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Ödsmål, Kville sn, Bohuslän

Hällristning
Fiskare från
bronsåldern

Rock carving
Bronze age
fishermen



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ON PHOSPHORUS IN
BALTIC SURFACE WATER

by

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CM 1976/C:23
Hydrography Committée

ON PHOSPHORUS IN BALTIC SURFACE WATER

by

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Abstract

Phosphate-phosphorus has been measured since 1959 in the Gotland Deep. From 1968 also total phosphorus has been included in the measurements. From the difference Tot-P - PO_4 -P, Organic phosphorus values have been obtained. All the parameters have been plotted on diagrams showing variations in the surface water. The variations are discussed and it is shown that the variations mainly are caused by biological activity. A possible increase of the winter values during the last decade is also demonstrated. Difficulties in the interpretation of the results is discussed.

During the expeditions with the ships of the National Board of Fisheries, phosphate-phosphorus has been regularly measured about four times per year since 1959 in the Baltic. In 1964 the analytical method was changed from the old ^{stanno}chloride technique to the new ascorbic acid technique (Murphy and Riley 1962). No significant differences in the results, due to the change of method, have been detected. Since 1968 total phosphorus has also been analyzed using the peroxodisulfate oxidation method by Koroleff (1972).

Fig. 1 shows mean values of phosphate-phosphorus and total phosphorus in the surface water of the Gotland Deep between the island of Gotland and the Latvian coast. The mean values have been computed for standard depths down to the thermcline at every expedition carried out with our ships. All values with same temperature and salinity have been used in order to include the whole

homogenous layer. This water also shows rather homogenous phosphorus values and therefore I have used mean values instead of single surface values. These may sometimes be disturbed by contamination and show rather large variations. The mean values are considered to be more representative for the surface water column. In the diagram some results from other countries during the International Baltic Year 1969-70 have been included.

In the figure we can see the effect of the turnover of the deep water of the Baltic in 1961. During the winter 1961-1962 the vertical convection brought up water with high phosphate concentrations, which had been released from the stagnant deep areas. The surface values increased enormously during the winter, but normal values were fast restored and during the next winter no traces of this high concentration could be found.

From 1969 there seems to occur an almost continuous increase of the surface values of phosphate during the winters. This also can be seen in the total phosphorus values, which generally show the same pattern as the phosphate-phosphorus values, with maxima during the winters and minima during the summers. One would expect that the total phosphorus values should be constant during the year, because the organic phosphorus formed from the phosphate-phosphorus is included in these values. This is, however, not true. Large variations are caused by the fact that the organic part is bound to living organisms and that these partly are excluded in the analysis. The phytoplankton is eaten by higher organisms which may not be included in the sample. They may move away from the area. Dead phytoplankton sinks downwards and a part is in that way removed from the surface water.

If we look at the organic phosphorus values (these are obtained as a difference between total phosphorus and phosphate phosphorus in a sample), we find that we generally have higher values during the summer and lower values during the winter. During the summer we have a large production of phytoplankton and the phosphate phosphorus values may go down to zero or close to zero. Most of the phosphorus is then present as organic phosphorus. During the winter phosphate phosphorus is formed through oxidation of dead organic matter and no organic phosphorus is formed. A part of the dead organic matter sinks down below the thermocline (fig. 2). In the figure the organic phosphorus values from 1968 to 1976 are

represented. We can see that most years show high summer values (S) and low winter values (W). This is, however, not true for every year. It has to be stressed that we generally have only 3 or 4 observations per year and that the conditions even during the same month may vary considerably and that the climatic conditions also vary from year to year. Fig. 3 shows a section through the Baltic beginning in the Arkona basin, through the Gotland Deep to the Gulf of Finland. In the figure the phosphorus parameters for the surface water in March 1975 and 1976 have been plotted. It can be seen that the distribution of the different compounds is quite even over the whole section, but that there is a large difference in the concentration level, especially of total phosphorus between the both years. Because organic phosphorus is the difference between total phosphorus and phosphate phosphorus, we also find a much higher organic phosphorus level in March 1976. It is, however, not possible to tell if the production has been higher in March 1976. The plankton production may just have started a little earlier that year. Much denser sampling is necessary for a proper understanding of the phosphorus variations in the surface water. This is only possible by an international coordination in the Baltic. Careful intercalibration of the methods has to be carried out before such a programme is started.

