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Expert Group on Monitoring of Radioactive Substances in the Baltic Sea

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Background

This document contains monitoring results on the concentrations of Cs-137 and Sr-90 in seawater, fish and plants in the Polish sector of the Baltic Sea in 2018.

Action

The Meeting is invited to take note of the information.

^{137}Cs and ^{90}Sr in the Polish sector of the Baltic Sea, in 2018

Tamara Zalewska, Michał Saniewski, Anna Apanel

Institute of Meteorology and Water Management - National Research Institute, ul. Waszyngtona 42, 81-342 Gdynia, Poland, e-mail: tamara.zalewska@imgw.pl

Seawater samples were collected in June 2018 during the cruise onboard r/v 'Baltica'. Sampling was carried out at 17 stations located in the southern region of the Baltic Sea (Fig.1 and Fig.2). Samples were taken from surface, bottom (2 m above the seabed) and along water profile at 5 stations. Simultaneously salinity and temperature were measured along sampling profile.

^{137}Cs activity concentration in seawater samples was measured with gamma spectrometry, using an HPGe detector, with a relative efficiency of 40% and a resolution of 1.8 keV for peak of 1332 keV of ^{60}Co. The detector was coupled with an 8192-channel computer analyser and GENIE 2000 software. ^{90}Sr activity concentration was determined by radiochemical method followed by β-radiation measurements of ^{90}Y samples using Low-Level Beta Counter FHT 7700T (ESM Eberline) with the background count rate of 0.01 counts s^{-1} and the minimum detectable activity of 3 mBq per sample.

In 2018, the average concentration of ^{137}Cs in seawater in the Polish part of the Baltic Sea was equal to 19.8 Bq m^{-3} and was slightly higher as compared to the previous year mean concentration (17.2 Bq m^{-3}) – Fig. 3. In 2018, concentrations of ^{137}Cs changed in the range from 13.2 Bq m^{-3} to 27.8 Bq m^{-3}. The lowest ^{137}Cs concentrations in the offshore area were detected, as in the previous years, in the near bottom waters of the Bornholm Basin, as an effect of contribution of less contaminated waters from the North Sea, what was confirmed by higher salinity in deeper layers. The highest concentration of ^{137}Cs was found in the near-bottom water in the Gdańsk Deep.

In 2018, the average activity of ^{90}Sr (calculated as a mean value of all results obtained in the year) specific for the southern Baltic waters was equal to 5.6 Bq m^{-3} (Fig. 3) and was lower of 2.8 Bq m^{-3} than the value found in 2017. Presented values confirm the lack of unambiguous trends in concentrations of ^{90}Sr in seawater, what is the common feature observed since 1997. In general, ^{90}Sr was uniformly distributed in the Polish sector of the Baltic Sea. The lowest concentration of ^{90}Sr (4.3 Bq m^{-3}) was recorded in the bottom waters of the open sea areas: in the Bornholm Basin and in the Slupsk Furrow. The highest concentrations of this isotope (9.5 Bq m^{-3}) was found in the near bottom waters of coastal areas.

