# 6- Coastal and Marine Areas

## Introduction:

Egyptian coasts are approximately 3000 km in length of which some 1150 km extends along the Mediterranean Sea from Salloum, west, to Rafah, east, and 1850 km covering Egyptian Red Sea coasts at the main Red Sea basin (some 1200 km) and both Gulf of Suez and Gulf of Aqaba (about 650 km).

Egypt marine and coastal area environment – as the case is for all coastal countries – is a renewable source of living and non-living wealth and basic foundation for civilization and economic progress. A coastal area is an attraction center for many projects in different economic and social domains, such as entertainment and tourist, fish wealth and processing, and international trade projects. However, such areas are always and disparately subject to pollution from several land and marine sources.

It has been well known – as noted by UN reports (GESAMP, 1990) and later confirmed by many field studies and research – that almost 80% of marine environment pollution and coastal deterioration are attributed to different land activities whether industrial, agricultural, urban or physical, in particular those produced wastes and emissions that are not treated in a sound environmental manner. The remaining 20% is due to other sources ahead of which are marine sources, i.e. different offshore activities such as oil, mineral and natural gas exploration and drilling operations, besides fishing, shipping and unloading, and marine transportation. Furthermore, there are wastes and leaks from increasing launches and different marine entertainment and tourist boats.

Fig. (6-1) shows marine pollution sources.

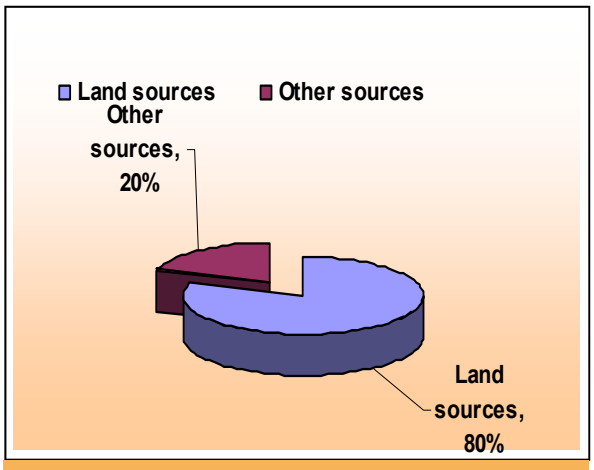


Fig. (6-1) Marine Pollution Sources

It has been well stated that such activities, if not environmentally rationalized, will have a negative impact not only on marine environment and wealth, but also on different aspects of development and investment activities in the coastal area. It also imposes several threats on human health as well.

## Egyptian Coastal Water Environmental Monitoring Program

MSEA and EEAA were keen to monitor the marine environment and coastal area status in 2006 (as in the previous years) through the ongoing environmental monitoring program for Mediterranean and Red Sea coastal water quality.

In this program, marine samples from selected stations along Egyptian coasts are collected and analyzed 4 times a year: in March, May, July and September so as to represent physical, chemical and biological conditions in the 4 seasons. The program – implemented in collaboration with specialized stakeholders in Egypt – focuses on monitoring bacterial total number, nutrient salt (ammonia, nitrates, nitrites and phosphorus) and chlorophyll A concentrations. Some hydrographic measurements that may help explain natural phenomena impacting marine environmental status are also made.

Following in this report are the main results for 2006 monitoring program compared with previous year 2005 similar results. This aims at reaching some conclusions on the improvement, settlement or deterioration of marine environment status during this period, in addition to shedding some light on potential reasons for such improvement or deterioration.

## Mediterranean Coastal Water Quality

Mediterranean coastal water quality was monitored in 31 stations along the coast from Salloum (Me1) to Rafah (Me 47a). Map (6-1) locates these stations relatively with the coastline.


**Map (6-1) Distribution of monitoring specimen collection locations**

| | |
|---|---|
| Western area: | From Salloum (Me1) to West Nobareya Drainage (Me8) |
| Alexandria area: | From Hanoville (Me9) to M'addeya straits (Me25) |
| Delta area: | From Rashid (Me29) to Gamil Straits east (Me40) |
| Eastern area: | From Port Said (Me41) to Rafah (Me47a) |

## Bacterial Measurement( Bacteriological Count) Results In 2006

To estimate coastal water environment status at those stations, bacterial counts for three pathogenic bacteria in water samples: coliform, E. coli and faecal Streptococci bacteria were measured.

As stipulated by the Executive Regulations of the Environment Law, the maximum limit allowed is 500 units/100 ml of sea water for the first type (coliform) and 100 units/100 ml of sea water for the second and third types (E. coli and faecal Streptococci). These are the permissible limits between polluted and unpolluted water and are represented by the horizontal lines in histograms (6-2, 6-3 and 6-4).

Results showed 15 out of 27 stations monitored polluted with one or more of such bacteria. The most polluted stations included Dekhela, Max, Western Harbour and East Abu Qir.

