Journal of Environmental Protection and Ecology 2, No 2, 482–487 (2001)

Marine ecology

ESTIMATING THE WATER QUALITY OF ROMANIAN BLACK SEA COAST

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Abstract. The paper presents the results on microbiological pollution sea water in the southern part of Romanian Black sea coast from 1990 to 2000. During this period was determined in a monitoring system the main faecal indicator bacteria (*Total coliforms, Faecal coliforms, Faecal streptococci*) in three distinct coastal areas: bathing zone, harbour area and coastal area near the points of sewage discharges. The results of the bacteriological examinations showed in the bathing area a seasonal pattern with increased levels in summer due to high recreational use of the coastal area in this period (10^3-10^4 /ml).The level of faecal bacteria was also increased near the points of sewage discharges (more than 16 000 bacteria /100ml).

Keywords: Black sea, faecal pollution, monitoring, bacteria.

AIMS AND BACKGROUND

Romanian Black sea coast (245 km length) is a coastal area with high average population density and multiple social and economic activities (fishery, industry, harbours, touristic facilities).

In the southern part of the Romanian Black sea coast there are many resorts with a high number of recreational facilities used on a seasonal basis: Navodari, Mamaia, Eforie, Neptun, Costinesti, Vama Veche. On the Romanian coast exist also some areas with very high population density and high frequency of industrial and agricultural activities entire year, like Constanta, Mangalia, Eforie. Along the Romanian Black sea shore are located three ports: Constanta, Mangalia and Midia. The most important port is Constanta harbour, situated at the end of the Rhine-Main-Danube channel that crosses Europe from north-west to south-east and connects the Black sea to many supply sources and various markets, and, due to its geographical position, is one of the most important and strategic European ports[1].

Therefore, coastal sea water quality from Romanian area is under the influence of the anthropic activities.

Quality of Black sea water is severely controlled by the National Institute for Marine Research and Development "Grigore Antipa" in a monitoring system along the entire Romanian coast for over 30 years. The aim of this research monitoring is assessment of chemical, physical and biological quality of the coastal water.

EXPERIMENTAL

In evaluation of coastal water quality three microbiological parameters (*Total coliforms, Faecal coliforms, Faecal streptococci*) have been studied in compliance with sea water quality monitoring requirements of Directive of European Comission (76/160/EEC).

The techniques used in these studies was the MPN (most probable number) technique[2-4]. Surface sea water samples were taken at the shoreline, with monthly sampling frequency.

In the coastal water quality monitoring activity the specific focus has been given to areas with known sources of pollution: harbours and urbanity coastal areas where the frequency of industrial pollution and discharge of sewage are highest. Other areas of specific interest are areas with a high number of recreational facilities.

