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CURRENT SITUATION OF WATER POLLUTION AND ITS EFFECT ON AQUATIC LIFE IN EGYPT

By

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Abstract

Water is a multi-dimensional issue and a prerequisite for achieving human security, from the individual to the international level. The Nile River has long been a crucial component of both the identity and the vitality of Egypt. Egypt faces a rapidly increasing deterioration of its surface and groundwater due to increasing discharges of heavily polluted domestic and industrial effluents into its waterways. Excessive use of pesticides and fertilizers in agriculture also causes water pollution problems. Many disasters in Egypt were happening and leading to water pollution. Toxicity of fishes in Egypt occurs due to water pollution from chemical plants and sewage pipes. The water quality assessment is very important for implementation of the monitoring and remediation programs to minimize the risk promoted by hazardous substances in aquatic ecosystems. Evaluation of the degree of contamination of aquatic environments must take in account its chemical characteristics which has potential toxic effects and allows an integrated evaluation of its effects on populations of the aquatic system. During the last few decades, great attention has been paid to the possible dangers of heavy metal poisoning in human due to the consumption of contaminated fish. Industrial and agricultural discharges such as coal and oil combustion, phosphate fertilizers, plastics and pesticides are considered the major sources of heavy metal pollutants of water.

Key words: Water pollution- Industrial pollution- Agriculture pollution- Domestic Pollution- Tourism

Sources of water:

In Egypt we have many resources of water, starting with Nile River, Groundwater in Delta and Valley, Deep groundwater, Drainage water reuse such as canals in the Delta region, Bahr Yousef, wastewater reuse, rainfall and flash floods. The unconventional sources of water are the followings: Wastewater reuse, Desalination, Rain water and Ground water.

Availability and current use of water

Nile River availability is (Billion Cubic Meter) BCM/annum, 55.5, (75.2%), Underground availability 11.3 BCM/annum (15.3%), Agriculture availability 5 BCM/annum (6.8%), Wastewater availability 1.5 BCM/annum (2.03%), Rainfall 0.5 BCM/annum (0.67%) with a total of 73.8 BCM/annum, the total current use is 62.6 BCM/annum, (Allam, 2007).

Specifications of fresh water, according to Law 48 of 1982 (Article 60 of the Regulations)

The statement	**The statement of standards and specifications (mg / l unless otherwise stated) except pH**
Color	does not exceed 100 degrees
Total solids	500
Temperature	5 degrees above normal
Dissolved oxygen	for at least 5
PH	of at least 7 and not more than 8.5
BOD	for no longer than 6
Chemical oxygen consumer	no more than 10
Organic nitrogen	is not more than 1
Ammonia	is not more than 0.5
Greases and oils	is not more than 0.1
Total alkalinity	of not more than 150 and not less than 20
Sulphate	of not more than 200
Mercury compounds	does not exceed 0.001
Iron	is not more than 1
Manganese	is not more than 0.5
Copper	is not more than 1
Zinc	no more than 1
Detergents	no more than 0.5
Nitrate	is not more than 45
Florides	no more than 0.5
Phenol	is not more than 0.02
Arsenic	is not more than 0.05
Cadmium	is not more than 0.01
Chrome	does not exceed 0.05
Cyanide	is not more than 0.1
Lead	is not more than 0.005
Silinium	no more than 0.01

What is water pollution?:

Water pollution is a relative concept; where there is no water is completely pure. Contaminated water that poses threat to human can be used in the field of industry. Electricity for example, is requiring the use of a certain quality of the water free of minerals, as it leads to corrosion of boiler used in this industrial activity. Water pollution is the contamination of natural water bodies by chemical, physical, radioactive or pathogenic microbial substances (WHO, 2010 and Hogan, 2013).

Main Sources of pollution:

Agricultural runoffs, industrial effluents and municipal sewage are being recklessly dumped into the Nile River, gradually making its water unfit for human consumption. Sewage water from slums and many other areas in Cairo is discharged into the river untreated due to lack of water treatment plants. Agricultural runoffs frequently contain pollutants from pesticides and herbicides, which have negative effects on the river and the people using it. Industrial effluents are often highly toxic, containing heavy metals that can combine with the suspended solids in domestic wastewater to form muck. All of these factors combine together to make Nile a polluted river which may spell doom for the generations to come (Dakkak, 2013).

1-Industrial Pollution

Egypt faces a rapidly increasing deterioration of its surface and groundwater due to increasing discharges of heavily polluted domestic and industrial effluents into its waterways (Ali et al; 2011). There are estimated to be some 24,000 industrial enterprises in Egypt, about 700 of which are major industrial facilities (Ezzat et al; 2002). Egyptian industry uses 638 Million m3/ yr. of water, of which 549 Million m3/ yr. is discharged to the drainage system. Industrial activities in the Greater Cairo and Alexandria regions use 40% of the total. The River Nile supplies 65% of the industrial water needs and receives more than 57% of its effluents.

2-Domestic Pollution

The way domestic pollution affects water quality heavily depends on the way of disposal of pollutants. Approximately 65 percent of Egypt's population is connected to drinking water supply and only 24 percent to sewage services, although the latter percentage is expected to grow rapidly, due to works under construction. The population not connected to sewage systems relies on individual means of excreta and wastewater disposal such as latrines and septic tanks. The domestic wastewater spread into soil and groundwater by discharging and collecting wastewater in permeable septic tanks. The domestic wastewater is considered as the main source of pollution of groundwater. It contains many toxic and injurious chemical constituents that have serious effect on public health problems (Easa A. and Abou-Rayan A., 2010).

