

**ON THE INFLUENCE OF WATER POLLUTION UPON
THE FISHERY GROUNDS IN EL-SALLUM,
ABU-QIR AND EL-BORULLUS
REGIONS.**

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ABSTRACT

The petroleum pollution in the western regions are at its maximum in El-Sallum Bay. Comparatively rich fish catch is found in the Bay. Abu-Qir Bay was surveyed to trace the influence of pollution upon its water's chemical characteristics and fishes. About 221×10^6 ton/year of chemical compounds are estimated as discharged pulp-mill wastes in the Bay. The decline of its fish stock is clear. The coastal regions north to El-Borollus shores is found containing surplus 1500 tons of P ions and 90×10^3 ton of COD. The corresponding fish catch is found stable and may reach 300 ton/year.

INTRODUCTION

Recently, the Egyptian waters are subjected to serious pollution with three kinds of material. They are heavy petroleum fractions, the drain and sewage discharge and the industrial waste products. Various localities near the shores suffer from the spreading of one or more of these pollutants.

MATERIAL AND METHODS

Since 1960, the Institute of Oceanography and Fisheries carry out periodical hydrographic surveys in the near shore waters of the S.E. Mediterranean. Seasonal trips were made by means of the research vessels (Faras El-Bahr), (Ichthyolog) and other boats during 1960, 1964, 1966, 1970, 1974, 1976 and 1978 to collect water samples from a network of stations covering the continental shelf waters. The results of chemical and biological analysis are used in the following discussion to estimate the recent change in the environmental conditions (Al-Kholy and El-Wakeel, 1975; El-Hehyawi, 1974).

The water samples were collected with reversible bottles provided with standard and calibrated reversible thermometers. The results of analysis were processed in the Egyptian National Oceanographic Data Center. Generally, the chemical analysis were performed according to the techniques given by Strickland and Parsons (1968).

The annual reports of fishery statistics helped, also, in evaluating the fertility of the fishery grounds. Fishing experiments in the region of El-Sallum, Mersa Matruh, Arab's Gulf, Abu-Kir Bay and El-Borullus regions were performed during 1970-1978.

The Oil Pollution in the Western Regions

The surface water of the coastal regions is partially influenced by the south eastwardly flowing current which has its waters from an Atlantic origin. The core water layer of this current is characterised by lower salinity and higher nutrient content than the surrounding waters. The concentration of the soluble phosphate salts in the current water vary from 0.15 to 0.32 $\mu\text{g-at PO}_4 - \text{P/l}$. These values drop to less than 0.09 $\mu\text{g-at PO}_4 - \text{P/l}$ in the waters beyond the frontal zone of the current, (Table 1). In addition, the oxygen saturation values 102-105 % in the current waters reveal its relatively higher fertility.

Table (1)
The range of concentrations of some chemical characteristics
of the sea water in three regions of the
S.E. Mediterranean coast during 1967-1972.

Regions	Salinity ‰	$\text{PO}_4 - \text{P}$ $\mu\text{g-at} / \text{l}$	O_2 Saturation %	Petroleum mg / m^2	C.O.D. mg / l
El-Sallum	38.3 - 39.2	0.00 - 0.32	95 - 105	00 - 007	0.20 - 0.80
El-Borullus	38.2 - 39.3	0.05 - 0.50	95 - 115	00 - 0001	0.24 - 00.68
Abu - Qir	38.3 - 39.7	0.00 - 1.20	15 - 110	01 - 2000	1.00 - 45.00

Moreover, these regions suffer from oil pollution. The spilled heavy fractions of oil from the various kinds of ships could relatively be evaluated during the cold seasons by means of its floating tar-like oil residues upon the water surface. About 70 mg. heavy oil lumps per square meter of the surface were found during February, 1972. The highest concentrations were found in the localities at about 5 - 15 miles north to El-Sallum shores. Excluding the probability of tanker accidents and the catastrophic spillage of oil, the before mentioned magnitude of oil pollution could be considered at its moderate level (El-Hehyawi, 1979).

