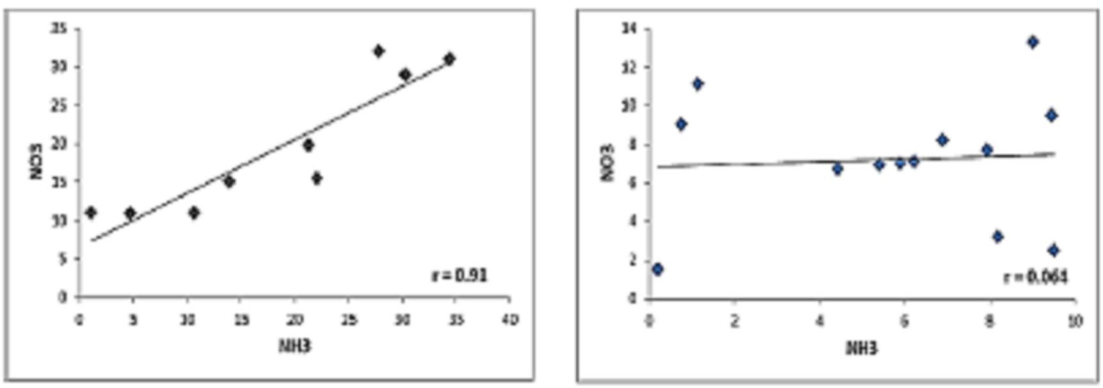


Figure (9): Rosetta Branch Physiochemical analysis (Drains and Nile during Feb. 2012).

The dissolved oxygen (DO) is strongly and positive correlated with ammonia nitrogen (NH_3), during June month, Rosetta Drain water (r = 0.89) and vice versa for Rosetta Nile water.

The dissolved oxygen (DO) is strongly and negative correlated with nutrients (NO_3), during February (Nile, r = - 0.80) and June (Drainr = - 0.72) month, Rosetta water and vice versa for Rosetta, February Drain and June Nile, water.

The total dissolved salts (TDS) is strongly and positive correlated with fecal coli form (E. coli) (r = 0.69) and nutrients (NO_3, r = 0.72), during February month, Rosetta Nile water and Vice versa for biological Oxygen demand (BOD), chemical Oxygen demand (COD) and ammonia nitrogen (NH_3) during February and June months Rosetta water.

Temperature (Temp) is strongly and negative correlated with biological Oxygen demand (BOD) (r = - 0.76) and is strongly and positive correlated with fecal coliform (E.Coli) (r = 0.96 and r = 0.99) during February and June months Drain Rosetta water and vice versa for chemical Oxygen demand (COD), ammonia nitrogen (NH_3) and nutrients (NO_3).

Biological Oxygen Demand (BOD) is strongly and positive correlated with chemical Oxygen demand (COD), fecal coliform (E.Coli), ammonia nitrogen (NH_3) and nutrients (NO_3, except June) February and June Drain water. For Nile water (BOD) is strongly and positive correlated with chemical Oxygen demand (COD) February and June months and vice versa for fecal coliform (E. Coli), ammonia nitrogen (NH_3) and nutrients (NO_3). Chemical Oxygen demand (COD)) is strongly and positive correlated with faecal coliform (E.Coli), ammonia nitrogen (NH_3) and nutrients (NO_3, except June) February and June Drain water.

Faecal coliform (E.Coli) is strongly and positive correlated with ammonia nitrogen (NH_3) and nutrients (NO_3, except June) February and June Drain water.