3-Agricultural Pollution

Excessive use of pesticides and fertilizers in agriculture also causes water pollution problems. In many agricultural areas, local surface and groundwater contamination resulted from leaching of nitrates from fertilizers and bacteria from livestock and feed wastes (Ezzat et al; 2002).

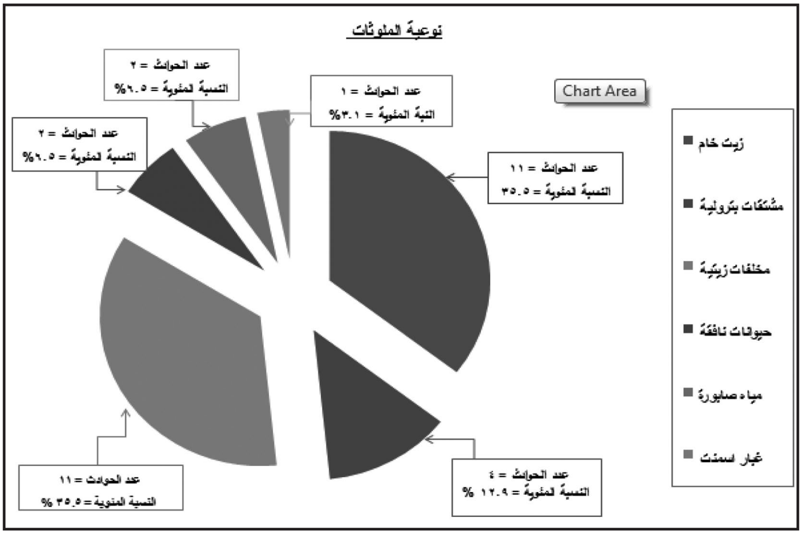
4-Tourism as a source of marine pollution

Marine pollution resulted from frequent small spills of oil and other contaminants. In addition, waters are polluted by garbage and animal carcasses thrown overboard by ferries and ships.

Pollution sources and related potential pollutants

Pollution sources		Potential pollutants
Domestic activities	Leakage from sewage system septic tanks, sewage water drains	Bacteria Nitrate and ammonium phosphate Heavy metals, organic micro compounds
Agricultural activities	Excessive use of fertilizers Excessive use of pesticides Waste water irrigation	Nitrate pesticides Phosphate Bacteria (from waste water irrigation)
Industrial activity	Food production Textile industry Wood, paper and graphica industry Chemical industry Oil and soap industry Metal and machine industry Energy production industry Construction industry Small scale services (like petrol stations and garages)	Non chemical hydrocarbons as proteins Ammonia Oil products Heavy metals (Cd, Zn, Cu, etc) Aromatic hydrocarbons Mineral oil Heavy metals (Cd, Zn, Cu, etc) Phenols Aromatic hydrocarbons Chlorinated hydrocarbons (chloroform) Cyanide Polycyclic hydrocarbons (naphthalene)

Wahab and Badawy (2004)



(Ministry of Environment 2012)

Examples of Disasters occurring in Nile River during the last few years

Emergence of an oil slick along the 6 km in the city of Edfu in Aswan, the inefficient control of industrial wastewater plants located on both sides of the Nile River was the cause the disaster (Khedr, 2010). Another time in 2012 (Egyptian Gazette/Egypt Independent, 2012) repeated incident of oil slick in the south of Isna, occurred in a different way, as the oil leak, this time from an old ship burned stands near the shore, and turned to store petroleum products, and with winter blockage, and the lack of water level ship listed to its side before sinking, leaving an oil slick with a length of about 1.5 km, and 700 meters.

Also, villages and towns located on the shore of Nile at Kafr El Sheikh Rashid branch, suffered from ammonia intoxication after its leakage from factories Kafr El Zayat Pesticides, and the Bank of Alrhowa in Giza Governorate, causing the deaths of tens of tons of fish, in addition to the risks to the health of citizens.

Water contamination (branch of the Nile Rashid) stops the process of fishing, due to pollution from chemical plants and sewage pipes.

Lately the Egyptian government removed the illegal fish farms that cause contamination of rashid branch in kafr shikh.

Types of pollutants

Natural contaminants are components of the environment including biological contaminants like harmful insects, microbes, and parasites.

Biological contaminants like bacteria, viruses, fungi, protozoa and dead animal.

Chemical contaminants are of the most noticeable pollution that has an impact on the validity of water for. These chemical pollutants can be of industrial sources, and emmisions from transportation means due to incomplete combustion of petroleum derivatives. In the rural environment, pollution arises from residues of agricultural chemicals, as fertilizers and pesticides. United Nation reports that 61 % of the population in rural areas and nearly 26% of the urban population do not have safe drinking water due to contamination with pesticides that reach these waterways. It has been confirmed by many studies that transmission of pesticide residues cause toxicity to fish by disturbing the alleged amounts of eggs produced by affected fishs.