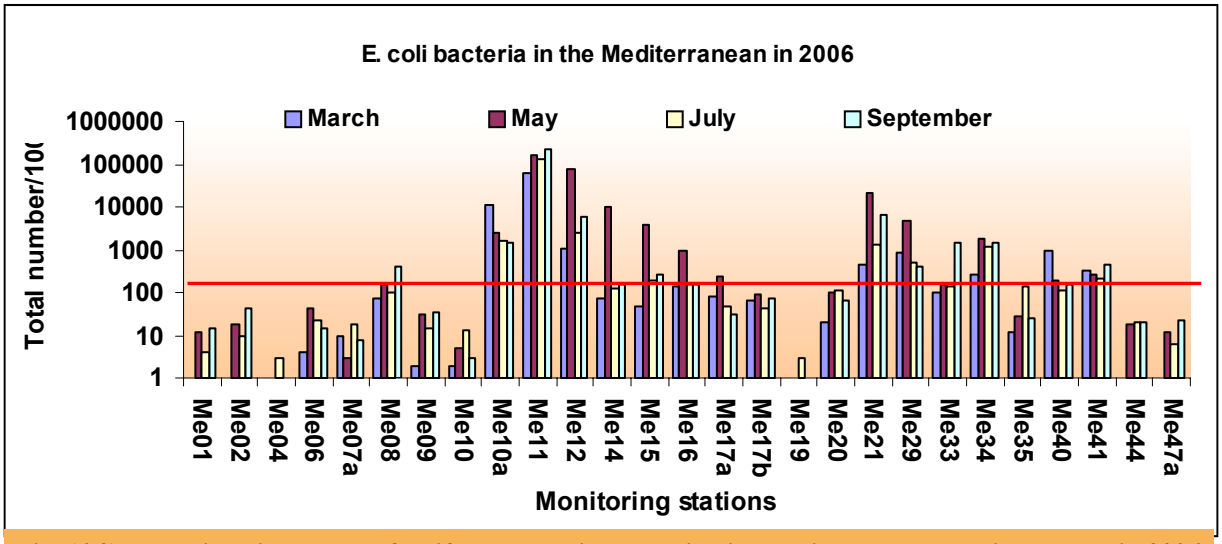


**Fig. (6-2) Bacteriological count of coliform bacteria at monitoring stations on the Mediterranean in 2006**

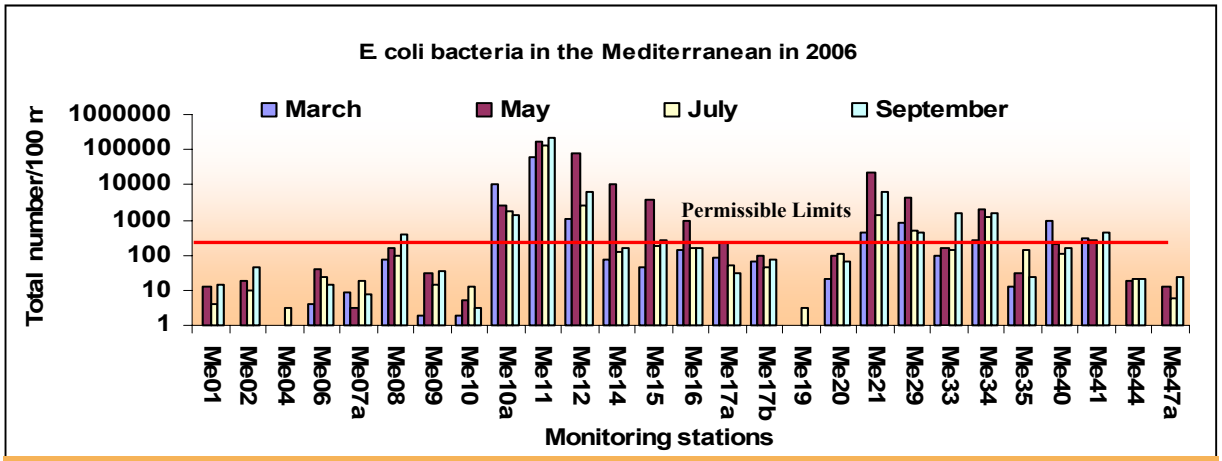


**Fig. (6-3) Bacteriological count of E.coli bacteria at monitoring stations on the Mediterranean in 2006**

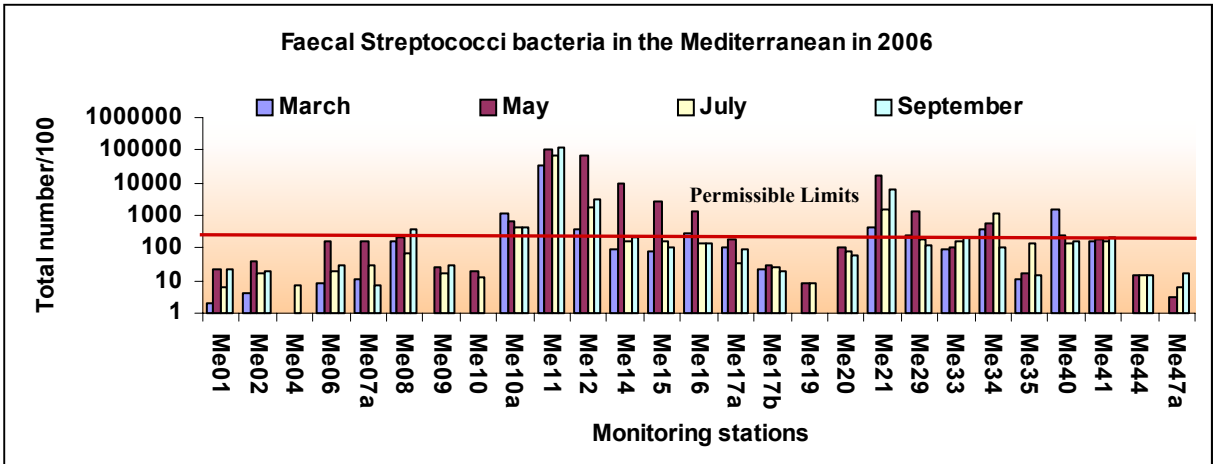


**Fig. (6-4) Bacteriological Count of Faecal Streptococci bacteria at monitoring stations on the Mediterranean in 2006**

Such results assert the fact that the most polluted areas along the coast are those related to untreated or partially treated sewage discharge sources (such as Dekhela (Me10a) and Max (Me11)), those with population density higher than the water capacity of such areas, those with untreated sewage discharge (Abu Qir (Me21)) or those with any other leaks (Western Port (Me12)).

## Nutrient Salt And Chlorophyll-A Concentration Results In 2006

Monitoring results showed a noticeable contrast in nutrient salt and chlorophyll-A levels between different areas along the Mediterranean coast in 2006 as shown in figures (6-5, 6-6, 6-7, 6-8 and 6-9).

