Annual report on water quality data from the coastal waters of The Mediterranean Sea Year ٢٠٠٠.

Summary

This report reviews the most significant results of the EIMP monitoring of water quality parameters from the Egyptian coastal areas of the Mediterranean Sea in the year ٢٠٠٠.

Bacteriological Water Quality

The major findings regarding biological water quality were:

- The bacteriological water quality was poor at a quite large proportion of the visited stations in year ٢٠٠٠. The guideline values for indicator bacteria (i.e. Total Coliform bacteria, *E.Coli* and Faecal streptococci) were thus exceeded at least once for at least one type of indicator bacteria at ٣٠ of the ٣٧ stations visited. The Alexandria Region is decidedly the region which was most polluted by bacteria closely followed by the Delta Region. The Western and Eastern Regions were much less polluted (generally ranging from not polluted to slightly polluted).
- The bacteriological water quality in the Alexandria and Delta Regions in the year ٢٠٠٠ did not differ significantly from ١٩٩٨ and ١٩٩٩. A slight increase in the number of samples violating the standards was observed in the Western Region. The bacteriological water quality in the Eastern Region did not deteriorate compared to previous years
- The source of bacteria is primarily untreated domestic sewage

Eutrophication parameters

The major findings regarding eutrophication parameters were:

- The stations in the Western Region from Salloum to El Alamein were generally mesotrophic (i.e. having medium levels of nutrients) with very low levels of chlorophyll-a (which is a measure of plankton biomass
- The stations in the Alexandria Region were eutrophic (i.e. having high levels of nutrients) with high to very high levels of chlorophyll-a. The highest levels were encountered at El Mex (Me ١١), Alex Eastern Harbour (Me ١٥ and Me ١٦), Abu Quir Bay (Me ٢١-Me ٢٣) and Maadia (Me ٢٤ and Me ٢٥)
- Most stations in the Delta Region were mesotrophic with high levels of chlorophyll-a. However, El Gamil (Me ٣٩ and Me ٣٢) at the outlet from Lake Manzala were eutrophic with very high phytoplankton biomass.
- The waters in the Eastern Region at Port Said (Me ٤١) were eutrophic with very high levels of chlorophyll, but further east the degree of eutrophication decreased.
- Despite the high levels of nutrients and chlorophyll, which were encountered at most stations, poor oxygen conditions were not encountered in year ٢٠٠٠
- The concentrations of chlorophyll-a in the Western- and Alexandria regions in ٢٠٠٠ were comparable to the concentrations encountered in ١٩٩٨ and ١٩٩٩. A significant annual variation in the concentration between years was observed in the Delta- and the Eastern regions. The variations were due to annual variations in the plankton production in Lake Manzala, which is a major source of eutrophication at El Gamil in the Delta region and Port Said in the Eastern region.
- There seems to be a decreasing trend of dissolved inorganic nitrogen in the Alexandria and Delta regions from ١٩٩٨.
- The concentrations of reactive phosphate did not differ significantly between the years

- The sources of nutrients are domestic and industrial sewage and agricultural runoff from the Nile, the coastal lakes and their related drainage systems.

Introduction

The aim of the Coastal Water Monitoring Program (CWMP) is to establish a marine monitoring system in the Egyptian coastal waters. The CWMP is part of the EIMP, which is directed by a Steering Committee with representatives from the EEAA and the Danish International Development Assistance (Danida). The EIMP Coastal Water Monitoring Programme comprises ١) Monitoring of Water Quality parameters on water samples ٢) Monitoring of contaminants in sediments, shellfish and corals and ٣) Monitoring of bentic infauna and coral reefs.

This report reviews the most significant results of the monitoring of water quality parameters from the Egyptian coastal areas of the Mediterranean Sea in the year ٢٠٠٠.

The monitoring was carried out six times in ٢٠٠٠ (i.e. in January, April, May, July, September and November). A total of ٤٧ stations were visited during each sampling campaign. The locations of the sampling stations are presented in Figure ١.

The coast was subdivided into four regions:

- The **Western Region**, including the stations from Salloum (Me١) to Nobaraeya (Me ٨)
- The **Alexandria Region**, including the stations from Hanoville (Me ٩) to El-Maadia outlet (Me ٢٥)
- The **Delta Region**, including the stations from Idku (Me ٢٦) To east of El-Gamil outlet (Me ٤٠)
- The **Eastern Region**, including the stations from Port Said (Me ٤١) to east of El-Arish (Me ٤٥)

On each sampling campaign the following parameters were measured: ١) Hydrographical conditions (water temperature, dissolved oxygen, salinity and pH), ٢) Bacteriological parameters (total coliform, E. coli and faecal streptococci bacteria), ٣) Eutrophication parameters (chlorophyll-a, total suspended matter, transparency, total nitrogen, nitrate, nitrite, ammonium, reactive and total phosphate and reactive silicate). Furthermore, visual observations on weather condition, oil pollution and sewage impacts were made. All measurements were carried out according to international standards.

Figure ١. Sampling stations for water samples in the Mediterranean Sea in year ٢٠٠٠.

Bacteriological parameters

The occurrence of pollution indicator bacteria is used as sanitary parameters for evaluation of water quality (i.e. Total coliform bacteria, *E.Coli* and Faecal streptococci). The bacteria are found in the intestinal tracts of mammals, including humans and the source is untreated sewage, which is discharged to the sea. High levels of these bacteria indicate a potential risk to public health.

The results of measurements of total Coliforms, *E. Coli* and Faecal streptococci are presented in Figures ٢, ٣ and ٤, respectively.

The data for Coliforms and *E. Coli* were compared with the levels stipulated in the Egyptian guideline for bacteriological water quality. The guideline accept ٥٠٠ bacterial counts/١٠٠ml seawater for Coliforms and ١٠٠ bacterial count /١٠٠ml seawater for *E. Coli*. The data for faecal Coliforms were compared to the Council of European Union (EU) standard of ١٠٠ bacterial counts/١٠٠ ml.

The bacteriological water quality was poor at a quite large proportion of the visited stations in year ٢٠٠٠. The guideline values for indicator bacteria were thus exceeded at least once for at least one type of indicator bacteria at ٣٠ of the ٣٧ stations visited.

The Alexandria region is decidedly the most polluted closely followed by the Delta Region. In the Alexandria Region ٤٢-٥١ % of all collected samples violated the standards whereas ٢٤-٤٣٪ of the samples in the Delta Region did not meet the standards (Figure ٥). The Western and Eastern Regions were much less polluted.

In the Western Region, the waters at Ras El Kanayes and the Marina at El Alamein were not polluted at all. The other sites were only slightly to relatively polluted (Table١).

In the Alexandria Region several sites were highly polluted with extremely high bacterial counts on all or almost all visits (i.e. El Mex (Me ١١), NIOF E (Me ١٣), Shatby (Me ١٧a) and Abou Quir (Me ٢١)). Most other sites in the region could be classified as being relatively polluted to polluted. The popular bathing beaches at Hanoville (Me ٩) and El Bitach (Me ١٠) were, however, only slightly polluted and the El Mamoura bathing beach was not polluted at all (Table١).

In the Delta Region the waters at Rashid (Me ٢٩), El Burg E (Me٣٣) and Gamasa (Me ٣٤) were highly polluted. Except for the Idku station, which was relatively polluted, the other sites were only slightly polluted (Table١).

In the Eastern Region, Romana (Me ٤٢) and one station at El Arish were not polluted. The other sites in the region were only slightly polluted (Table ١)

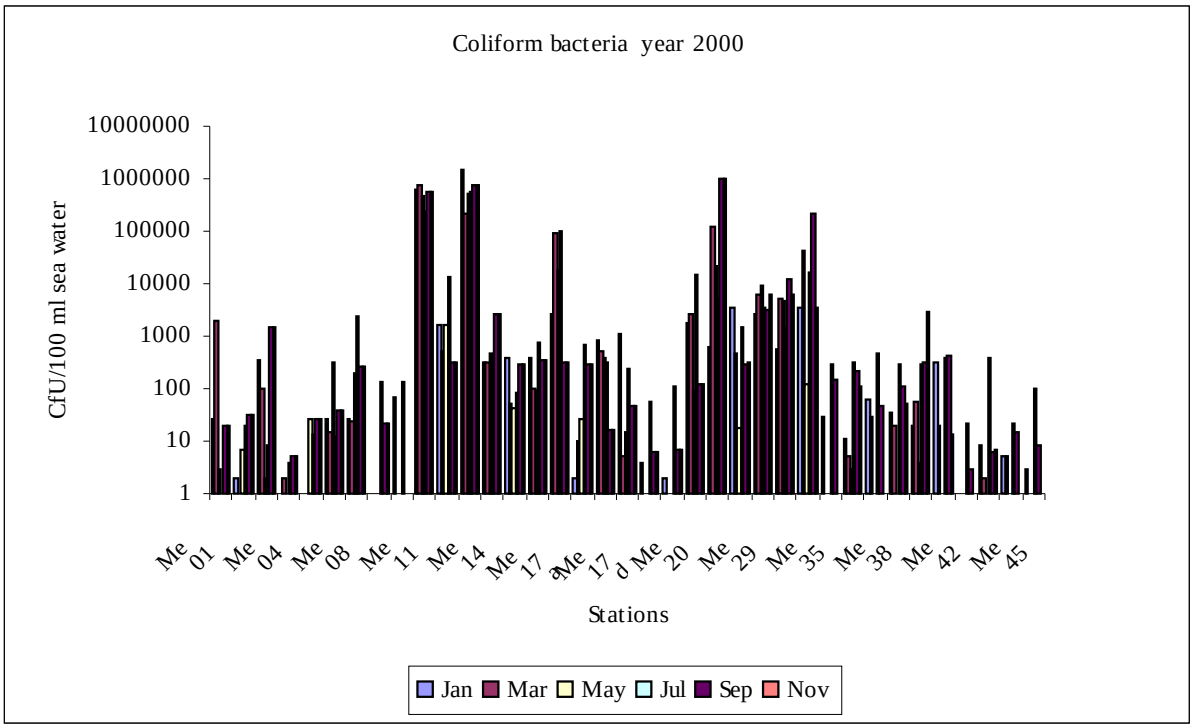


Figure ٢. Coliform bacteria. Counts per ١٠٠ ml seawater in the Mediterranean Sea in year ٢٠٠٠ (Logarithmic scale)