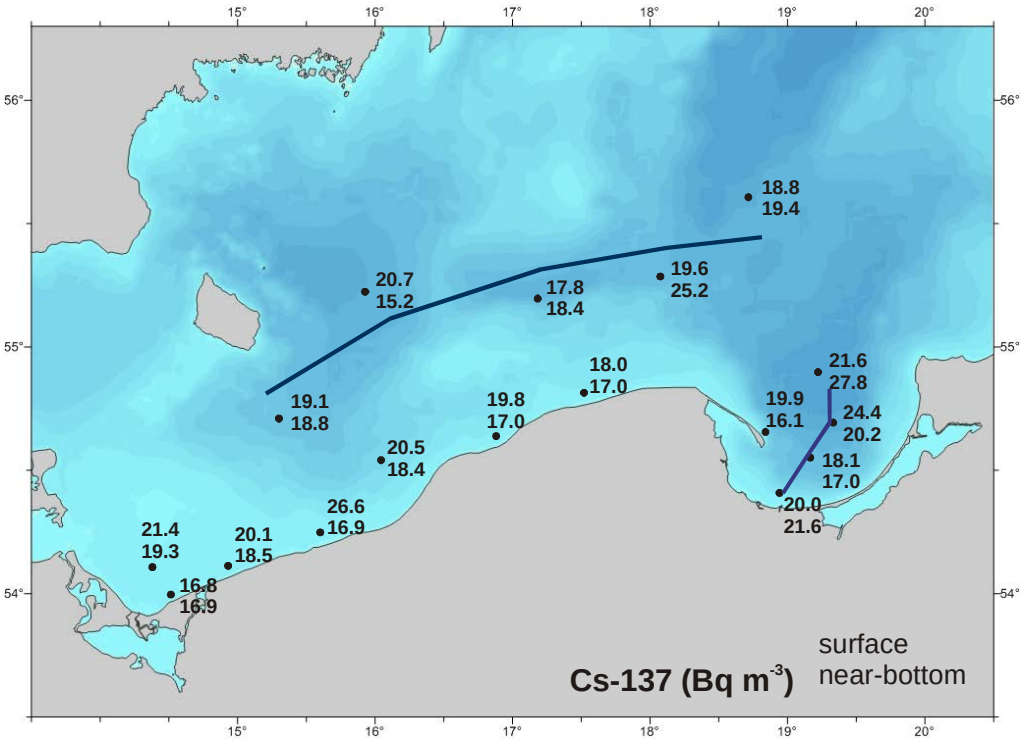

Fig.1 ^{137}Cs activity concentrations in surface and near-bottom water in the Polish sector of the Baltic Sea in 2018 (lines indicate profiles – see Fig. 3)

