MODARIA Working Group 9
Population Modelling

- Status and proposed planning -

Frédéric Alonzo (IRSN), Jordi Vives i Batlle (SCK-CEN)

Second Technical Meeting of the IAEA Modelling and Data for Radiological Impact Assessments program - MODARIA

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MODARIA Working Group 9

Main objectives:

- to describe a methodology for extrapolating from laboratory-derived effects endpoints at the organism level to ecologically relevant population responses
- to provide generic population models for radiological assessment on a range of representative taxonomic groups based on a review of existing population models and a development of new population models
- to develop scenarios for model applications and inter-comparisons

MODARIA WG9 capitalises on new knowledge and developments from population modelling tasks in the continuation of two programmes: IAEA EMRAS II programme and EC-funded STAR project

The population modelling group is coordinated by Frederic Alonzo and Jordi Vives i Batlle
Task 1: Methodology for population modelling

Subtasks:

- 1.1 - Methodology for building confidence intervals in model predictions

« The goal of demographic analyses is to estimate demographic parameters. Because they are estimated from imperfect data, such estimates are uncertain. It is important, especially when the results have policy implications, to quantify that uncertainty. » (Caswell, 2001)

→ Presentation of the Bootstrap technique to build confidence intervals
→ The technique is applied to population modelling in STAR
→ Needs to be practically applied to other population modelling approaches
→ Other approaches (Bayesian...) remain to be considered
Task 1: *Methodology for population modelling*

Subtasks:

- **1.2** - Definition of “population” (model) in the context of radiological protection
  
  → Discussions led to an agreement on two definitions.
  
  → The population is defined as a group of individuals sharing the same species and ecological characteristics...

  1/ ...collectively responding to a common constant level of radiation stress (in the perspective of testing dose criteria);
  
  2/ ...undergoing different exposure conditions - depending on the extent of the contamination zone relative to the species geographical range (in the perspective of risk assessment).

  → implications for testing DCRLs criteria to be discussed during this meeting.
Task 1: Methodology for population modelling (2/2)

Subtasks:

● 1.3 - Mathematical / conceptual model to consider effects data from both acute and chronic radiation exposures
  → In order to make the most robust use of all the available data (instead of predicting chronic effects based on data from acute situations)
  → Two approaches proposed:
    1/ an extension of Kryshev’s model to chronic effects data;
    2/ a toxicokinetic / toxicodynamic model recognized as a powerful approach in the ecotoxicology community

● 1.4 - Existing population models for plants
  → some initial review (more than 350 available references)
  → needs to progress
**Task 2: Set of population model parameters and databases**

Subtasks:

- **2.1** - Guide to parameter collection from the literature
  - written document listing needed data
  - produced Excel template to circulate and fill by participants

- **2.2** - Collection of life history, ecology parameters and radiation effects datasets for ICRP reference animals and plants and additional species
  - template currently circulated, data already filled for some taxonomic groups

- **2.3** - Guide to field data collection from the literature
  - needs discussion

- **2.4** - Review of lab and field data for model calibrations
  - to be started during this meeting

- **2.5** - Application of population models to representative wildlife species
  - later
Proposed agenda

Monday afternoon
- Subtask 1.4 *Existing population models for plants*
- Subtask 2.2 *Collection of life history, ecology parameters and radiation effects datasets for plant species*

Tuesday morning
- Subtask 2.2 *Collection of life history, ecology parameters and radiation effects datasets for animal species*
- Subtask 2.3 *Discussion on collection of field data*

- Short presentations by participants
- Experience with the template
- Coordination of follow-up work with plants models
Proposed agenda

Tuesday afternoon:

- **Subtask 1.2 Definition of “population” model**
  - Discussion about how we may use population models to test current criteria for DCRL values
  - Predator/prey plankton model by Jordi Vives

- **Subtask 1.3 Model to consider both acute and chronic radiation exposures**
  - Progress by modellers
  - DEBtox application to nematodes exposed to gamma by Fred Alonzo
  - Discussion on the species to which the approach should be applied

- **Subtask 1.1 Building confidence intervals in model predictions**
  - Coordination of follow-up work
Proposed agenda

Wednesday morning (after the plenary session):
- Wrap-up and future actions

Wednesday afternoon (reserved to WG8)

Thursday morning:
- Jordi Vives’ hands-on session with Modelmaker (action q)

ROOM MOE79
Key issues

- How can we make population models more useful for regulators?
- Can we improve the relevance of population dose effects models for real wildlife situations?
  - Can models describe populations in realistic ecological conditions without involving too many parameters and eco-physiological factors (food availability, density-dependence, self-limiting growth etc.)?
  - Can simple experimental systems in controlled laboratory conditions help understanding the complicate population responses in the field?
  - Are radiation effects data from acute and/or short-term exposures representative of chronic exposure situations over several generations?
  - Should species be considered in isolation or as part of ecosystems (with trophic predator-prey interactions)?
  - Should models consider potential interactions between radioactive and non radioactive substances?
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