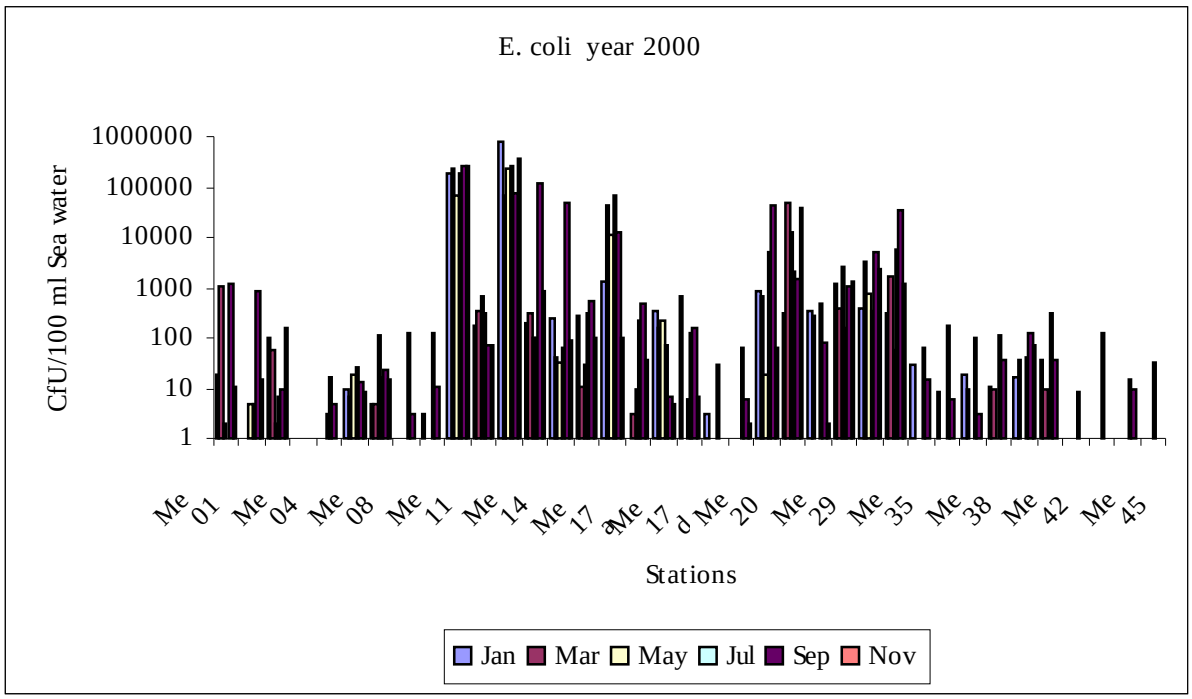


Figure ٣. E. coli bacteria. Counts per ١٠٠ ml seawater in the Mediterranean Sea in year ٢٠٠٠ (Logarithmic scale)

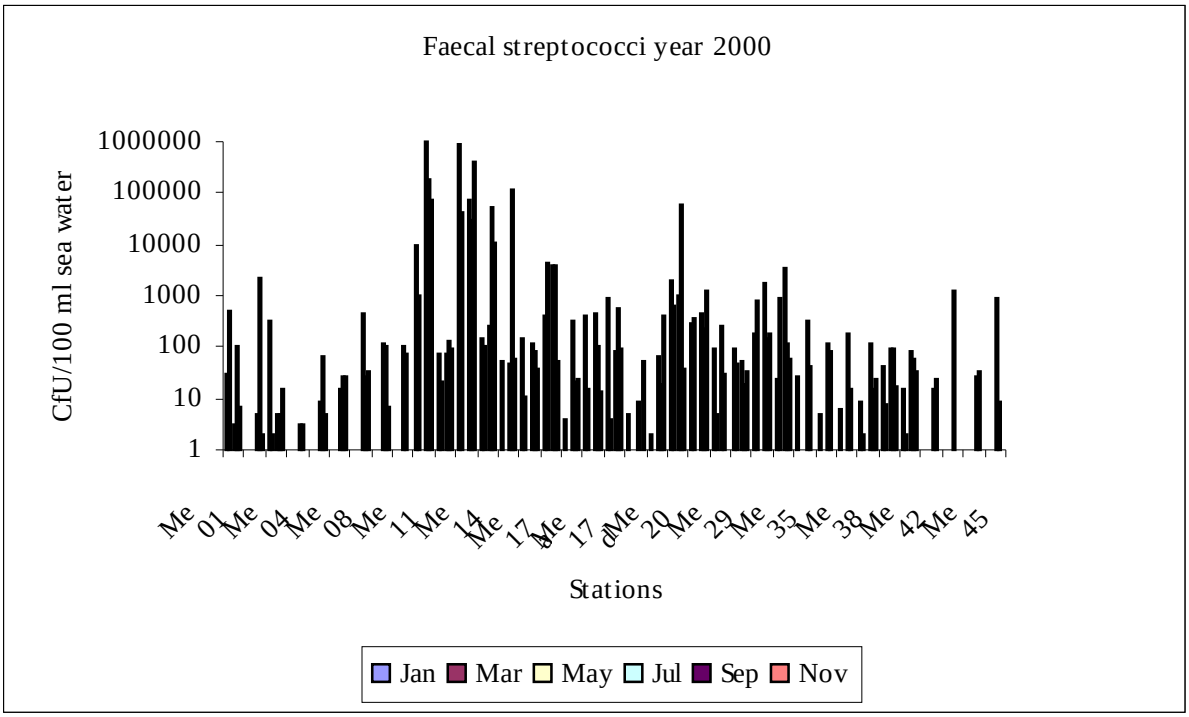


Figure ٤. Faecal streptococci. Counts per ١٠٠ ml seawater in the Mediterranean Sea in year ٢٠٠٠ (Logarithmic scale)

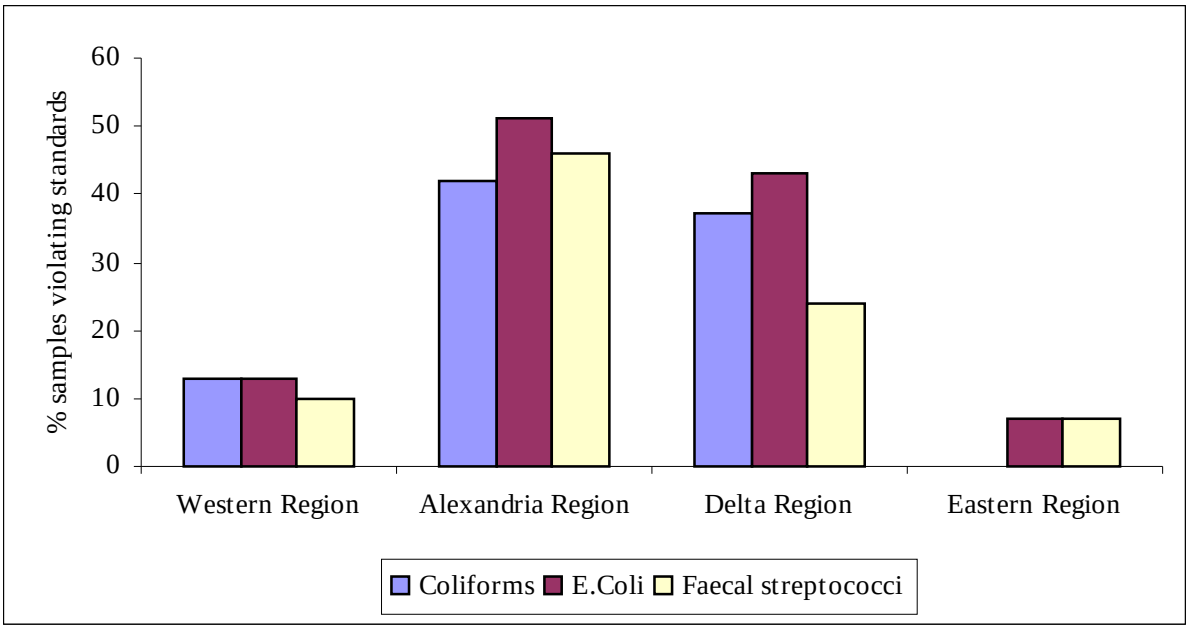


Figure ٥. Percentage of samples in each Region, which are violating the Egyptian and EU standards for Coliforms, E.coli and Faecal streptococci.