Contamination of drinking water and food by nitrates, represent a major threat to human health when exceeding World Health Organization threshold limit value for nitrate salts of 1 mg / L. (MWRI 2003)

Contamination with heavy metals:

The primarily responsible for the pollution of waterways and soil with heavy metals is the increase in industrial activity, along with theresidues from mineral fertilizers. A report was published in 1992 denoting that metallurgical industry is responsible for about 50% of industrial waste while spinning , weaving, dyeing responsible for disbursing about 30% of the total industrial sewage. That about 250 industrial establishments in Greater Cairo, which represent about 35 % of the total industrial activity, contribute to about 40% of the total loads of heavy metals dumped into waterways and this is equivalent to 0.72 tons per day or the equivalent of 273 tons of heavy metals in the year to the waterway. As in the Delta with about 150 manufacturing facility is responsible for the exchange of about 25 % of the total loads of heavy metals in waterways - this quantity does not include the city of Alexandria, where there were about 175 industrial facilities (representing about 25 % of the total industrial activity in Egypt - and responsible exchange for 10% of the total loads of heavy metals in waterways) (El Bouraie et al., 2010).

Major industrial releases of cadmium are due to waste streams and leaching of landfills, and from a variety of operations that involve cadmium or zinc and plastics and petrochemicals. In particular, cadmium can be released to drinking water from the corrosion of some galvanized plumbing and water main pipe materials as well as the manufacture of fertilizer (Tawfiq, 1998).

Mercury from industrial activities disposed to the waterways is considered the main source of water pollution with mercury. Fish concentrates mercury in their muscles. El-Moselhy (2006) reported that levels of Hg in the edible parts of the investigated organisms showed the ranges 2.62 – 25.45 and 0.94 – 7.94 ng/g wet wt. in fish, 16.02 – 117.26 and 9.86 – 64.18 ng/g wet wt. in crab, 4.55 – 14.67 and 5.76 – 15.58 ng/g wet wt. in shrimp, and 1.06 – 36.31 and 5.38 – 69.59 ng/g wet wt. in bivalves from Lake Timsah and Bitter Lakes, respectively. High accumulation of Hg was recorded in Lake Timsah organisms which receives wastewaters from different polluted sources. Also, high concentration of Hg was detected in the internal organs of the organisms, especially liver compared with a lower one for the edible tissues.

The liquid wastes of industrial productions such as the cooling water generated by certain industries or resulting from power plants represents a source of thermal pollution of the environment.

Effect on aquatic life:

Ahmed et al; (2013) reported that residues of aliphatic and polycyclic aromatic hydrocarbons (PAHs) were monitored in some fish species collected from Temsah Lake, near Ismailia, Egypt. Fish species were Clupea sirm, Mugil sehli, Mugil capito, Morone labrax, and Sciasna sp. Clupea sirm; a surface feeder fish had the highest concentration of aliphatic hydrocarbons, (320 ±54 ng g-1), while Morone labrax, a predatory fish that live in the water column, had the highest concentration of PAHs, (315.87 ±46 ng g-1). Even-number aliphatic hydrocarbons were more frequently detected in all fish species in comparison to odd-number aliphatic hydrocarbons, suggesting a petrogenic origin of these compounds. Meanwhile, the pattern of PAHs detected in the study suggested that they originate from atmospheric deposition rather than land – based runoff.

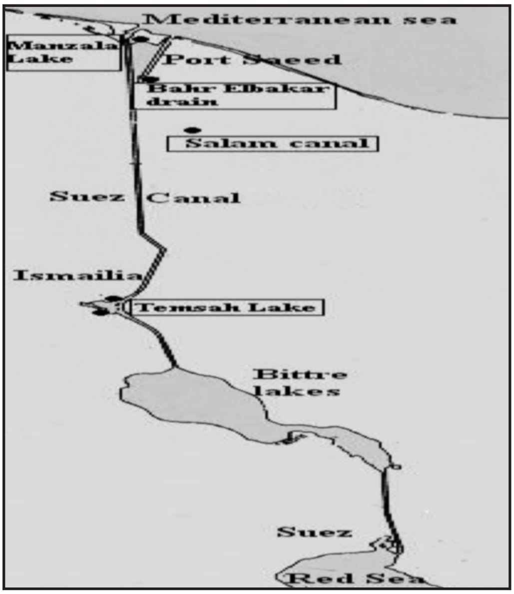
Another study in Suez canal region was done by Elnwishy et al; (2012) providing the first record of monitoring of 17 β- estradiol (E2) residues in some Egyptian aquatic ecosystems. Samples of water were collected from three water bodies located in the Suez Canal region. Interestingly, marine lakes contained significant levels of 17 β-estradiol ($P < 0.05$). Lower levels were detected in the rivulet streams supplied by the River Nile. Detection of estradiol in the aquatic ecosystems of the Suez Canal region grabs the attention towards the heavy reliance on some esterogenic medicinal products in the area, and the eventual effect on the aquatic systems including biodiversity of a variety of organisms. There is a global concern about the presence of the estrogenic residues in the aquatic ecosystems (Seifert et al., 2003). The source of these estrogenic residues is industrial wastes and medicines (Nolan et al, 2001), and as additives in animal feed (Bruce, 2005; Hailing et al., 2002). The effect of these traces is remarkable on marine animals and consequently on humans.Tundo et al; (2005), in Lake Temsah which is the end-point of several wastewater effluents. In the present study, residues of polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs), dioxin-like polychlorinated biphenyl (PCB) and polycyclic aromatic hydrocarbons (PAH) were monitored in the sediment of the lake. PCDDs and PCDFs were detected in all sediment samples collected from various sampling stations. Results showed some progressive increase in PCDDs concentrations relevant to increase in chlorination. In the PCDD group of congeners, 1, 2, 3, 4, 6, 7, 8, 9 octa-CDD had the highest detected concentrations in all samples, while 2, 3, 7, 8 tetra-CDD showed the lowest concentrations.

