

HOW TO EVALUATE ENVIRONMENTAL QUALITY OF BOTTOM SEDIMENTS USING ORGANIC MATTER CONTENT IN ESTUARIES

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To assess the environmental quality in estuaries, the bottom sediments have been observed for long time and the data have been stored to become a substantial amount in Japan. We are currently developing the computer system including database and visualization subsystems to utilize such kind of data effectively. In this study using the prototype of the system, we developed a method to evaluate the bottom sediment quality with the data indicating organic matter content.

Firstly we compiled database of the bottom sediment data observed in three estuaries located nearby but different in degree of enclosure, namely Miyako, Yamada, and Ofunato estuaries in Iwate prefecture, Japan. Following seven observed items were used for analysis: mud content, ignition loss, COD, total carbon, total nitrogen, total phosphorus, and total sulphur of sediment. Total sulphur is the index for both organic matter content and dissolved oxygen depletion in the bottom sediment. When the relationship among observed items were analyzed by cluster analysis, two sets of items, COD and total nitrogen, and also ignition loss and total carbon, were firstly grouped together. On the other hand total sulphur was the most diverged variable, and was characterized by a log-normal distribution. In Ofunato estuary bottom sediments had significantly higher organic matter contents than those in other two estuaries by nonparametric tests. The ANCOVA for total sulphur adjusted by COD, indicator of easily decomposable organic matter, revealed that even at the same level of COD, total sulphur was significantly higher in Ofunato estuary than in others. This result suggested the summer formation of anoxic layer in the bottom layers in Ofunato estuary was affected by not only high organic matter content but also other factors like water movements. The prevention of water circulation due to the sill at the mouth of the estuary might be one possible cause. Moreover the geographical contour plots of residuals of total sulfur from regression showed the higher values occurred along the shallows in the estuaries, which suggested the potential risks of oxygen depletion. These statistical treatment and geographical information could provide the key to elucidate the organic pollution in estuaries.