Table ١. Percentage of total number of samples collected in year ٢٠٠٠, which are exceeding the Egyptian and EU criteria for indicator bacteria (٥٠٠ CfU/١٠٠ml for Total Coliforms and ١٠٠ CfU/١٠٠ml for *E. Coli* and Faecal streptococci. The degree of pollution by bacteria is indicated.

Station	Location of station	Percentage of samples exceeding the criteria for Total Coliform	Percentage of samples exceeding the criteria for *E. Coli*	Percentage of samples exceeding the criteria for Faecal streptococci	Degree of pollution by bacteria
	Western Region				
Me ١	Salloum	٣٣	٣٣	١٧	Relatively polluted
Me ٢	Mersa Matrouh	١٧	١٧	١٧	Slightly polluted
Me ٣	Rommel island	١٧	١٧	١٧	Slightly polluted
Me ٤	Ras El Kanayes	٠	٠	٠	Not polluted
Me ٦	Marina El Alamein	٠	٠	٠	Not polluted
Me ٧	Nobareia	٠	٠	١٧	Slightly polluted
Me ٨	Nobareia	١٧	٣٣	٣٣	Relatively polluted
	Alexandria Region				
Me ٩	Hanoville	٠	٠	٣٣	Slightly polluted
Me ١٠	Bitach	٠	١٧	٠	Slightly polluted
Me ١١	El Mex	١٠٠	١٠٠	١٠٠	Highly polluted
Me ١٢	Alex W-harbour	٦٧	٦٧	٣٣	Polluted
Me ١٣	NIOF-E	١٠٠	١٠٠	١٠٠	Highly polluted
Me ١٤	NIOF W	٣٣	٦٧	٦٧	Polluted
Me ١٥	Alex E-harbour	١٧	٣٣	١٧	Relatively polluted
Me ١٦	Alex E-harbour	١٧	٥٠	٣٣	Relatively polluted
Me ١٧a	Shatby	٨٣	٨٣	٨٣	Highly polluted
Me ١٧b	Sidi Gaber	٣٣	٣٣	١٧	Relatively polluted
Me ١٧c	Gleem	١٧	٥٠	٣٣	Relatively polluted
Me ١٧d	Sidi Bisher	١٧	٥٠	٣٣	Relatively polluted
Me ١٨	El Mamourah	٠	٠	٠	Not polluted
Me ١٩	Montaza	١٧	٠	١٧	Slightly polluted
Me ٢٠	Abu Quir W	٦٧	٦٧	٦٧	Polluted
Me ٢١	Abu Quir E	١٠٠	١٠٠	١٠٠	Highly polluted
	Delta Region				
Me ٢٦	Idku	٣٣	٥٠	١٧	Relatively polluted
Me ٢٩	Rashid	١٠٠	١٠٠	٠	Polluted
Me ٣٣	El Burg-E	١٠٠	١٠٠	٨٣	Highly polluted
Me ٣٤	Gamasa	٨٣	٨٣	٥٠	Highly polluted
Me ٣٥	Damietta El Gededda	٠	٠	١٧	Slightly polluted
Me ٣٦	Ras El Bar	٠	١٧	١٧	Slightly polluted
Me ٣٧	Damietta W	٠	٠	١٧	Slightly polluted
Me ٣٨	Damietta E	٠	١٧	١٧	Slightly polluted
Me ٤٠	El Gamil	١٧	١٧	٠	Slightly polluted

Table ١ (continued)

Station	Location of station	Percentage of samples exceeding the criteria for Total Coliform	Percentage of samples exceeding the criteria for *E. Coli*	Percentage of samples exceeding the criteria for Faecal streptococci	Degree of pollution by bacteria
	Eastern Region				
Me ٤١	Port Said	٠	١٧	٠	Slightly polluted
Me ٤٢	Romana	٠	٠	٠	Not polluted
Me ٤٣	El Arish (West)	٠	١٧	١٧	Slightly polluted
Me ٤٤	El Arish (Centre)	٠	٠	٠	Not polluted
Me ٤٥	El Arish (East)	٠	٠	٠	Slightly polluted

Eutrophication Parameters

Domestic and industrial sewage and drainage water from agricultural land contains organic matter and nutrients ($NH_٤$, $NO_٢$, $NO_٣$ and $PO_٤$). Discharge of nutrients stimulates the growth of phytoplanton (microscopic algae). This process is called eutrophication. Microorganisms in the water column degrade the organic matter and release nutrients. The degradation of discharged organic matter and dead plankton algae consumes oxygen, so when the load of organic matter and nutrients are very high, oxygen depletion may occur, which in turn may adversely affect the marine flora and fauna.

The concentrations of selected eutrophication parameters measured in year ٢٠٠٠ are presented in Figures ٦-١١. Table ٢ presents a classification of each sampling site according to the degree of eutrophication. The levels of nutrients are classified in three categories: oligotrophic (low levels of nutrients), mesotrophic (medium level of nutrients) and eutrophic (high levels of nutrients) based on experience from Italian and Yugoslav Mediterranean waters. The stations are also classified according to the level of chlorophyll-a, which is a measure of phytoplankton biomass. The four regions of the Egyptian Mediterranean waters can be classified in terms of degree of eutrophication as follows:

- In the Western Region the stations from Salloum to El Alamein were generally mesotrophic with very low levels of chlorophyll-a.
- The stations in the Alexandria Region were eutrophic with high to very high levels of chlorophyll-a. The highest levels were encountered at El Mex (Me ١١), Alex Eastern Harbour (Me ١٥ and Me ١٦), Abu Quir Bay (Me ٢١-Me ٢٣) and Maadia (Me ٢٤ and Me ٢٥)
- Most stations in the Delta Region were mesotrophic with high levels of chlorophyll-a. However, El Gamil (Me ٣٩ and Me ٣٢) at the outlet from Lake Manzala are eutrophic with very high phytoplankton biomass.
- In the Eastern Region the waters at Port Said (Me ٤١) were eutrophic with very high levels of chlorophyll, but further east the degree of eutrophication decrease.

The sources of nutrients are domestic and industrial sewage and agricultural runoff from the River Nile, the coastal lakes and their related drainage systems. The major source of the very high levels at El Gamil is sewage from Cairo, which is discharged to Lake Manzala. The waters at Port Said and Romana (Me ٤٢) contain water discharged from Lake Manzala, which is dispersed eastwards by the prevailing east-going currents. A major source of the eutrophication observed at Port Said and Romana is thus probably Lake Manzala although of course the town of Port Said also contributes.

It is worth noting that the chlorophyll concentration at El Gamil and Port Said was exceptionally high compared to the other stations visited (Fugure١٠). This is probably due to the fact that a major part of the water originates from Lake Manzala. In Lake Manzala the water is more stagnant which allows phytoplankton to utilise the nutrients better than in the more turbulent waters at the other stations along the Mediterranean Coast.

Despite the high levels of nutrients and chlorophyll, which were encountered at most stations, poor oxygen conditions were not encountered in year ٢٠٠٠ (Poor oxygen conditions are defined as concentrations below ٤ mg/l (Nixon et al ١٩٩٦)).

Table ٢. Characterisation of the sampling stations in terms of level of phytoplankton biomass (expressed as concentration of chlorophyll-a) and eutrophication (based on concentration of nutrients). Classification according to EU commission and experience from Italian and Yugoslav waters.

Station	Location of station	Concentration of Chlorophyll-a [١)]	Degree of eutrophication [٢)]
	Western Region		
Me ١	Salloum	Very low	Mesotrophic
Me ٢	Mersa Matrouh	Very low	Mesotrophic
Me ٣	Rommel island	Moderate	Mesotrophic
Me ٤	Ras El Kanayes	Very low	Oligotrophic
Me ٥	Sidi Abdul Rahman	Very low	Mesotrophic
Me ٦	Marina El Alamein	Very low	Mesotrophic
Me ٧	Nobareia	Moderate	**Eutrophic**
Me ٨	Nobareia	Moderate	**Eutrophic**
	Alexandria Region		
Me ٩	Hanoville	High	**Eutrophic**
Me ١٠	El Bitach	High	**Eutrophic**
Me ١١	El Mex	**Very high**	**Eutrophic**
Me ١٢	Alex W-harbour	High	**Eutrophic**
Me ١٣	NIOF-E	High	**Eutrophic**
Me ١٤	NIOF W	High	**Eutrophic**
Me ١٥	Alex E-harbour	**Very high**	**Eutrophic**
Me ١٦	Alex E-harbour	**Very high**	**Eutrophic**
Me ١٧a	Shatby	High	**Eutrophic**
Me ١٧b	Sidi Gaber	High	**Eutrophic**
Me ١٧c	Gleem	High	**Eutrophic**
Me ١٧d	Sidi Bisher	High	**Eutrophic**
Me ١٩	Montaza	High	Mesotrophic
Me ٢٠	Abu Quir W	High	Mesotrophic
Me ٢١	Abu Quir E	**Very high**	**Eutrophic**
Me ٢٢	Taabia pump station	**Very high**	**Eutrophic**
Me ٢٣	Taabia pump station	**Very high**	**Eutrophic**
Me ٢٤	Maadia	**Very high**	**Eutrophic**
Me ٢٥	Maadia	**Very high**	**Eutrophic**

١) Very low = < ١ µg/l; Low = ١µg/l: Moderate > ١ – ٢ µg/l; High > ٢ - ٥µg/l; Very high > ٥µg/l (Nixon et al ١٩٩٦).