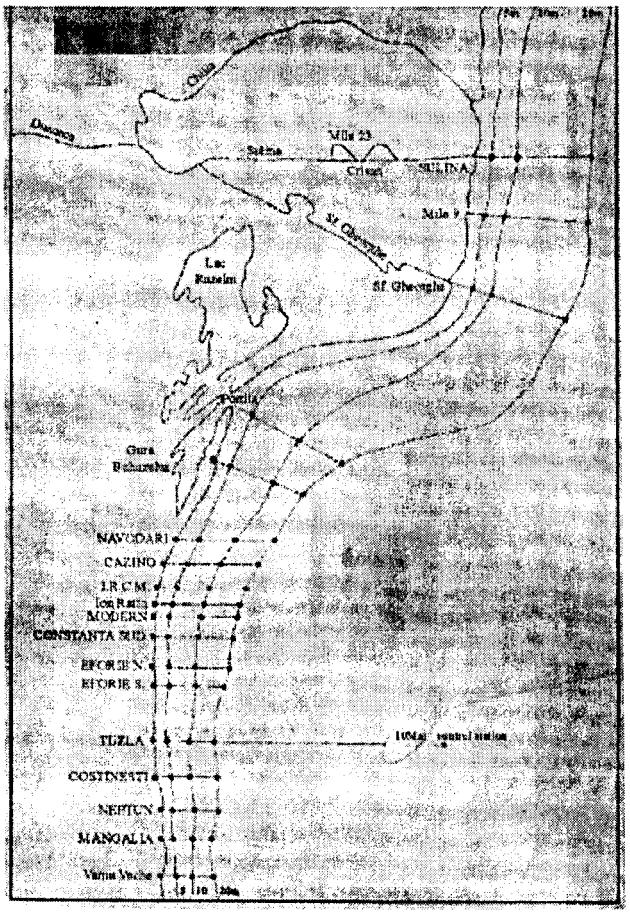

Fig. 1. Sampling stations for microbiological analyses along the Romanian Black sea coast

The network of stations including a control station (Tuzla) situated at 2 km offshore in the monitoring work is illustrated in Fig.1.

RESULTS AND DISCUSSION

During 1990-2000 the bacteriological parameters have been detected in all sea water samples collected from the network monitoring station.

Using the European and national standards, the quality of the coastal water shows a variable picture across the Romanian coast with relative non-contaminated area up to a very high degree of contamination.

In recreational areas the highest levels of the bathing pollution were during the summer season (from May to

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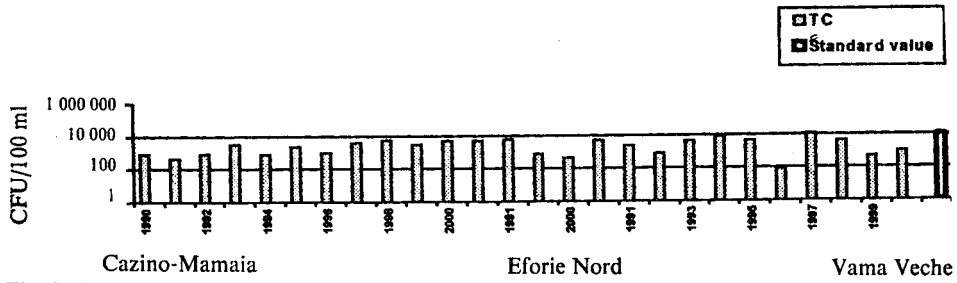
September) as compared to the standard value (10^3-10^4/100 ml). These areas have a high number of recreational facilities which may explain this seasonal pattern given a higher number of people in the area in this period, creating a higher level of domestic sewage output (Figs 2-4).



Cazino-Mamaia Eforie Nord Vama Veche

Fig. 2. Annual average concentrations of *Total coliforms* in the coastal recreational areas from 1990 to 2000

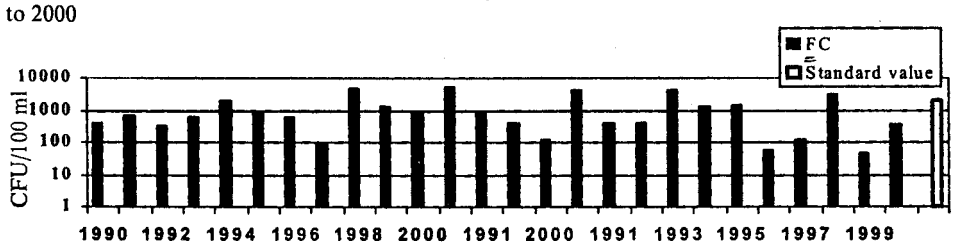


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Fig. 3. Annual average concentrations of *Faecal coliforms* in the coastal recreational areas from 1990 to 2000

In general, the bacteria concentration increases with increased water temperature and an increased number of people visiting the recreational areas along the coast. Mamaia Bay, one of the most intensively exploited resorts on the Black sea coast, which is visited by hundreds thousand of tourists annually, during 1990-2000 had levels of bacteria above acceptable levels .

