Chernobyl Terrestrial Scenario

Data sources

- Open literature
- IRL data holdings
- Collaborative studies by CEH and IRL
- ERICA partner data

Organisms

- Graminaceous vegetation
- Range of bird species
- Range of mammal species
- Amphibians
- (A) invertebrate
- (A) reptile

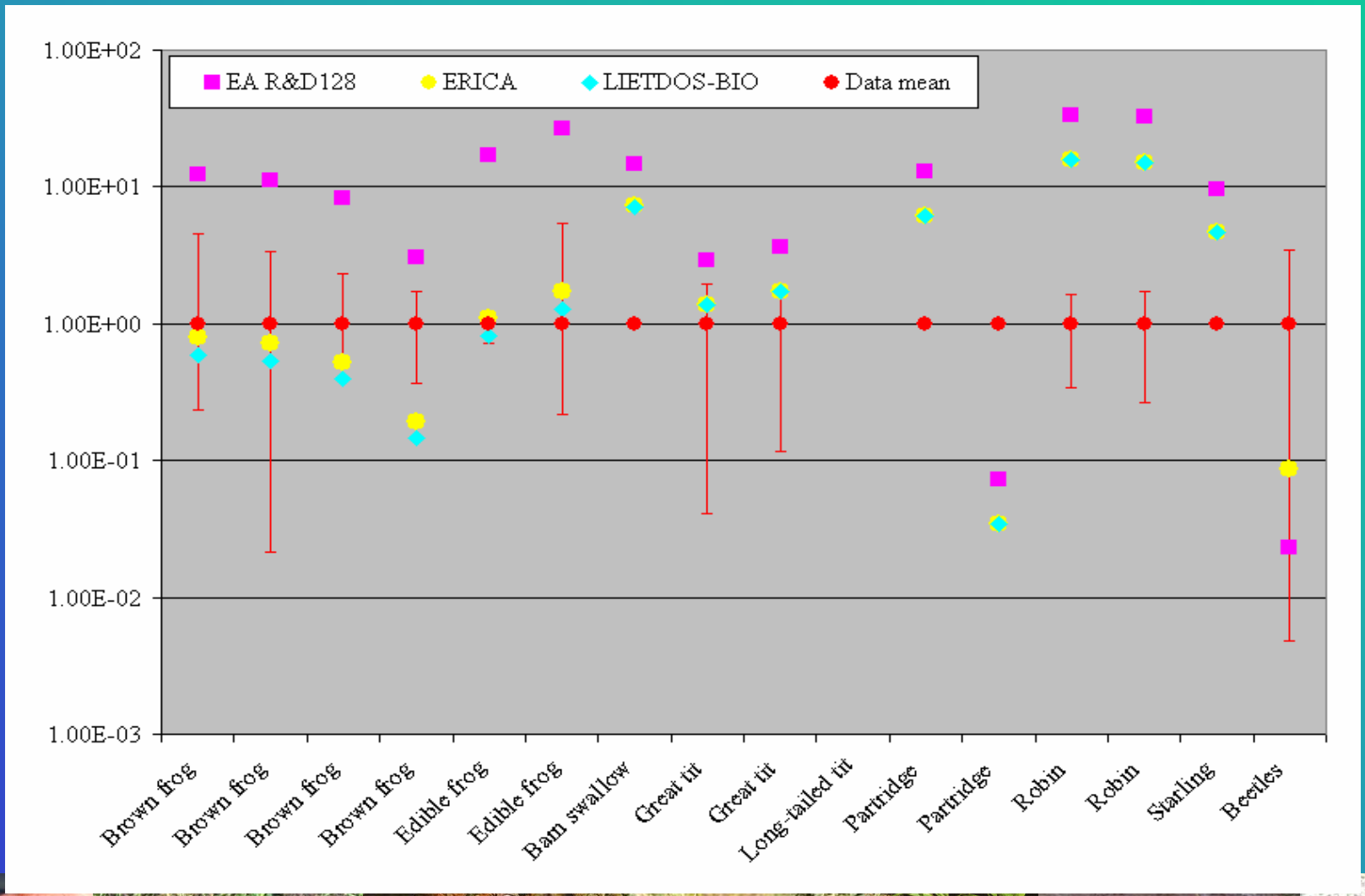
Radionuclides

- Majority for ^{137}Cs and ^{90}Sr
- Some for Pu-isotopes and ^{241}Am
- TLD results for some small mammal species [6 data entries]