٢) Oligotrophic = <٠,٥ µM/l $NH_٤$; <٠,٥ µM/l $N٠_٣$. Mesotrophic = >٠,٥ < ٢,٠ µM/l $NH_٤$; >٠,٥ < ٤,٠ µM/l $N٠_٣$. Eutrophic = >٢,٠ µM/l $NH_٤$; >٤,٠ µM/l $N٠_٣$ (Adapted from Vucak, Skrivanic & Strin ١٩٨٢,Franco ١٩٨٣ and Marchett ١٩٨٤.

Continued overleaf.

Table ٢. (continued).

Station	Location of station	Concentration of Chlorophyll-a	Degree of eutrophication
	Delta Region		
Me ٢٧	Rashid	High	Mesotrophic
Me ٢٨	Rashid	High	Mesotrophic
Me ٢٩	Rashid	High	Mesotrophic
Me ٣٠	Rashid	High	Mesotrophic
Me ٣١	Rashid	High	Mesotrophic
Me ٣٢	El Burg	High	Mesotrophic
Me ٣٣	El Burg-E	High	Mesotrophic
Me ٣٥	Damietta El Gededa	**Very high**	Mesotrophic
Me ٣٧	Damietta W	High	Mesotrophic
Me ٣٨	Damietta E	High	**Eutrophic**
Me ٣٩	El Gamil	**Very high**	**Eutrophic**
Me ٤٠	El Gamil	**Very high**	**Eutrophic**
	Eastern Region		
Me ٤١	Port Said	**Very high**	**Eutrophic**
Me ٤٢	Romana	High	**Eutrophic**
Me ٤٤	El Arish	Moderate	Mesotrophic

١) Very low = < ١ µg/l; Low = ١µg/l: Moderate > ١ – ٢ µg/l; High > ٢ - ٥µg/l; Very high > ٥µg/l (Nixon et al ١٩٩٦).

٢) Oligotrophic = <٠,٥ µM/l $NH_٤$; <٠,٥ µM/l $N_{٠٣}$. Mesotrophic = >٠,٥ < ٢,٠ µM/l $NH_٤$; >٠,٥ < ٤,٠ µM/l $N_{٠٣}$. Eutrophic = >٢,٠ µM/l $NH_٤$; >٤,٠ µM/l $N_{٠٣}$ (Adapted from Vucak, Skrivanic & Strin ١٩٨٢,Franco ١٩٨٣ and Marchett ١٩٨٤.

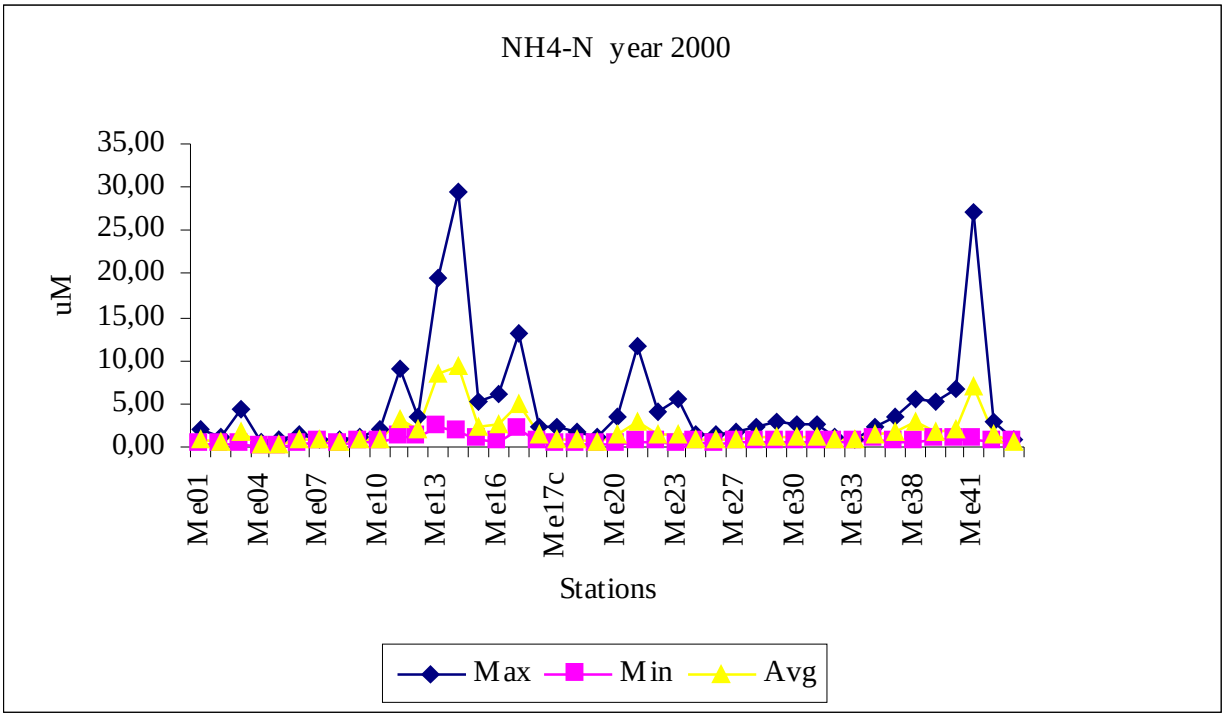


Figure ٦. Annual maximum, minimum and average ammonia concentrations (µmol/l) along the Mediterranean coast in ٢٠٠٠.

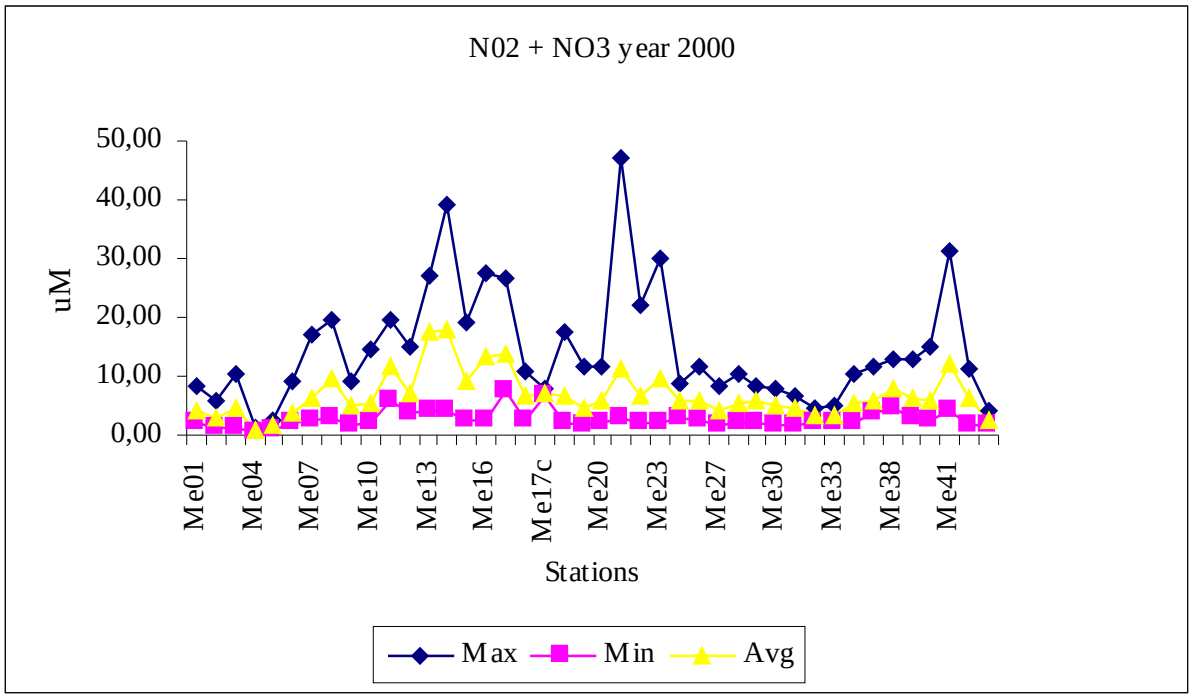


Figure ٧. Annual maximum, minimum and average nitrate + nitrite concentrations (µmol/l) along the Mediterranean coast in ٢٠٠٠