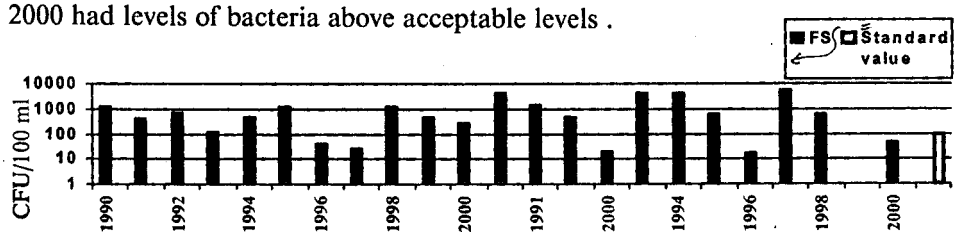

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Fig. 4. Annual average concentrations of *Faecal streptococci* in the coastal recreational areas from 1990 to 2000

The level of bacteria was increased dramatically in coastal areas near the points of sewage discharges with values more than 16 000 bacteria/100 ml (Figs 5-7).

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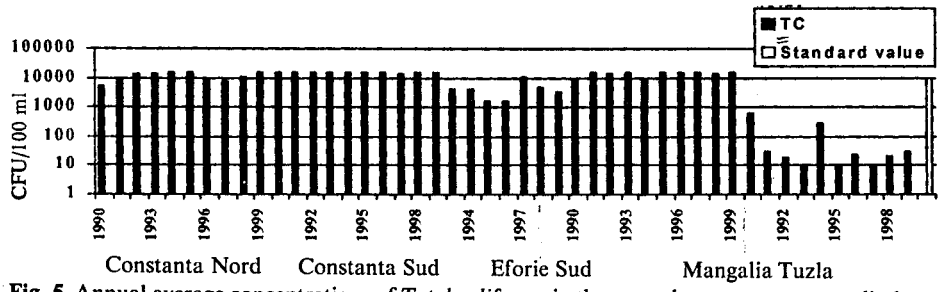

Fig. 5. Annual average concentrations of *Total coliforms* in the coastal areas near sewage discharges from 1990 to 1999

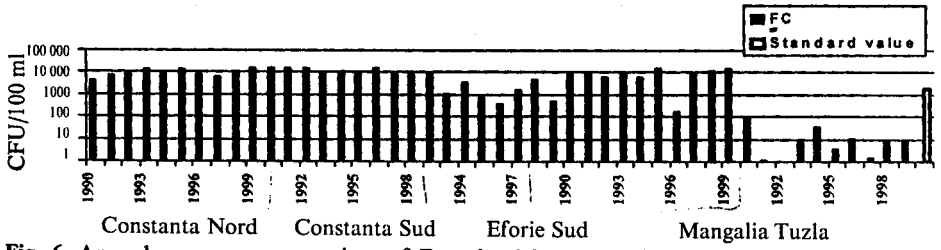

Fig. 6. Annual average concentrations of *Faecal coliforms* in the coastal areas near sewage discharges from 1990 to 1999

This high concentration are a solid indication of untreated or only partially treated domestic wastewater discharges into the marine environment. Discharge of wastewater into the marine environment from Constanta Nord, Constanta Sud, Eforie Sud and Mangalia domestic treatment plants is the main source of microbial water polution at the Romanian Black sea coast[5,6].

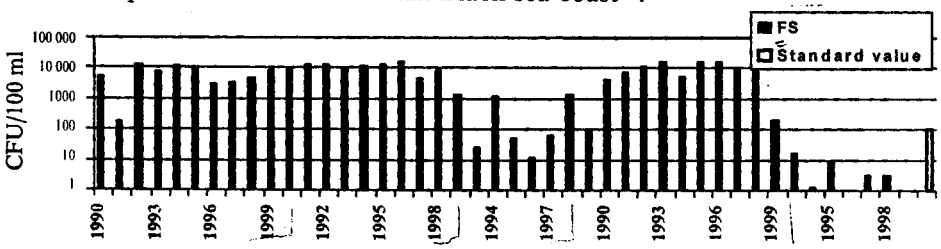

Fig. 7. Annual average concentrations of *Faecal streptococci* in the coastal areas near sewage discharges from 1990 to 1999

In the Constanta harbour area (Bazin Vechi, Intrare Port, Dana 34 stations) the level of bacteria was also increased with no seasonal variation (Figs 8-10).