Additionally, in the same area of Suez Canal another study by Tundo et al; (2005) on residues of PCDDs/F, non-ortho, mono-ortho PCBs, and other PCBs. they were monitored in the tissues of mullet fish, bolti fish, bivalves and crab taken from Lake Temsah, at Ismailia, Egypt. Results showed that 2,3,7,8 Tetra CDD and 1,2,3,7,8 Penta CDD were the most frequently detected PCDD congeners. Similarly, 2,3,7,8 Tetra CDF, 1,2,3,7,8 Penta CDF and 2,3,4,7,8 Penta CDF were the most frequently detected PCDF congeners. No relationship was apparent between the concentrations of detected PCDDs congeners and the degree of chlorination, except with crab samples in which an increase in the chlorination coincided with a decrease in the concentrations of the congeners. In PCDF congeners, detected residues have had a reversed relationship with chlorination increase. In PCDD congeners, Octa CDD had the highest detected concentrations in the two fish species, while in the bivalves and crab, 2,3,7,8 Tetra CDD had the highest concentrations. The mullet fish had the highest total PCDDs concentration, at 0.398 pg/g fresh weights, followed by crab at 0.395 pg/g fresh weight, then bivalves and bolti fish at 0.187 and 0.062 pg/g fresh weight, respectively. In all the examined organisms, the total concentrations of PCDFs were much higher than the total concentrations of the PCDD congeners.

The WHO–TEQ (Toxic Equivalency factor) values (Van den Berg et al, 2006) were 11.92, 39.12, 25, and 3.6 pg/g fresh weights, for mullet fish, bolti fish, bivlaves and crab, respectively. The concentration of the mono-ortho congeners CB 118 was the highest detected of all non-ortho and mono-ortho PCBs congeners, with values of 0.382, 0.022, 0.231 and 0.357 ng/g fresh weights, in mullet fish, bolti fish, bivalves and crab, respectively. The WHO– TEQ concentrations were 0.799, 0.003 pg/g fw, 0.05 pg/g fresh weight, 0.676 pg/g, and 0.799 pg/g fresh weight, for the same species, respectively. The total concentration of PCBs 28, 52, 95, 99, 101, 105, 110, 118, 138, 146, 149, 151, 153, 170, 177, 180, 187 were 6.86 ng/g fresh weight for mullet fish, 0.2 ng/g fresh weight, for bolti fish, 2.72 ng/g fresh weight for bivalves and 2.8 ng/g fresh weight for crab, respectively.

Ahmed et al., (2001) investigated Lake Temsah which is the end point where some municipal, agricultural and industrial wastewaters are discharged and detected residues of some chlorinated hydrocarbon pesticides, polycyclic aromatic hydrocarbons and polychlorinated biphenyls were monitored in some of the lake's organisms. Mullet, crab and bivalve were selected as representatives of various strata of the lake ecosystem. Residues of an endosulfan, DDE, Dieldrin, heptachlor epoxide and Dicofol were detected. Aroclor residues were not seen. Endosulfan had the highest detected concentration of all organochlorines: concentrations were 24.1, 52.3, 124.8, and 65.6µg kg-1 in fish skin, fish gills, fish muscles and bivalves respectively. DDE was the most frequent detected organochlorine in all samples, while Dieldrin was only detected in bivalves and crab. The concentration of polycyclic aromatic hydrocarbons was lowest in fish skin, 2.7 µg kg–1, and highest in bivalves, 48.9 µg kg–1. Fluorine and anthracene were the most frequently detected polycyclic aromatic hydrocarbons compounds, while acenaphthene was the least detected. The highest concentrations of organochlorines and polycyclic aromatic hydrocarbons, 108 and 48.9µg kg-1, respectively, were detected in bivalves. Bivalves also had the widest spectrum of detected organochlorines and polycyclic aromatic hydrocarbons. All tested organisms showed a higher ability to accumulate organochlorines in comparison to polycyclic aromatic hydrocarbons.

In Rosetta Branch of the River Nile, El Bouraie et al, (2010) detected pollution from of domestic, sewage, agricultural and industrial origin. Heavy metals (Al, Ba, Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb and Zn) were measured three times before, during and after winter period (low flow conditions) from August 2007 to April 2008, in surface river water and the bed sediments of Rosetta Branch. The heavy metal concentrations in the river sediments were high remarkably especially during closure winter period. However, the concentrations in surface water were within the permissible limits.