The dominantly prevailing north westerly winds, during about 8 months especially in the cold seasons of the year, help the drift of the spilled oil to the shore. Therefore, during May 1976, the sand in some localities of El-Sallum beaches, especially in the land water interface, was found contaminated with 0.1 - 0.3 % of the weight by heavy petroleum fractions.

The fishing experiments with light during the beginning of autumn 1971 indicated a range of catch 1.5 - 50.0 kg./h of sardines and other pelagic fishes in the nearshore waters of El-Sallum. The fish eggs in these regions may exceed 1.3 count / m². Both the fish catch and the abundance of the fish eggs decrease significantly in the waters north to Mersa Matruh - Arab's Gulf regions (El-Sayed El-Hehyawi and Hamid, 1977). This is noticed inspite of the less petroleum pollution in these regions than in El-Sallum waters. It may also indicate that the pollution in El-Sallum is much less than the lethal limits.

Under the above mentioned conditions, the fish landings from the western regions were estimated to reach about 100 tons / year. But according to the recent fishing experiments in 1978, this magnitude could be increased to about 60 kg / hour in case of fishing by purse seine and light. The increase beyond 70 mg / m² of oil pollution may in the future injuriously affect the fish production.

The Pollution With industrial wastes

Before 1965, the shallow water of Abu-Qir Bay was one of the most productive resources in the coastal area. The bay is situated north to Lake Idku. Both the bay and the lake are at about 60 Km to the east of Alexandria. During the years 1960-1964, the bay received about 0.61.0 km³/year of outflowing water through the lake-sea connection. The lake waters carried significant load of organic matter and nutrient salts especially during July-September period of the Nile flood to the sea. The phosphate concentrations in the bay waters used to fluctuate in between 0.4 and 3.8 µg-at PO₄-p/l. The pH values ranged from 8.0 to 8.5 while the oxygen saturation was about 120%. The low oxygen saturation was a result of the oxidation of high load of organic matter from biological origin. Therefore this process contributed to the fertility of the sea water.

Since 1966 the magnitude of the components interacting in Abu Qir Bay and Lake Idku regions has been greatly changed. Recently the flood water seized. The lake receives about 2.1 Km³/year of polluted water from the drains. The excess lake water which may exceed about 0.5 Km³/year is discharged to the bay. In addition, the paper factories, which were fully constructed after 1965, discharged about 18.0 x 10⁶m³/year during 1977-78. The wastes have C.O.D. values about 800.0 mg/l and B.O.D. (biological oxygen demand) values 1500.0 mg/l (Abbas, 1969). According to the data about the total discharge from El-Tabia pumps to the bay (personal contact), the estimated content of the B.O.D. in the polluted water discharge is highly significant (Table 2).

Table (2)
The estimated load of essential chemical components
discharged to Abu-Qir Bay during
1976 - 1978.

Discharged water kind	Average discharged volume (m ³ / year)	Oxygen content (ton / year)	B.O.D. (ton / year)
Paper mill black liquor	018.0 x 10 ⁶	000.0	027.0 x 10 ³
Pumps discharge to Abu-Qir Bay	666.0 x 10 ⁶	940.0	166.5 x 10 ³
	Dissolved organic matter	Reactive PO ₄ -P (ton / year)	Reactive nitrogen (ton / year)
Paper mill black liquor	13.95 x 10 ³	0.00	6.35
Pumps discharge to Abu-Qir Bay	50.60 x 10 ³	6.19	5.59

It is well known that the organic solid matter is mainly legnine and cellulose compounds. The other dissolved matter in the discharge contain harmful toxic compounds of phenolic structure, in addition to the sulphur salts (Table 3). Therefore both of the lake and the industrial discharge waters distribute different chemical compounds of harmful and toxic influence upon the living organisms.

