



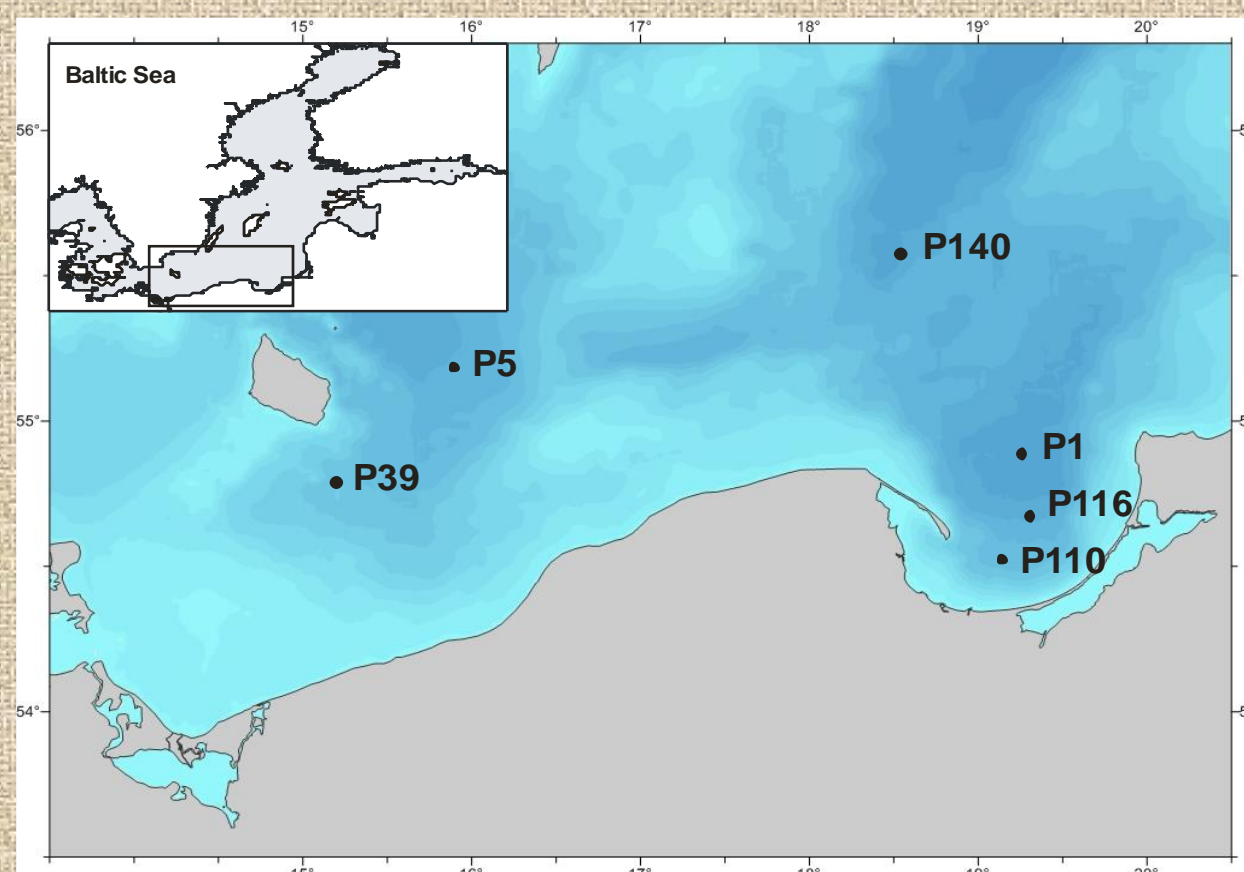
Monitoring of radioactive contamination of southern Baltic Sea in 2016-2018

