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ENVIRONMENTAL CONDITIONS IN THE BALTIC 1971-1973

/Summary/ <sup>x</sup>

by

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In the period 1971-1973 two expeditions were made each year on board the IMGW research vessel, the "Hydromet" in the area extending from Skagerrak to the Gulf of Finland, one of them in spring and the second one in autumn time. The investigations were carried out <sup>on</sup> nearly 50 hydrographic stations /Fig.1/, including the meteorological and hydrophical parameters, nutrients, benthos, oil, DDT, aerzols, radioactive contaminations and others. At the beginning of the period under review the hydrographic conditions in the Baltic were typical for a stagnation period. The oxygen content in the nearbottom layers was almost depleted, and hydrogen sulphide was found in a number of places of the Baltic. This oecologically adverse situation was somewhat improved in the beginning of 1972. There was a improvement in the near-bottom oxygen conditions /in March/. The improvement,

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<sup>x</sup> The full text of the paper will appear in the proceedings of the 9th Conference of Baltic Oceanographers in Kiel 1974

however, was not to be a lasting one and already in the second half of the year hydrogen sulphide made its reappearance /Fig.2/. Nevertheless, the inflow of 1972 had left its marked traces e.g. in the form of higher salinity of the nearbottom layers in the Southern Baltic and a vertical upheaval of water masses in their upper layer.

Early in 1973 salt rich water appear in the Arkona Deep and during the year ascending movements were observed in the surface water, still the oxygen conditions had remained rather poor. Hydrogen sulphide further was found in the northern part of the Gotland Deep and toward the end of that year it prevailed in larger amount in the deepest spots of the region. Therefore it should be inferred that the present hydrological regime in the Baltic is generally critical and there is no tendency seen yet for that state permanently to improve.

The distribution of phosphates underwent some fluctuations but irrespective of the current hydrological situation, however, in the deep water layers there are huge amounts of phosphorus compounds stored in a manner hardly accessible for the primary production, whereof only small part will become mobilized by the salt inflows. Taking into consideration the period of 1947-1973 it can be stated that those amounts together with the discharge of nutrients from other sources are maintained in the Baltic active layer the high level of phosphate concentrations, started where in the sixties /Fig.3/.

The content of inorganic nitrogen salts in the surface waters had varied within a wide range of concentrations: from almost

complete utilization up to 20  $\mu$ gat N/P. Maximum concentrations were found most often along southern and eastern coasts of the Baltic, predominantly in the gulfs and bays. In the northern part of the sea the productive layer was remarkable for its low content of nitrogen compounds; considering the phosphate-rich character of that area, it points to a marked influence of the Gotland Basin deep waters, which due to their frequent stagnations, are usually devoid of nitrogen salts other than ammonia. This kind of spatial differentiation of the environmental conditions is also the argument to prove that nitrogen is at present the factor limiting primary production, at least in the northern part of the Baltic proper.

The mean values of N/P ratio generally point to the relative surplus of phosphate compounds. An attempt to calculate the proportions in which the assimilable forms of nitrogen and phosphorus reach the productive layer from their external sources and from the near-bottom mineralization process resulted in revealing relations that nearly approach the optimum conditions for the different variants of the marine phytoplankton elementary composition. Considering the extreme estimations of primary production in the Baltic it appears that absolute amount of nutrients supplied from the above mentioned sources proves to be insufficient - both in the case of nitrogen and of phosphorus - for providing of such a high intensity of assimilation process as is recently being observed in the Baltic.

Maximum discharge of biogenic salts from the Polish territory takes place in summer, viz. at the time when fertilizers are most intensively used. High concentrations of chlorophyl were observed near the

large river mouths where they had reached 10-30 mg/m<sup>3</sup> in the surface water /in open sea 1-2 mg/m<sup>3</sup>/.