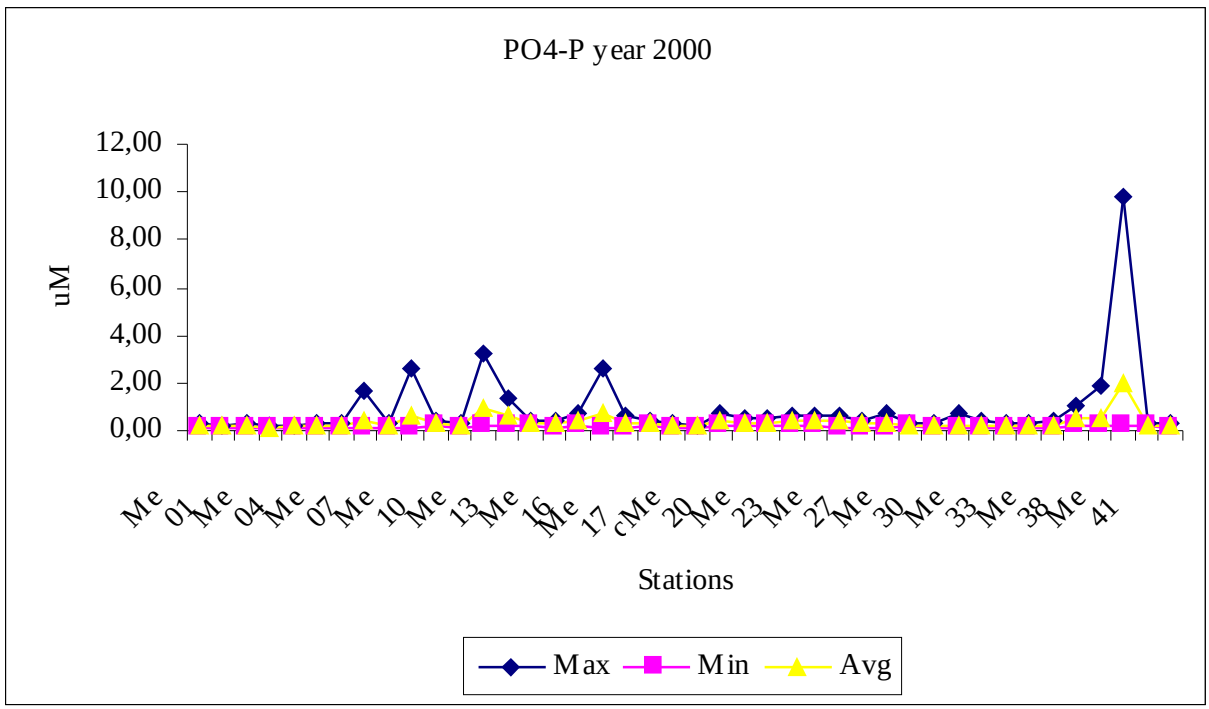


Figure ٨. Annual maximum, minimum and average reactive phosphate concentrations (µmol/l) along the Mediterranean coast in Egypt in ٢٠٠٠.

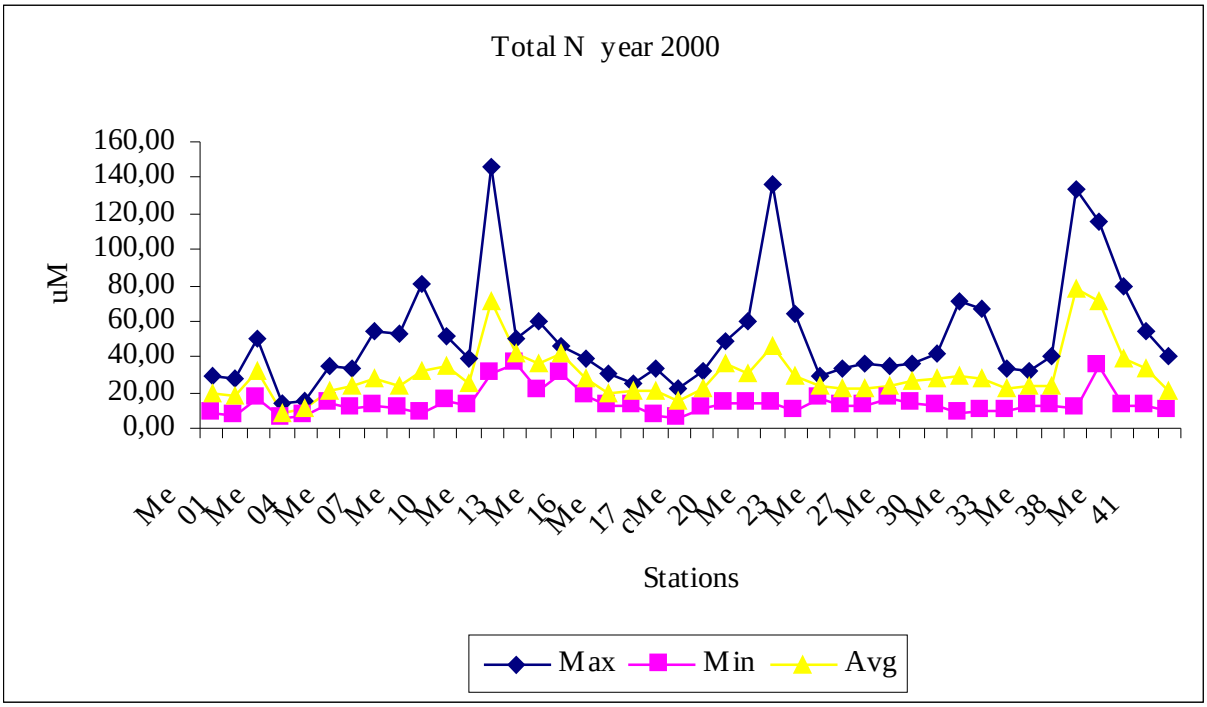


Figure ٩. Annual maximum, minimum and average total nitrogen concentration (μmol/l) along the Mediterranean coast in Egypt in ٢٠٠٠.

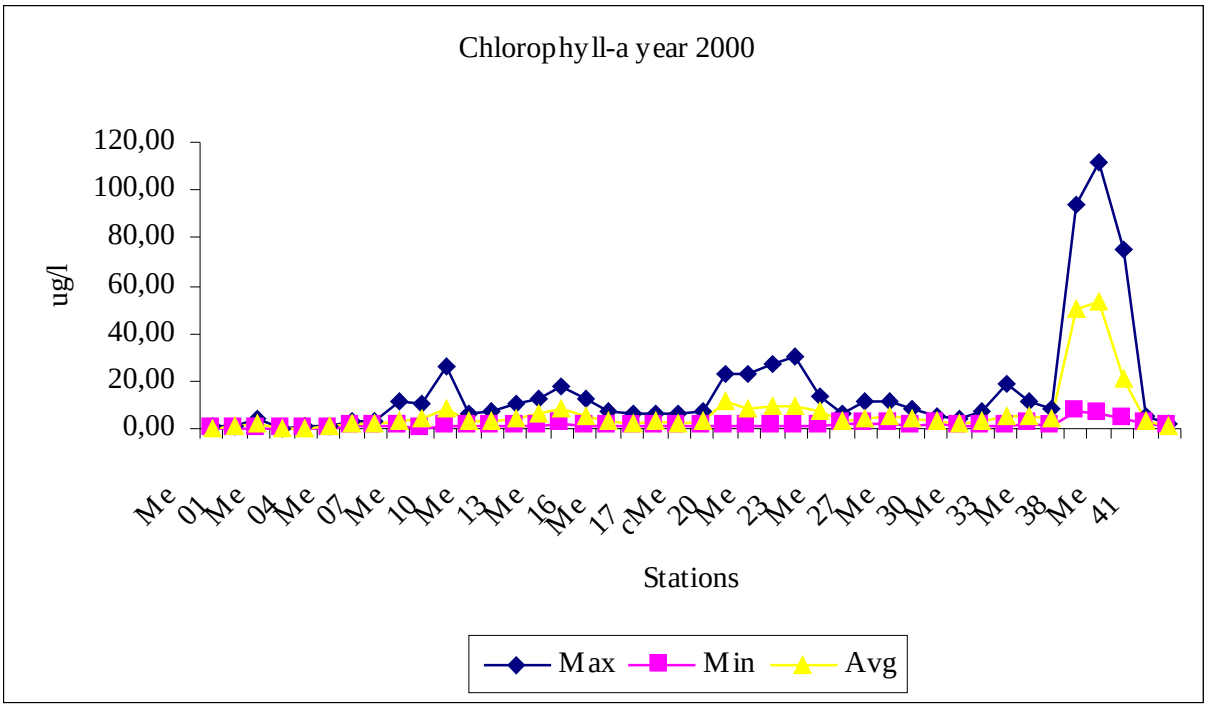


Figure ١٠. Annual maximum, minimum and average chlorophyll-a concentrations (μg/l) along the Mediterranean Coast in ٢٠٠٠.