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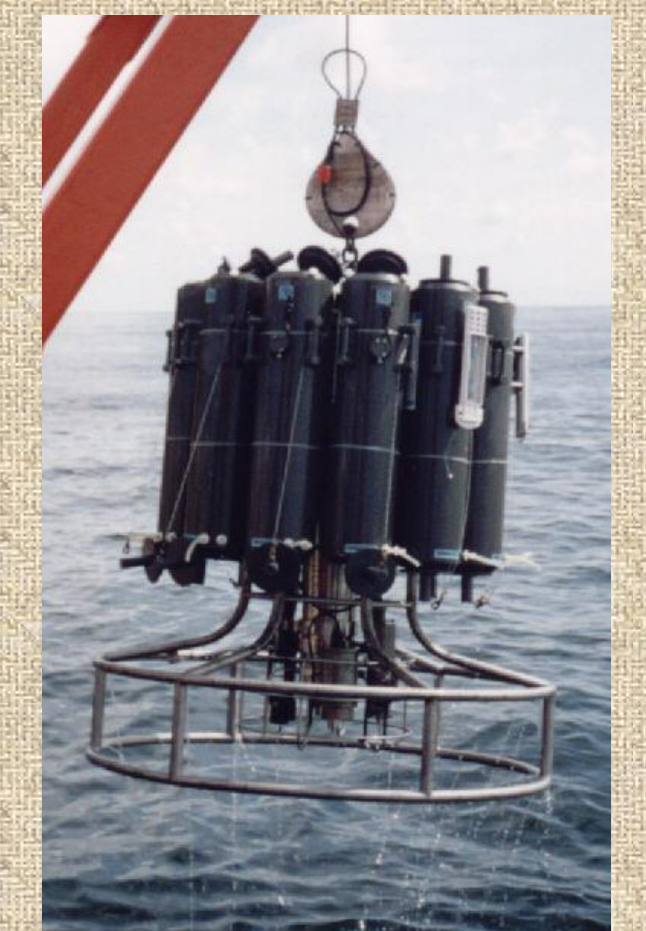
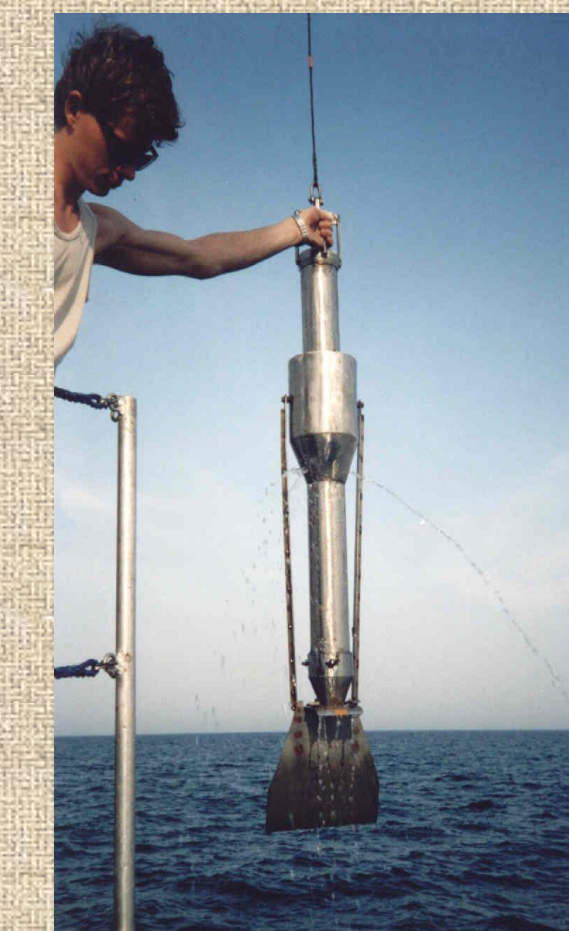
Central Laboratory for Radiological Protection have performed regular observations on radioactive contamination of southern Baltic Sea environment since 1986. Studies are coordinated by Helsinki Commission.

Current research includes determination of ^{137}Cs , ^{238}Pu , $^{239,240}\text{Pu}$ in bottom sediments, ^{137}Cs , ^{40}K , ^{226}Ra and ^3H in water and ^{137}Cs in fish.