Since 1960s, fringing reef has been chronically polluted, where Ras Shukeir area was used by Gulf of Suez Oil Company (GUPCO) for oil production. Khalaf et al; (2002) studied ecological aspects of the fringing reef of Ras Shukeir. Its present status showed a moderate level of petroleum hydrocarbon pollution. Field survey showed that the reef was seriously degraded where about 99% of its coral cover was destroyed along the whole investigated shore. Only sporadic colonies (1% cover) of the genera Acropora, Echinopora, and Platygyra with some individuals of associated fauna especially the giant clam Tridacna squamosa and the sea urchin Echinometra mathaei could withstand such conditions. Meanwhile, the reef flat is sparsely covered by the seaweeds Dictyosphaeria cavernosa, Caulerpa serrulata, Padina pavonica, Laurancia obtusa and Cystoseira merica, whereas Sargassum dentifolium, S. latifolium and Grateloupia filicina are occasional. Besides, Damselfish of Pomacentrus spp. and Chrysiptera spp., Butterflyfish of Chaetodon spp., parrotfish of Scarus spp., and the surgeonfish Acanthurus sohal were sporadically reported along the investigated reef. Finally, no signs of coral recovery have been observed.

Among indirect impacts there, are sewage run-off, sedimentation following urban construction, dredging, coastal alteration, over-fishing (including sharks as well as invertebrates like sea cucumbers) and destructive fishing (blast fishing), pollution, discharge of chemicals (chlorine, copper…) from desalination plants… For example, coastal modification around Hurghada for touristic land reclamation has been the prime cause of reef degradation through the discharge of increasing quantities of fine sediment (El-Gamily et al. 2001). It was estimated that 73% of the coral along the Egyptian coast has been damaged as a result of construction. The last report “Reefs at Risks revisited” (Burke et al. 2011) classified overfishing as the major local threat affecting 55% of reefs, through an increase in commercial fishing and heavy trawling.

A study on Zaki Reef, a shallow fringing reef at 55 km south of the Suez Canal showed that between 2004 and 2007, dead coral cover increased by 50%, sea urchin counts increased by 58% and fish abundance decreased (Moustafa et al. 2008).

Abdel-Sabour et al; (2001) reported that the studied area (Shoubra El-Khima, Bahteem and Mostorod) lies in the industrial area north of Greater Cairo. Results indicated that industrial and domestic wastewater samples contain several toxic levels of tested heavy metals (Cd, Co, Pb and Ni) which have a serious impact on surface waterways in the area. Shebin El-Qanater collector drain samples exhibited the highest levels of Cd, Co, Pb and Ni compared to other tested water bodies. Mostorod collector drain samples showed the highest levels of Zn and Cu. Industrial effluent samples collected from Cairo Company for Fabric industry had the highest amounts of total Zn Cu, Cd, Co and Pb, while Delta steel company discharges the highest amounts of total Fe and Mn. Al-Ahleya Plastic Company discharges the highest amounts of total-Ni.

El-Moselhy (2006) studied the concentration of vanadium in 73 sediment samples collected along the coastal area of the Egyptian seas (Mediterranean and Red Seas). The results indicated that the mean value of vanadium in Red Sea sediments (52.61 µg/g) was higher than the mean value of the Mediterranean (40.58 µg/g). This result could be attributed to the high petroleum activities of the Red Sea.

Along the Mediterranean coast, the sector in front of Port Said area exhibited the highest mean value of vanadium (103.9µg/g) than other sectors, which suffers from many sources of pollution.

A study done by Osman and Kloas (2010) from Aswan to Damietta reported significant increase in trace metals in the water, sediments and tissues of Clarias gariepinus. It was evident that, liver was the site of maximum accumulation for the trace metals, followed by gills then muscles.

Sleem and Hassan (2010) reported that Dahab and El-Warrak are among 144 islands along the River Nile in Egypt declared as protected areas in 1998. Rotifer density increased in the highly populated stations as an indicator of organic pollution. The species diversity of both zooplankton and macrobenthos were found to be slightly increased in unpopulated segments of the islands and decreased with increase of pollutants.

Toufeek (2011) showed a temporal variation in Cd and Pb concentrations, in the water of Aswan Dam Reservoir and River Nile, concurrently with the physicochemical conditions of water as temperature, dissolved oxygen, pH and wastes discharged. The concentrations of lead in Nile water at Aswan was obviously higher than Aswan Reservoir, exceeding of permissible limits at the eastern side. The concentration of Pb during spring is higher than the other periods, while Cd levels are higher in summer and autumn. Both Pb and Cd levels exceeded the permissible limits in most sites. Increasing the tourist ships discharging its wastes into the Nile at Aswan and wastewater input of Kema fertilizer factory through El- Sail Drain may be the main reason for elevation lead and cadmium concentrations at the studied sites.

Yousry (2011) determined the concentrations of non-residual heavy metals (Iron, Manganese, Lead, Cadmium, Chromium, Copper, Nickel and Zinc) in Lake Nasser bed sediments as compared with total heavy metals contents in order to identify their environmental risk in Lake Water. It was found that, the non-residual heavy metal levels (mg kg-1) in bed sediments were (0.11±0.05, 13.28±5.02, 12.52±2.89, 25.54±11.1, 24.53±11.29, 27.66±7.29, 11610±2810 and 418.87 ±190.91) for Cd, Cr, Pb, Ni, Cu, Zn, Fe and Mn respectively. It represents about (20.4, 19.9, 25.2, 38.6, 57.6, 49.3, 41.1 and 45.8%) from the total content of these metals respectively. Fe-Mn oxides and organic matter seem to be the main carrier phases for the non-residual fraction of these metals.