Table (3)
The total discharge of solid and dissolved matter
of the black liquor (prepared at 110°C) in the
pulp mill wastes to Abu-Qir Bay during
1966 - 1978.

Compounds	Concentration gm / l	Content (Ton / year)
Solid matter	6.50	110.80 x 10 ³
Suspended matter	2.50	032.50 x 10 ³
Dissolved matter	4.50	077.50 x 10 ³
Na ₂ S	0.06	01.10 x 10 ³

Recently the phosphate concentrations and the oxygen saturation values in the bay waters are frequently found much less than 0.20 $\mu\text{g-at PO}_4\text{-P/l}$ and 100% respectively. The pH values range from 7.5 to 10.5. This wide range of variations confirms the waters unfavourable tendency to be either acidic or alkaline according to the season and the locality. In addition, the pollution with the heavy fractions of petroleum upon the water surface may reach about 10-50 mg/m^2 . Other much higher values could be found in the discharged waters by El-Tabia pump station to the bay. The sand at the land-water interface in El-Tabia beach is polluted with heavy petroleum fractions reaching about 2-5% of the weight of the sand in the surface layer.

The high values of oxygen demand and the low values of oxygen saturation which may reach less than 15% indicate the harmful influence of the chemical constitution of water upon the aquatic organisms. The fish landings in Abu-Qir Bay centers declined from about 5×10^3 tons during 1964 to about 1036 tons during 1974.

The treatment and purification of the drain waters are of utmost importance to secure successful fish resources.

The Pollution With The Drain and Lake Waters

The drains carry different organic and inorganic compounds in addition to the sewage discharged from the adjacent governorates to the lakes. The coastal water, north and northeast to El-Borullus outlet, were recently found attaining high content of nutrient salts and organic matter.

The phosphate concentration and the oxygen and the oxygen saturation in the mixed coastal water may reach about 0.50 $\mu\text{g-at PO}_4\text{P/l}$ and about 115% oxygen. The chemical oxygen demand (C.O.D.) may reach about 0.8 $\text{mg O}_2\text{/l}$ especially in the shallow nearshore waters. The pH values are exclusively high; reaching about 9.14, whereas the surrounding waters all along the coast of the S.E. Mediterranean attain pH 8.1-8.3 (Table 4).

The wide range of variation of the oxygen saturation may indicate high biological activity. But the comparatively high phosphate concentrations in association with the exceptionally high pH values may reveal significant pollution. The distribution of the water masses in the northern region to El-Borullus lake shows that about $4 \times 10^3 - 6 \times 10^3 \text{ Km}^2$ of the coastal 20 m water layer is recently influenced by the lake waters (Al-Kholy & ElWakeel, 1975). An estimate of the surplus phosphate-P and C.O.D. may reach 992-1530 tons and $64 \times 10^3 - 96 \times 10^3$ tons respectively in these regions. These values is about 10-15 times higher than the total content

Table (4)

The maximum values of chemical characteristics of the regions north to Lake El-Borullus, during 1971.

Month	pH	Salinity ‰	O ₂ ml / l	PO ₄ -P µg-at / l	NO ₂ -N µg-at / l	NO ₃ -N µg-at / l	SiO ₃ /Si µg-at / l
II	9.16	38.98	6.35	0.24	0.08	3.1	05.0
V	8.26	38.81	5.37	0.56	0.16	0.6	21.6
VIII	8.22	39.10	4.73	0.13	0.00	1.9	02.0
IX	8.19	39.09	4.60	0.23	0.13	0.0	04.0

in the waters carried out by the river discharge from Rosetta branch to the sea during 1972. It is worth to mention that the river discharge have not exceeded this amount since 1970. The surveys reveal the mentioned 0-20 m layers to be oversaturated with about 50,000-80,000 tons oxygen especially during winter. It indicates high phytoplankton production.

