DISTRIBUTION AND ANTIBIOTIC RESISTANCE OF HETEROTROPHIC AND INDICATOR BACTERIA IN THE COASTAL AREAS OF TURKEY, SYRIA AND LEBANON

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Abstract
The levels of indicator and heterotrophic bacteria (HPC) and the frequency of antibiotic resistant bacteria with respect to the areas from which they were isolated were investigated and compared in the sea water samples taken from the coastal area of the Eastern Mediterranean (Turkey, Syria, Lebanon) and the offshore area (Northern Aegean Sea). While the highest levels of resistant bacteria were found in the samples taken from Syria, the lowest level of resistant bacteria was found in the samples taken from the offshore area of the Northern Aegean Sea.
Keywords: Bio-Indicators, Bacteria, Eastern Mediterranean

Introduction
In this study, bacterial studies were conducted with an aim to detect the level of indicator and heterotrophic bacteria and compare the level of antibiotic resistant strains in the coastal areas between Cesme and Cevlik (Turkey), Lattakia (Syria) and Beirut (Lebanon) and also the offshore area extending from the eastern part of Andros Island to the southern part of Gokceada -Thasos Island.

Material and methods
Two cruises were conducted with R/V YUNUS-S and sea water samples were collected during the months of August in 2007 and 2008 (Fig 1). Indicator bacteria analyses using the membrane filtration method [1] and HPC analyses using spread plate method with Marine Agar were carried out. Antibiotic resistance analyses were done according to NCCLS [2].
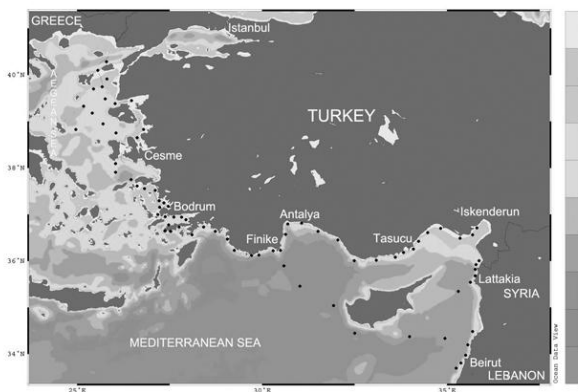

Fig. 1. Study Area

Results and Discussion
Faecal coliform, total coliform and HPC were found to be between<1,0–1,0 $\log_{10}$ CFU/100 ml, <1,0–2,1 $\log_{10}$ CFU/100 ml, 5,4–7,1 $\log_{10}$ CFU/100 ml, respectively at 15 stations, during August 2007, in the Aegean offshore area ranging from the eastern part of Andros Island to the southern part of Gokceada-Thasos Island. Also in 2007, results of analyses conducted at 97 points between Cesme and Cevlik in the Eastern Mediterranean coastal area of Turkey were found to be between 1,7-4,7 $\log_{10}$ CFU/100 ml for faecal coliform, 1,8-6,9 $\log_{10}$ CFU/100 ml for total coliform, and 5,5-8,8 $\log_{10}$ CFU/100 ml for HPC. Again in 2008, results of analyses conducted at 90 points between Cesme and Cevlik in the Eastern Mediterranean coastal area of Turkey were found to be slightly lower than in 2007. In 2007, results of analyses conducted at 6 points along the coastal area of Syria were found to be between 2,5-3,7 $\log_{10}$ CFU/100 ml for faecal coliform, 3,1-4,5 $\log_{10}$ CFU/100 ml for total coliform, and 5,5-6,6 $\log_{10}$ CFU/100 ml for HPC. Once more in 2008, results of analyses conducted at 6 points along the coastal area of Syria were found to be slightly higher than in 2007 (2,7-3,8 $\log_{10}$ CFU/100 ml for faecal coliform, 2,9-4,1 $\log_{10}$ CFU/100 ml for total coliform, and 5,8-6,2 $\log_{10}$ CFU/100 ml for HPC). Also in

the year 2008, results of analyses conducted at 5 points along the coastal area of Lebanon were found to be between 1,0 -3,2 $\log_{10}$ CFU/100 ml for faecal coliform, 1,9-5,2 $\log_{10}$ CFU/100 ml for total coliform, and 5,5-7,8 $\log_{10}$ CFU/100 ml for HPC.
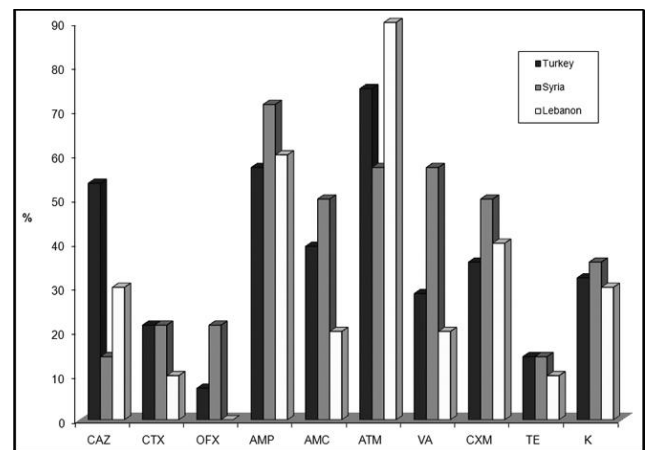

Fig. 2. Distribution of Antibiotic Resistant Strains

While the highest Multiple Antibiotic Resistance (MAR) was found in the bacteria isolated from the coastal area of Syria (48%), the bacteria isolated from Turkey (38%) and Lebanon (31%) respectively followed it. The bacteria isolated from the offshore area of the Northern Aegean Sea did not show resistance against antibiotics. The antibiotic derivates which were found to be resistant to bacteria were different in different regions. This situation shows that pollution input and the usage rate of antibiotics have differences related to geographic regions. In this study the first comparative bacterial data were obtained for these regions. There is a need for international long term monitoring studies for the purpose of detecting point pollution in these areas.

References
1 - APHA., 2000. Standard Methods for the Examination of Water and Wastewater 20th Edition, *In:* Clesceri, L.S., A.E Greenberg and A.D Eaton (eds), *American Public Health Association, American Water Works Association and Water Environment Federation.* Washington, D.C.
2 - National Comittee for Clinical Laboratory Standards., 1999. (NCCLS) Performance standards for antimicrobial susceptibility testing, Ninth Informational Supplement, M100-S9, Wayne.