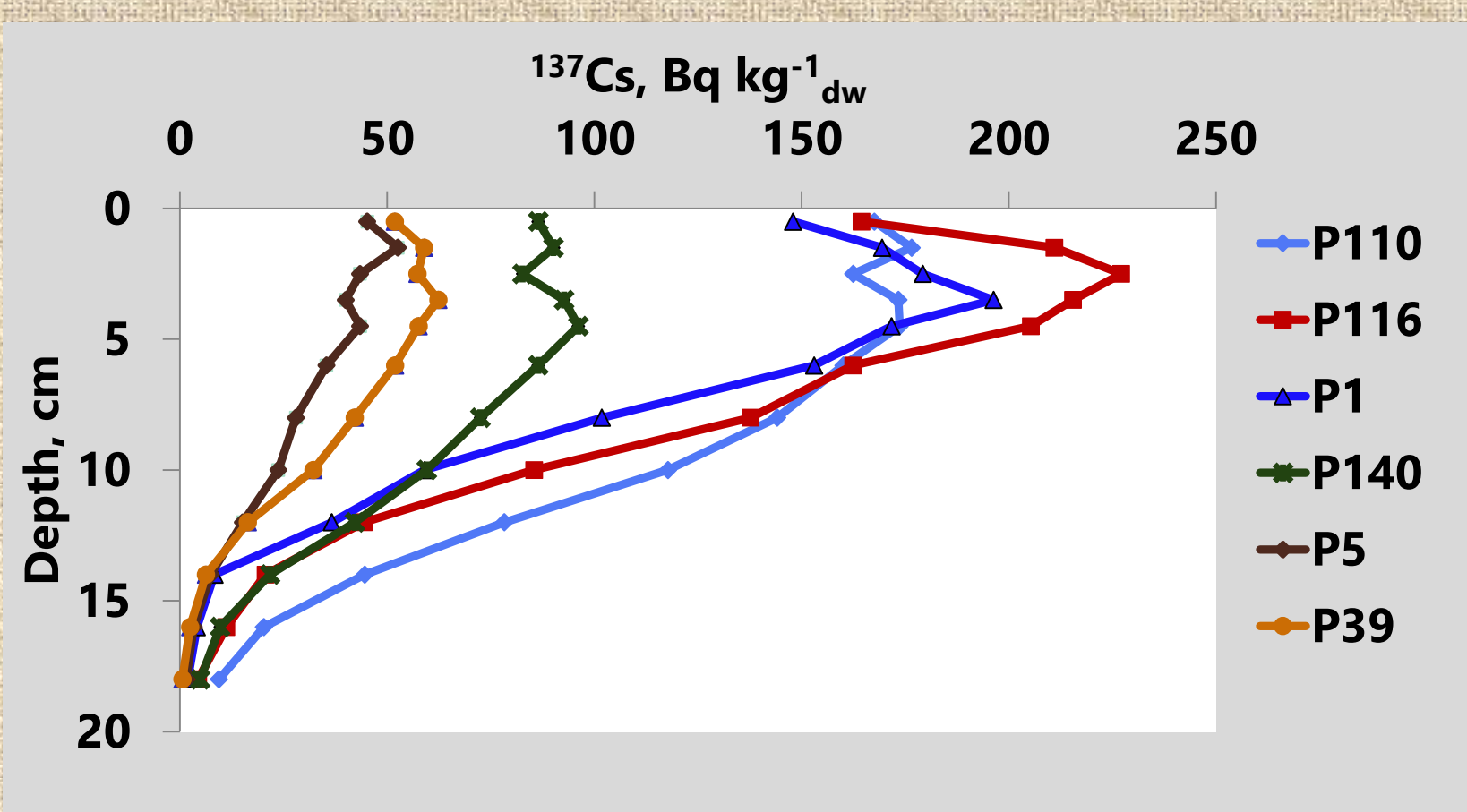
Sediment core samples and water samples were taken during the sampling cruises with r/v "Baltica" in permanently selected six sampling stations located in the Gdańsk Basin (3), Gotland Basin (1) and Bornholm Basin (2).

Radioactive contaminations of bottom sediments in the southern Baltic Sea were uneven. The concentration of ^{137}Cs and plutonium isotopes were higher in the Gdansk Basin than in the Bornholm Basin.