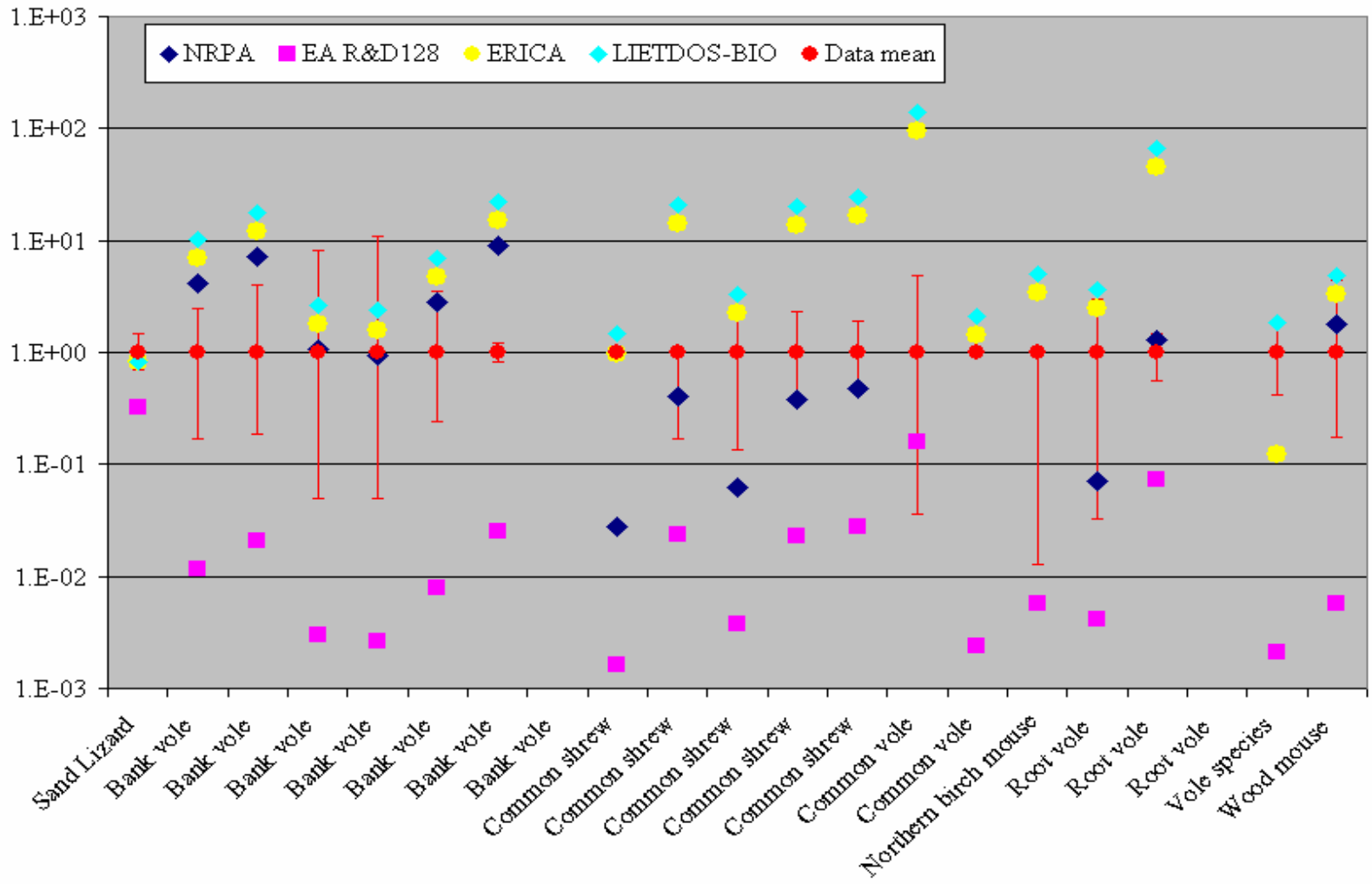
Results to date

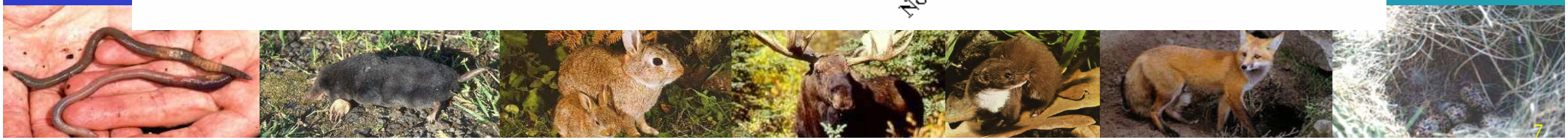
- **England & Wales EA R&D 128**
- **FASTer-Doses3D (NRPA)**
- **ERICA**
- **LIETDOS-BIO**
- **RESRAD-BIOTA**
- **AECL**

