

DISTRIBUTION OF HETEROTROPHIC BACTERIA IN COASTAL AND OFF-SHORE WATERS OF THE CENTRAL ADRIATIC

Krstulović Nada

Institute of Fisheries and Oceanography, Split, Yugoslavia

In the 1968-1978 period monthly research was being made on the distribution of heterotrophic bacteria in the coastal waters (the Bay of Kaštela) and off-shore waters (Stončica) wherein the ZoBell 2216 medium was used.

The horizontal distribution, annual as well as seasonal oscillations dependent on some abiotic factors such as temperature, salinity and quantity of organic phosphate were monitored.

The density of heterotrophic bacteria in the coastal waters was, as a rule, larger than off shore - in the majority of cases by order of magnitude. In other words, analyses of the ratio of water samples and the number of colonies have shown that the highest percentage of heterotrophic bacteria appears in the Bay of Kaštela in the ranges of 100-999 colonies/ml and in the ranges of 10-100 colonies/ml at Stončica. Such great differences in the density of heterotrophic bacteria are most probably related to the amount of available nutrients as well as to the incoming load of chemoorganotrophic bacteria from the land which remain in the coastal waters for a certain period of time.

Annual variations in the density of bacteria were also noted in the research period (1968-1978). These variations were noted at both research stations leading to the assumption that the factors influencing the oscillations act simultaneously in the coastal and the off-shore waters. The density of the bacteria reached its maximum (1968, 1969) in the time of water "ingression" from the body of the Eastern Mediterranean.

Monthly oscillations in the distribution of heterotrophic bacteria were analyzed so that monthly averages of a 10-year-period research were taken into account. Since the monthly oscillations in the Bay of Kaštela are very high and thereby the standard errors in the assessment of averages quite visible, the significance of the differences between the minimum and the maximum values were tested by T-test. This helped us arrive at the summer maximum which very much differed from the winter minimum. Throughout the Bay of Kaštela the considerably larger oscillation in the distribution of heterotrophic bacteria than at Stončica was identified, which can be explained by the influences generated on land and by the increased pollution of the area.

Apart from the high summer maximum which is statistically significant being at the level of 0.05 % when compared with all other months, the monthly oscillations at Stončica were noted as less conspicuous.

The summer maximum figures led to the conclusion that the main factor influencing the distribution of heterotrophic bacteria should be temperature. All the findings arrived at over the 10-year research period both for the Bay of Kaštela (366 pairs)

and for Stončica (602 pairs) were correlated to both salinity and temperature. As the result, it was determined that temperature played no significant part at neither of the stations. The analysis of the correlation of heterotrophic bacteria to salinity proved insignificant for Stončica, since the oscillations of salinity in the area are very low and thus irrelevant for the distribution of heterotrophic bacteria which have adapted to the environment.

In the Bay of Kaštela where the oscillations of salinity were higher, the correlation coefficient of salinity to the number of heterotrophic bacteria was also higher. Taking into account the total number of pairs (366) the coefficient was -0.2 , although several annual coefficients of correlation over the research period were very high. This can be explained by a larger amount of bacteria which came in the environment from land and were thus unadapted to the high salinity.

The distribution of heterotrophic bacteria was also related to the amount of organic phosphate, so that the average monthly quantities of bacteria were correlated to the average monthly amounts of organic phosphate. The correlation factor for the Bay of Kaštela was 0.30 and for Stončica 0.36 .

Summarizing the findings we arrived at the conclusion that all the mentioned factors acted jointly and influenced the distribution of bacteria in the sea water. Not one of them could be singled out. Besides, sea currents should not be neglected, since they are one of the essential elements of transport and distribution of bacteria in sea water (unpublished data by Gačić and Krstulović).