

Characteristic changes in the hydrological and hydro-chemical
conditions of the Central Baltic in 1961

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During 1961 investigations were carried out in the central part of the Baltic Sea in February, May, August and October. Temperature, salinity, content of dissolved oxygen and inorganic phosphorus were determined.

The main feature of the hydrological regime of the central Baltic in 1961 was a powerful inflow of North Sea waters of high salinity which reached the central part of the Gotland Deep by the middle of the year.

The intensity of the inflow of water from Kattegat can be judged from a sudden change of the hydrological and hydrochemical conditions which took place in the central Baltic within a very short period between May and August.

An increase of salinity at the bottom in comparison with February (by 1.10 ‰ from 12.11 ‰ in February to 13.21 ‰ in May) was observed in the southern part of the Gotland Deep (St. 6) though on stations 8 and 9 salinity remained almost unchanged. On station 8 maximum increase of salinity at the bottom was observed in August (salinity 0.52 ‰ higher than in May) and on station 9 in October.

In October salinity in the centre of the Gotland Deep (St. 8) decreased somewhat in comparison with August whereas on stations situated northward salinity continued to increase, which permits to draw a conclusion as to a short duration of transport of saline water mass through the Central Baltic.

It must be underlined that such an abrupt increase of salinity of the whole water layer in the centre of the Gotland Deep within so short a period of time (May-August) has been registered for the first time in the history of the investigations that were carried out in the Baltic Sea since 1902. Mean salinity values throughout the water column in this area of the sea in August 1962 were close to extreme.

Mean value of the salinity of the water column in the Gotland Deep from the surface to a depth of 200 m for the period from 1902 till 1954 equals 9.77 ‰. The highest salinity value registered in the layer during this period was 10.75 ‰ in the year of 1948. In August 1961 the average salinity of the 0-200 m layer was 10.69 ‰.

The inflow of a great amount of water from the southwest Baltic has entirely changed the oxygen conditions in the central part of the sea. Whereas in February 1961 no oxygen was found in this area at a depth of 180 m to the bottom, in August the average oxygen content in the respective layer was 165 µg.-atom/l which amounts to 21% of saturation. In February and May the water layer below 180 m was contaminated by hydrogen sulphide. In August hydrogen sulphide was not found in any of the localities of the sea covered by our investigations.

Less favourable oxygen conditions remained in the second half of 1961 only north of the Gotland Deep. Here the content of oxygen at the bottom varied within the range of 18 to 45 µg.-atom/l.

In 1960 when detailing the results of investigations on the oxygen content in the Central Baltic Sea an intermediate layer of oxygen minimum was registered at a depth of 80 to 100 m. In 1961 it was found that this layer spreads over the whole water area of the Gotland Deep and northward at depths from 75 m to 110 m.

During 1961 great changes were also observed in distribution of mineral phosphorus in the deep layer. In the Gotland Deep (st. 8) the content of phosphorus in February and May in the water layer 180 m to 230 m was approximately the same, namely about 5.2 $\mu\text{g.}-\text{atom}/\text{l}$. In August the content of phosphorus in the same layer dropped to 1.94 $\mu\text{g.}-\text{atom}/\text{l}$ which is in perfect agreement with the change of chlorinity, and appearance of oxygen in the near-bottom layer and is explained by the influx of "new" water into the deep layer of the Central Baltic. In October the phosphorus content had not changed in comparison with August.

In the "active" layer of the sea (0-60 m) usual seasonal fluctuations were observed in mineral phosphorus content, i.e., from winter maximum in February (0.19-0.29 $\mu\text{g.}-\text{atom}/\text{l}$) it decreased (as a result of spring development of phytoplankton through May to a maximum depletion in the vegetative period in October (0.13-0.19 $\mu\text{g.}-\text{atom}/\text{l}$).

Since the water exchange between the Baltic Sea and Kattegat through the Danish sounds serves as one of the principal factors determining the hydrochemical conditions of the deep layers in the Baltic Sea, it is very important for prediction purposes to establish which factors influence the intensity of such water exchange. I.I. Nikolaev on the basis of the available data on river discharge suggested that the inflow of the Kattegat waters into the Baltic Sea decreases in the years of intensified river discharge and increases in the years of low waters. At the same time the volume of river discharge as well as the water exchange through the sounds are known to be dependent on the character of atmospheric circulation in separate years.

Furthermore, penetration of the North Sea waters into the Baltic Sea largely depends on the state of the baric field at a given moment.

A direct influence of wind should certainly not be excluded either, though our investigations during recent two years confirm I.I. Nikolaev's opinion; his forecasts on the changes of hydrological and hydrochemical conditions in the Baltic Sea are supported by our data.