References

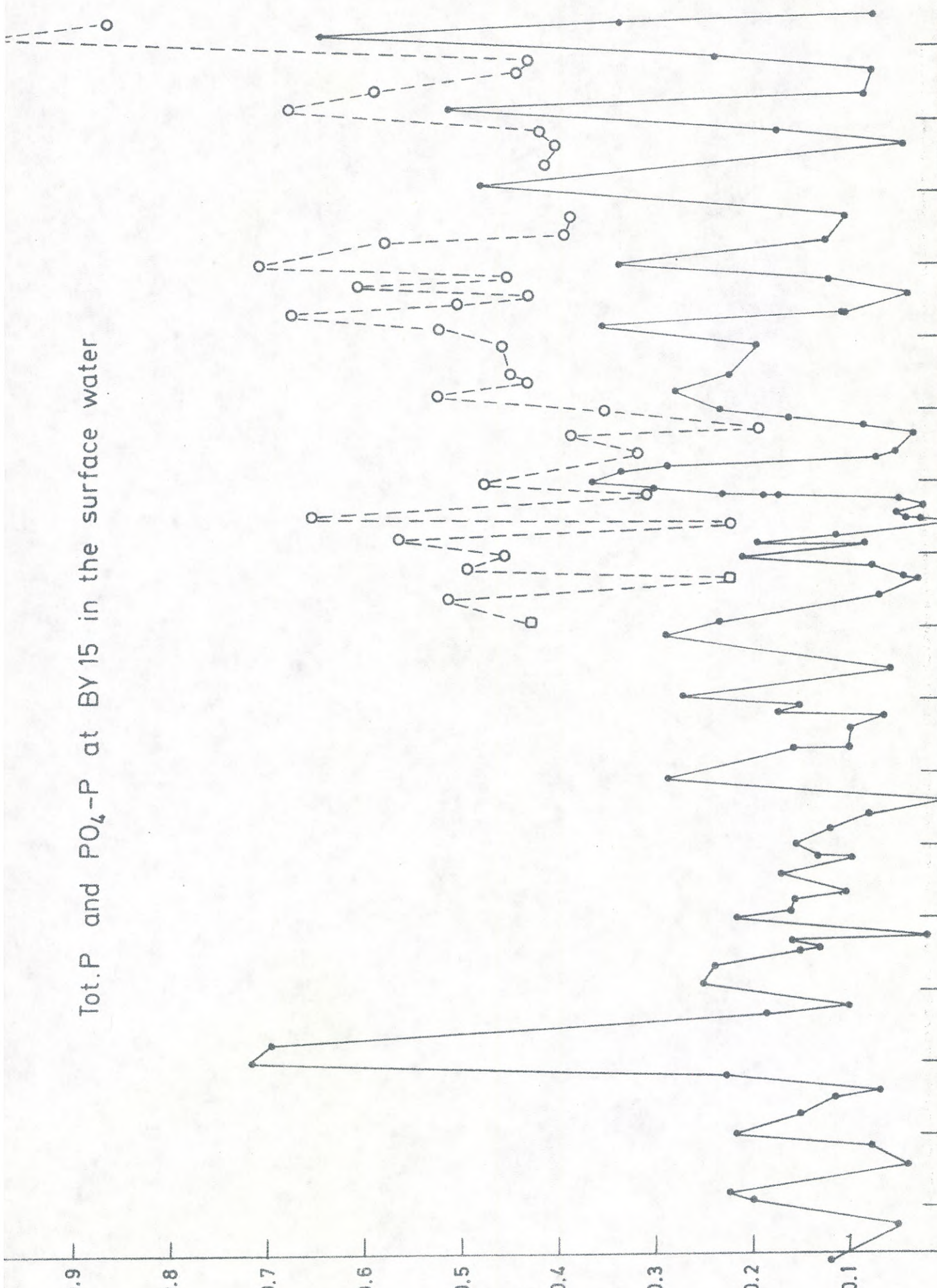
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Fig. 1