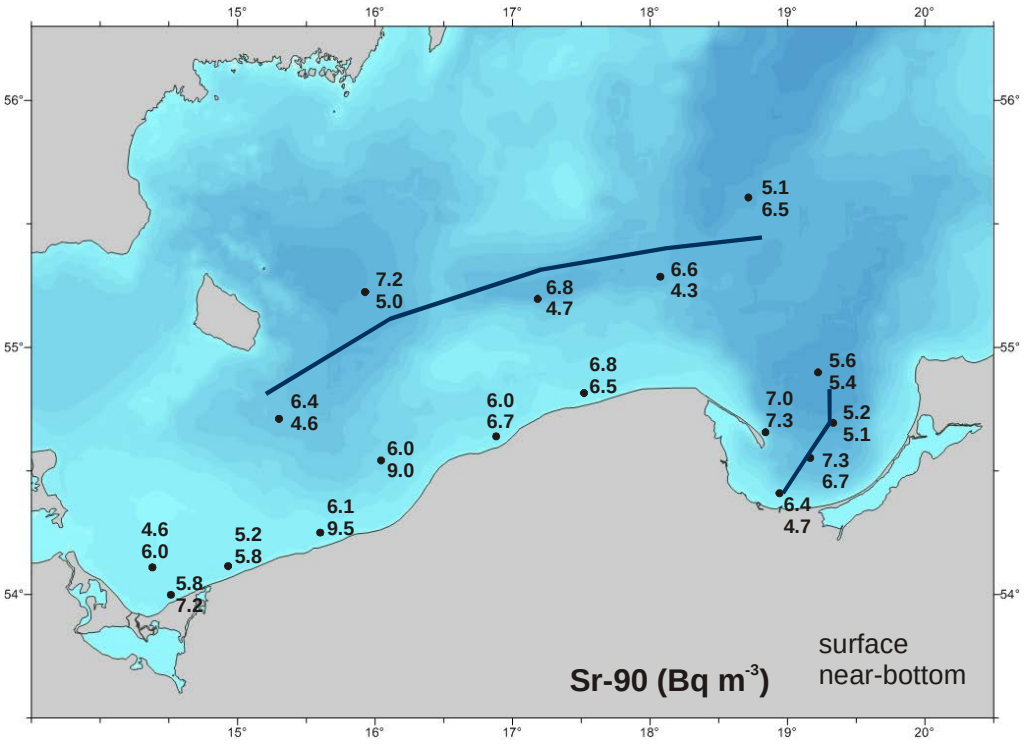

Fig.2 ^{90}Sr activity concentrations in surface and near-bottom water in the Polish sector of the Baltic Sea in 2018, (lines indicate profiles).

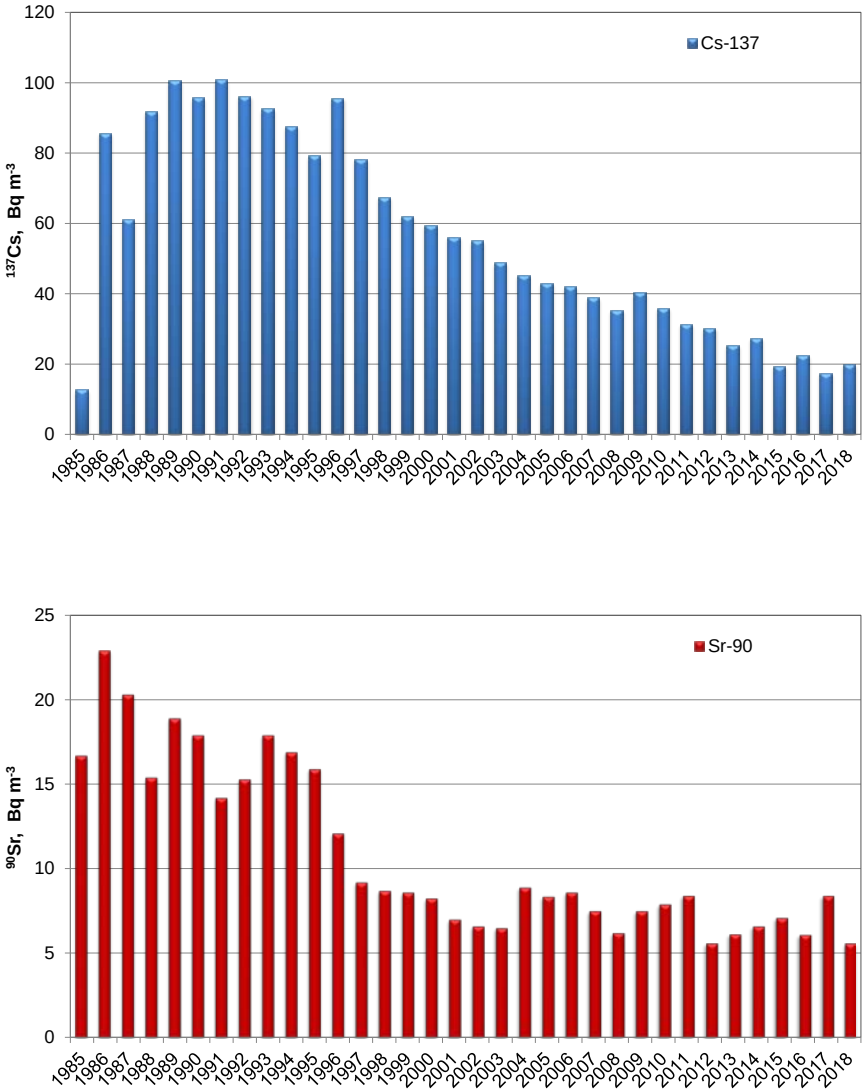

Fig.3 Average activity concentrations of ^{137}Cs and ^{90}Sr in seawater, in the Polish sector of the Baltic Sea in 1985-2018

