

Application of genetic structure analysis to explore the cause of variation in radionuclide contamination among Asian black bear populations in Fukushima

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Abstract

1. After the Fukushima Daiichi Nuclear Power Plant accident in 2011, radionuclides have been detected in the tissues of wild animals. It was found that some individuals had higher radiocesium activity concentrations than others, despite being captured in the same area. One of the reasons for this disparity was attributed to migration from areas where radiocesium contamination level was different. 2. We identified the genetic population of Asian black bears using two genetic markers, such as mtDNA D-loop haplotype and SNPs by MIG-seq analysis. Then, we assessed migration between populations and variation in the radiocesium activity concentrations in the muscle tissue of distinct populations. 3. The SNPs analysis identified clearer two populations (SP1 and SP2) than the mtDNA analysis. Population distribution inferred based on SNPs was affected by geographic features and land use. 4. The radiocesium activity concentrations in muscle tissues in SP2 were higher than those in SP1. The radiocesium activity concentrations in muscle tissue were positively correlated with radiocesium contamination levels at the capture site. Since the radiocesium contamination levels at the capture sites of SP2 were higher than those of SP1, it was inferred that the levels of radiocesium contamination in each population would show a similar pattern. 5. Migration occurred between the genetic populations and migration rate differed between the genetic populations, with the rate of individuals migrating from SP2 to SP1 being smaller than that from SP1 to SP2. Therefore, it was suggested migration was responsible for some individuals having relatively higher radiocesium activity concentrations in muscle tissue, despite being captured in the same area. 6. This study is the first report that showed the genetic structure of Asian black bear in Fukushima Prefecture in fine scale, the migration rate between the populations, and the effect of migration on the variation of radiocesium activity concentration.

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