Cs-137 activity concentrations

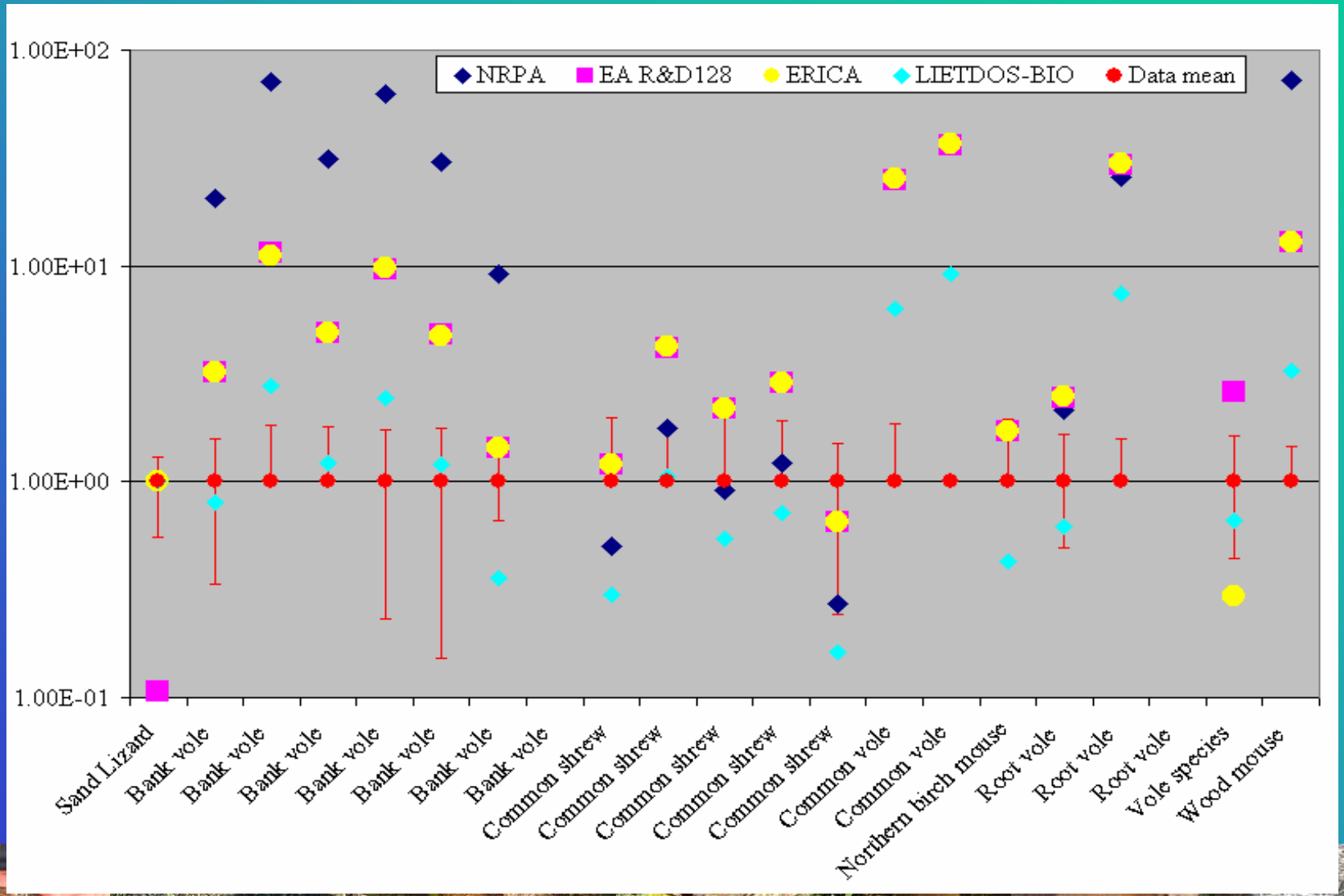


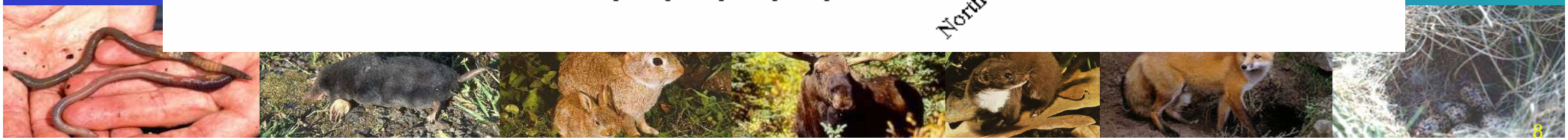
Cs-137 activity concentrations



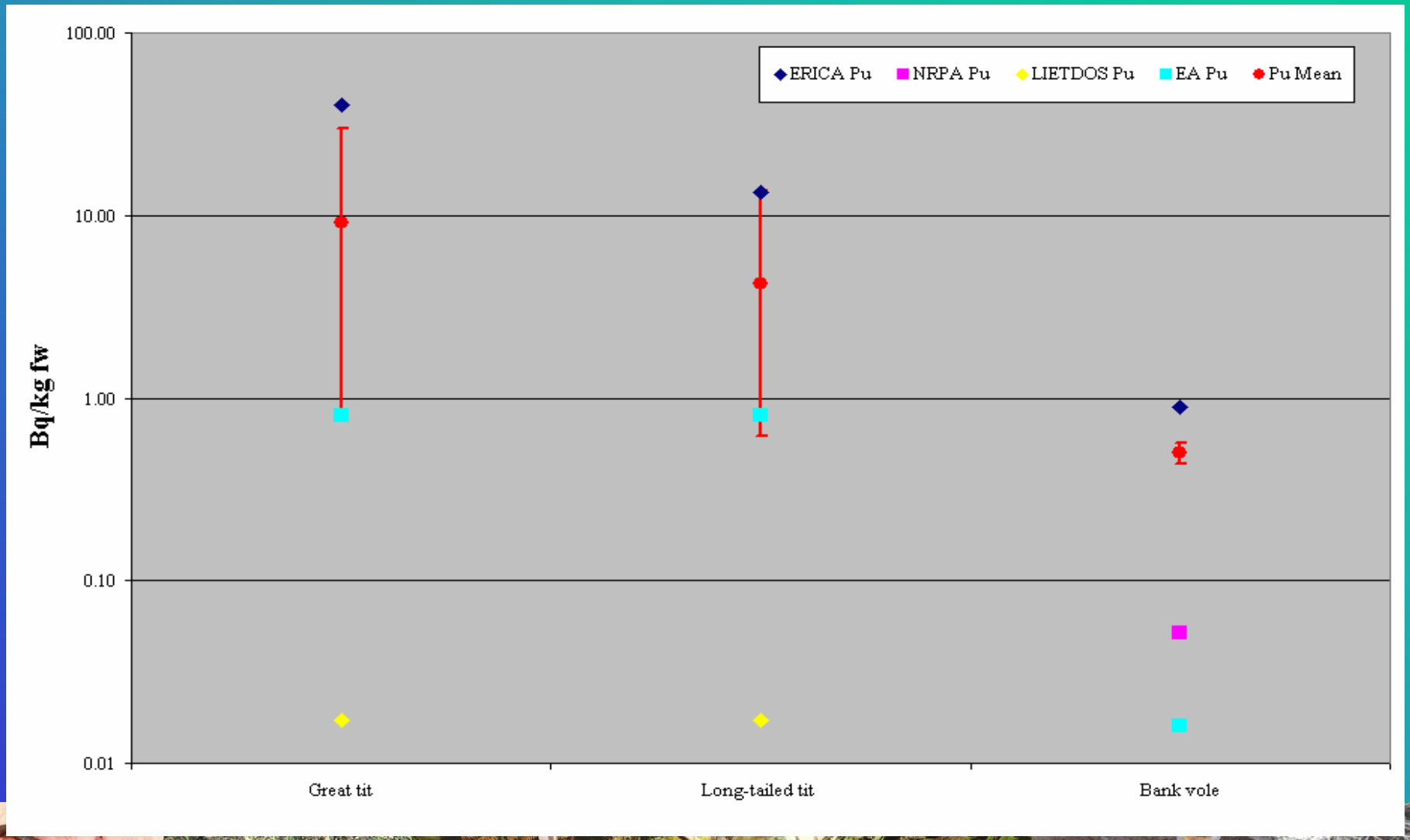


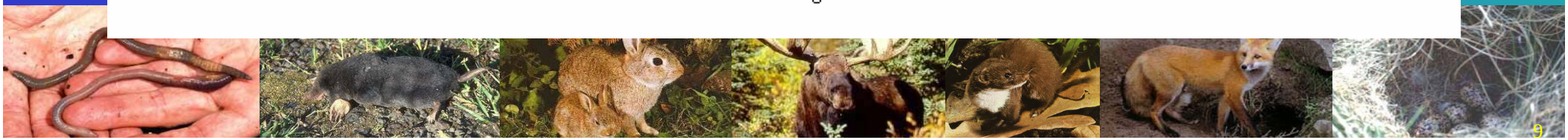