Changes in ^{137}Cs and ^{90}Sr concentrations and changes in salinity in the water column along two profiles: (i) the Vistula mouth profile and (ii) the open sea profile (Figs. 1 and 2), are presented in the Figures 4 – 6. Similarly to the previous years, in the western areas of the open sea, changes in ^{137}Cs concentrations in the water column were related to the salinity, with higher salinity being accompanied by lower concentrations of the isotope (Figs. 4 and 5). This was particularly evident in the Bornholm Deep area and this is closely related to the fact that the inflowing, more saline waters of the North Sea are characterized by lower concentrations of the discussed isotope. The vertical distribution in the Gdańsk Deep and in the Eastern Gotland Basin was much more even. However, in the Vistula estuary profile in surface waters, the reverse relationship was observed, because water with lower salinity was also characterized by lower concentrations of ^{137}Cs (Figure 4 and 5), which is associated with a significant share of river waters in this region.

In the case of ^{90}Sr, there is no clear relationship between concentrations and salinity and distribution in the water column at the open sea locations was more uniform.

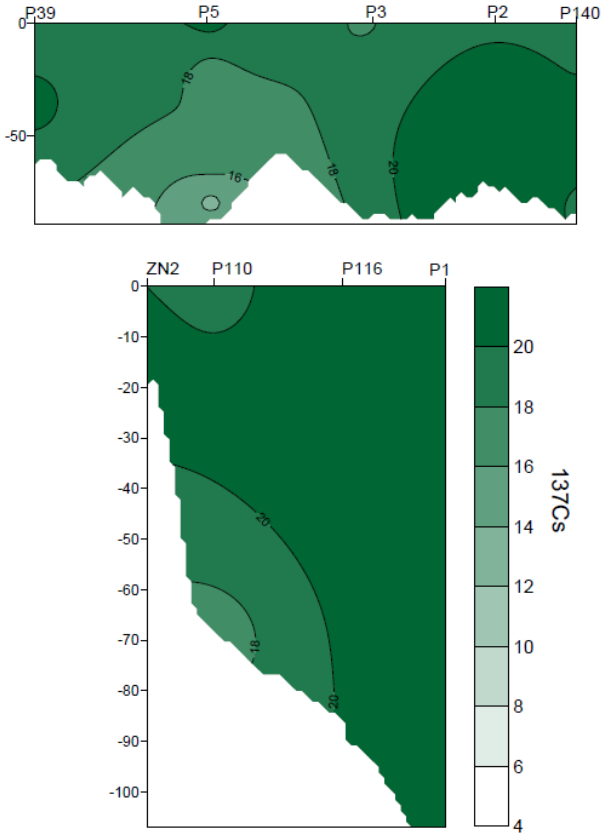

Fig.4 Spatial distribution of ^{137}Cs in seawater in the open sea and Vistula outflow areas in 2018.

