EMRAS II, Working Group 6
Biota "Dose Effects Modelling"

Tom Hinton; IRSN

BROAD OBJECTIVES

- Dose – Effect Modelling to assist Risk Assessments
- **Derivation of Screening Level Values / Protection Thresholds**
- Reach Consensus; Document Methods; Publish Guidance

FREDERICA Database Update
Quality Control Analysis

Almudena REAL; Spain

EMRAS-II. Effects group (WG-6).
Vienna, 26-27 January 2010

GOBIERNO DE ESPAÑA · MINISTERIO DE CIENCIA E INNOVACIÓN · Ciemat Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas

FREDERICA Update: Quality Control Analysis

STATISTICS	Marks available
Number of replicates of the experiment	**Select one statement only and enter that statements score**
No replicates	0
1-3 replicates	2
4-6 replicates	3
7-9 replicates	4
10 or more replicates	5
Number of individuals	**Select one statement only and enter that statements score**
1-3 individuals	2
4-6 individuals	3
7-9 individuals	4
10 or more individuals	5
Number of points per curve	**Select one statement only and enter that statements score**
No dose response undertaken (only one dose given)	0
2 points	1
3 points	2
4 points	3
5 points	4
6 or more points	5
Method used for statistical analysis	**Select each appropriate statement and add the scores of these statements together**
No statistical methods used	0
Name of statistical methods stated	1
Calculation of statistics stated	2
Reasons/justification of statistical methods used stated	2
Confidence Limits	**Select one statement only and enter that statements score**
No confidence limits given	0
All significant differences reported to <0.10	2
All significant differences reported to <0.05	3
All significant differences reported to <0.01	5
TOTAL FOR SECTION	MAXIMUM 25
GRAND TOTAL	MAXIMUM 80

Marks available
statement and add the scores of these atements together
0
1
2
1
2
1
only and enter that statements score
0
3
5
statement and add the scores of these atements together
1
2
2
1
statement and add the scores of these atements together
1
2
1
1
MAXIMUM 40

FREDERICA Radiation Effects Database

www.frederica-online.org

- References found: English (405), Russian (255), Japanese (7), French (2), Chinese (1)

- References included: 141 (FREDERICA= 1,509 Refs; Aprox 10% increase)

  Wildlife groups: Mammals (36%); Amphibians (11%); Insects (8%); Protozoa (8%), Others (microorganisms, fish, crustacean, mollusc, aq. plants, soil fauna, fungi) (37%)

  Type of exposure: Acute (75%); Chronic (25%)

  Umbrella effects: Mortality (30%); Reproduction (28%); Morbidity (27%); Genetic (11%); Others (4%)

- Quality Control: Dose-Response Analysis

134 Refs analysed

41 QC<35

93 QC>35

85 Refs analysed

19 No Dose-Response (single dose)

66 Potentially useful for Dose-Response

EMRAS-II (WG6): FREDERICA Update

TASK	Participants	Deadline
Literature survey	Stanislav GERAS´KIN Nele HOREMNAS Almudena REAL Tatiana SAZYKINA Karolina STARK Synnove SUNDELL-BERGMAN Hildegarde VANDENHOVE Satoshi YOSHIDA	March 2009
Add new data to FREDERICA database	Laura NEWSOME Nele HOREMNAS Almudena REAL Karolina STARK Synnove SUNDELL-BERGMAN Hildegarde VANDENHOVE Christine WILLDROT Satoshi YOSHIDA	June 2009
QA/QC and score entry	David COPPLESTONE Almudena REAL Synnove SUNDELL-BERGMAN Christine WILLDROT	Sept 2009 Jan 2010

International Science and Technology Center (ISTC)

Member Countries:
Armenia
Belarus
Canada
EU
Georgia
Japan
Kazakhstan
Kyrgyz Republic
Norway
Republic of Korea
Russian Federation
Tajikistan
United States