Elnimr (2011) measured the concentrations of cadmium, mercury, manganese, phosphorus, lead and zinc in samples of Basa fish (Pangasius hypothalmus) and some fresh water fish (Tilapia nilotica, named Bolti and Karmout) collected from Kafer-El-Zayat. Karmout fish contained the highest level of metals where phosphorus level was 3.45 µg/g, lead (1.51µg/g), zinc (1.03µg/g), cadmium (0.17µg/g), manganese (0.08 µg/g) and mercury (0.007 µg/g). In Bolti fish, phosphorus level was 4.03 µg/g, lead (0.83µg/g), zinc (0.62µg/g), cadmium (0.12µg/g), manganese (0.08µg/g) and mercury (0.004µg/g). In Basa fish, phosphorus level was 4.06 µg/g, lead (0.79µg/g), zinc (0.6µg/g), cadmium (0.12µg/g), manganese (0.07µg/g) and mercury (0.004µg/g). Cadmium and lead levels in all examined fish were higher than permissible safety level of human use (0.1 ppm).

Authman (2012) investigated aluminium (Al) concentrations in water and its accumulation in livers of fresh water fish (Oreochromis niloticus), from Al-Atf drainage canal, Al-Minufiya Province, Egypt. The concentrations of Al in water were higher than the permissible limits, and its concentration in livers of the fish is higher than that of the canal water.

El Zokm et al; (2012) reported the metals'concentrations in water that varied between 85.5-1240.9; 2.595-23.921; 0.552-25.9; 0.231-18.953 and 0.096-1.902 µg/l for Fe, Zn, Cu, Pb and Cd, respectively. Metals concentrations in sediment ranged from 1193.325 to 4405.0; 86.625 to 331.338; 38.363 to 84.775; 27.240 to 46.463 and 1.260 to 3.325 µg/g dry weights for Fe, Zn, Cu, Pb and Cd respectively.

Yacoub and Gad (2012) evaluate levels of some heavy metals (Cu, Mn, Pb and Zn) in certain tissues (gills, intestine and muscles) of Oreochromis niloticus collected from different sites of the River Nile at Upper Egypt during winter and summer. The obtained results revealed that the abundance of heavy metals in fish organs followed the order: Mn>Zn>Pb>Cu. The highest levels of the heavy metals were recorded in the intestine and the lowest was recorded in the muscles. The concentrations of Cu in the fish muscle were below the maximum permissible limit, however, Mn, Pb and Zn exceeded the permissible limits. Moreover the effect of accumulated heavy metals on total proteins, total lipids and the activities of transaminase enzymes (ALT and AST) were significantly lower in the muscles of the studied fish.

Gaber et al; (2013) conducted a study to assess the effect of the water quality of El-Rahawy drain at El-Rahawy village, Egypt, on the African catfish Clarias gariepinus blood, biochemical parameters and histology of digestive tract, testis and ovaries. In addition to that, samples of water and C. gariepinus fish were collected from the River Nile at Delta Barrage in front of El-Kanater El-Khayria City as references for comparison. Also, certain heavy metals (Cu, Fe, Pb, Cd, Mn and Zn) in water were measured from the two sites. Results showed that heavy metals concentrations in water were higher in El-Rahawy drain than in River Nile due to sewage and other pollutants discharge, that increase blood parameters in fish caught from El-Rahawy site than those of River Nile. The study recommended treatment of the agricultural, industrial and sewage discharges before their entrance into El-Rahawy drain to protect the fish and people from the dangers of pollution.

Mansour et al; (2013) studied the geochemistry and texture of marine surface-sediments in selected areas along Hurghada area. Surface sediments reveal high total concentrations of Fe, Mn, Pb, and Zn at Desert Rose Resort transect (avg. 0.43%, 77.14, 5.00, and 19.70 ppm respectively), Cd at El-Samaka Village transect and Abu-Shaar transect (avg. 0.15 ppm), Cu at Tourist Harbour (avg. 8.80 ppm), Ni at Abu-Shaar transect (avg. 20.80 ppm), and Hg at El-Samaka Village transect (avg. 0.07 ppm). Comparing the current findings with other regional data and other areas in the world clarifies that the metal pollution in Hurghada area is still localized and low.

Ibrahim (2013) investigated some physicochemical parameters of water at three selected stations (Kafr El-Zyat, Tamalay on Rosetta branch of the River Nile and Shanawan drainage canal at Shanawan village, Egypt). Also, the effect of water quality changes on histology of gill and kidney obtained from Oreochromis niloticus fish living in these three stations were studied. The results revealed noticeable changes in water quality at the three studied regions but in different degrees. Also, the collected fish from the three regions suffered from several histopathological signs in their gills and kidney including: necrosis, degeneration, hemorrhage, hemolysis, hemosidrin, fibrosis, hyperplasia and fussion.

