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Prediction of the Environmental Impact of Coastal Population on the Quality of the Sea

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The increase of coastal population -especially by tourists- is something considered as flourishing of the socio-economic conditions of the district. Too little -if any- attention is given to the effects caused by this situation. In the present study taking into consideration the quality of the seawater as the main parameter affecting the population of tourists, an attempt has been done in order to predict the variation of the quality of seawater with population. To achieve that, the beaches were classified according to their use -and consequently the amount of wastewater discharged into the sea -into four groups: I) coasts that are used only for swimming and recreational purposes, II) coasts used simultaneously for dwelling, swimming and recreational purposes, III) coasts along which only dwellings exist, and IV) natural and man-made harbours.

Bodrum -one of the most popular touristic resorts of Turkey -was selected as the experimental site where six beaches; one from group I, one from group II, one from group III, two from group IV and one transitional group I-II, were selected as the survey areas. Three stations close to each other in approximately 10-20 meters from the shore were chosen for sampling. Samples collected at all three stations at each survey beach were mixed to obtain a typical composite sample. Samples were collected three times a day - early in the morning before people started coming to the beach; at noon when the beach was most crowded; and late in the afternoon when people started to leave the beach. During the survey 40320 observations were made between December 1985 to February 1988. Parameters such as atmospheric pressure, air temperature, cloudiness, sunny period, prevailing wind direction and its speed, precipitation, light intensity, turbidity, seawater temperature, pH, colour, salinity and coliform concentration were determined. Assuming the concentration of the total coliform as the most important microbial pollution indicator for beaches an attempt has been done for the determination of the variation of coliform concentration as a function of the remaining parameters. To achieve this a multilinear regression program was used in which the number of total coliform was treated as the dependent variable while the others were accepted as independent variables. As a result of this analysis, the following relation was obtained:

$$N = \frac{(C_1 \sqrt{P} + C_2)}{10 A^{-3}}$$

$$A = \frac{\ln(10.29 T_u^{-0.072}) + 1.22}{0.95\theta^{-20}}$$

where

N is the number of total coliforms per 100 milliliters,
I is the intensity of light (lux),
T_u is the turbidity (FTU),
θ is the temperature of seawater (°C),
P is the population density (number of people/100m²),
C₁ is the population density coefficient and
C₂ is the coastal characteristic coefficient.

The coefficients C₁ and C₂ of this equation have been found to have the values given below:

Coast Group	C ₁	C ₂
I	15.7	0.020
I-II	78.4	0.223
II	220.5	0.682
III	281.7	0.293
IV	1310.5	2173.0

Parameters such as BOD, total nitrogen, total phosphorus etc. proved that they didn't contribute significantly to the total coliform concentration. The correlation obtained between actual determined values and the values estimated by the derived equation is above 86 percent.

The results obtained by this study is a significant contribution for the prediction of the environmental impact of tourist population to seawater quality and consequently for the prevention of the deterioration of the environment and protection of public health.