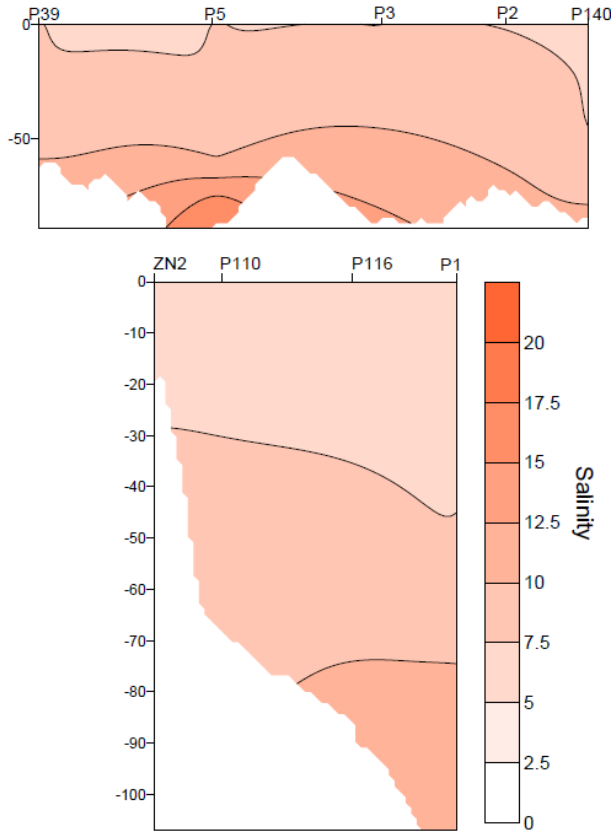

Fig.5 Salinity in the open sea and Vistula outflow areas in 2018.

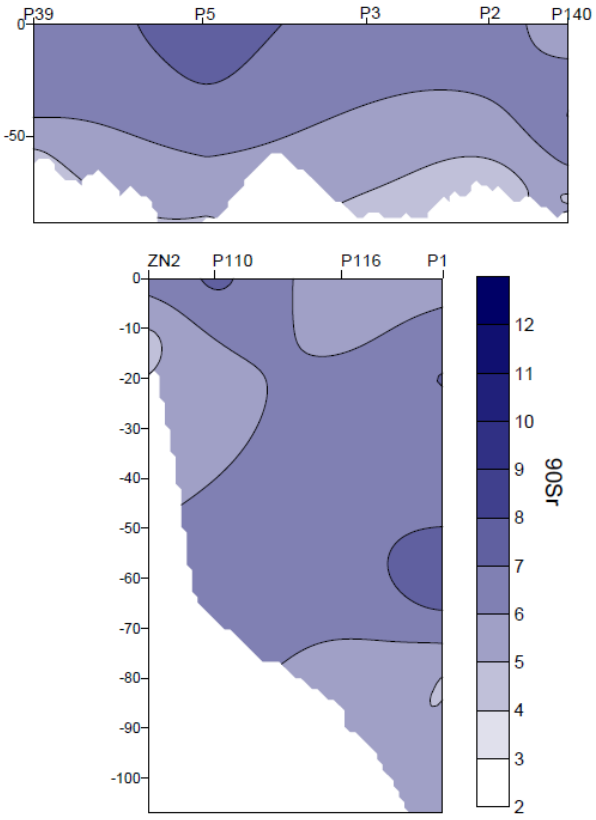

Fig.6 Spatial distribution of ^{90}Sr in seawater in the open sea and Vistula outflow areas in 2018.

In 2018, concentrations of ^{137}Cs in perch from the Szczecin Lagoon varied within a range, from 2.2 to 4.9 Bq kg^{-1} w.w in the case of females and from 1.6 to 7.7 Bq kg^{-1} w.w in the case of males (Fig. 7). The mean values were similar: 2.8 Bq kg^{-1} w.w. - females and 3.2 Bq kg^{-1} w.w. - males and were visibly lower than observed in the previous year: 7.2 Bq kg^{-1} w.w. and 6.2 Bq kg^{-1} w.w. In the Vistula Lagoon, the concentrations of ^{137}Cs remained at lower levels, the average values were respectively 1.4 Bq kg^{-1} w.w. (female) and 1.1 Bq kg^{-1} w.w. (male) and were lower than the values observed in the previous year: 2.2 Bq kg^{-1} w.w. (female) and 2.5 Bq kg^{-1} w.w. (males).

