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241Pu in the southern Baltic Sea ecosystem

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Most contamination studies have focused on alpha emitting plutonium isotopes so far. ^{241}Pu is less important in terms of its radiotoxicity than the α -emitting plutonium radionuclides $^{238,239,240}\text{Pu}$ but is quite significant because of its huge contribution to the whole plutonium fallout. Our previous experiments on air samples indicated extreme increase of ^{241}Pu amount in atmospheric dust in April 1986. The available information about the bioaccumulation and distribution of ^{241}Pu in the Baltic Sea ecosystem and Poland territory is still very limited. The main purpose of the present work was to complete the present knowledge and estimate the further levels of the Baltic Sea environment contamination.

The highest total ^{241}Pu concentration in seawater was found in the Slupsk Bank ($3.35 \pm 0.17 \text{ mBq}\cdot\text{dm}^{-3}$) and this area had the highest concentration of ^{241}Pu connected to suspended matter as well ($1.94 \pm 0.12 \text{ mBq}\cdot\text{dm}^{-3}$). High concentrations of ^{241}Pu in the central part of the southern Baltic Sea can be a result of Baltic water circulation.

The ^{241}Pu activity in phytoplankton sample from the Pomeranian Bay was $1.06 \pm 0.09 \text{ mBq}\cdot\text{g}^{-1} \text{ dw}$. Within zooplankton samples the highest ^{241}Pu activity was found in samples from the central part of the southern Baltic ($2.66 \pm 0.16 \text{ mBq}\cdot\text{g}^{-1} \text{ dw}$) and from the Gdańsk Deep ($2.64 \pm 0.70 \text{ mBq}\cdot\text{g}^{-1} \text{ dw}$). In zooplankton samples, similar situation to seawater samples was noticed –the highest concentrations of ^{241}Pu were found in the central part of the southern Baltic Sea, and similarly to seawater it could be a result of Baltic water circulation. Generally the data show significant differences in ^{241}Pu concentrations among all the species examined. The highest values of ^{241}Pu activities for whole organism were found in fish from Perciformes: benthic round goby ($0.863 \pm 0.066 \text{ mBq}\cdot\text{g}^{-1} \text{ ww}$) and pelagic perch ($0.666 \pm 0.001 \text{ mBq}\cdot\text{g}^{-1} \text{ ww}$). The lowest ^{241}Pu activity was found in flounder ($0.104 \pm 0.009 \text{ mBq}\cdot\text{g}^{-1} \text{ ww}$). The plutonium was also non-uniformly distributed between the organs and tissues of the analyzed fish, especially pelagic herring and cod as well as benthic flounder.

In sediments, the highest amount of plutonium was found in the middle parts of all analyzed sediments and came from the global atmospheric fallout from nuclear tests in 1958-61. The distribution of ^{241}Pu in analyzed sediments samples was not uniform and depended on the sediment geomorphology and depth as well as on its location.

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