The investigations of recent years have revealed the existence of vast biological deserts in the Baltic deep, devoid of any bottom fauna or inhabited by very sparsely dispersed benthos organisms. The extent of those areas may vary in the particular years but the deserts themselves will not disappear altogether even after the refreshing inflows, such as the one of 1972. The only effect of that inflow was the slight shrinkage of the desert in the Central Baltic and partial decline of the desert in the Bornholm Deep. Never were such vast deserts recorded in the Baltic - a symptom of far-reaching environmental changes in the sea lately. The shrinkage of the zooplankton was observed, particularly acute throughout 1971 and 1972. A distinct shrinkage was observed among the two popular inhabitants of the deeper water layers, being the *Sagitta elegans forma baltica* and *Cyanea capillata*. The Baltic cod, its spawn and larvae being very non - numerously found there among the Baltic plankton. During 1971-1972 no cod spawn whatever was found in the usual permanent spawning grounds in the central part of the Gdańsk and the adjacent Gotland Deep. Now this is actually a severe threat to the future of the Baltic cod fisheries.

The results obtained from the 1971-1973 investigations clearly point to the high dissatisfactory character of changes of the biological conditions that hitherto prevailed in the Baltic; they reveal large amount of the near-bottom waters to have become retransformed into the vast abiotic zone.