Hamed et al; (2013) studied the surface seawater and superficial sediment collected from from the Egyptian Mediterranean beach. The obtained data indicated that Nile Delta, Port Said and Alexandria beaches, which are the most industrialized areas in the Egyptian Mediterranean Sea, showed high levels of mercury in water compared to other studied sites. These areas receive huge amounts of wastes from many sources. Sinai side and north coast beaches could be used as reference sites, as they are almost uncontaminated without harmful outfalls. In the same context, Alexandria beach showed the absolute high level of tin in water (1.225 µg/l), while the minimum level was recorded at Port Said area (0.226 µg/l). On the other hand, the highest mean value of Hg in sediments (14.938 ng/g) was found in Sinai Beach and Sn (1.414 µg/g) was at Alexandria beach.

Concentrations of Hg in sediments of the present investigated area comparing to other studies

Region	Hg_t conc. (µg/g)	References
Mediterranean, Egypt	0.009–0.023	Present study (Hamed et al.,2013)
Alexandria coast	0.8	El-Sokkary (1978)
Suez Canal	0.063–0.264	Hamed (1996)
Gulf of Suez	0.012–0.150	Hamed (1996)
Aqaba Gulf	0.016–0.047	El-Moselhy and Hamed (2000)
Gulf of Suez	0.012–0.419	El-Moselhy and Hamed (2000)
Red Sea proper	0.018–0.215	El-Moselhy and Hamed (2000)
Suez Canal (Port Said coast)	0.05–0.12	Abd El-Azim (2002)
Alexandria coast	0.03–17.82	Shobier et al. (2011)
Typical concentration	0.1–0.5	Moore (1991)

Concentrations of Sn in sediments of the present investigated area comparing to other studies.

Region	Snt conc. (µg/g)	References
Mediterranean, Egypt	0.419–3.790	Present study (Hamed et al.,2013)
Lake Mariute	1.875–8.19	Aboul-Dahab et al. (1990)
Red Sea proper	0.045–0.904	El-Moselhy and Hamed (2000)
Gulf of Suez	0.021–1.183	El-Moselhy and Hamed (2000)
Aqaba Gulf	0.024–0.890	El-Moselhy and Hamed (2000)

Mandour (2013) did a study in El-Mansoura district; Network of Shoha compact unit shows high values of Ni and Pb and in Talkha district; Mit-antar and Demera compact units show high values of Cd and Pb and in Sherbin district; Network of main station1shows high values of Cd and Ni and in Bilqas district; main station, network of main station and El-Satamony compact unit show high value of Cd and In El-Gamalis district; network of main station shows high value of Cd and Ni and In Nabaru district; Nabaru compact unit shows high value of Pb and In Miyet el-nar; Mit asm compact units shows high value of Cd and In Mit-ghamr district; Network of Tafahna el-Ashraf well, Atmeda well, Damas well show high value of Cd as well as high value of Pb in Damas well and Sahragt El-kobra well, Mit-el-ezz well shows high value of Ni and In Aga district; Ikhtab well, Mit-el-amil well, Aga el-gadida well after chlorine addition and network of Aga el- gadida well show high value of Cd as well as high value of Ni in network of Aga el-gadida well.

The great difference between the assayed concentrations and the acceptable limits may be ascribed to the geological characteristics of the studied area or to the unbounded amounts of phosphates fertilizers and so many types of pesticides used in the agriculture activities may also led to the high concentrations of Cd and Ni in drinking water in this area.

The results revealed that samples of Network of Shoha Station, Mitghorab well, El-Rahmania well, Mit-el ezz well and Miyet Sammanoud well before addition of chlorine that contain high numbers of total count of bacteria and exceed the recommended permissible limit.

El-Motaium (2000) reported that in Egypt, the use of raw sewage effluent as a source of irrigation and fertilization has been practiced for almost 80 years at ElGabal ElAsfar farm. At Helwan sewage effluent has started to be used in agriculture since 1992. Raw sewage sludge and sewage water are considered to be a valuable source of plant nutrients and organic matter. However, it contain several pollutant which can adversly affect the environment (water resources, plants, soils, animal and human health). The continuation of using raw sewage water and effluent in irrigation could result in environmental pollution, which is reflected in the accumulation of the following dominant pollutants: 1) Heavy metals (e.g. Cd, Pb, Ni, Co, Cr, Zn, Cu, Fe, Mn) which is found in soil, plant and water table. As such metals enter the food chain it creats hazards to animals and human health. In addition, heavy metals affects plant growth, soil microbial activity and soil fertility 2) Toxic organic compounds (e.g. detergents, pesticides, dyes, phenolic compounds, chlorinated hydrocarbones) which are biologically resistance to degradation, highly toxic and carcinogenic 3) Harmful pathogens (parasites, bacteria and viruses) which transit significance diseases to animal and human 4) Sewage water from industrial area are always mixed with industrial waste, in particular waste of nitrogen fertilizer factories contain high concentration of nitrate salts. The leached nitrate represent a hazards to the environment, human and animal health such pollutants could reach groundwater; through direct leaching from contaminated soil, human food; through the food chain, reating environmental and health problems. This situation started to cause governmental and public concern.

Approaches of Solutions of water pollution:

For the prevention of water pollution, Egypt has taken the following measures:

I-Scientific approaches (Biological)

A-Silver carp fish:

One of the approaches to solve the pollution problem is the silver carp fish. Each kilogram of fish consumed eighty kilograms of contaminated algae. Silver carp fish is a certain type of fish to purify the waters of the Nile and its accessories, a safe purification through the farming of the Fish -friendly environment of the carp family, with the ability to collect outstanding micro-algae and plants on the surface of the water while breathing and get the dissolved oxygen which are assembling these micro-algae. Algae do not absorb heavy metals from the water as they live on surface water for not more than 15 centimeters because they need the sun. While heavy metals are setelled deep in water (Xie 1999).

