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Ecological half-life of ^{137}Cs in fungi in Pasvik

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Introduction

Radiocaesium in mushrooms have been monitored in Norway since the Chernobyl-accident in 1986. As most of the radiocaesium in Finnmark stems from the nuclear bomb-tests in the 1950's and -60's, rather than the Chernobyl disaster, Finnmark is a good starting point for looking into long-term effects of fallout.
The level of ^{137}Cs in the fungi sampled from 2001 - 2010 varied from one year to the next, and from one specie to the other with Red-banded Cortinarius (C. armillatus) containing the highest levels of ^{137}Cs, and Birch Bolete (Leccinum) containing the lowest levels.

Sampling procedure

All samples were collected in the area of Strand in Sør-Varanger municipality, Finnmark County, Norway (red dot in fig. 1). Samples were collected by species, and all parts of the mushrooms above ground were collected (stem and cap, including gills). The different species were divided into 200 g samples, consisting of a homogeneously mix of stem, cap and gills, in the laboratory and placed in measurement beakers (ø: 100 mm, h: 28 mm).

Fig. 1: Map over Barents region (area of Strand in red)


Pic. 1: Sample collection (photo by Martin Blom)


Pic. 2: Mushroom assortment in the laboratory


Pic. 3: 3" NaI detector used for fresh samples

Measurement procedure

All samples were measured on a 3 inch NaI-detector (1024 channels), an energy-window (516 - 721 keV) was set to identify 137Cs in the samples. The detector was preset to register 6 000 counts within the energy-window to ensure satisfactory confidence level and statistical uncertainty for 137Cs in each sample. Total measurement uncertainty for the applied method is ± 10% (Bq/kg) at a 95% confidence level.

Results

When comparing the results from the four species of fungi to the right (figs. 2 – 5), an expected trend of decrease in 137Cs in the fungi is apparent for all but Lactarius rufus (Roufus Milkcap or Red Hot Milk Cap).
The growth season for fungi is influenced by a range of factors, including, but not limited to; precipitation, temperature, canopy, sun-hours etc., resulting in differences in uptake of 137Cs from one year to the next. Differences in soil properties also influence the uptake of caesium to large extent. These different factors result in a large variance in the level of 137Cs in mushrooms picked within the same time frame and geographical region.
The ecological half-life for L. rufus in this area and period (2001-2010) is actually negative, with an estimated "double-life" of 8.82 years, i.e. an exponential growth over the last 10 years.

Due to these variations, it is difficult to estimate the ecological half-life for fungi based on the data available.

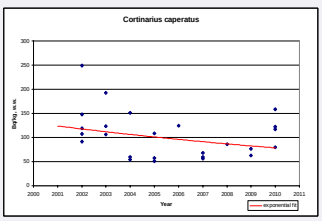

Fig. 2: Radiocaesiumlevels in fresh C. caperatus

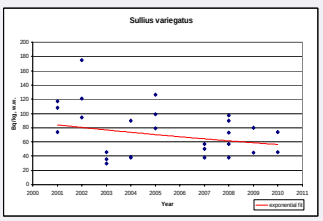

Fig. 3: Radiocaesiumlevels in fresh S. variegatus

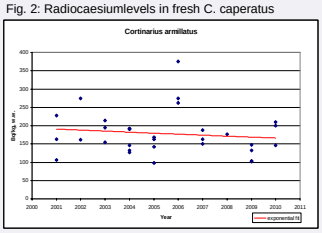

Fig. 4: Radiocaesiumlevels in fresh C. armillatus

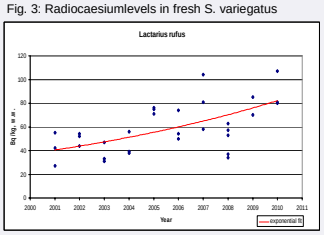

Fig. 5: Radiocaesiumlevels in fresh L. rufus

References: fig. 1: (barents map) from wikipedia user NormanEinstein
picture 2 by Martin Blom, other figures and pictures by NRPA

Aknowledgement: Nyttevekstforeningen
the Norwegian Ministry of the Environment