It is scientifically proved that nutrient salt concentrations, such as nitrates, nitrites and ammonia in a certain area is directly and indirectly related to the biomass of the phytoplanktons of such area, which are expressed by high chlorophyll-A values. Any increase in such nutrient salt concentrations results in a parallel increase in phytoplankton productivity, which often leads to abnormal growth of marine algae, or to the occurrence of the "red tide" phenomena harmfully impacting environment and public health. Usually, high levels of nutrient salt concentration are associated with and a result of different human and industrial activities which discharge their untreated, partially or insufficiently treated wastes into the coastal marine environment.

Consequently, marine monitoring results showed the following:

- The Western Area recorded moderate nutrient salt and chlorophyll-A levels except Bagoush which had low chlorophyll-A level, and Sidi Krir and Nobareya where chlorophyll-A was high.
- In Alexandria, most stations indicate a high levels of nutrient salts, which resulted in high phytoplankton content in water, which, in turn, led to high concentrations of chlorophyll-A, particularly in Dekhela, Max, Western Harbour, Eastern Harbour, Shatbi and Sidi Gaber.
- Delta had moderate to high levels of nutrient salts, and the whole area from Rashid to Gamil had high chlorophyll-A content.
- Most Eastern area stations had moderate levels of nutrient salts except Port Said which had high levels of ammonium and nitrates, which was reflected on chlorophyll-A concentrations in such stations.