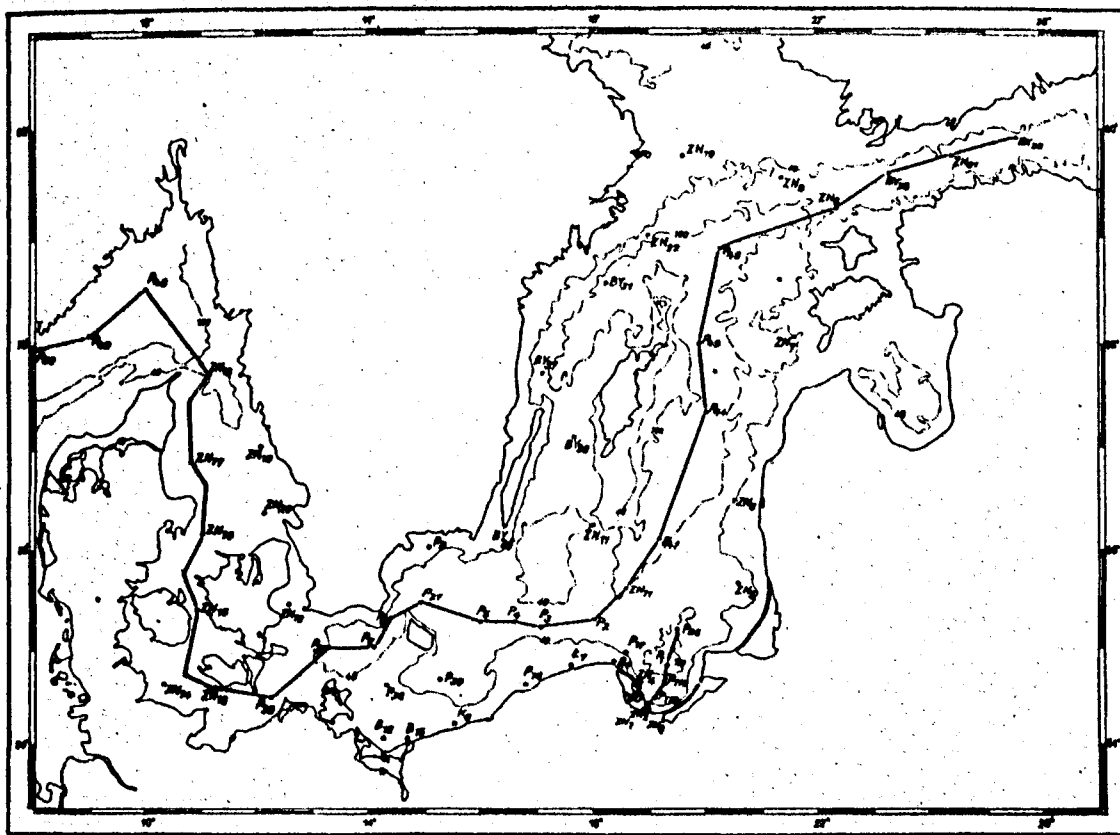


Fig. 1 Hydrographical stations visited by R/V "HYDROMET" in 1971-1973

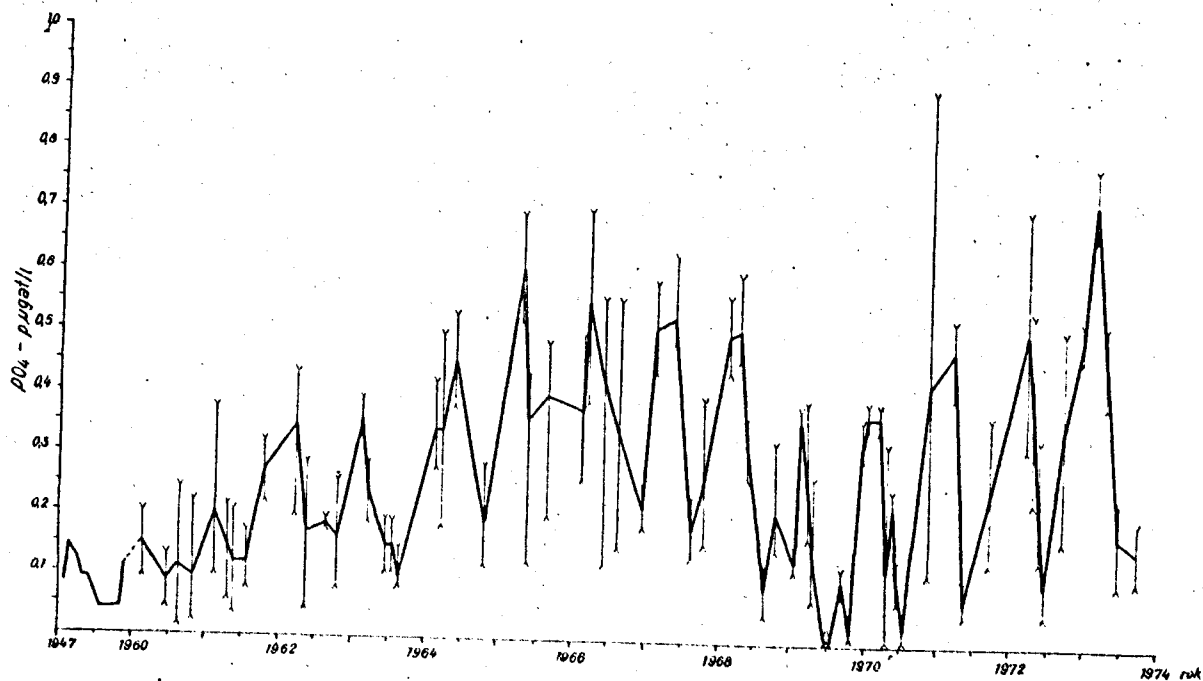


Fig. 3 Phosphate concentrations /mean values and amplitudes/ in the surface waters of the Bornholm Deep /0 - 20 m/ within 1960-1973

