BIOLOGICAL INDICATORS

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The importance, classification and use of biological indicators are discussed and the requirements which should satisfy a good hydrological indicator are listed.

On discute l'importance, classification et usage des indicateurs biologiques et on énumère les réquisitions que le bon indicateur hydrologique doit satisfaire.

Biological indicators s.l. include hydrological, ecological, geological indicators and indicators of fisheries and pollution. Biological indicators s.s. are hydrological only.

There are two principal methods to differentiate water masses and their movements: a) physico-chemical and b) biological. The former method is based on the measurements of mainly temperature and salinity. As these parameters are quantitative they are easier to work with than data derived from the mainly qualitative study of biological indicators. In addition numbers always have a more convincing and "impartial" appearance. But this does not mean that the tabulated value always represent the essence of a phenomenon correctly. Sea water has not just two properties but many and several of them are either very difficult to measure or remain unknown at the present time, although we know that they exist. They cannot be measured by apparatuses made by men. Organisms, however, feel all these properties and their changes and they react to them. The difficulty consists in deciphering these changes oceanologically.

In addition in many cases biological indicators can be used as drift bottles, an old but still effective method for studying surface currents. In this case biological indicators also have an advantage because an oceanographer is never able to prepare as many drift bottles as the number of plankters used as hydrological indicators.

These reasons explain why in many cases biological indicators can give better results than the physico-chemical method.

A good hydrological indicator should be: a) without self propulsion, b) abundant quantitatively, c) easy to identify d) without daily vertical migration, e) known well biologically, f) be sensitive to the changes of ecological parameters, and g) possess a relatively long individual life. The next to the last requirement, however, should be taken with the following reservation. Indicator with a small tolerance range are useful to separate water masses, but indicators with a large tolerance range (but not cosmopolitan!) are most useful to trace a current, because they do not disappear with small changes in the milieu and thus give an accurate picture of the distribution of the current.

All plankters can be used as hydrological indicators but it is believed that the best ones are foraminifera, as they satisfy more completely the requirements cited above.

The use of biological indicators to decipher the surface hydrology is especially promising in the areas of complicated hydrology where different water masses meet. This is illustrated in a study of the southwestern Atlantic by means of both physico-chemical methods and biological indicators. The physical oceanographers could not agree on the location of the Zone of Subtropical/Subantarctic Convergence. This is explained by the absence of agreement with respect to what salinity and temperature values should be considered as criteria to distinguish water masses. The planktologists, who know their group well, do not have this problem; they can decide exactly and unanimously which plankters represent Subtropical waters and which ones represent Subantarctic waters. On the basis of a study of foraminifera in more than 3,500 samples detailed surface hydrological schemes for both summer and winter of the area mentioned were prepared for the first time (Boltovskoy, 1970). Later studies of the distribution of some other planktonic groups gave same results as far as the location of several limitts between different water masses is concerned.

Boltovskoy, E., 1970. Masas de agua (característica, distribución, movimientos) en la superficie del Atlántico Sudoeste, según indicadores biológicos - Foraminíferos. Argentina, Serv. Hidr. Nav., H.643, p.1-99.