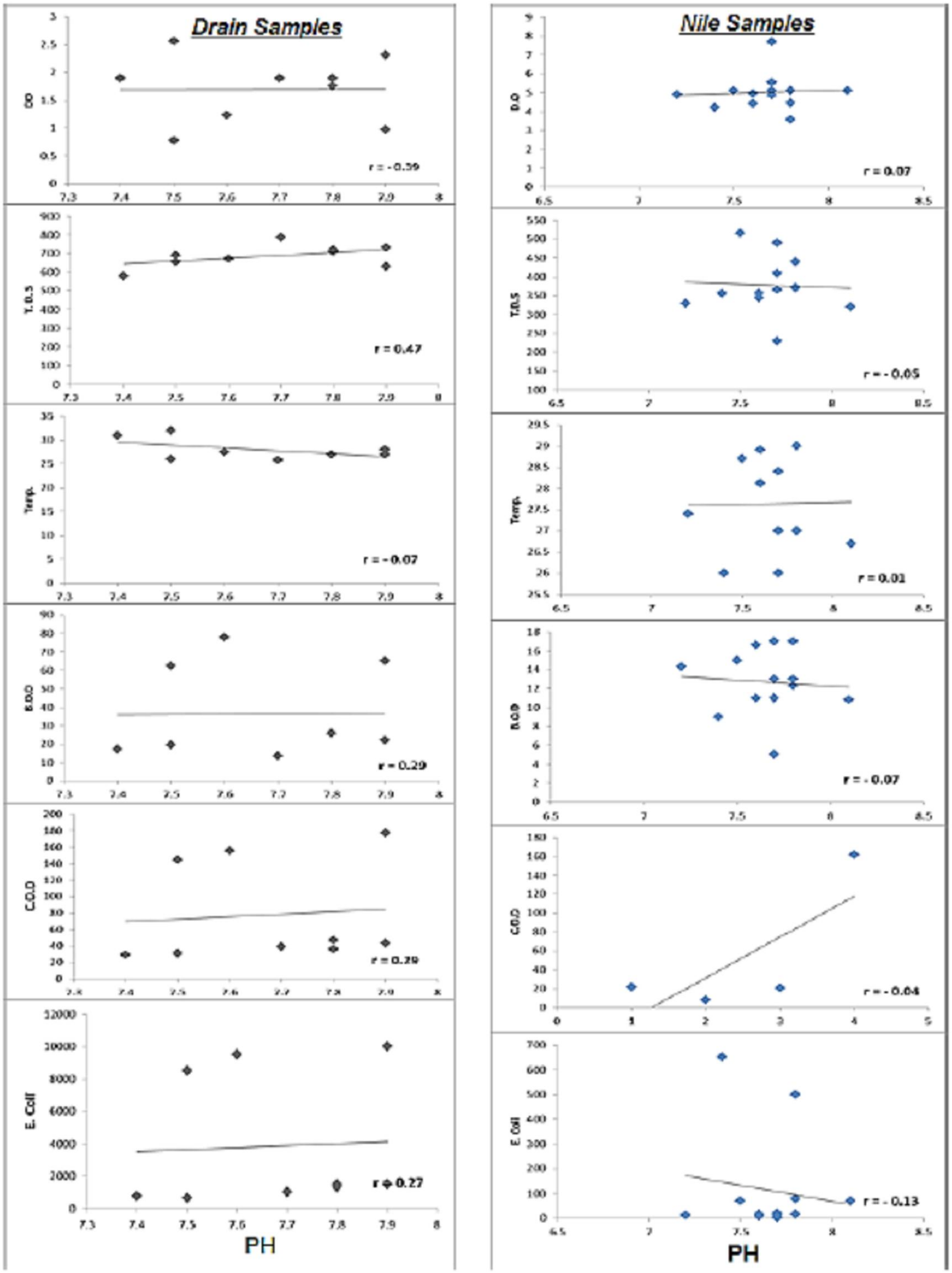
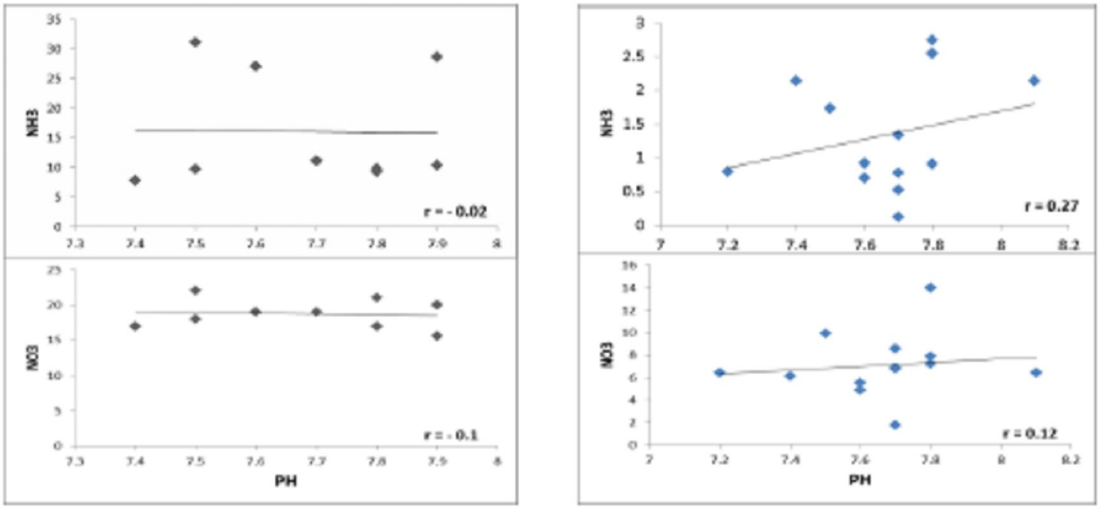


