# Making the most of what we've got: developing radioecological extrapolation approaches

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The application of the concentration ratio (CR) to predict radionuclide activity concentrations in wildlife from those in soil or water has become the widely accepted approach for environmental assessments. Recently, both the ICRP and IAEA have produced compilations of CR values for application in environmental assessment. However, the CR approach has many limitations most notably that transfer of most radionuclides is largely determined by site-specific factors (e.g. water or soil chemistry). Moreover, there are few, if any, values for many radionuclide-organism combinations. To address this problem, a number of extrapolation approaches have been used which provide default model parameters and enable whole organism activity concentrations to be estimated. Recent developments in extending the applicability of two of these approaches, phylogeny and allometry, will be presented.

Soil-to-plant transfer of elements of radiological interest has previously been shown to be related to plant evolutionary history, or phylogeny. Phylogenetic relationships present a potential approach to enable predictions of transfer, with some scientific justification, for taxonomic groups for which there are no data either at the generic or site-specific level. The potential to derive phylogenetic relationships for organisms other than plants has also been demonstrated for marine organism in laboratory studies. Field observations of Cs in 53 freshwater fish species from 67 sites were analysed using a Residual Maximum Likelihood (REML) mixed-model regression to investigate if a phylogenetic relationship could be observed. Differences in Cs transfer to different taxa of freshwater fish were demonstrated. However, based upon the available data detailed phylogenetic relationships could not be described. However, the outputs of the REML analysis of the available data are proposed as an alternative approach to the CR as they provide a mechanism of accounting for site specific variables. The application of this alternative approach has been successfully tested using data from 26 lakes in Finland.

The application of allometric, or mass dependent, relationships within radioecology has increased with the evolution of models to predict the exposure to organisms other than man. Sufficient data across a range of species with different masses are required to establish allometric relationships and this is not always available. An alternative allometric approach to predict the biological half-life of radionuclides in homoeothermic vertebrates which does not require such data has been derived. Biological half-life values have been predicted for four radionuclides and compared to available data for a range of species. All predictions were within a factor of five of the observed values when the model was parameterised appropriate to the feeding strategy of each species. This is an encouraging level of agreement given that the allometric models are intended to give a broad approximations rather than an exact value.