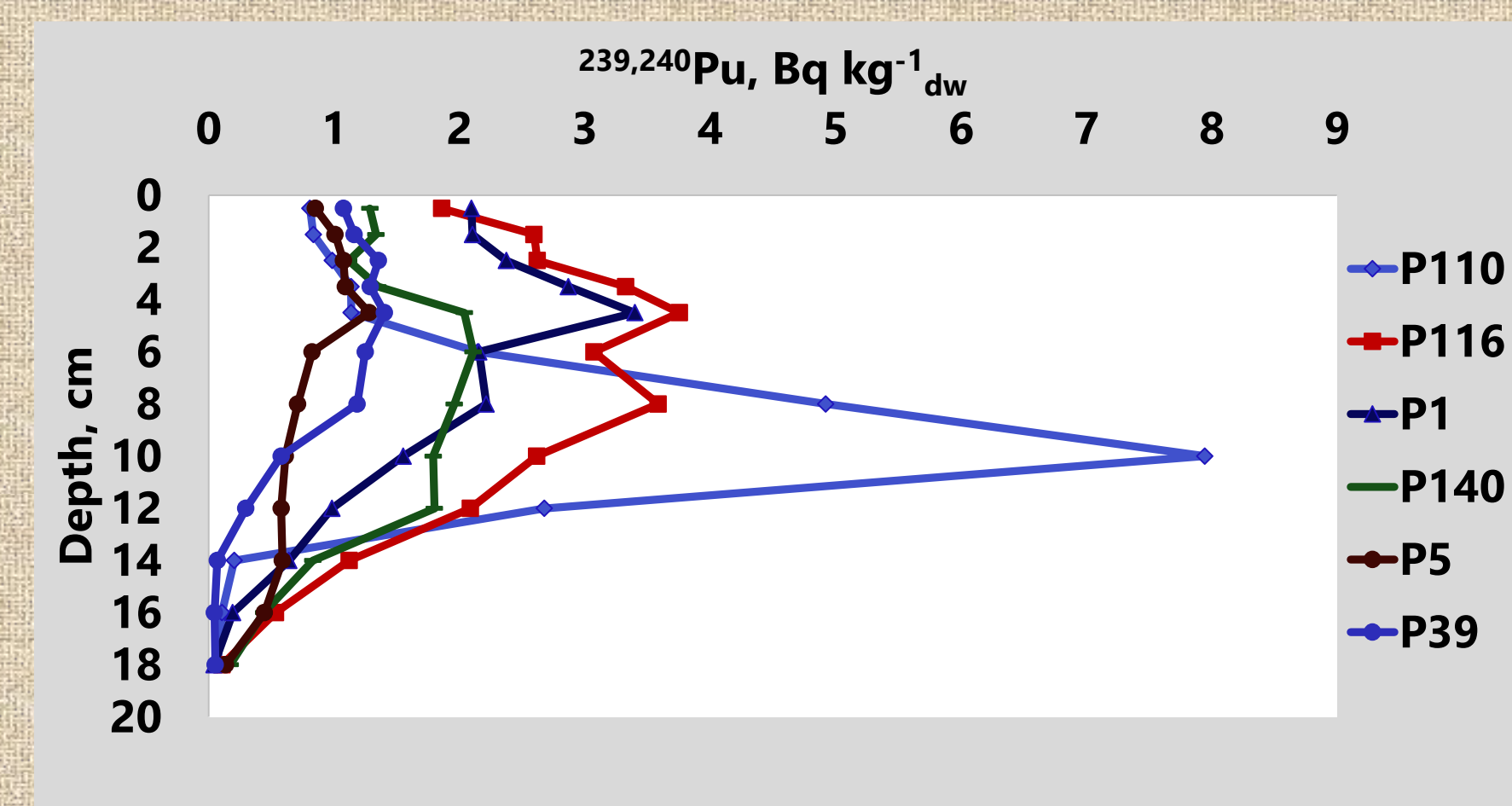


Sampling stations of bottom sediments and water samples

Sampling equipment for bottom sediment and water samples



The vertical distributions ^{137}Cs activity show that the highest concentrations were found in the upper sediment layers. In the Gulf of Gdansk reached up to $227 \text{ Bq kg}^{-1}_{\text{dw}}$ in 2018 while in Bornholm Deep it was $52.5 \text{ Bq kg}^{-1}_{\text{dw}}$.



Higher concentrations of plutonium isotopes were observed in deeper layers. The highest concentration of $^{239,240}\text{Pu}$ were found in Gulf of Gdansk - $7.9 \text{ Bq kg}^{-1}_{\text{dw}}$ while in Bornholm Deep it was $1.1 \text{ Bq kg}^{-1}_{\text{dw}}$.

