

Rooks as possible bioindicators of radioactive contamination in the vicinity of the Mayak facility

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The region surrounding the Mayak facility was the site of three major radioactive events: the release of radioactive waste into the Techa River (1949–1956), the Kyshtym disaster (1957), and the dispersal of radioactive dust from the drying Lake Karachay (1967). Between 1949 and 1956, the Mayak facility released approximately 76 million m³ of liquid radioactive waste containing over 100 PBq of Sr-90, along with significant quantities of Cs-137, Ce-144, and Pu-239. The Kyshtym disaster, caused by an explosion in a high-level waste storage tank, released about 740 PBq of radioactivity. Contamination extended across 23 000 km², with the East Ural Radioactive Trace (EURT) marking the most heavily affected area. In 1967, radioactive dust from Lake Karachay contaminated an additional 1800 km². The persistent presence of radionuclides such as Sr-90, Cs-137, Am-241, and Pu isotopes continues to pose environmental and health risks.

Birds are recognized bioaccumulators and serve as effective biomonitors of environmental contamination, including radioactive pollutants. Migratory birds are particularly valuable in this context due to their ability to transport contaminants over long distances. The accumulation of trace elements such as radionuclides in avian tissues is influenced by ecological, physiological, and behavioral factors, as well as environmental exposure routes. Certain species may be especially suitable for bioindication due to their ecology and exposure profiles. This research investigates the use of two migratory omnivorous corvids: Rook (*Corvus frugilegus*) and Jackdaw (*Corvus monedula*) as possible bioindicators of radioactive contamination. Rooks wintering in Poland are known to partially nest in the southern Ural region, an area severely affected by historical nuclear contamination. Simultaneously utilizing the jackdaw as a reference sample due to its different migration range and habitat preferences. Analyses are focused on soft tissues, bones, and feathers. Given the ecology, diet, and synanthropic behavior of corvids, they are exceptionally well-suited for studying radionuclide bioaccumulation and long-range transport. This study are employed gamma spectrometry, beta spectrometry (LSC), alpha spectrometry, and radiochemical methods to quantitatively determine the levels of radionuclides such as Cs-137, Sr-90, Am-241, uranium isotopes, plutonium isotopes, and other short-lived gamma emitters.

The research will involve only Rook and Jackdaw individuals that died from natural causes or circumstances independent of the researchers (e.g., roadkill, choking on plastic wrap, winter starvation). The project team holds a valid permit issued by the General Directorate for Environmental Protection, authorizing the collection, storage, transportation, and preparation of deceased specimens of these species within the Małopolskie, Podkarpackie, and Lubelskie voivodeships. The project addresses a key gap in current research: the lack of comprehensive studies on migratory birds as vectors of transboundary radionuclide movement. It will provide novel insights into the effectiveness of avian biomonitoring in post-nuclear contamination zones.