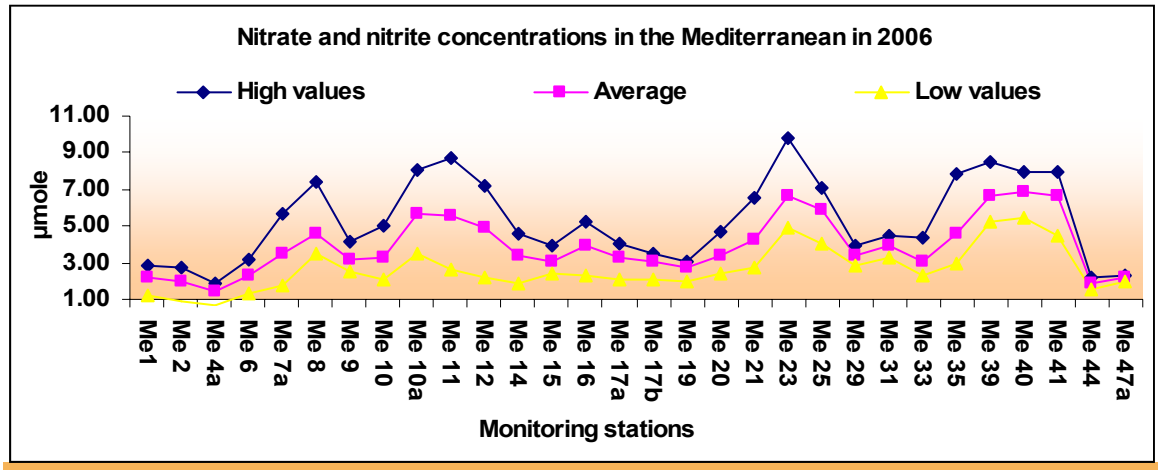


**Fig. (6-5) Nitrate and nitrite salt concentrations at monitoring stations on the Medit. in 2006**

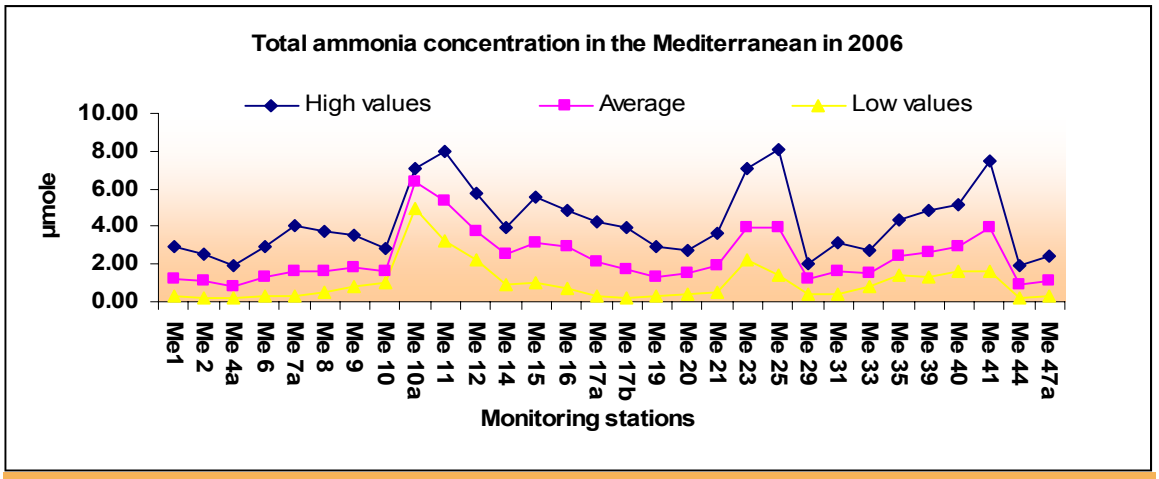


**Fig. (6-6) Ammonia concentrations at monitoring stations on the Mediterranean in 2006**

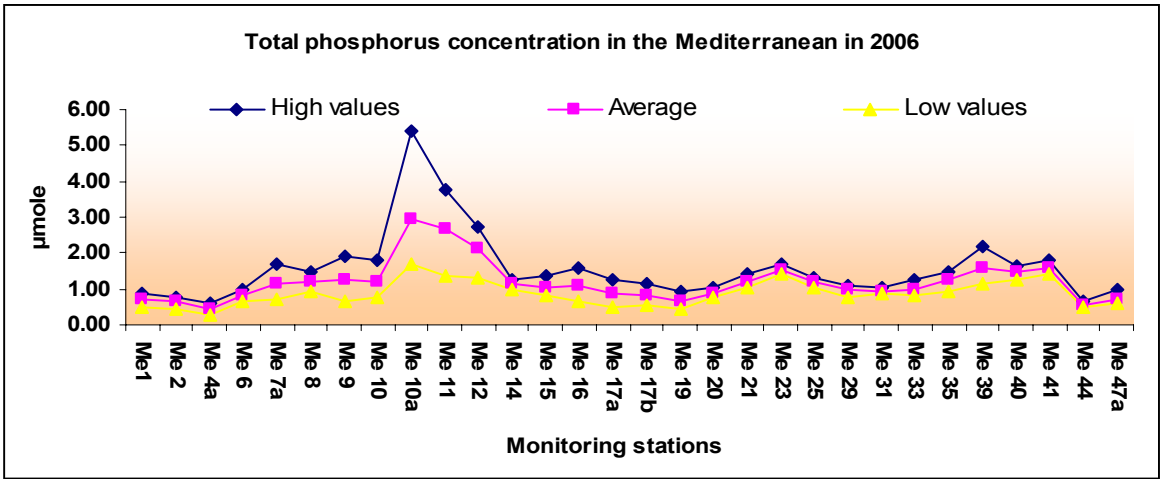


**Fig. (6-7) Total phosphorus concentration at monitoring stations on the Mediterranean in 2006**

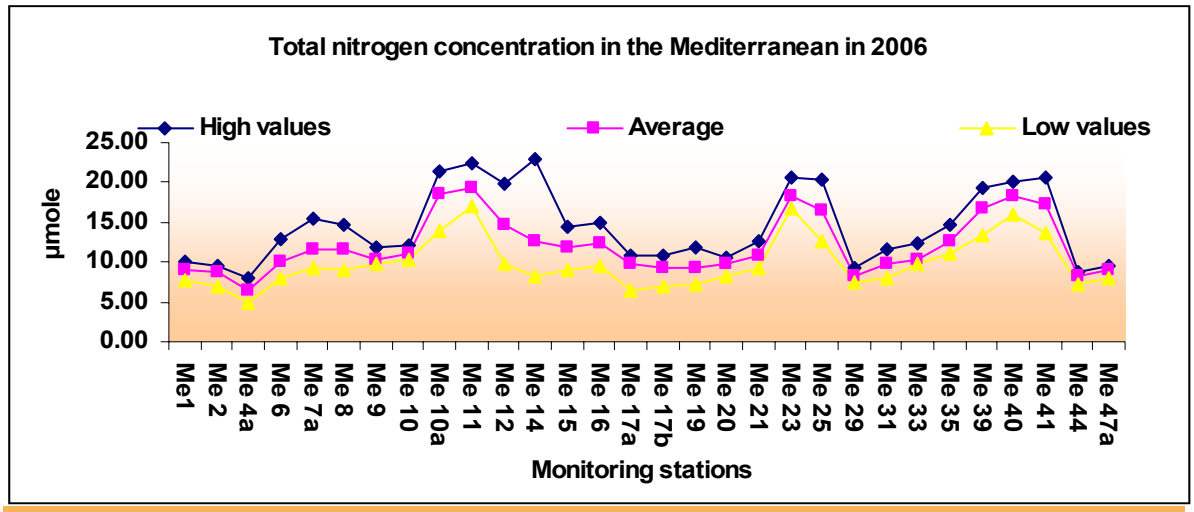


**Fig. (6-8) Total nitrogen concentration at monitoring stations in the Mediterranean in 2006**

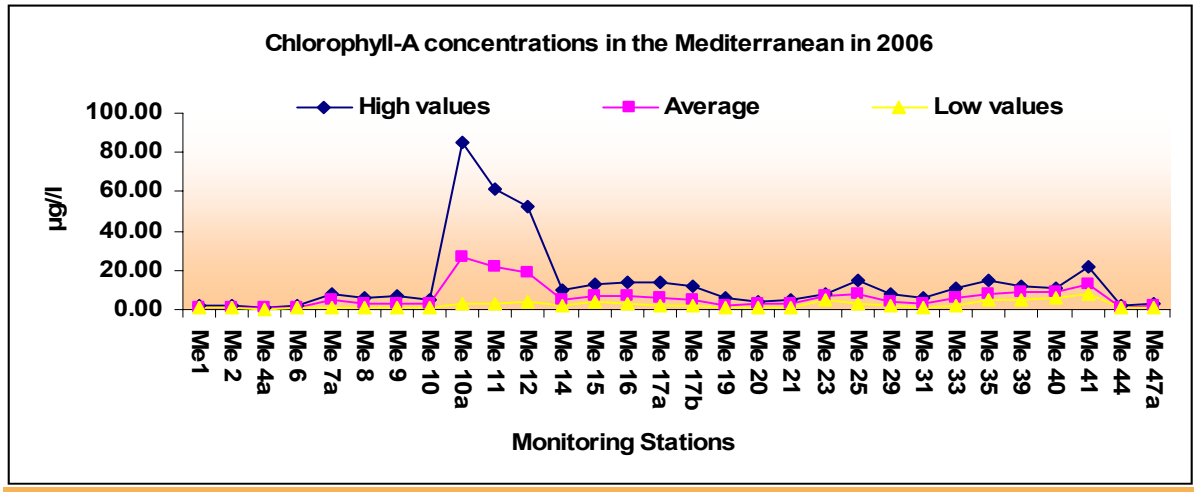


**Fig. (6-9) Chlorophyll-A concentrations at monitoring stations on the Mediterranean in 2006**

**Note:**

Under the marine monitoring program, chlorophyll-A concentration was classified as per the following scale:

- Low: concentration is less than 1 µg/l
- Average: concentration is more than 1-2 µg/l
- High: concentration is more than 2-5 µg/l
- Extremely high: concentrations is more than 5 µg/l

Nutrient salt concentration was classified as per the following scale:

- Low: nitrate and ammonia concentration is less than 0.5 µmole/l
- Average: ammonia concentration is > 0.5 and < 2 µmole/l
- Average: nitrate concentration is > 0.5 and > 4 µmole/l
- High: ammonia concentration is > 2 µmole/l
- High: nitrate concentration is > 4 µmole/l.