Figure (10): Rosetta Physiochemical analysis (Drains and Nile during June 2012).



Con. Figure (10): Rosetta Physiochemical analysis (Drains and Nile during June 2012).

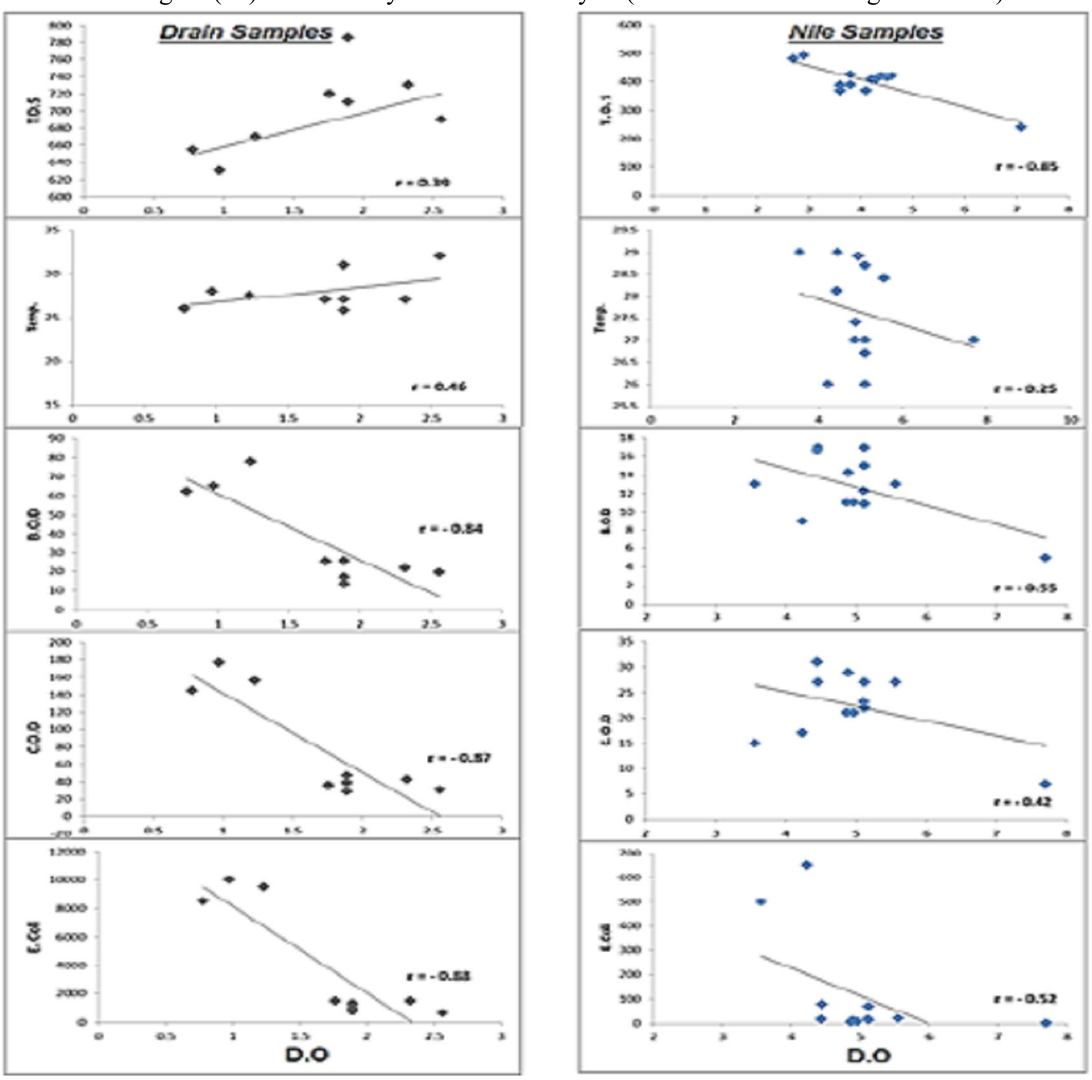


Figure (11): Rosetta Physiochemical analysis (Drains and Nile during June 2012).