Sr-90 activity concentrations



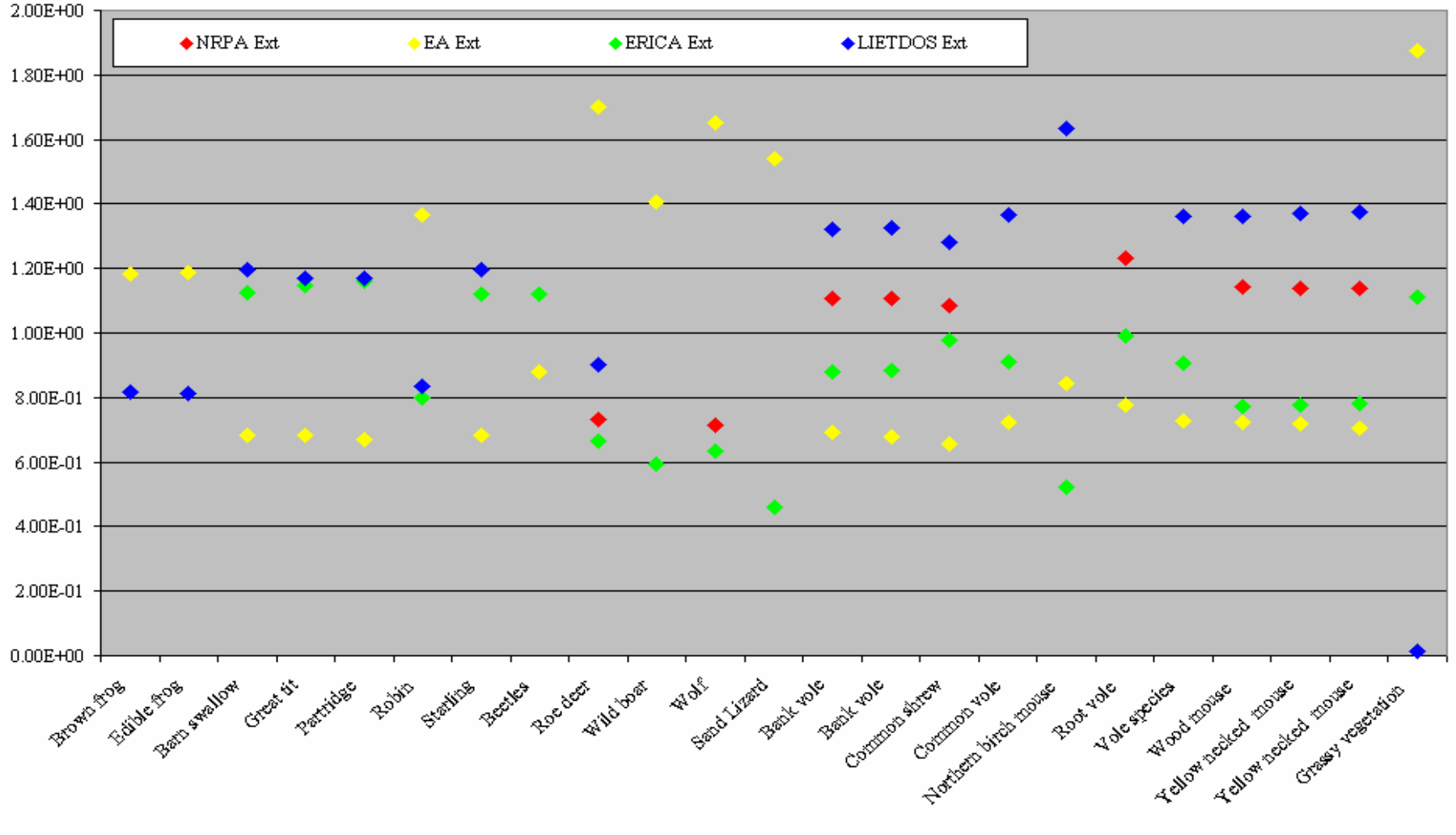


Pu activity concentrations

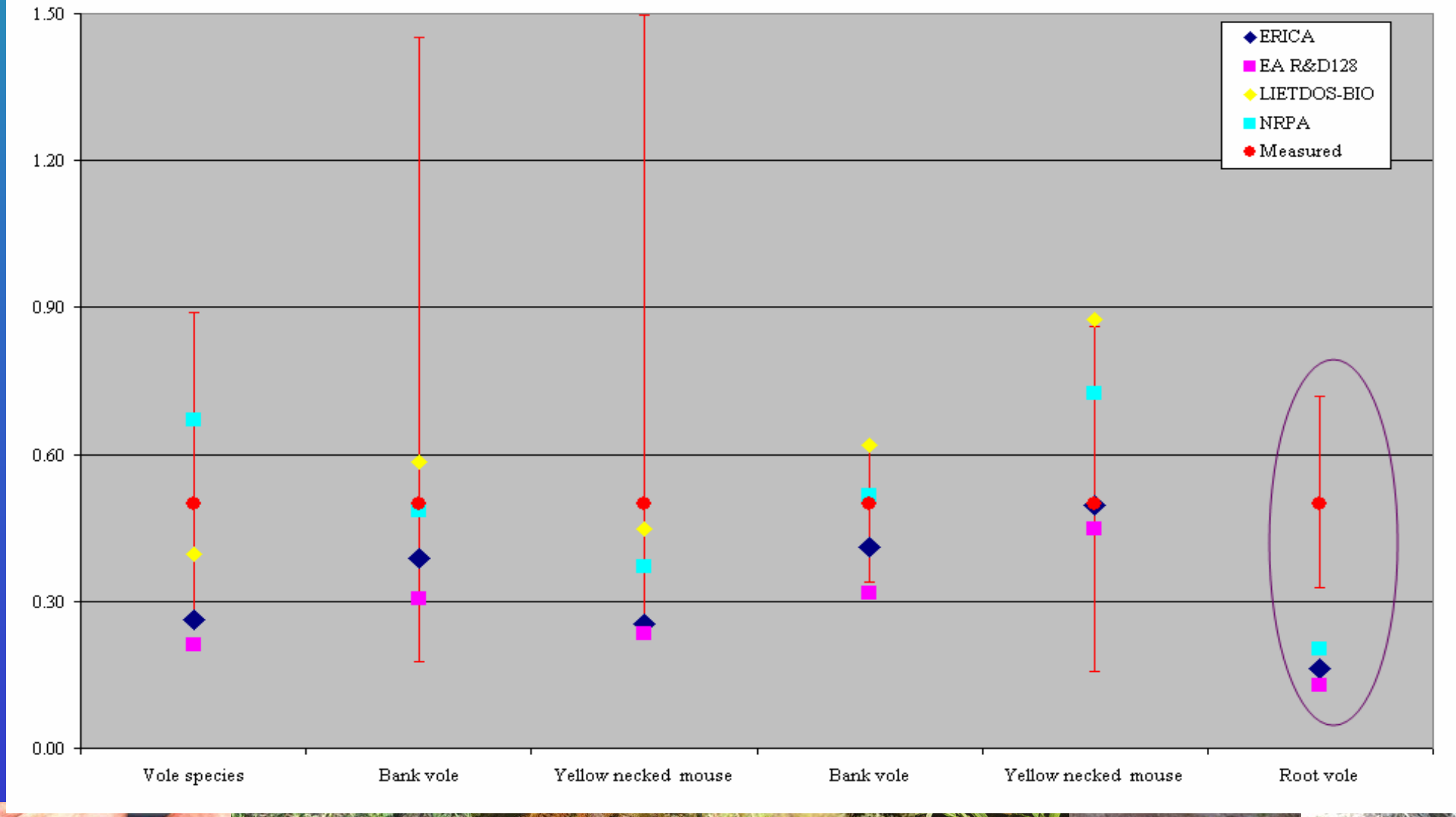




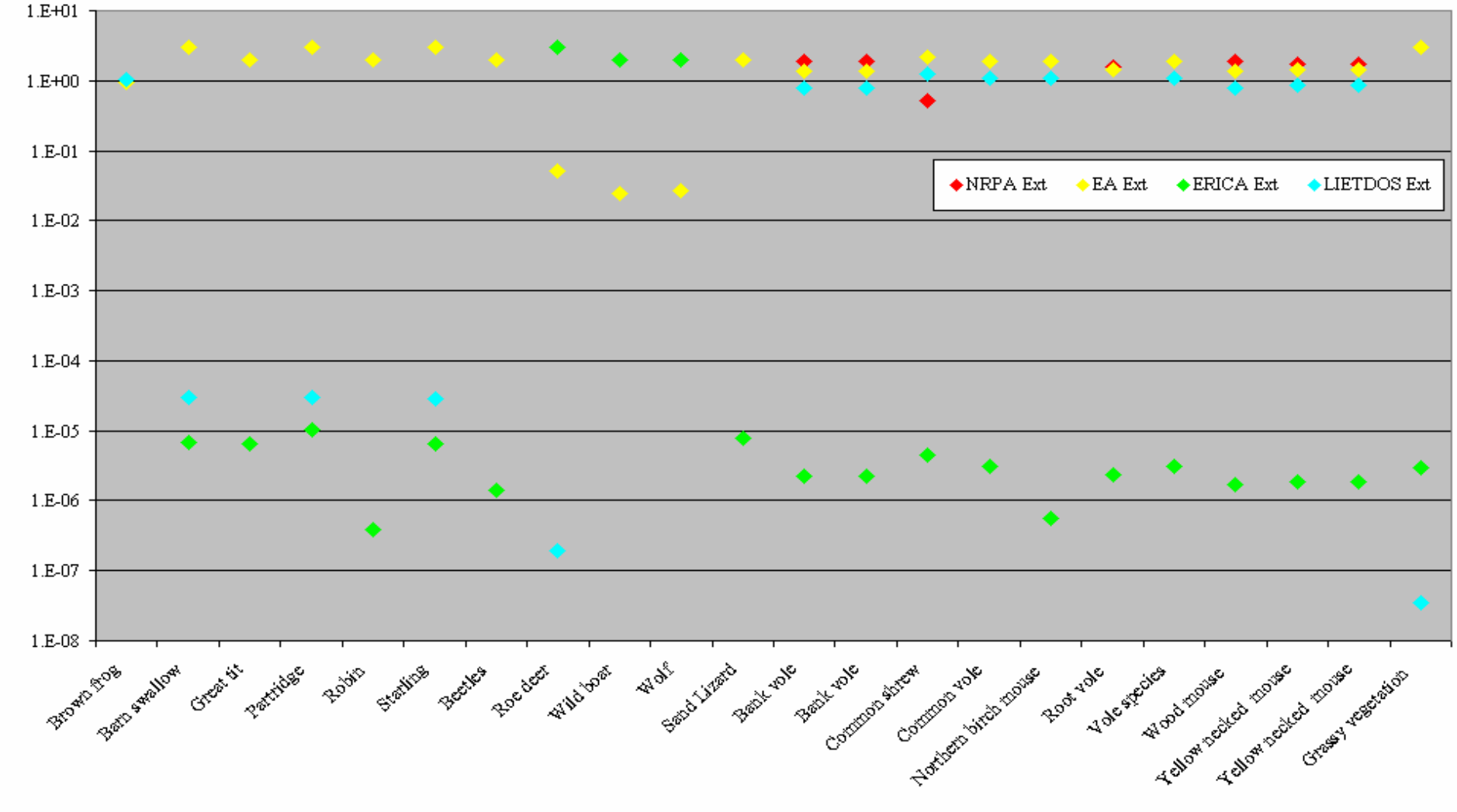
Cs external dose