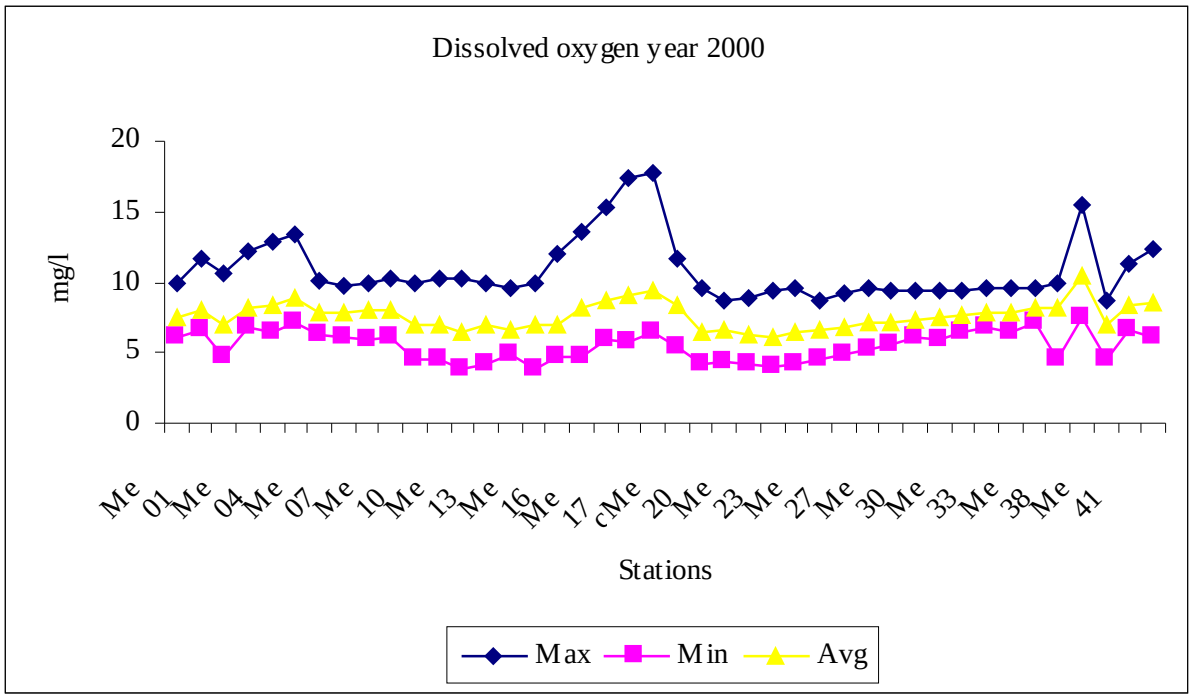


Figure ١١. Annual maximum, minimum and average oxygen concentrations (mg/l) along the Mediterranean coast in ٢٠٠٠.

Comparison with previous years

Bacteriological parameters

In the Alexandria and Delta Regions the bacteriological water quality in ٢٠٠٠ did not differ significantly from ١٩٩٨ and ١٩٩٩ (Figure ١٢-١٤).

A slight increase in the number of samples violating the standards was observed in the Western Region. This increase took place at Salloum (Me ١), Mersa Matrouh (Me ٢) and Rommel Island (Me ٣). The bacteriological water quality in the eastern region did not deteriorate compared to previous years.

Eutrophication parameters

In the Western- and Alexandria regions the concentrations of chlorophyll-a in ٢٠٠٠ were comparable to the concentrations encountered in ١٩٩٨ and ١٩٩٩.

In the Delta- and the Eastern region a significant annual variations in the concentration of chlorophyll-a between years are observed. The highest concentrations were encountered in the Delta region in the year ٢٠٠٠. The variations are observed at the stations at El Gamil and Port Said. The concentrations observed at the other stations in the Delta- and Eastern regions are comparable to previous years. The variations are thus due to annual variations in the plankton production in Lake Manzala, which is a major source of eutrophication at El Gamil and Port Said (cf. Above).

There seems to be a decreasing trend of dissolved inorganic nitrogen in the Alexandria and Delta regions from ١٩٩٨.

The concentrations of reactive phosphate did not differ significantly between the years. In the Eastern region a significant increase in the mean concentration was observed in ٢٠٠٠. This is exclusively due to

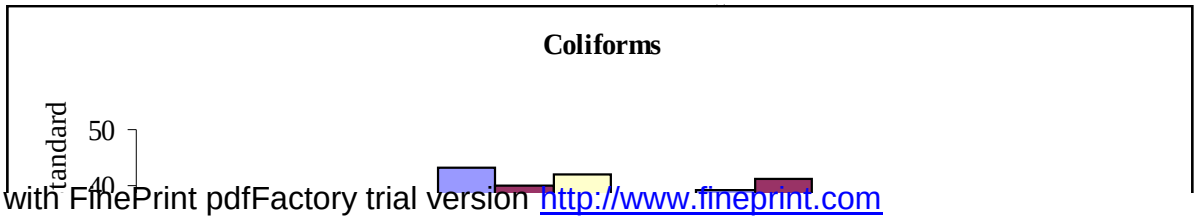


Figure١٢. Percentage of the total number of samples collected in the different regions of the Mediterranean coast that violated the Egyptian guide standard of ٥٠٠ CfU/١٠٠ml for Coliforms in ١٩٩٨،١٩٩٩ and ٢٠٠٠. Only stations visited all three years was included in the calculations.

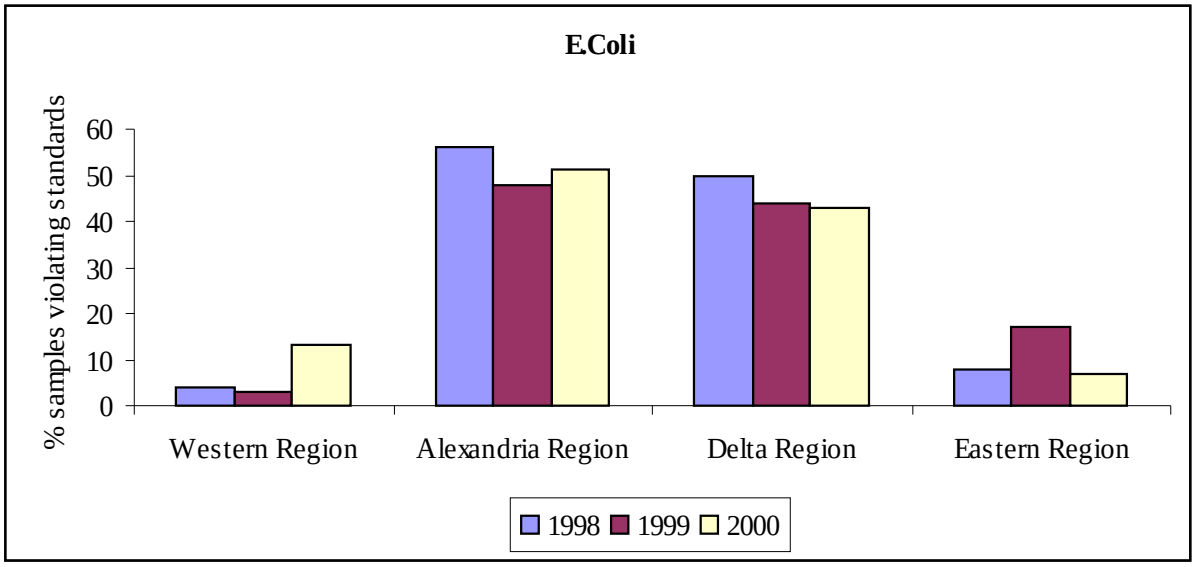


Figure١٣. Percentage of the total number of samples collected in the different regions of the Mediterranean coast that violated the Egyptian guide standard of ١٠٠ CfU/١٠٠ml for E.Coli in ١٩٩٨،١٩٩٩ and ٢٠٠٠. Only stations visited all three years was included in the calculations.