Con. Figure (11): see above Figure (14).

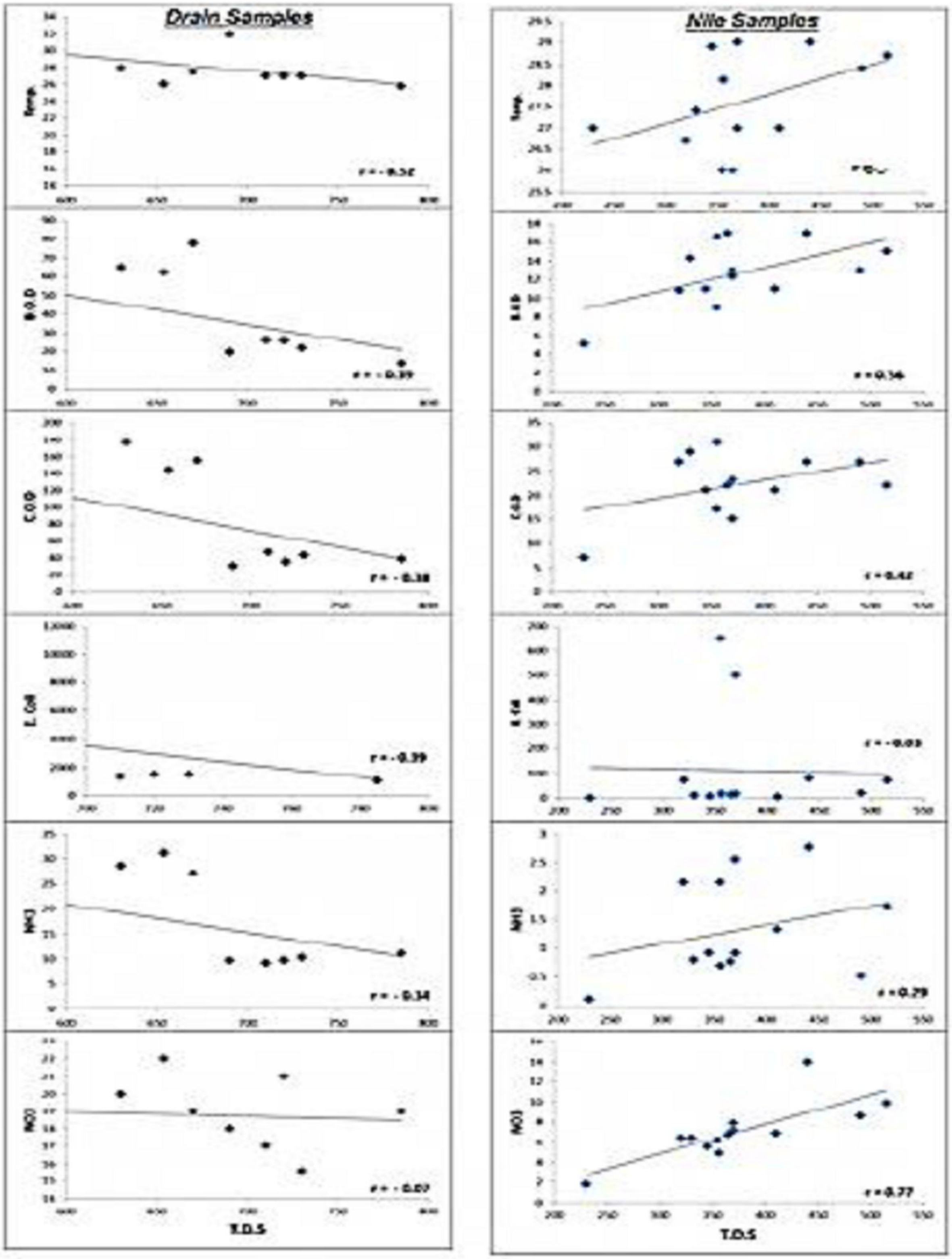


Figure (12): Rosetta Physiochemical analysis (Drains and Nile during June 2012).