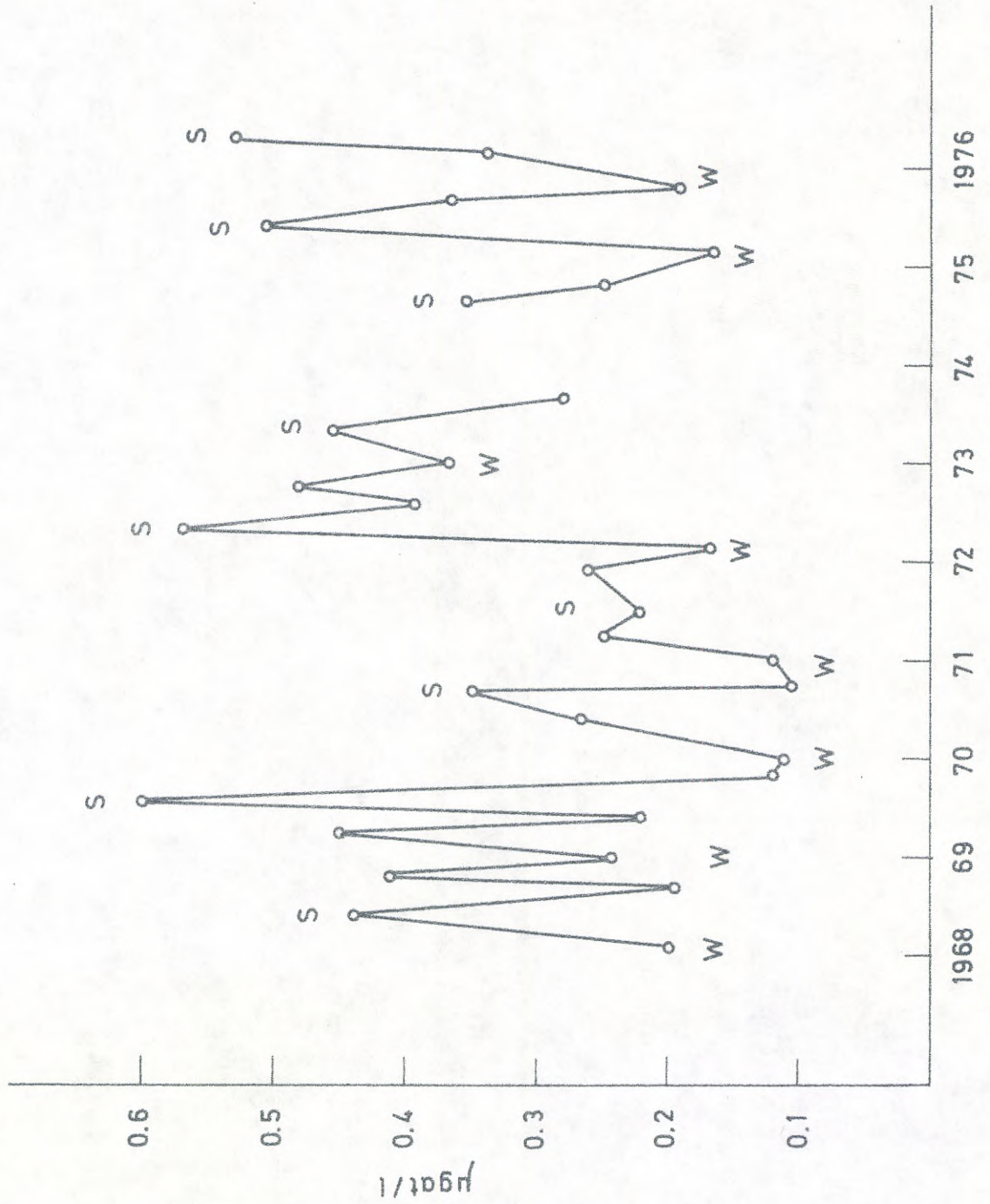
Tot.P and PO₄-P at BY 15 in the surface water

0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
µgat/l

Year
1960
61
62
63
64
65
66
67
68
69
1970
71
72
73
74
75
76



Organic P (Tot. P-PO₄-P) at BY15 in the surface water



Surface mean values of the phosphorus components in a section through the Baltic from BY 2 over the Gotland Deep to BY 25 in March 1975 and 1976

- Tot. P 1976
- " 1975
- △ PO₄-P 1976
- " 1975
- + Org. P 1976
- x " 1975