Figure 1. Vertical distribution of ^{137}Cs in bottom sediments

Figure 2. Vertical distribution of $^{239,240}\text{Pu}$ in bottom sediments

In the water samples activity concentrations of ^{137}Cs in 2018 were in the range of $18.0 \div 31.6 \text{ Bq m}^{-3}$.

The smallest value was determined in the nearbottom waters in Bornholm Deep and accompanied by the highest salinity. This characteristic is directly related to the impact of highly saline water from the North Sea that have lower concentrations of ^{137}Cs . In most locations' concentration of ^{137}Cs in surface waters was higher than in near bottom waters, which is in accordance with the long-term trend.

Activity concentrations of ^3H in surface and nearbottom water were 3.1 kBq m^{-3} and 2.4 kBq m^{-3} , respectively. 2018

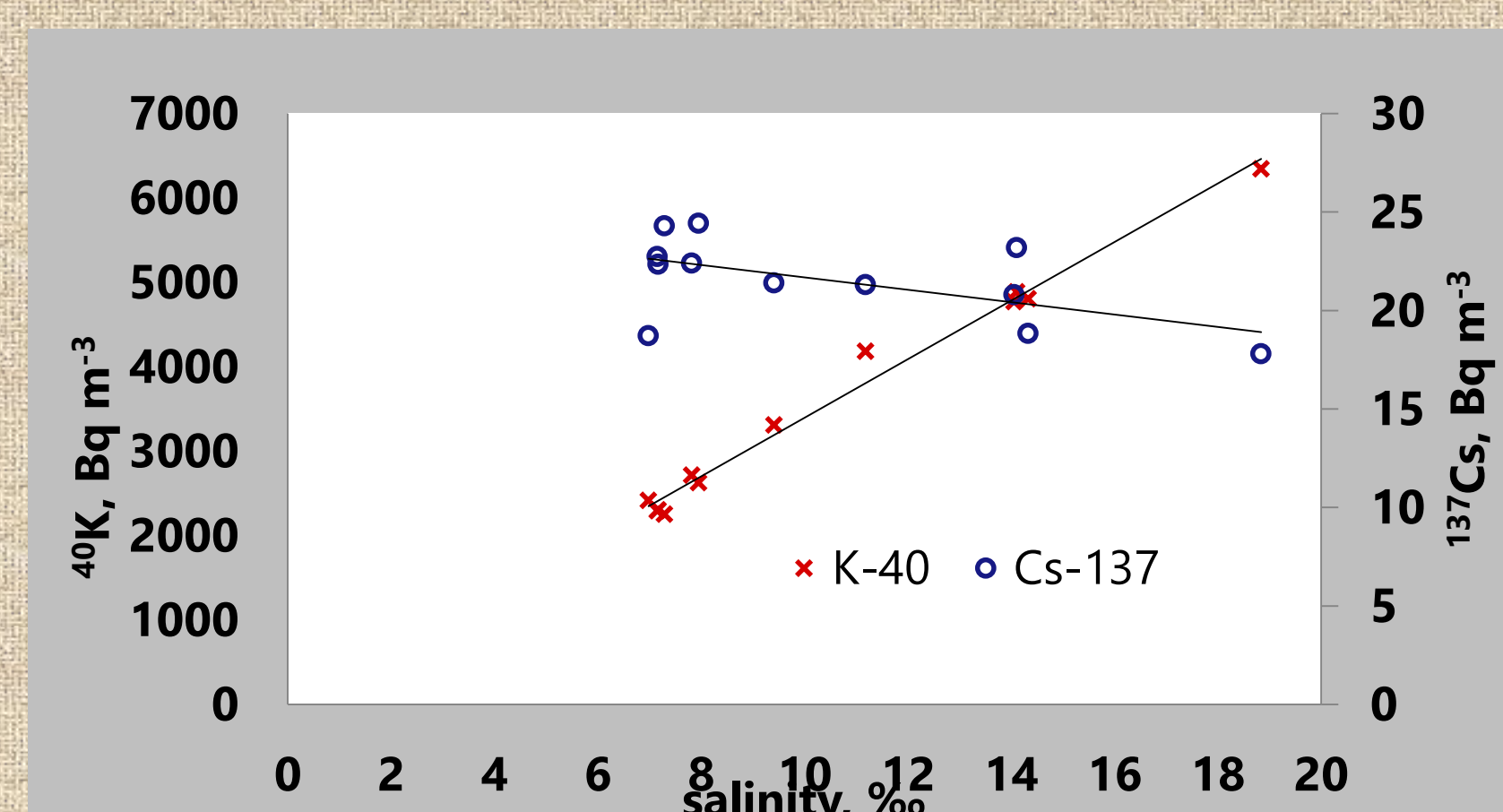


Figure 3. Activity concentration of ^{137}Cs and ^{40}K in Baltic Sea water in function of water slinity, 2016