**Comparing 2006 monitoring results with those of 2005, the following is concluded:**

(1)There is improvement in coastal water quality in most Western Area stations, where bacteriological pollution decreased generally. Bagoush area (Alamein – Marina) showed more significant improvement than in 2005.

(2)Coastal water quality in Dekhela, Shatbi and Sidi Gaber improved bacteriologically, but Max, Western Harbour, East Abu Qir, Anfoushi and Eastern Harbour were worth than in 2005. It is noteworthy that Max is still receiving wastewater from Mariout Lake through Max pumping station.

(3)Coastal water quality in Rashid, Borg. Gamasa and Gamil was more bacteriologically improved than in 2005.

(4)Bacteriological pollution almost disappeared in Arish and Rafah shores in 2006.

(5)Average concentrations for ammonia, nitrates and chlorophyll decreased in most stations in 2006 except Sidi Krir and Nobareya areas where chlorophyll-A concentration was high.

(6)A slight increase in ammonia and nitrate concentration occurred in 2006 in Dekhela, Max, Eastern Port, Anfoushi and Shatbi compared with 2005 concentrations. This is related to phytoplanktons in such stations.

## Red Sea Coastal Water Quality

During 2006, Red Sea coastal water quality was monitored in 24 stations distributed along the Egyptian Red Sea and Suez and Aqaba Gulf coasts.

Most monitoring stations were noticed to have a spread of several waste types and the accumulation of oils, petroleum spills and marine algae, particularly in the general Suez beach, Atkah beach, south of Suez, Fishing harbor beach, Tor, and Ras Ghareb, Safaga, Bir Shalateen on the Red Sea Coast.

### Bacteriological Count Results In 2006

Count results for the 3 bacteria types in figures (6-10, 6-11 and 6-12) showed the following characteristics:

- Ras Ghareb beach is still having the highest bacteriological pollution levels due to the continuous discharge of the city untreated sewage waste into the sea.
- Suez beaches (Cabnon and Rex) and Atka Port had less bacteriological pollution this year than in 2005 (1-2 as much the permissible limit) compared with the past years where bacteriological pollution in some cases was hundreds, even thousands, of types.
- The rest of shores in the Gulf of Suez were clean from bacteriological pollution, a significant improvement in the marine and coastal environmental status in such area that suffered from severe pollution problems in the past.
- The most polluted station south of the Red Sea was Bir Shalateen due to primitive fishing practices.
- There was moderate bacteriological pollution in Sharm el Sheikh Port and Naama Bay due to increased private launches and entertainment boats especially diving boats berthing in such areas and increased number of visitors in Sharm el Sheikh resorts.