ISTC Project 3003

funded by: NAAL of IAEA
Dr. Stanislav Gera'skin; RIARAE in Obnisk

35 Soviet-translated references

to FREDERICA

an additional 1800 entries

POPULATION MODELS (**T. Sazykina**; Russia)

Models Presented

Authors	Type of the model	Generic or specific	Environmental stresses considered	Validation or parametrization of parameters
Jordi Vives I Batlle et al.(in press)	Logistic growth model, **age classes**	Specific for European lobster	Radiation, fishing	Parametrization
Doi, M., and **Isao Kawaguchi** (Radioprotection, 2005)	Aquatic microcosm model, **3 species**	Specific for experimental microcosm	Radiation, ecological interactions	Validation on experimental data
A. Kryshev, et al. (REBS, 2008)	Dynamic population model, **repair**	Generic fish	Radiation, parasites	Parametrization comparison with data

Models Presented

Alonzo, F. et al. (JER, 2008)	Model of **age-structured population**	applied to earthworm and Daphnia	Radiation	Parametrization
Luigi Monte (JER, 2009)	Model based on Lotka-Volterra equations (**resources and consumers**)	Generic terrestrial	Radiation, migration	Parametrization
Sazykina T. et al. (Ecol.Model., 2000)	Ecosystem model **with limited resources**	Generic aquatic	Can be applied to radiation	

Develop a generic modelling approach, and identify **key parameters** responsible for the sensitivity of populations to radiation damage.

Comparison of population sensitivity to changes in different endpoints and different species

Daphnia magna

toxicité chronique de U et Am-241 dissous et radiations gamma externes (Cs-137)

Eisenia fetida

toxicité chronique de radiations gamma externes (Co-60)

Alonzo et al., 2008

⇨ Sensitivity of population depends on individual endpoints

⇨ Sensitivity of population depends on life history strategy of different species

IAEA EMRAS II
Biota Effects Group

Advances of the Multiple Stressor group

Hildegarde Vandenhove, Nathalie Vanhoudt, Almudena Real,

Clare Bradshaw, Nele Horemans

Multiple Stressor database

Study type
Ecosystem
Multispecies studies
Species studied
Species 1 Common name
Species 1 Latin name
Species 2 Common name
Species 2 Latin name
Species 3 Common name
Species 3 Latin name
Species 4 Common name
Species 4 Latin name
List of stressors
Stressor 1
Exposure levels stressor 1 single
Stressor 2
Exposure levels stressor 2 single
Stressor 3
Exposure levels stressor 3 single
Stressor 4
Exposure levels stressor 4 single
Stressor 5
Exposure levels stressor 5 single
Exposure levels combination
Short description of the experimental set up and conditions

Effects endpoints and results	
Umbrella effect	
Reproduction	**Which effect ?**
Morbidity	**Which effect ?**
Mortality	**Which effect ?**
Genetic	**Which effect**
Physiological	**Which effect ?**
Population relevant endpoints for multipspecies studies (e.g. Numbers of species)	**Which effect ?**
Other	**Which effect ?**
Other 2	**Which effect ?**
Short description of Results	
Please express results as far as possible in terms of : no deviation from addition, potentiation, synergy, antagonism	
Major conclusions from the study	
QA/QC	
Are we confident about the data?	
Can we use the data for dose response curve development?	**Are we confident about the statistics and associated experimental design used to identify the interaction?**
Reference	
ID of person who put in data	

Multiples Stressors

(**H. Vandenhove**; Belgium with **IUR**)

57 entries from open literature

Only one case generated a dose response curve for the single stressors….. prior to an examination of multiple stressor responses

(prerequisite to say anything about synergism / antagonism)