There is, also, great probability that the outflowing water from the lake contains significant content of pesticides. Concentrations as 0.0005 gm/l of the carbamate may result the mortality of fish larvae within less than three hours.

The fish landings from the coastal regions north to El-Borullus shores indicate nearly stable magnitude within the range 100-200 ton/year. This is noticed in spite of the clear variation in its percent to the total catch from the S.E. Mediterranean regions before and after 1970. It also suggests clear confirmation to the influence of the lake discharge upon El-Borullus coastal regions which compensate the expected decrease in the nutritive elements resulting from the restriction of the river water discharge to the fishing grounds (Table 5).

Table (5)
 The percentage of fish catch from the sea waters north to El-Borullus coasts as compared with
 the total catch from the S.E. Mediterranean regions
 during 1972 - 1978.

REGIONS	FISH CATCH (TON / YEAR)									
	1962	1964	1966	1968	1969	1970	1971	1974	1976	1978
El-Borullus	366.0	385.5	276.5	210.3	136.4	72.5	314.3	381.5	222.1	287.8
Total	37832.2	25975.0	24686.4	13586.3	8520.6	8119.0	10560.3	6849.0	7142.0	11764.7
El-Borullus / total percentage	0.97	1.48	1.12	1.55	1.60	0.89	2.98	5.57	3.11	2.45

CONCLUSIONS

The Egyptian coastal waters of the Mediterranean Sea are influenced by the South East current of Atlantic water origin which increase the phosphate salts from the concentration of 0.09 to about 0.23 $\mu\text{g-at PO}_4\text{-P/l}$

The highest concentrations of the tar lumps in the western regions were found at 5-15 miles north to El-Sallum and may reach 70 mg/m^2 . The maximum fish catch was also found by the fishing experiments in these regions. The abundance of eggs 1.3 count/m^2 confirms also these observations. It is clear that adverse effect of oil pollution could be obvious at much higher concentrations than that in El-Sallum Bay.

Abu-Qir Bay was the most productive region of the coast. Recently the phosphate content of its water vary between 0.05 and 1.20 $\mu\text{g-at PO}_4\text{-P/l}$. The oxygen saturation ranges from 15 to 110%. Generally, the bay suffers from intense pollution with industrial wastes. The paper factories discharge no less than $18.0 \times 10^6 \text{ m}^3/\text{year}$ of industrial wastes. These wastes contain harmful organic and inorganic compounds. The chemical oxygen demand of the discharged solution is about 0.8 gm/l O_2 while its (B.O.D.) biological oxygen demand reaches about 1.5 gm/l O_2 . In addition, the oil disposal in the bay caused the contamination of the beach sand with heavy petroleum fractions. In some localities it reached about 5% by weight of sand at the sand-water interface. About 221×10^6 ton of solid and dissolved chemical compounds is annually discharged as paper-mill wastes to the bay.

In the future, the construction of factories for urea and other fertilizers will add highly significant amounts of harmful chemicals to the bay waters. The influence of the present pollution could be evaluated since the fish landings from the bay declined from about 5×10^3 tons in 1964 to about 1036 tons in 1974.

The water outflow from the delta lakes to the sea causes further rise in the nutrient salts. This could be noticed in the localities North and North East to El-Borullus outlet. The sea water in these localities is mixed with the outflowing polluted lake waters which continuously increase with the excess discharge of drain and sewage water from the neighbouring governorates to the lake. Therefore, the phosphate concentration in the above mentioned mixed sea water reach about 0.6 $\mu\text{g-at PO}_4\text{-P/l}$ while the oxygen saturation ranges from 95 to 115 % . About 1500 ton of surplus P-ions and about 90×10^3 ton of C.O.D. are estimated in the mentioned coastal waters. The organic content of this water mass can help in establishing exploitable fishery grounds.

However, the recent investigations show that the fish landings from these localities increased from 83 tons during 1970 to about 381 tons in 1974.

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