B-Aquatic plants (reed, papyrus, and hyacinth):

Aquatic plants could get ride of 83% of cadmium and 73% of lead. Aquatic plants naturally grow in Lakes allover Egypt, such as reeds and hyacinth that absorb heavy metals (cadmium, chromium, iron, copper, lead, zinc) and concentrate them in the roots of plants. According to the ability to accumulate elements, they are ranked as follows, papyrus - woven –hyacinth (Harley, 1996).

II-Preventive approaches

A-Wastewater treatment:

1-Treatment of wastewater and industrial wastewater in accordance with the rules and criteria established by the exchange on the water bodies, so as to maintain the quality of fresh water as a source of drinking water and to limit the growth of aquatic plants, which impede the ability of the waterway of self-treatment and affect the validity of the water in irrigation.

2-Prevent any contamination in Lake Nasser, either by erosion or other contaminants that accelerate the aging of the lake.

3-Establishment of sanitary drainage stations equipped with means of water treatment in places deprived of that service as the contamination of groundwater mostly due to unsafe disposal of waste on the surface of the ground, which will be reflected negatively on the quality of groundwater and increases the cost of processed and prepared for drinking and domestic use.

4-Maintain sea coasts from pollution activating and applying laws to protect the environment as environmental demand in the first place from wastewater of ships in marine water

5-Attention to wastewater treatment, including possible re- use for irrigation in the fish farms and lakes in order to increase water resources and the protection of water sources from pollution.

B-Groundwater safety measures:

1-Wastewater treatment before the arrival to the fresh water bodies by controlling activity of Maritime Transport (leaking oil or burning oil or rinsing).

2-Securily burial of the waste in some specific deserts, they might leak and threaten the groundwater

3- The imposition of precautions on a large scale in order to maintain the integrity of groundwater as a source of security of drinking water sources and especially in Valley and Delta.

4-Reduction of air pollution, which contributes to pollution of rainwater

III-Administrative approaches

1- Minamata Convention that held in Geneva, to prepare for the international treaty to prevent the emission of mercury, and the reduction of health effects and environmental destroyer.

2- In specific places citizens committed to installing filters on high-precision on water tapes to drink.

3-State imposes a financial penalty on large ships and factories, which dispose waste in the Nile (support treatment and removal of the damage). The Ministry of Irrigation and cooperation with the Ministry of Scientific Research supported competitions to reduce Nile pollution.

4-Raising awareness of the population to preserve water clean.

5-Law enforcement and implementation. (Mohammad Akram Ganzory, National Center for Water Research)

IV-Legislative approaches

Laws related to water resources according to the Egyptian Laws:

- The most important laws and regulations concerning the protection of water resources from pollution in the Egyptian Laws
- Law No. 93 of 1962 on the exchange of liquid wastes and its implementing regulations (Ministry of Housing, Utilities and Urban Communities

- Resolution No. (643) for the year 1962
- Resolution (44) of 2000 to amend the Regulations of Law No. 93 of 1962
- Act 53 of 1966? Amended by Law No. 116 of 1983? And modify some of its provisions, the law of 2 for the year 1985? Affair in Agriculture - Ministry of Agriculture
- Presidential Decree No. 2703 of 1966, the establishment of the High Water, Ministry of Health
- Act 38 of 1967 regarding the hygiene? And modify some of the provisions of Law 10 of 1967? - Act 31 of 1976
- He continued: Law 38 of 1967 and amending some of its provisions? Law 10 of 2005 regarding the hygiene
- Law No. 27 of 1978 concerning the regulation of public water supplies for drinking and use human consumption
- Law No. 48 of 1982 regarding the protection of the River Nile and waterways from pollution and its implementing regulations (no. 8) of 1983, as amended by its executive Resolution No. 402 of 2009
- Act 124 of 1983? Like in fishing and aquaculture? Organize and fish farms
- Law 12 of 1984 on Irrigation and Drainage and its implementing regulations issued by Decree 14717 of 1987
- Resolution No. (215) for the year 1985? Regarding the use of pesticides in agriculture - and the Ministry of Agriculture and Land Reclamation
- Resolution 301 of 1995 - the Ministry of Health? Specifications on private health outlet of drinking water and protection from pollution
- Law (4) for the year 1994 regarding protection of the environment as amended by Law No. 9 of 2009 and its implementing regulations
- Prime Minister’s Decree No. 2318 of 2009, the establishment of the Supreme Council for the Protection of the Nile River? Pollution of the Council of Ministers
- Resolution 301 of 1995 - the Ministry of Health regarding the specifications of private health outlet of drinking water and protection from pollution

Recommendations

1- Constant monitoring of the Nile river water quality is needed to record any alteration in the quality and mitigate outbreak of health disorders and the detrimental impacts on the aquatic ecosystem.

2- Attention should be paid to mitigate element mobilization from sediments as their effects may become significant during seasons and years of low water flow in the river.

3- Effective implementation of laws and regulations

4- Preparation of Cadres and capacity development

5- Periodic assessment of the possibilities of monitoring

6- Raise awareness

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