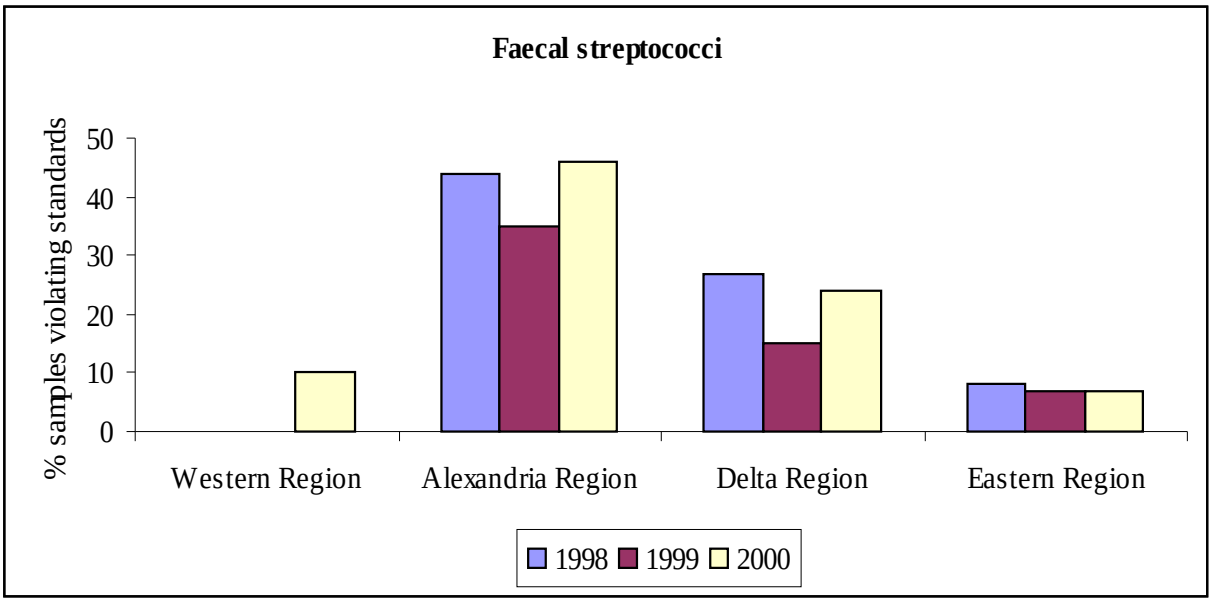
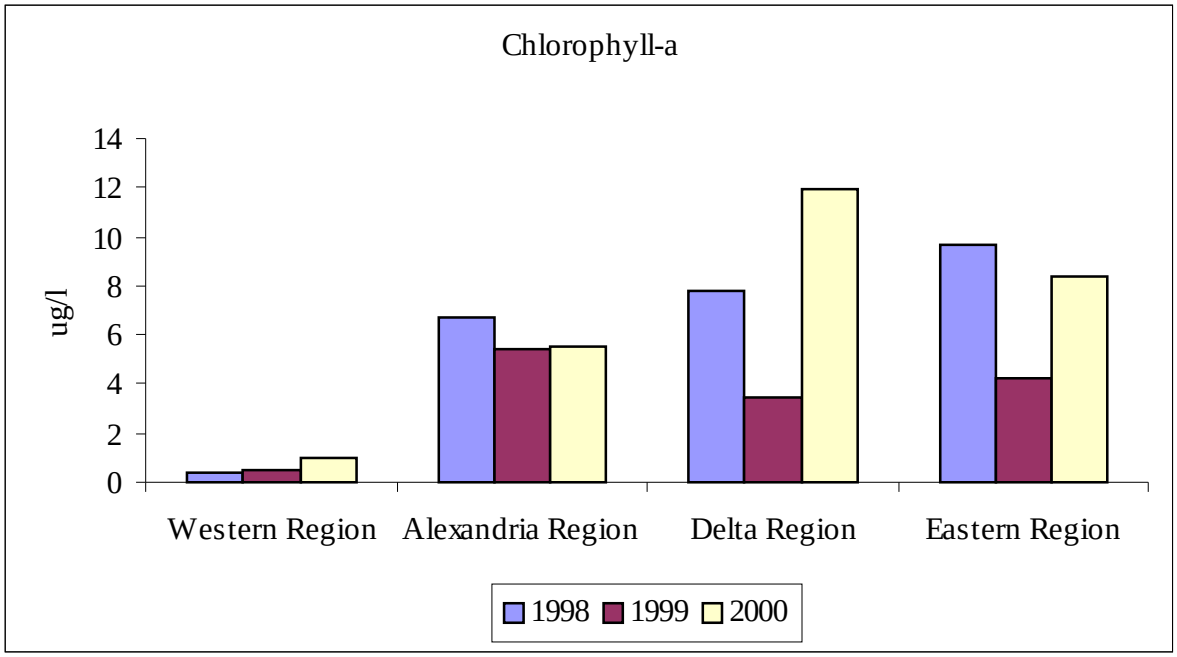


Figure ١٤. Percentage of the total number of samples collected in the different regions of the Mediterranean coast that violated the Egyptian guide standard of ١٠٠ CfU/١٠٠ml for Faecal streptococci in ١٩٩٨،١٩٩٩ and ٢٠٠٠. Only stations visited all three years was included in the calculations.



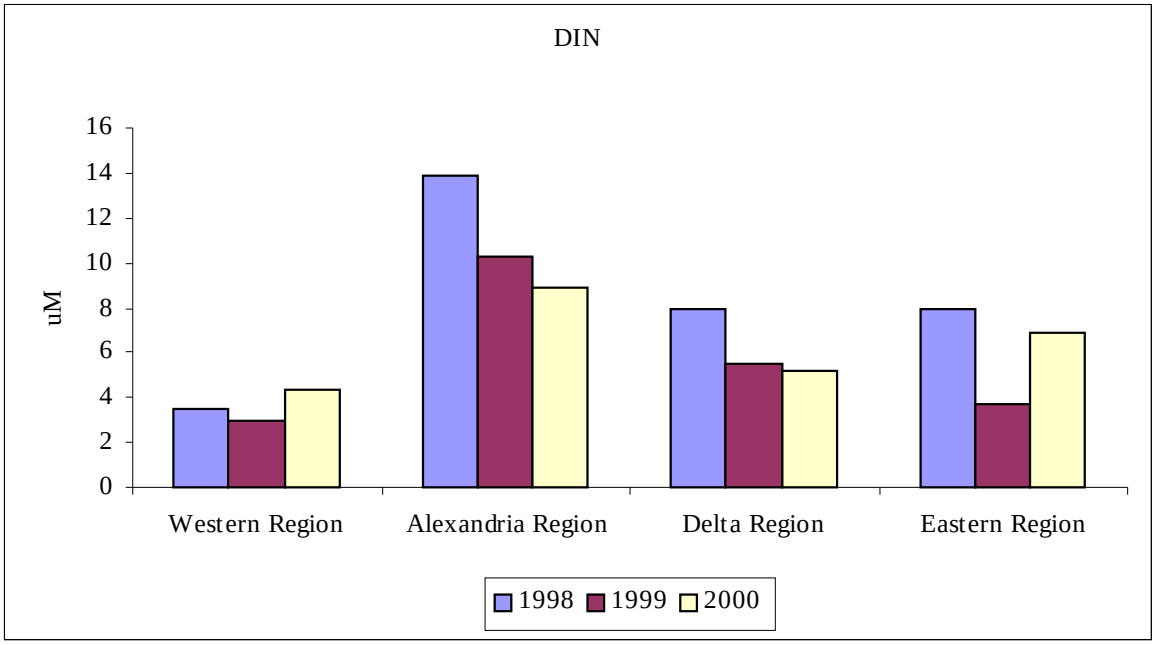


Figure ١٥. Mean concentration of chlorophyll-a in the four regions in ١٩٩٨-٢٠٠٠

Figure ١٦. Mean concentration of dissolved inorganic nitrogen ($NH_٤$ + $NO_٢$ + $NO_٣$) in the four regions in ١٩٩٨-٢٠٠٠

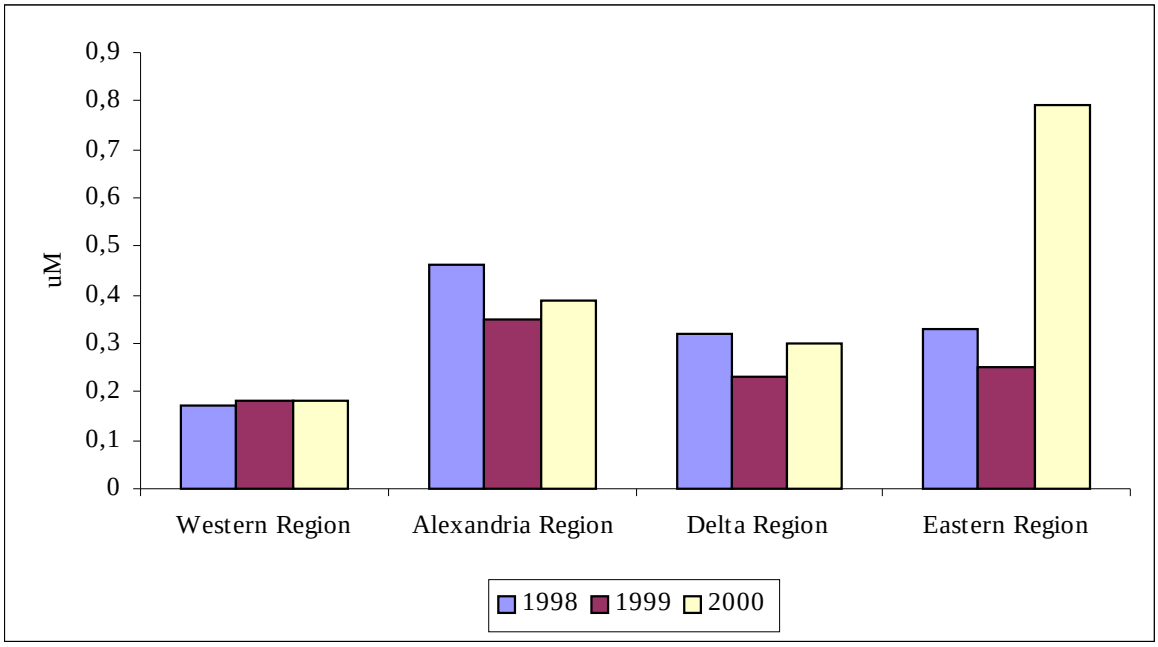


Figure ١٧. Mean concentration of reactive phosphate in the four regions in ١٩٩٨-٢٠٠٠