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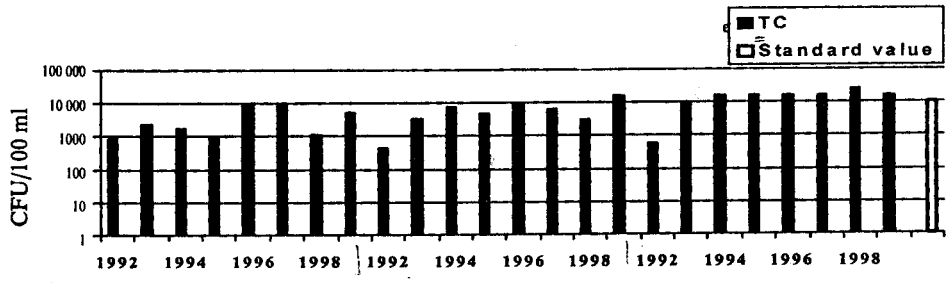

Fig. 8 Annual average concentrations of the *Total coliforms* in the Constanta harbour area from 1992 to 1999

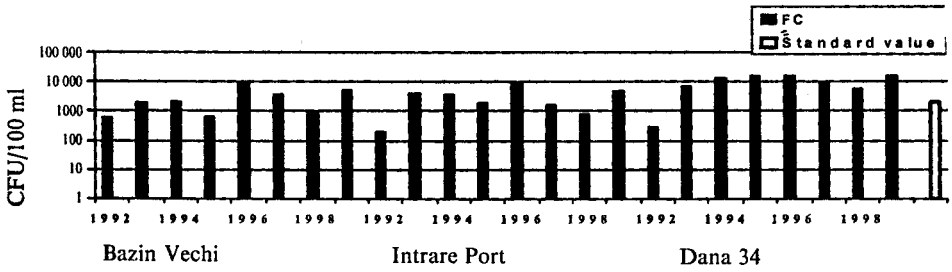

Fig. 9. Annual average concentrations of *Faecal coliforms* in the Constanta harbour area from 1992 to 1999

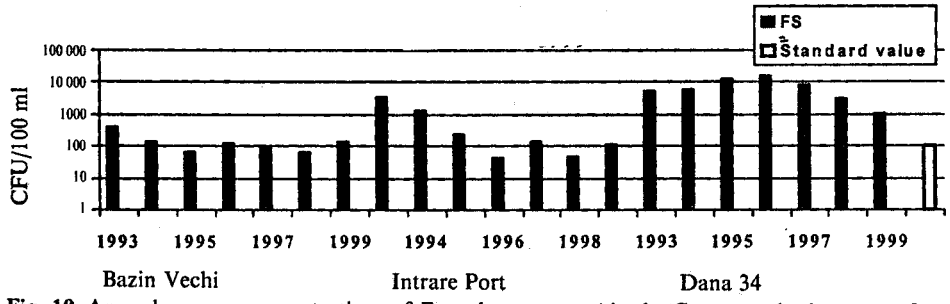

Fig. 10. Annual average concentrations of *Faecal streptococci* in the Constanta harbour area from 1993 to 1999

The activities developed in the Constanta harbour lead to the occurrence of solid and liquid waste both from ships and port operators[1]. Moreover, in the Constanta harbour basin there are some sewage outlets and were also identified points of rainfall and untreated sewage discharges (in Dana 34 station). All sources of pollution, which exist in this area, explain the high concentration levels registered during the last decade.

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CONCLUSIONS

Romanian coastal waters receive faecal pollution from a variety of sources. During 1990-2000 indicators bacteria have been detected in all sea water samples. The presence of indicator microorganisms in sea water at high concentrations indicated the faecal pollution of water associated with the health risk (waterborne diseases). Several recreational areas have levels of bacteria above acceptable levels, the highest level of faecal pollution was during the peak bathing season. The highest concentration of feacal bacteria in the period studied was near the points of sewage discharges and harbour area. The quality of the coastal water shows a variable picture across the Romanian coast with relative non-contaminated area up to a very high degree of contamination.

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Received 10 November 2000
Revised 25 April 2001