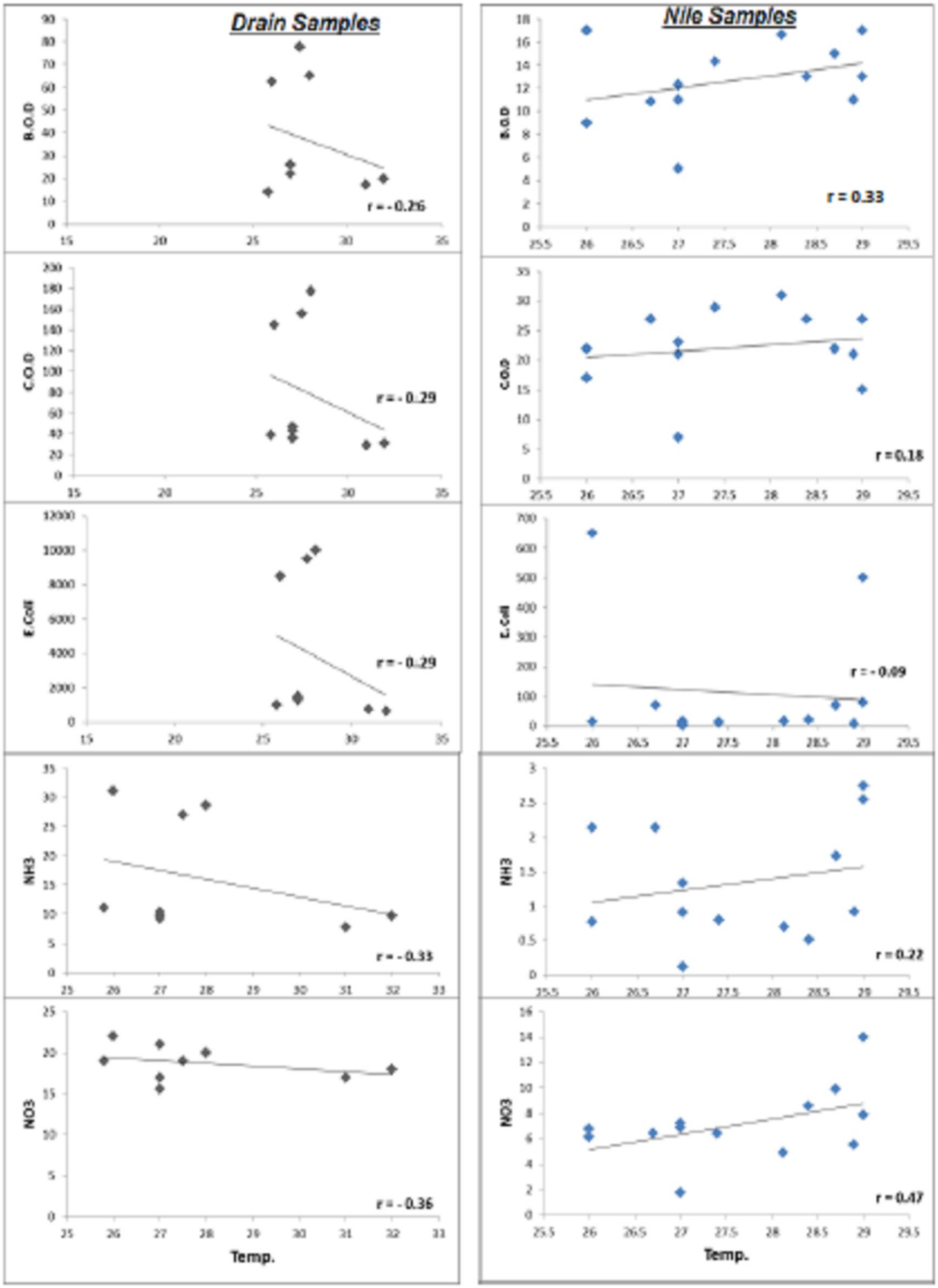
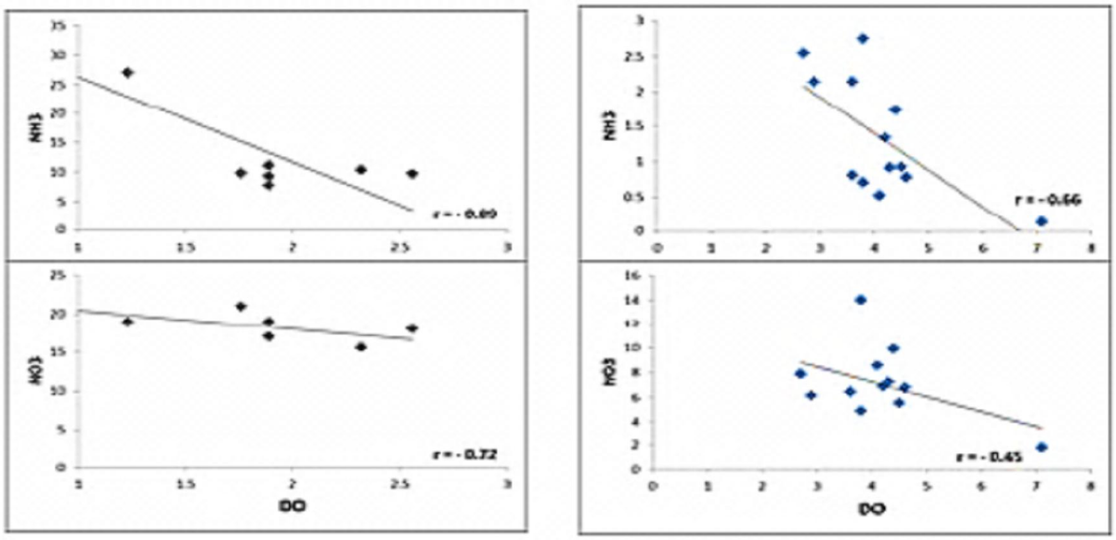