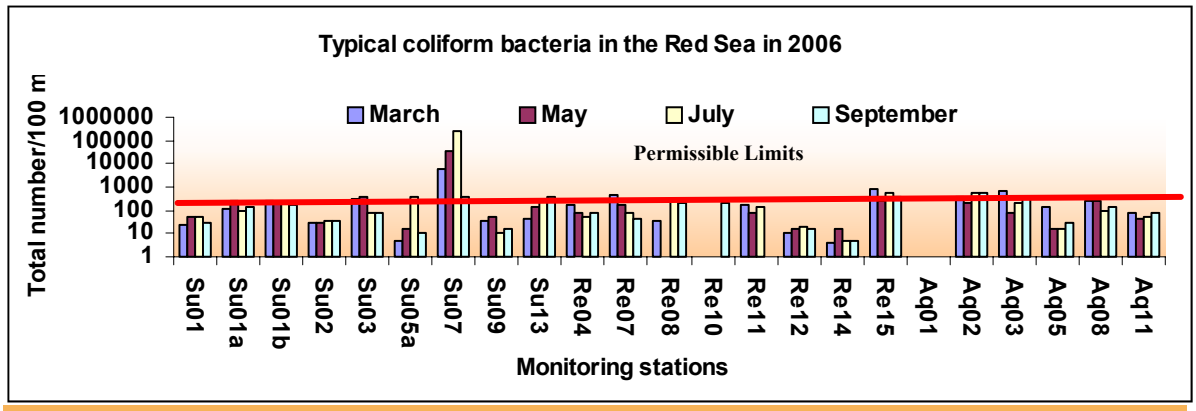


**Fig. (6-10) Bacteriological count of typical coliform bacteria at monitoring stations on the Red Sea in 2006**

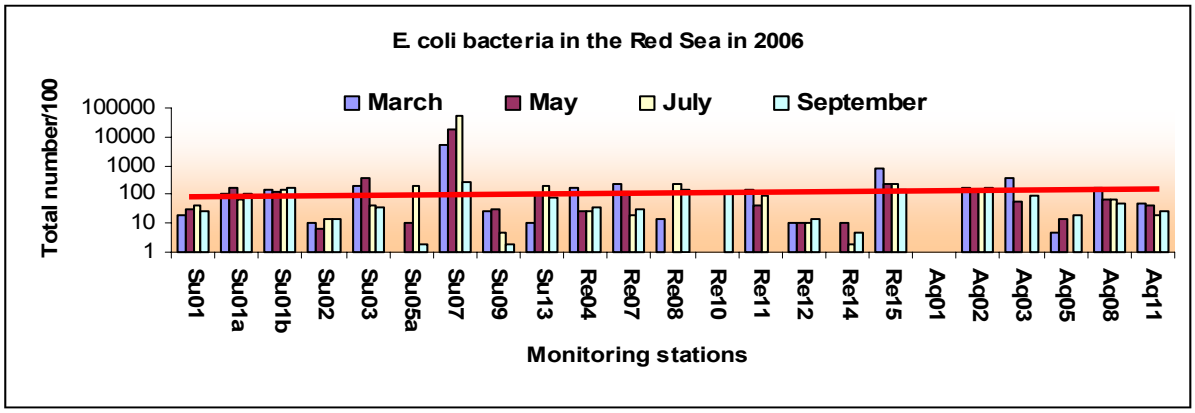


**Fig. (6-11) Bacteriological count of E. coli bacteria at the monitoring stations on the Red Sea in 2006**

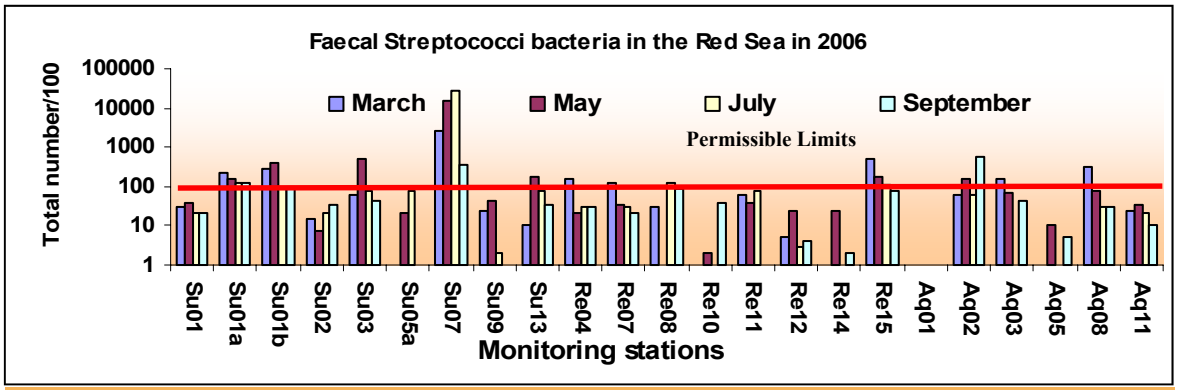


**Fig. (6-12) Bacteriological count of faecal streptococci bacteria at the monitoring stations on the Red Sea in 2006**

## Nutrient Salt And Chlorophyll-A Concentrations In 2006

Figures (6-13, 6-14, 6-15, 6-16 and 6-17), revealing nutrient salt and chlorophyll-A concentrations in the Red Sea coastal waters, show the following:

- There was significant increase in ammonia concentration around Suez city and Ras Ghareb, where the annual average of ammonia around Suez was 20 µmole, the highest concentration in Red Sea water, followed by Ras Ghareb (14 µmole). In the rest of the stations, the ammonia concentrations were less than 0.6 µmole.
- The annual average of nitrate concentration was high before Suez city (26.6 µmole), whereas concentrations in the rest of the stations did not exceed 0.7 µmole.
- stations had low concentrations of reactive phosphate except Ras Ghareb where it reached 0.6 µmole, and Bir Shalateen (0.11 µmole) as a result of human and industrial activities in such areas.
- Monitoring results recorded high concentrations of chlorophyll-A in the northern part of the Gulf of Suez (1.44 mg/l), while in the rest of the Gulf water, coastal Red Sea water and the Gulf of Aqaba, concentrations were relatively low (0.25-0.32 mg/l).