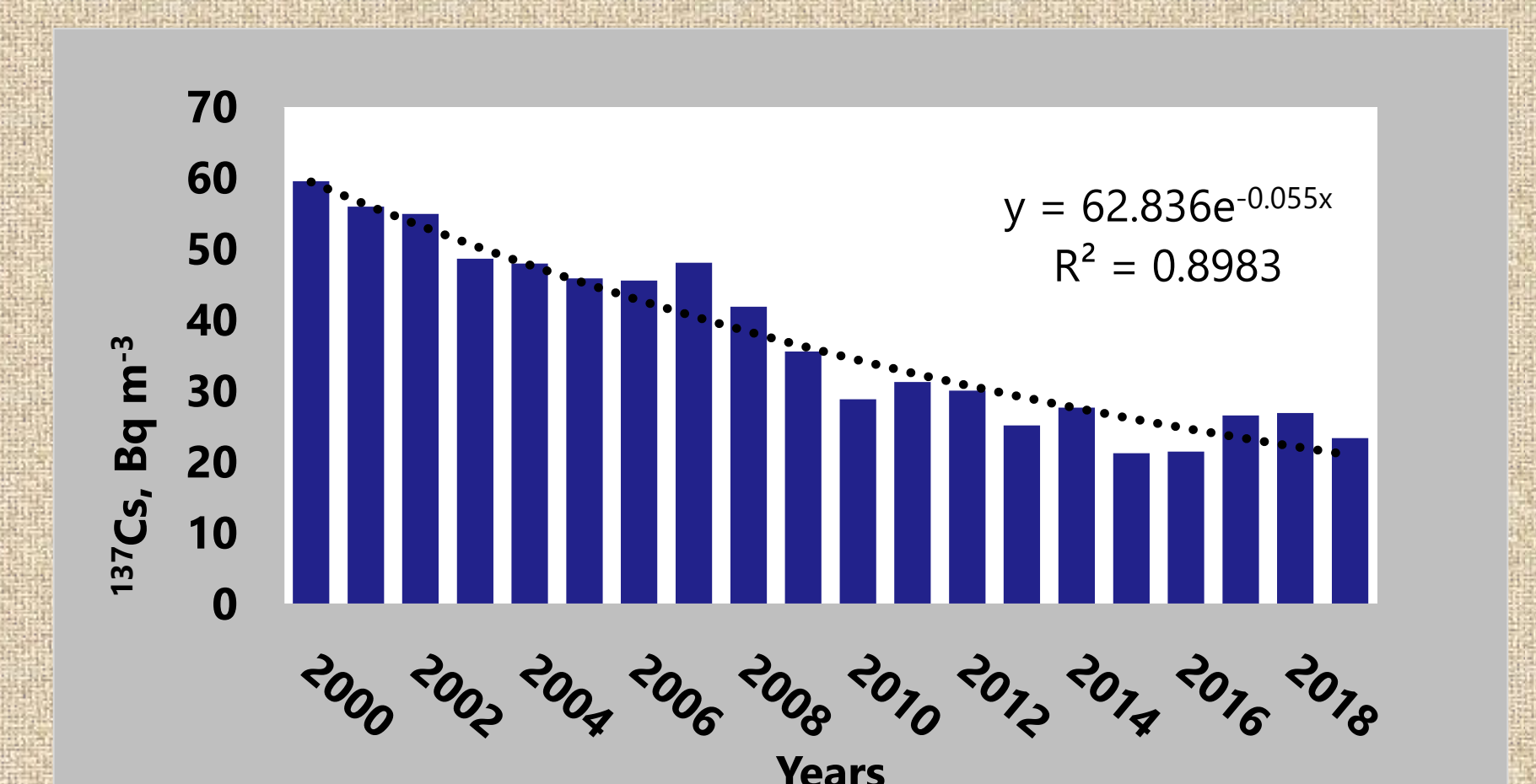


Figure 4. Average activity concentration of ^{137}Cs in Baltic Sea surface water 2000-2018