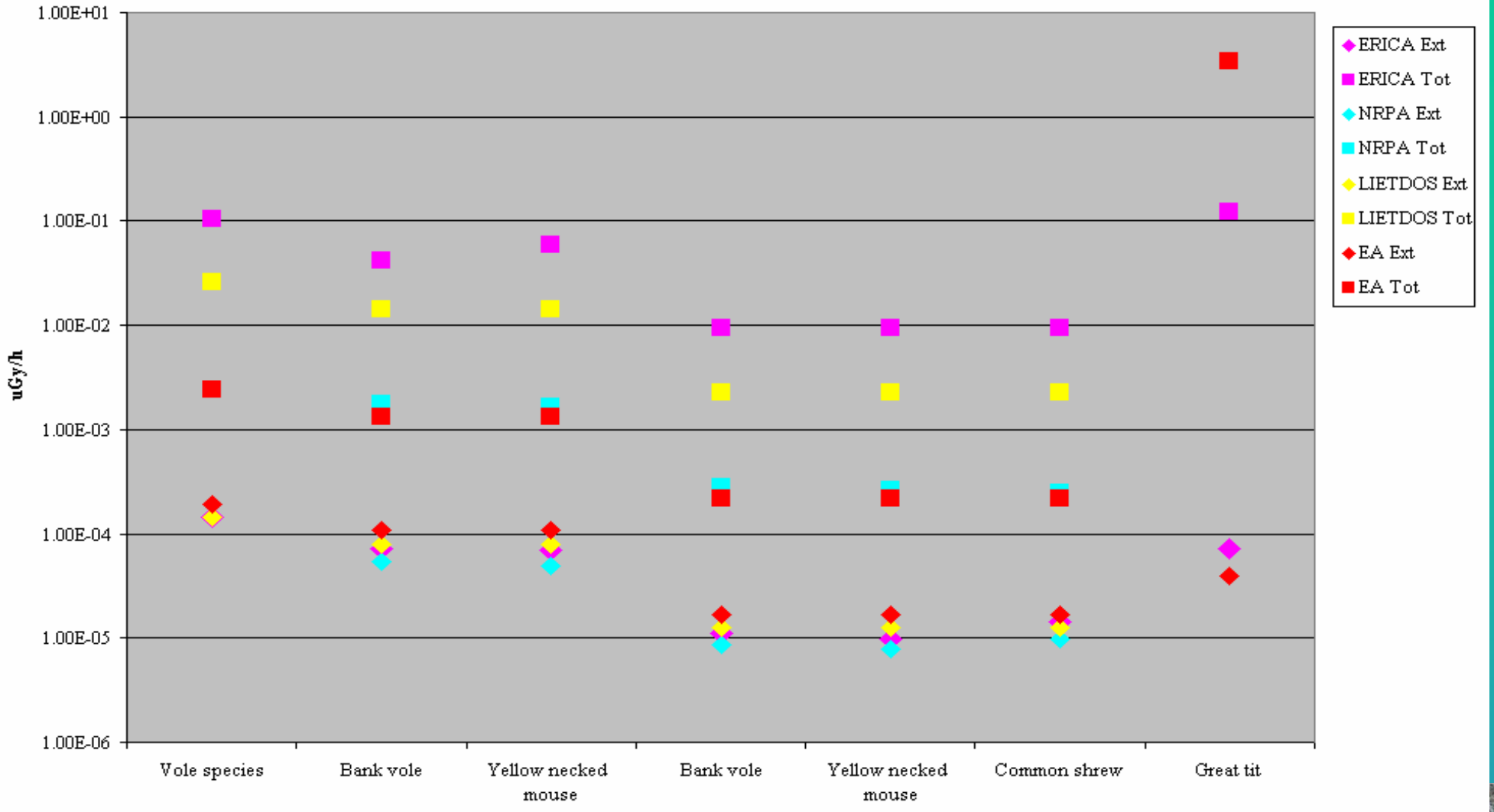
Prediction of TLD result



Sr-90 external



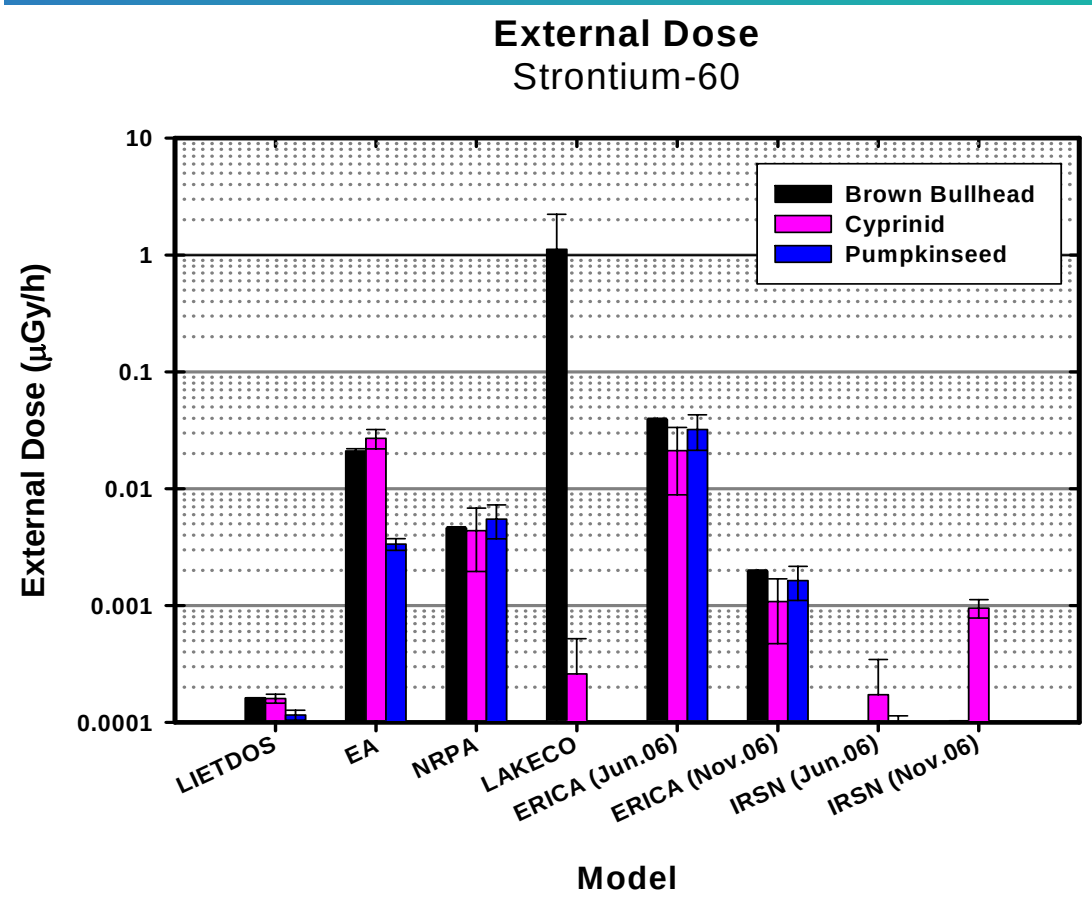
Pu dose rates

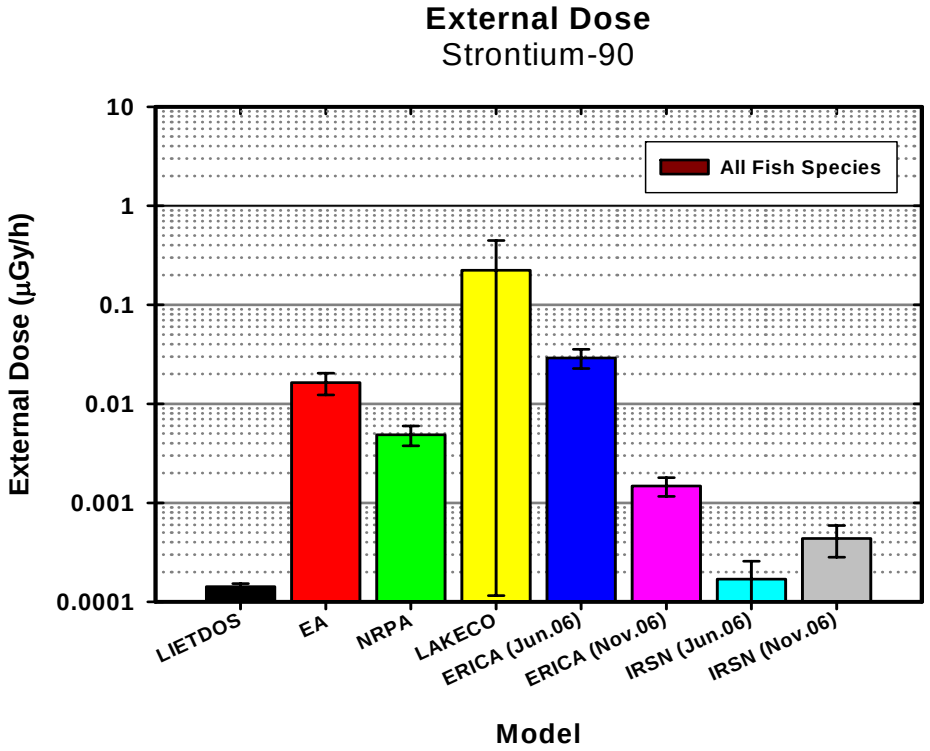


Perch Lake
Model Participants To-Date