MS-effect modelling course
Preliminary programme

	Day 1	Day 2	Day 3
Morning session	Opening and registration **Thomas Backhaus** (Göteborg University, Sweden) - Experimental design - Introduction to reference models (concentration addition and independent action) and to their strengths and sensitivities	**Claus Svendsen** (CEH, UK) Testing for deviations from reference models using surface design or isoboles	**Stefan Van Dongen** (University of Antwerp, Belgium) - Best-fit method for concentration-response curves - Statistical testing of deviations from reference models (including calculation of confidence belts)
Afternoon session	**Thomas Backhaus** continued **Calculus session** (**Nathalie Vanhoudt, Nele Horemans**, SCK•CEN, Belgium): prediction of mixture effect from single concentration-response curve	**Nina Cedergreen** (University of Copenhagen, Denmark) ***to be confirmed*** - Use of mixture toxicity within REACH and Water framework directive - Can the choice of endpoint lead to contradictory results	**Stefan Van Dongen** continued **Calculus session** continued Closing remarks

Organised by SCK•CEN and IUR
Suggestion: May 2010

Progress

Canadian Benthic Data (**S. Mihok**; Canada)

(Uranium mining; derive dose to benthos; multivariate stats)

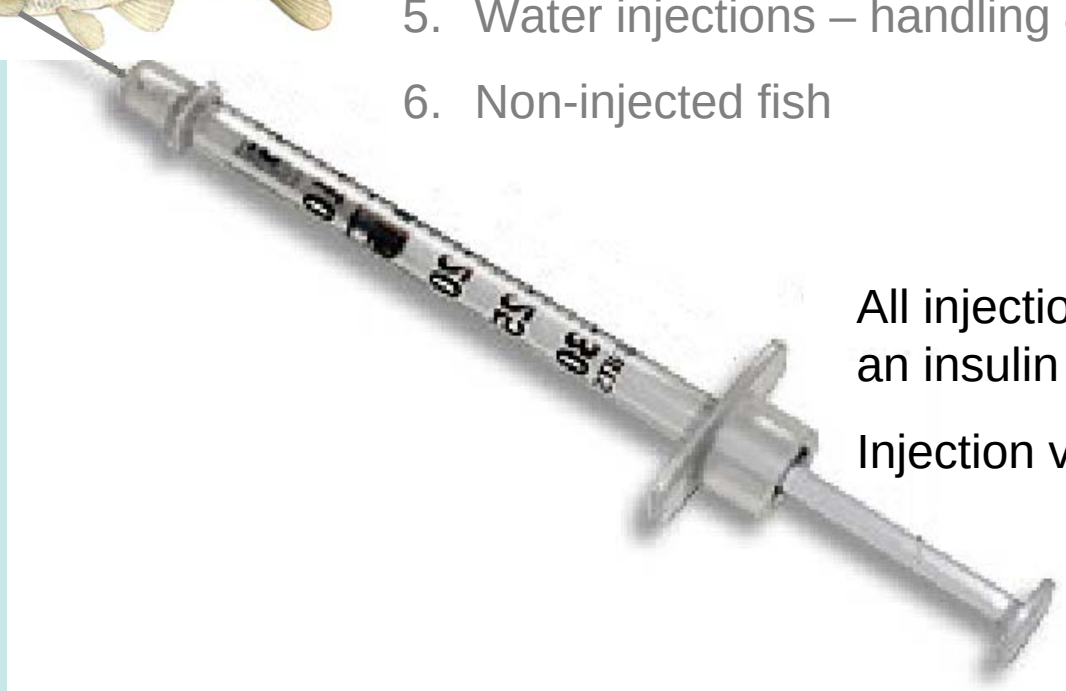
- large and diverse data set of sediment cores taken from U mining areas
  - discussion on statistical analyses
    - developed plans to interact with WG4

Effects of Chronic Exposure to Alpha-Emitting Radionuclides on Health and Reproductive Fitness of Biota

Carmel Mothersill; McMaster University, Canada

Preliminary acute injection experiment: Fathead minnow ^{226}Ra injections

1. 21 μBq fish^{-1} (dose based on fathead minnow field data; Clulow et al 1998)
2. 210 μBq fish^{-1} (10x field data dose)
3. 2100 μBq fish^{-1} (100x field data dose)
4. Nitric acid (^{226}Ra solvent) control injections
5. Water injections – handling & injection stress control
6. Non-injected fish