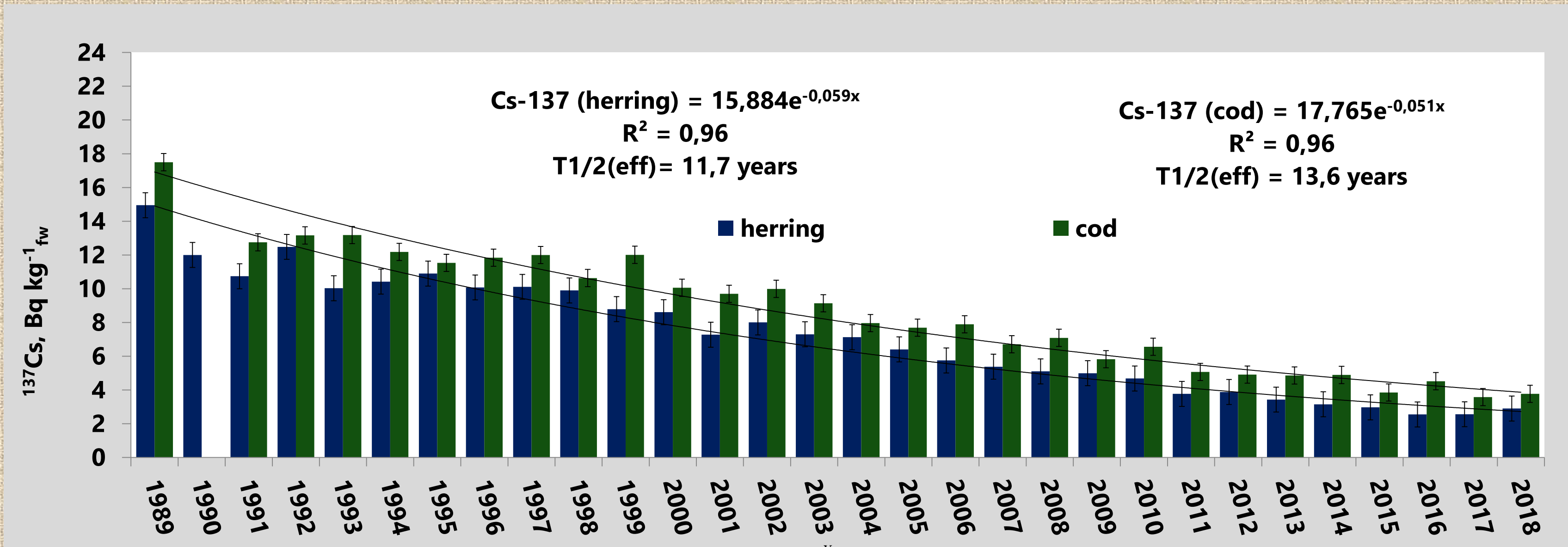


Figure 5. Decreasing trends in activity concentration of ^{137}Cs in the Baltic Sea fish

Years of research indicate a continuous decrease of ^{137}Cs both in water and Baltic Sea fish, which confirms that there are no new significant sources of radioactive contamination in the southern Baltic Sea.

Vertical distributions of ^{137}Cs and $^{239,240}\text{Pu}$ in the bottom sediments as well as knowledge of sedimentation rates show the changes of radioactive contaminations in the marine environment over time and may indicate sources of pollution.

Samples of fish (cod, herring, sprat and plaice) came from the Gdansk Bay, the Gdansk Basin and the Bornholm Basin.

The highest concentrations of ^{137}Cs were found in cod and the lowest in herring. In 2018 it was $3.77 \pm 0.48 \text{ Bq kg}^{-1}_{\text{ww}}$ and $2.85 \pm 0.28 \text{ Bq kg}^{-1}_{\text{ww}}$, respectively.

Average ^{137}Cs concentration calculated for above mentioned species in 2018 was $3.10 \pm 0.46 \text{ Bq kg}^{-1}_{\text{ww}}$, being almost five times lower comparing to the maximum recorded in 1989.