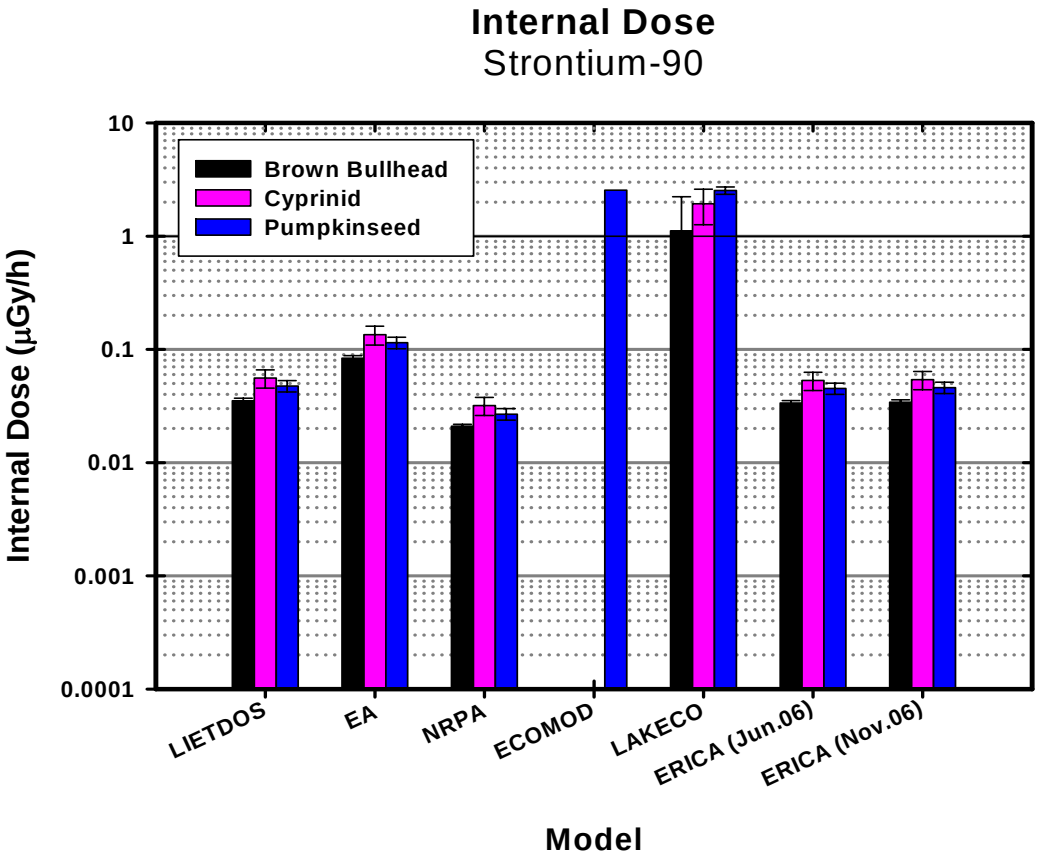
- ✓ To-date, a total of 9 Models have participated in the freshwater Perch Lake scenario, with representation from the UK, Russia, Lithuania, the Netherlands, Norway, France, 'Europe' and Canada.