Figure (13): Rosetta Physiochemical analysis (Drains and Nile during June 2012).



Con. Figure (11): Rosetta Physiochemical analysis (Drains and Nile during June 2012).

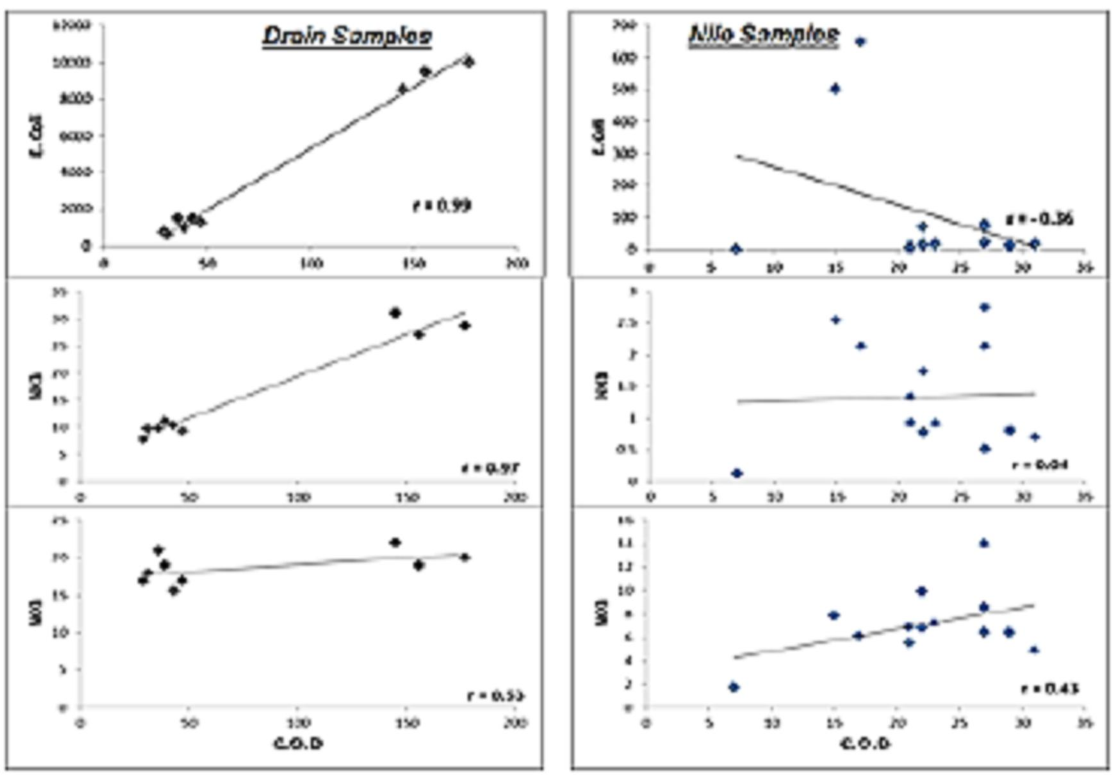


Figure (14): Rosetta Physiochemical analysis (Drains and Nile during June 2012).