Conclusion

From the results it can be concluded that:

- The bacteriological water quality was poor at a quite large proportion of the visited stations in year ٢٠٠٠. The guideline values for indicator bacteria (i.e. Total Coliform bacteria, *E.Coli* and Faecal streptococci) were thus exceeded at least once for at least one type of indicator bacteria at ٣٠ of the ٣٧ stations visited. The Alexandria Region is decidedly the region which was most polluted by bacteria closely followed by the Delta Region. The Western and Eastern Regions were much less polluted (generally ranging from not polluted to slightly polluted).
- The bacteriological water quality in the Alexandria and Delta Regions in the year ٢٠٠٠ did not differ significantly from ١٩٩٨ and ١٩٩٩. A slight increase in the number of samples violating the standards was observed in the Western Region. The bacteriological water quality in the Eastern Region did not deteriorate compared to previous years
- The stations in the Western Region from Salloum to El Alamein were generally mesotrophic (i.e. having medium levels of nutrients) with very low levels of chlorophyll-a.
- The stations in the Alexandria Region were eutrophic (i.e. having high levels of nutrients) with high to very high levels of chlorophyll-a. The highest levels were encountered at El Mex (Me ١١), Alex Eastern Harbour (Me ١٥ and Me ١٦), Abu Quir Bay (Me ٢١-Me ٢٣) and Maadia (Me ٢٤ and Me ٢٥)
- Most stations in the Delta Region were mesotrophic with high levels of chlorophyll-a. However, El Gamil (Me ٣٩ and Me ٣٢) at the outlet from Lake Manzala were eutrophic with very high phytoplankton biomass.
- The waters in the Eastern Region at Port Said (Me ٤١) were eutrophic with very high levels of chlorophyll, but further east the degree of eutrophication decrease.
- Despite the high levels of nutrients and chlorophyll, which were encountered at most stations, poor oxygen conditions were not encountered in year ٢٠٠٠
- The concentrations of chlorophyll-a in the Western- and Alexandria regions in ٢٠٠٠ were comparable to the concentrations encountered in ١٩٩٨ and ١٩٩٩. A significant annual variation in

the concentration between years was observed in the Delta- and the Eastern region. The variations are due to annual variations in the plankton production in Lake Manzala, which is a major source of eutrophication at El Gamil and Port Said.

- There seems to be a decreasing trend of dissolved inorganic nitrogen in the Alexandria and Delta regions from ١٩٩٨.
- The concentrations of reactive phosphate did not differ significantly between the years

Table ٣ provides an overview of pollution sources and the most significant water quality problems at the different stations in the year ٢٠٠٠.

Table ٣. Overview of the most significant water quality problems and pollution sourcesat the visited stations in the Mediterranean Sea in ٢٠٠٠. The numbers in the column are explained below the table.

Station numbers	Name	Most significant Water quality problems.	Sources of pollution
	Western Region		
Me ١	Salloum	١	Sewage from small village
Me ٢	Mersa Matrouh	١	Sewage from residential areas and resort areas.
Me ٣	Rommel Island	١،١٠	
Me ٤	Ras El-Kanayes		Reference site
Me ٥	Sidi Abdul Rahman		Sewage from resort village
Me ٦	Marina. El Alamein		Sewage from resort village
Me ٧	Nobareia		Drainage water from agricultural land.
Me ٨	Nobareia	١, ٣	Drainage water from agricultural land.
	Alexandria Region		
Me ٩	Hanoville		Sewage from residential and resort areas
Me ١٠	El-Bitach	٤	Popular bathing beach
Me ١١	El-Mex	١, ٢, ٣, ٥	Heavy discharge of industrial wastewater
Me ١٢	Alex Western Harbour	١, ٣, ٥,	Industrial wastewater
Me ١٣	NIOF-E	١ , ٣, ٤, ٥, ٦	Pipeline discharging domestic sewage and industrial wastewater
Me ١٤	NIOF-W	١ , ٣, ٤, ٥,	Pipeline discharging domestic sewage and industrial wastewater
Me ١٥	Alex Eastern Harbour	١, ٢, ٣. ٥	Pipeline discharging domestic sewage
Me ١٦	Alex Eastern Harbour	١ , ٢, ٣, ٥	Pipeline discharging domestic sewage
Me ١٧a	Shatby	١, ٣, ٥	Pipeline discharging domestic sewage
Me ١٧b	Sidi Gaber	١, ٤	Pipeline discharging domestic sewage
Me ١٧c	Gleem	١	Pipeline discharging domestic sewage
Me ١٧d	Sidi Bisher	١	Pipeline discharging domestic sewage
Me ١٨	El-Mamourah		Popular bathing beach
Me ١٩	Montaza		Popular bathing beach
Me ٢٠	Abu Quir- W	١	
Me ٢١	Abu Qir-E	١, ٢, ٣, ٥	Pipeline discharging domestic sewage
Me ٢٢	Tabia pump station	٢, ١٠	Wastewater from agricultural drains and from textile mills.
Me ٢٣	Tabia pump station	٢, ٣, ١٠	Wastewater from agricultural drains and from textile mills.
Me ٢٤	Maadia	٢, ٩, ١٠	Outlet from Idku Lake
Me ٢٥	Maadia	٨, ٩, ١٠	Outlet from Idku Lake

Continued overleaf

Table ٣. Continued.

Station numbers	Name	Most significant Water quality problems.	Sources of pollution
Me٢٦	Idku	١	Sewage
	Delta Region		
Me ٢٧	Rashid		Outlet from the Nile. Water contaminated with hazardous industrial waste, domestic sewage, fertilisers and pesticides from agricultural activities.
Me ٢٨	Rashid		As above
Me ٢٩	Rashid	١	As above
Me ٣٠	Rashid		As above
Me ٣١	Rashid		As above
Me ٣٢	El-Burg	٨	Outlet from Lake Borullus. Lake Borullus receive drainage water from the Nile Delta. The drainage water contains organic matter, nutrients and pesticides. Resort area.
Me ٣٣	El-Burg	١, ٨	As above
Me ٣٤	Gamasa	١	Popular bathing beach
Me ٣٥	Damietta El Gededa	٢	Domestic sewage
Me ٣٦	Ras El-Bar		Resort area with summerhouses and hotels.
Me ٣٧	DamiettaW		Outlet from the Nile. Water contaminated with hazardous industrial waste, domestic sewage, fertilisers and pesticides from agricultural activities.
Me ٣٨	Damietta E	٥	As above
Me ٣٩	El Gamil	٢, ٤ ,٦, ٧, ٨ , ٩, ١٠	Outlet from Lake Manzala Lake Manzala is very contaminated because it receives sewage from Cairo (via the Bahr el Baqar system), the two governorates Daqahliya and Sharqira and from Port Said
Me ٤٠	El Gamil	٢, ٤, ٥, ٦, ٧, ٨, ٩, ١٠	As above
	Eastern Region		
Me ٤١	Port Said	٢, ٣, ٤, ٥, ٧, ٨, ١٠	Industrial wastewater and domestic sewage
Me ٤٢	Romana	٨	Water from Port Said and Lake Manzala dispersed by the prevailing east-going currents
Me ٤٣	El-Arish(west)		Domestic sewage from residential and resort areas. There is a large resort area with privately owned summerhouses.
Me ٤٤	El-Arish(center)		As above
Me ٤٥	El-Arish(east)		As above

Notes:

١. *Bacteria above acceptable level*

٢. *High Levels of chlorophyll-a*

٣. *High levels of nitrate*

٤. *High Levels of phosphate*

٥. *High levels of ammonia*

٦. *High levels of total nitrogen*

٧. *High levels of total phosphate*

٨. *High levels of total suspended matter*

٩. *Low levels of transparency*

١٠. *High levels of silicate*

References

Nixon et al (١٩٩٦). " The harmonised monitoring and classification of ecological quality of surface waters in the European Union". EU Commission WRc Ref: CO ٤١٥٠ EU.

Franco P (١٩٨٣): Fatorri influent sulla productivita primaria dell Adriatico Settentrionale Proc. Int. Conf. problems of the Adriatic Sea. Trieste pp ١٥٥, A٤.

Marchetti R (١٩٨٤). Quadro analitico complessivo dei resultati delle indagini condotte negli anni ١٩٧٧-١٩٨٠. Su problem a dell eutropizzazione nelle acque costiere dell Emilia Romagna: Situzione ipotesi di intervento, Bologna Regionale Emilia Romagna, ٣٠٨

Vucak, Skrivanic & Strin, J (١٩٨٢). Basic physical chemical and biological data reports, R.V.A Mohorov Adriatic cruises ١٩٧٤-٧٦. Hydrographic Institute of Yugoslav Navy, Split ١٧٥ pp.