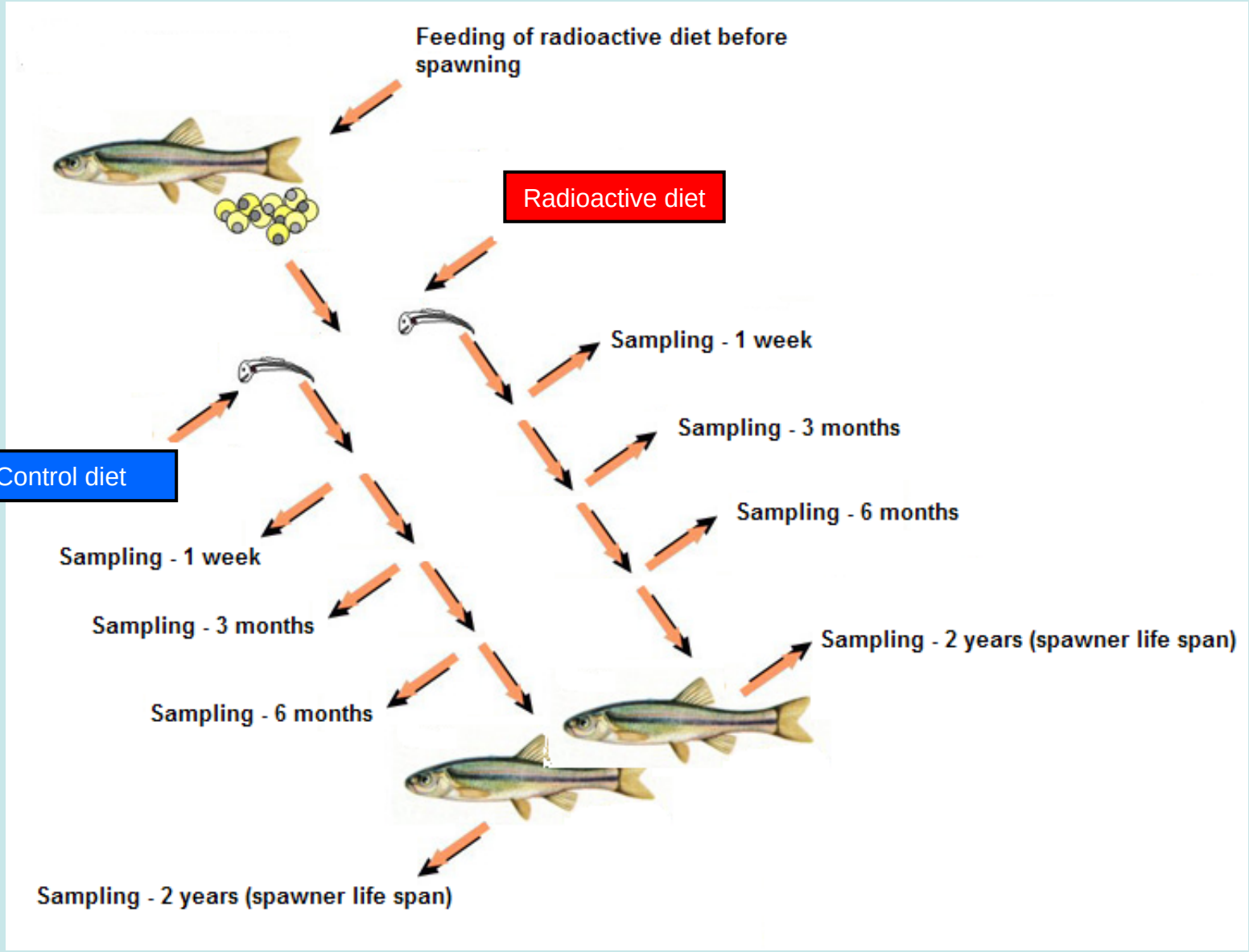


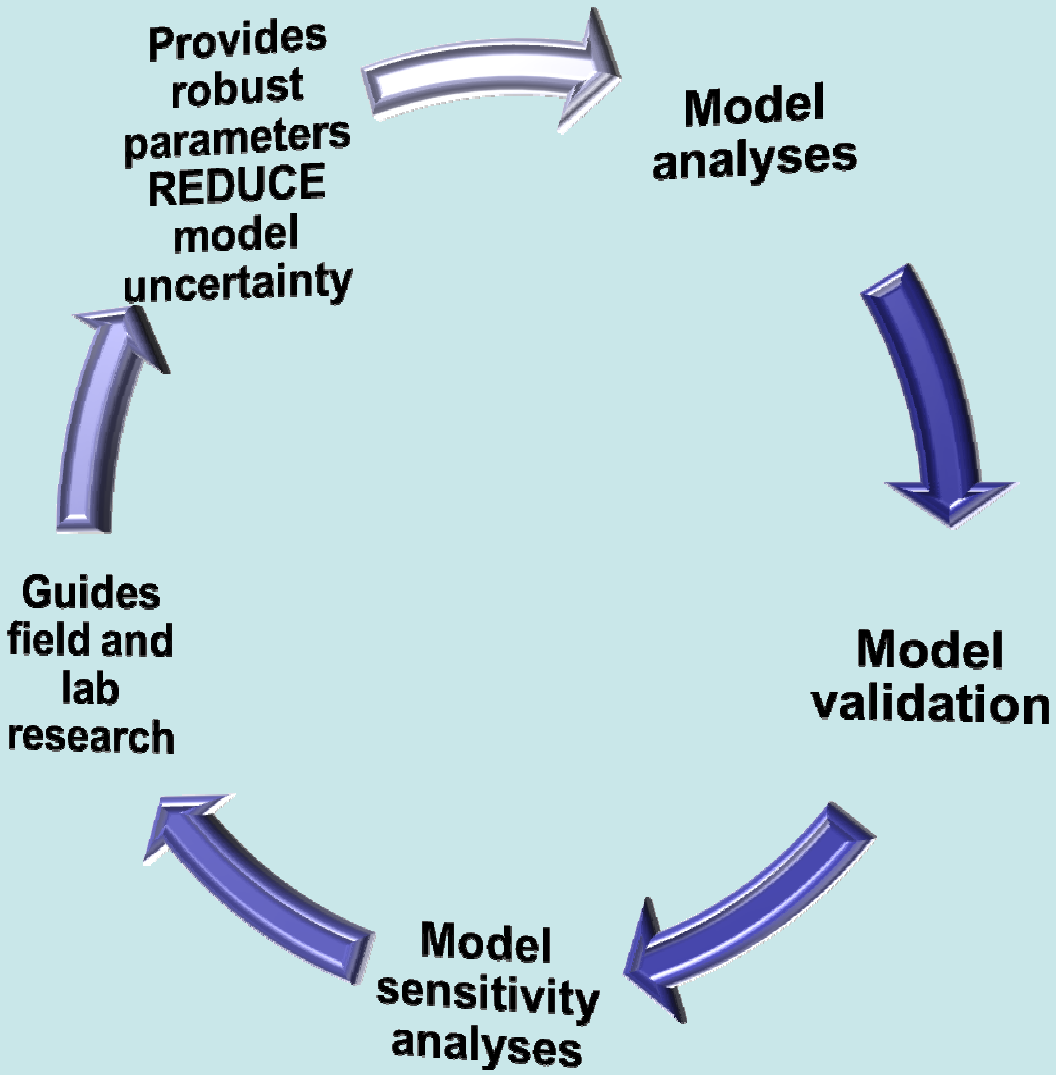
All injections administered i.p. via an insulin syringe (29G needle)

Injection volume = 3μl fish^{-1}

Clulow et al, 1998. Env. Pol. 99: 13 – 28

Experimental outline 2




Provides robust parameters REDUCE model uncertainty
Model analyses
Model validation
Model sensitivity analyses
Guides field and lab research