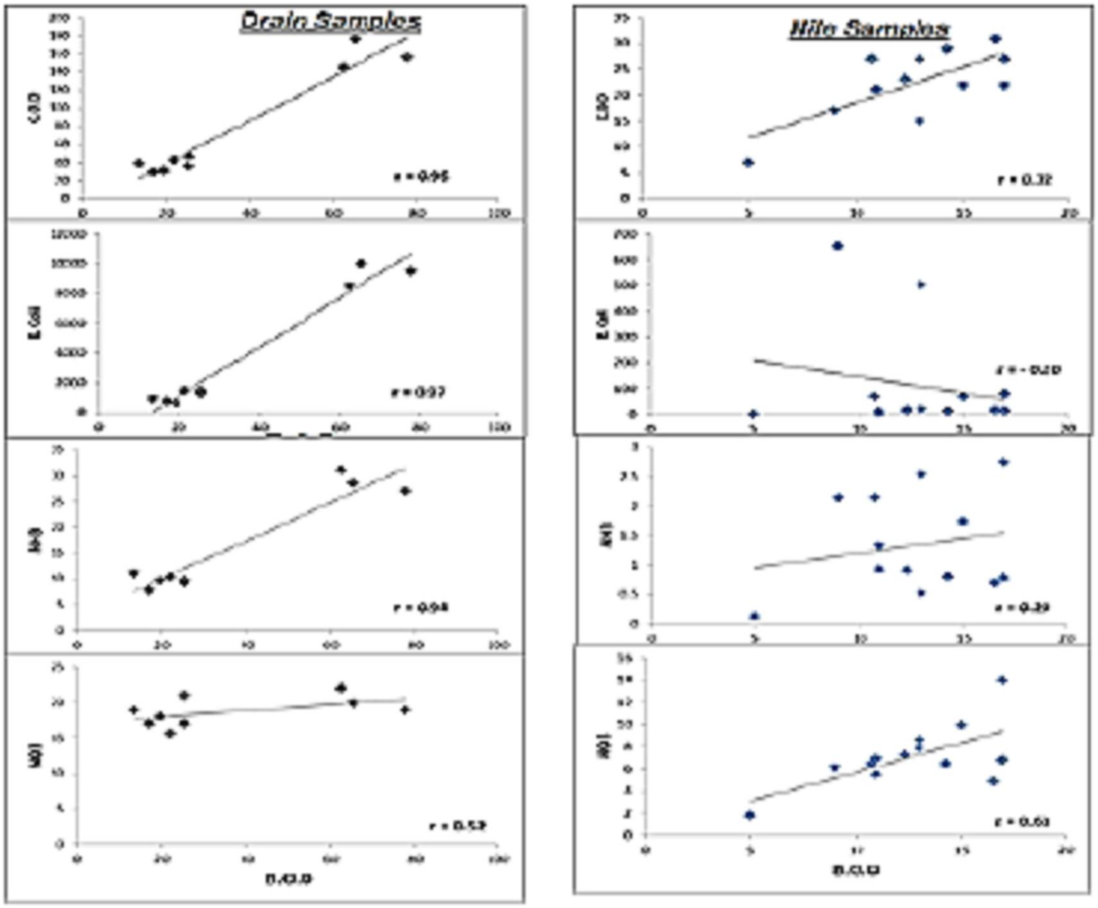


Figure (15): Rosetta Physiochemical analysis (Drains and Nile during June 2012).