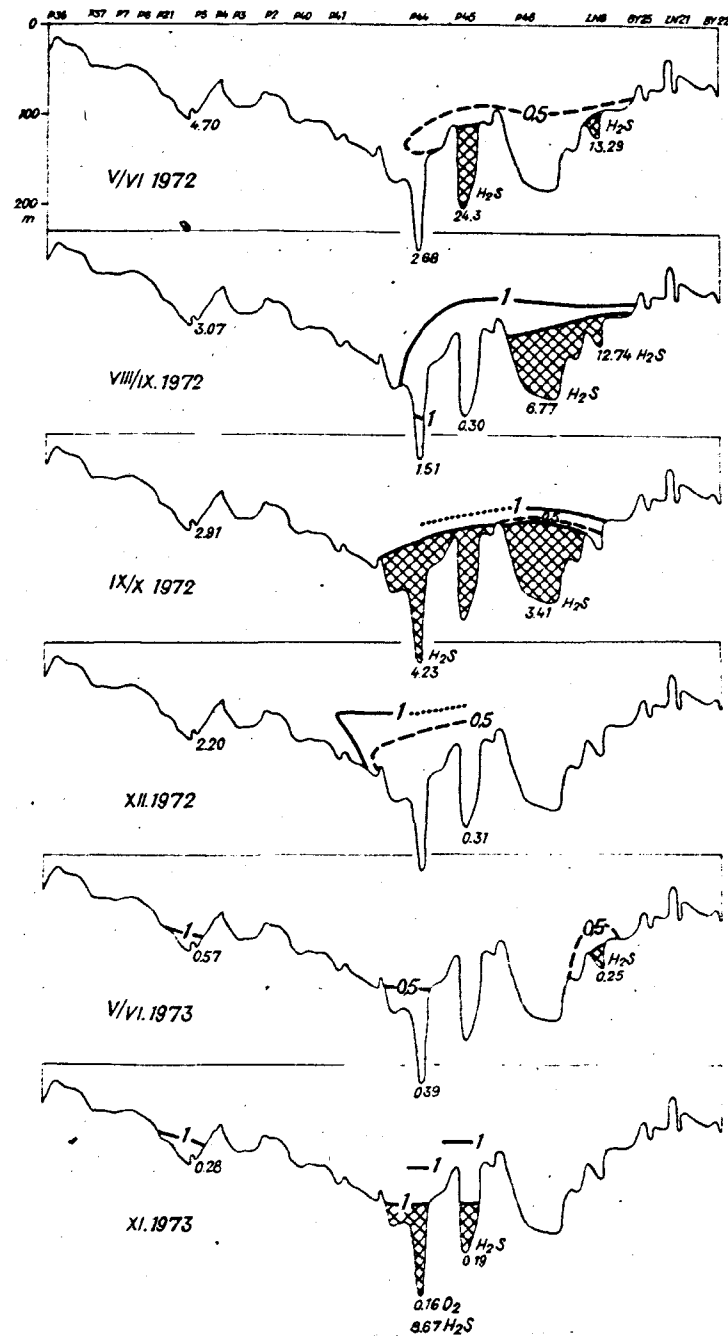
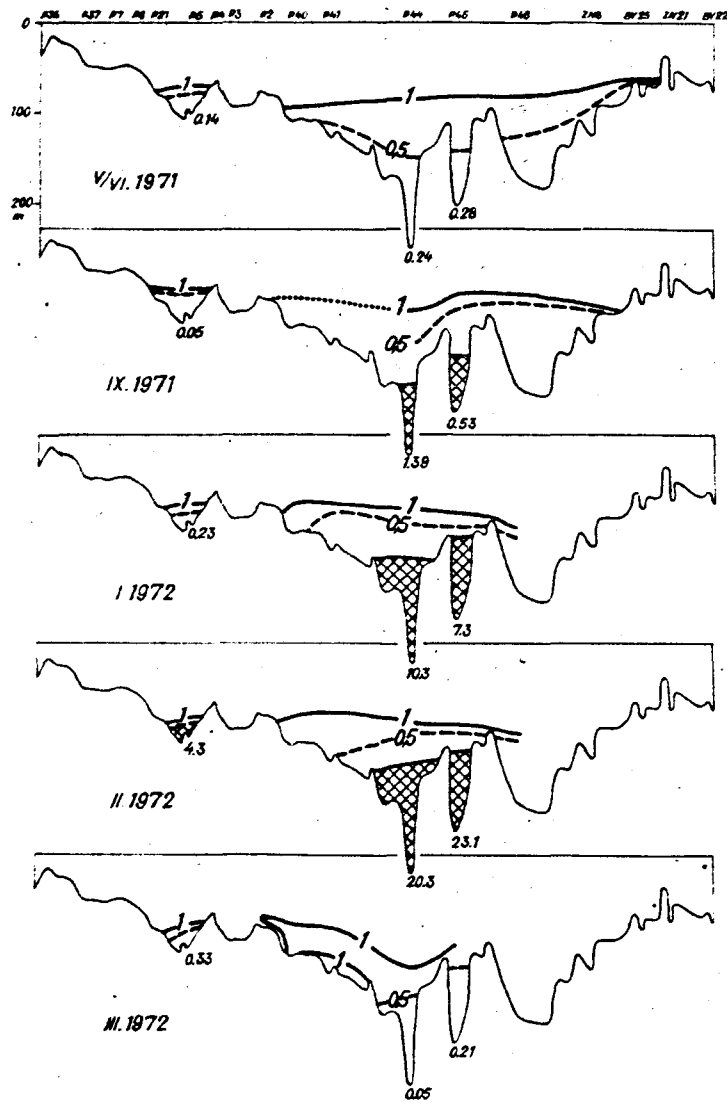


Fig.2 The position of isolines 1 and 0,5 ml/l O<sub>2</sub> restricting life development in the deep water of the sea and zones of appearance of hydrogen sulphide in the longitudinal section of the Baltic