EFFECTS OF RADIATION ON THE HEALTH OF FISH FROM CHERNOBYL

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Abstract

Fish are considered as the most radiosensitive aquatic species and have been highly exposed in freshwater systems at Chernobyl, and in both freshwater and marine systems at Fukushima. Although the biological effects of acute exposure to radiation have been extensively studied, little is known about the effect of long-term chronic exposure of organisms exposed in the natural environment.

A few studies have highlighted some anomalies in the reproductive system of fish after several generations post-accident (over two decades), despite the continuing decrease of ^{137}Cs specific activity. However, the data, whilst informative, were qualitative and quantification of the observed effects is still lacking. At the molecular level, it is well established that ionising radiation induces DNA damage, but only a few studies have investigated DNA damage in relation to radionuclides in the environment.

In the present work, we wanted to assess whether three decades of direct and multi-generational exposure to radiation from the Chernobyl accident was significantly affecting the genetic material and the reproductive system of freshwater fishes in their natural environment. Perch (*Perca fluviatilis*) and roach (*Rutilus rutilus*) were collected from 7 lakes located inside and outside the Chernobyl Exclusion Zone (CEZ) that represent a gradient of contamination.

The results revealed that fish from the CEZ are still highly contaminated with ^{137}Cs and ^{90}Sr. A biomagnification phenomenon was observed for ^{137}Cs with an activity concentration 2-3 times higher in perch than in roach. ^{90}Sr activity concentrations were similar between the two species and a gradient of activity was observed as follows: Glubokoye > Yanovsky > Cooling Pond. The general health condition of the fish, assessed by the presence of external and internal sign of disease and calculation of the index conditions, didn't significantly vary between fish from control and contaminated lakes. The micronucleus test, reflecting the loss of genetic material from the nucleus of blood cells, didn't reveal any damage in contaminated fish. Finally, the histological analyses of the female reproductive system demonstrated a significant difference between the maturation stage of the gonads of perch and roach. Female perch from lakes inside the CEZ displayed a higher proportion of immature eggs than fish from reference or low contaminated lakes and this is more pronounced than for the roach.

As a whole, our work highlights that, 30 years after the accident, the fish are in good general health condition, however, the exposure levels are still considerable and significant effects on the reproductive system especially in perch are evident.

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