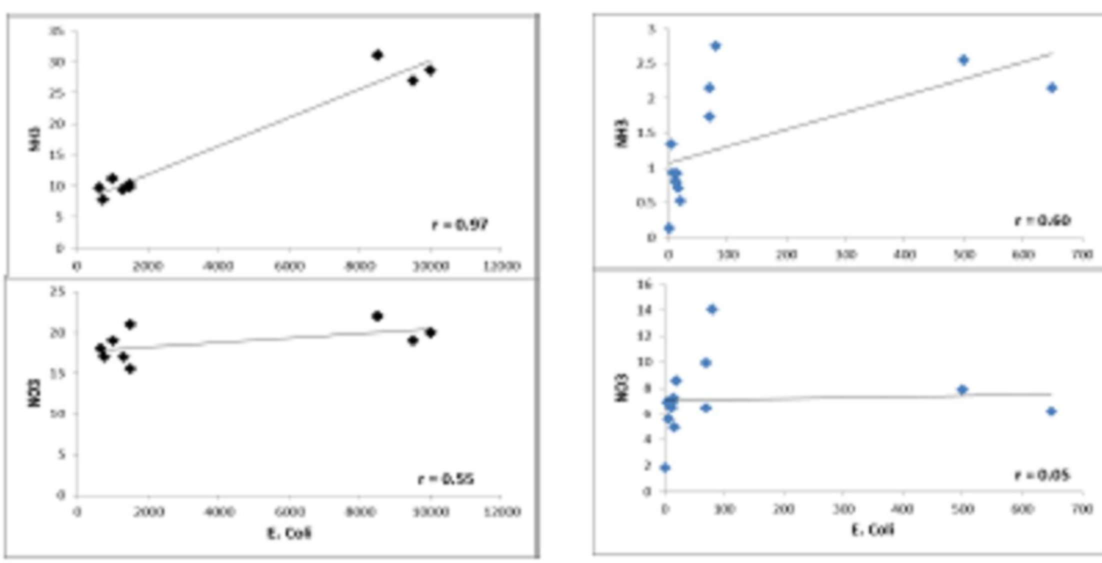


Figure (16): Rosetta Physiochemical analysis (Drains and Nile during June 2012).

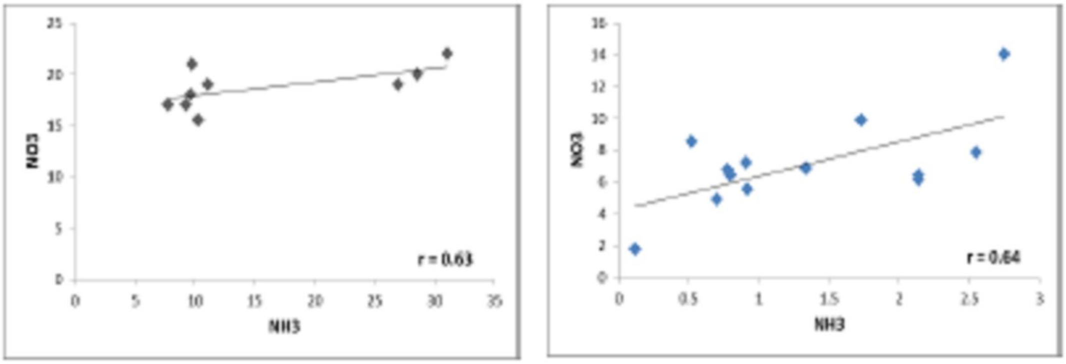


Figure (17): Rosetta Physiochemical analysis (Drains and Nile during June 2012).

Conclusions:

The results of WQI calculations according to House and Newsome 1989, showed that; the worth case was found along El–Rahawy drain at the area between Abu Rawash City and Nekla Village, their water are classified as very bad water quality level. However, the water discharging from El-Rahawy (outfall) classified as bad water quality.

It is worth to mention that, the water quality of Wardan Village, Bani Salama Village, Tamalay Village, Nadir Village, Ganoub El Tahrir drain, Zawieyt El-bahr drain and Kafr Meshla Village are classified as bad water quality level. However, the water quality of Kafr El Zayat City at km 35, Kafr El Zayat City (outlet of Tala drain), Kafr -El Zayat City at Maliya Factories, Benover Village after Maliya Factories, Abig Villageand Fuoa City El Mahmoudya City are classified as medium water quality level. On the other hand, the water quality at Delta Barrage, El Farastaq Village, Mehallat Abo- Ali Village, Motubis City, Edfina Barrage end of Rosetta branch are classified as good water quality level.

Physiochemical Parameters and biological characteristics Correlation Matrix reveals thatdata shows some clear hydro-chemical relationships can be readily inferred and the changes in Physiochemical Parameters of the water are followed by significant changes in structure of the biota. Therefore, the quality of Rosetta Branch water should be assessed on the basis of Physiochemical Parameters and biological characteristics in order to provide complete spectrum of information for proper water management.

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