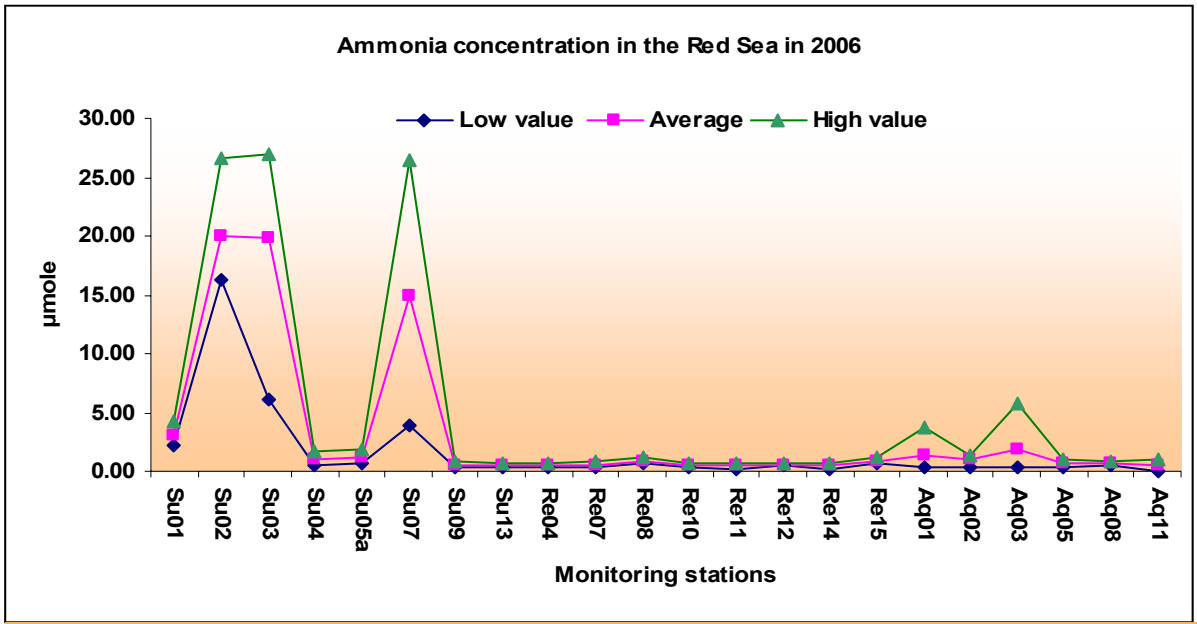


**Fig. (6-13) Ammonia concentrations at monitoring stations on the Red Sea in 2006**

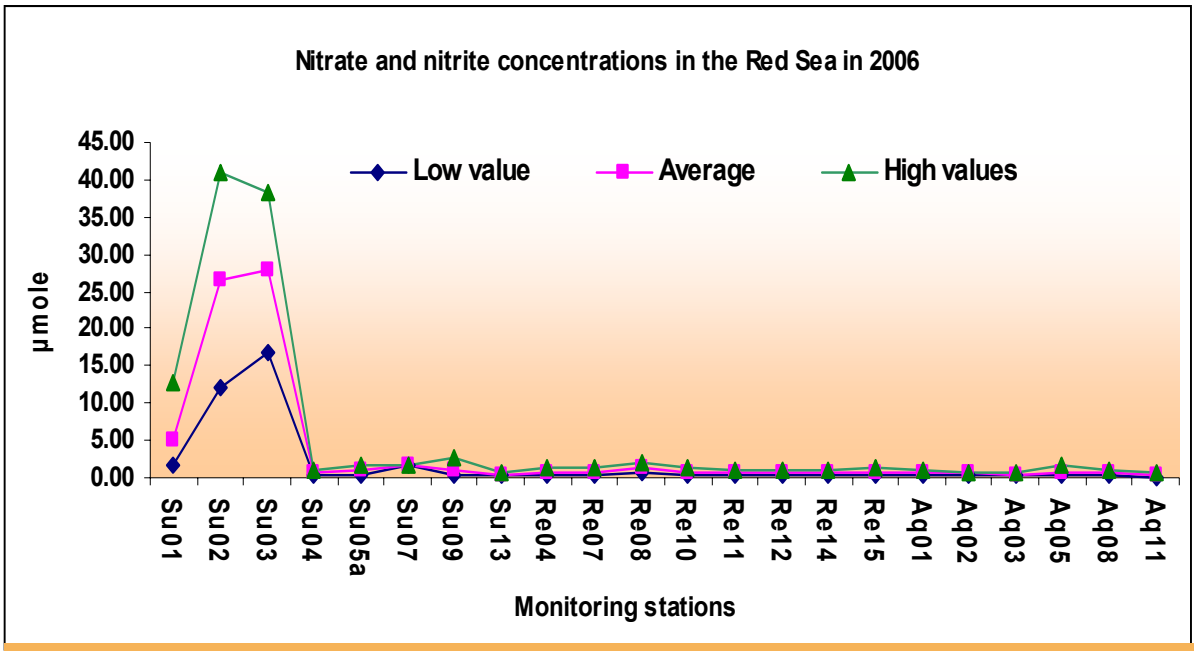


**Fig. (6-14) Nitrate and nitrite salt concentrations at monitoring stations on the Red Sea in 2006**

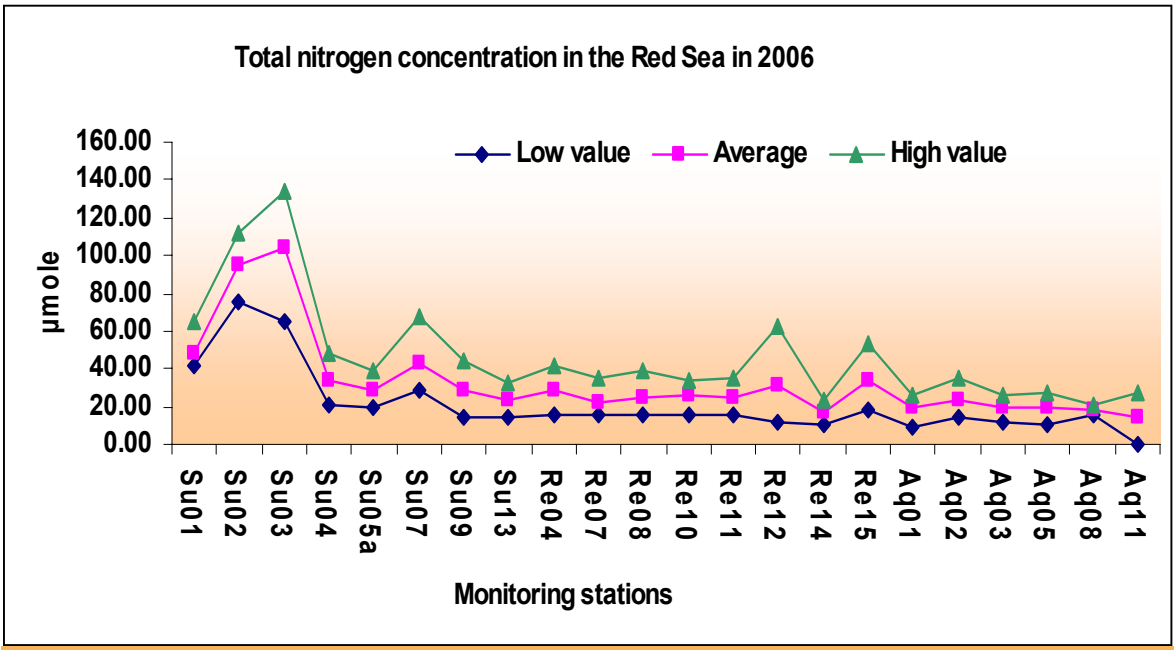


**Fig. (6-15) Total nitrogen concentrations at monitoring stations on the Red Sea in 2006**

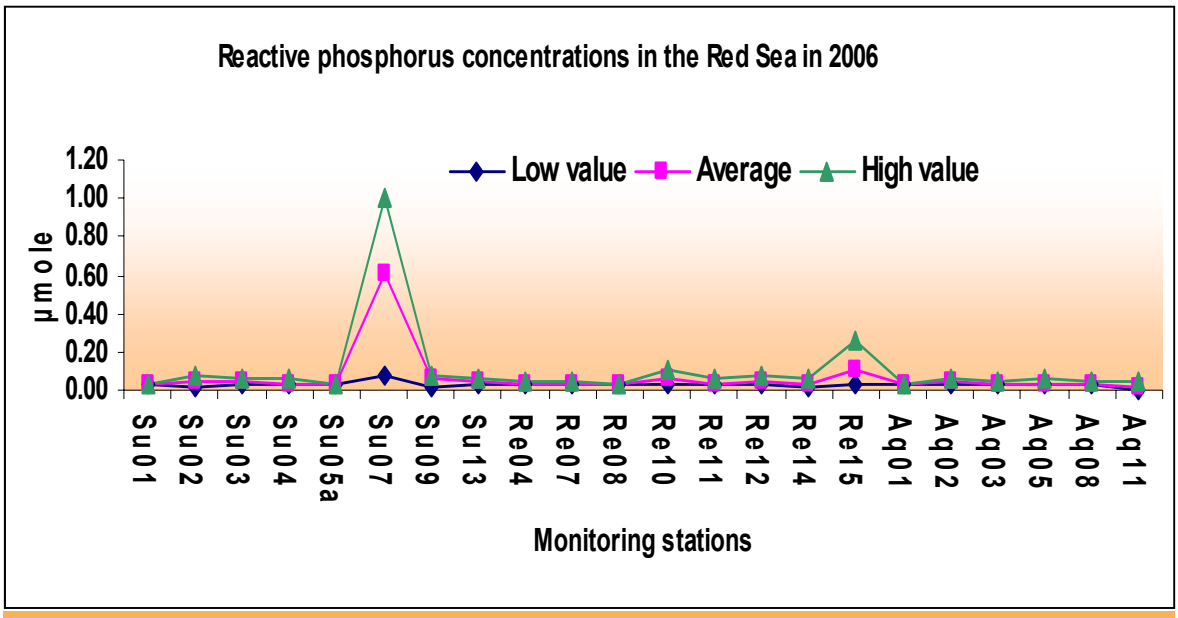


**Fig. (6-16) Reactive phosphorus concentrations at monitoring stations on the Red Sea in 2006**

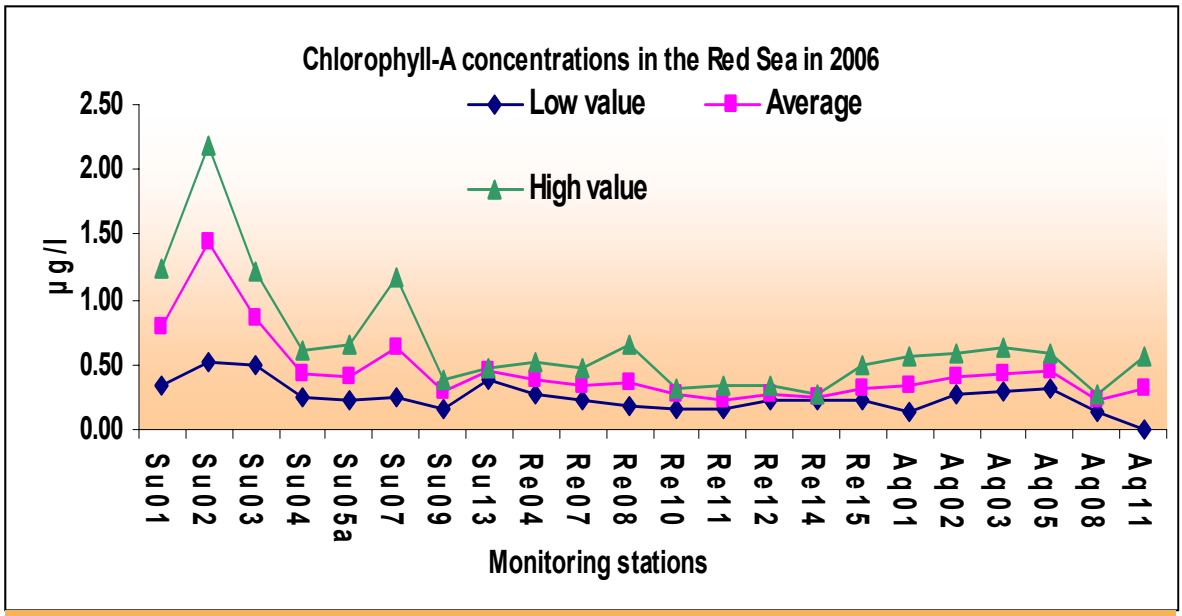


**Fig. (6-17) Chlorophyll-A concentrations at monitoring stations on the Red Sea in 2006**

**Comparing monitoring results in 2006 with those of 2005 the following is detected:**

- In north Gulf of Suez, bacteriological pollution was decreasd from 2-8 as much the limit allowed in 2005 to 1-2 as much the limit allowed in 2006, a partial improvement from what has been the case before. This is attributed to taking measures to stop the drainage from some polluting activities in this area into the Gulf of Suez water.
- Bacteriological pollution increased in Ras Ghareb from 6-28 as much the permissible limit in 2005 to 113-196 as much the limit permissible in 2006, an indication of marine environmental deterioration in this area.
- Bacteriological pollution on the shoreline from Hurghada to Bir Shalateen decreased from 4-21 as much the limit permissible in 2005 to 1-3 as much the limit permissible in 2006.
- There was no tangible change in coastal water quality in the Gulf of Aqaba from Ras Mohamed to Taba.
- No significant changes took place in nutrient salt or chlorophyll-A levels from 2005 to 2006 in general, which indicates environmental settlement in most Red Sea areas with the exception of Suez area and Ras Ghareb for ammonia concentrations often resulting from industrial activities which discharge their untreated drainage into neighboring coastal water.

## References

GESAMP (Group of Experts on Scientific Aspects of Marine Pollution) (1990). The State of the Marine Environment – London, United Kingdom