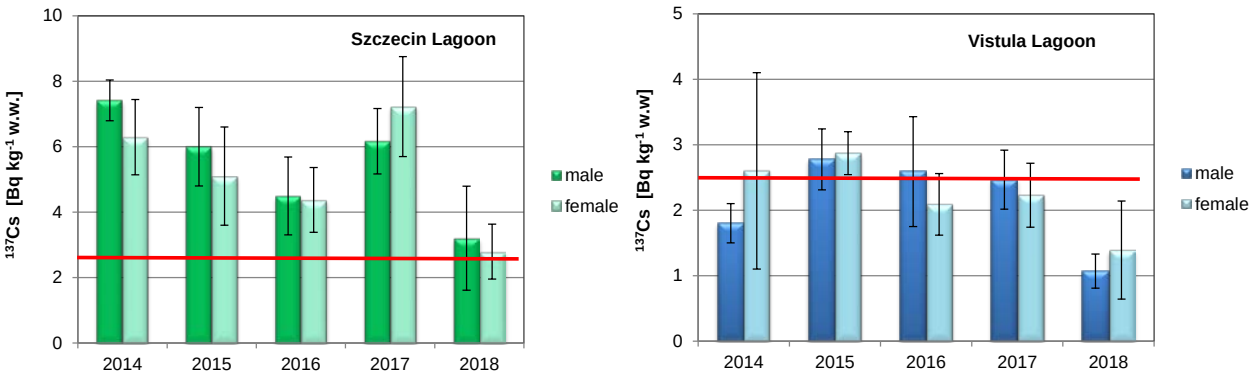

Fig. 7 Concentrations of ^{137}Cs in perch (*Perca fluviatilis*) in the Szczecin Lagoon and Vistula Lagoon in 2014-2018.

The mean concentrations of ^{137}Cs in macrophytobentic plants sampled in June and September 2018 in the Gulf of Gdańsk stayed in the range from 2.7 Bq kg^{-1} d.w. in *Furcellaria lumbricalis* to 8.4 Bq kg^{-1} d.w. in *Verterbrata fucoides* both representing red algae. The highest concentrations in these species were found in coastal waters of the Bornholm Basin (22.1 Bq kg^{-1} d.w. – *V. fucoides*) and in Slupsk Furrow (22.5 Bq kg^{-1} d.w. in *F. lumbricalis*). In vascular plants mean concentrations were equal to 3.3 Bq kg^{-1} d.w. in *Zanichellia palustris*, 2.9 Bq kg^{-1} d.w. in *Stuckenia pectinate* and 4.4 Bq kg^{-1} d.w. in *Zostera marina*.

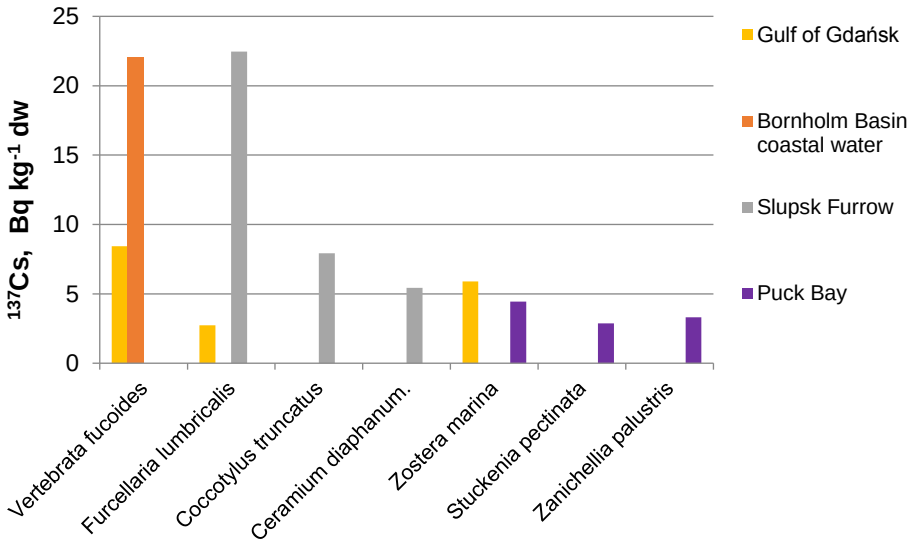

Fig. 7 Concentrations of ^{137}Cs in macrophytobentic plants in 2018.