- ✓ It is expected that predictions will be submitted for RESRAD-BIOTA.

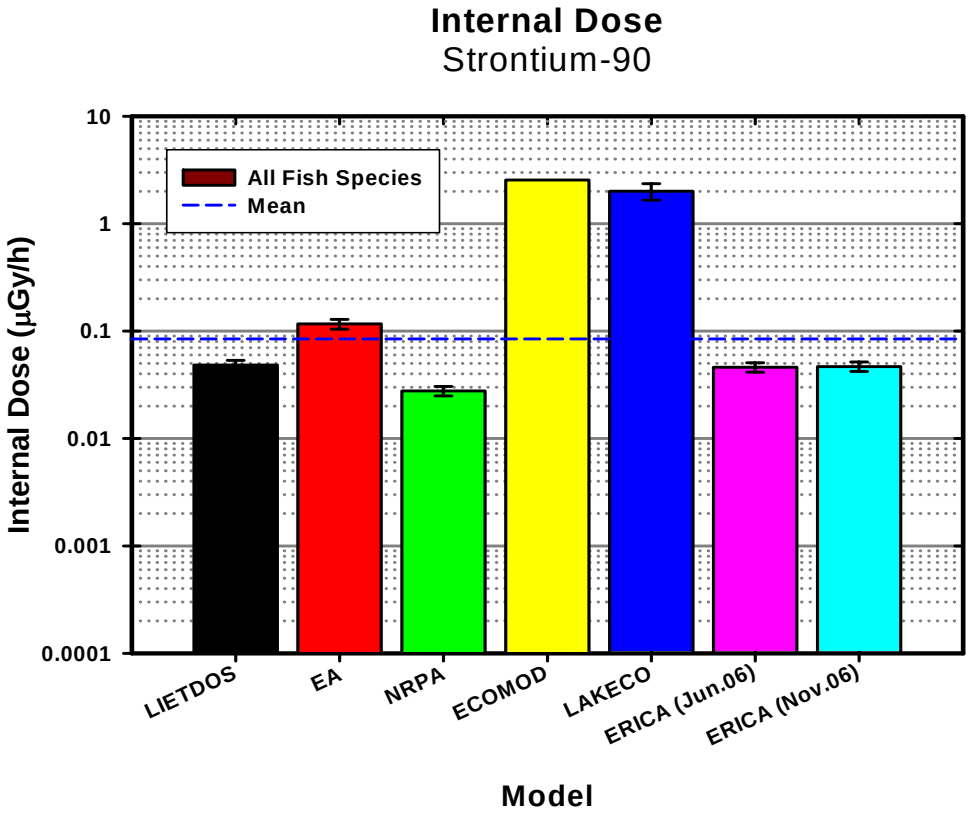
Total External Strontium-90 Dose Rate to Freshwater Fishes (uGy/h)





Total Internal Strontium-90 Dose Rate to Freshwater Fishes (uGy/h)





Next meeting

Norway, week 25–29 June 2007

Status of national and international activities for protection of the environment from ionising radiation

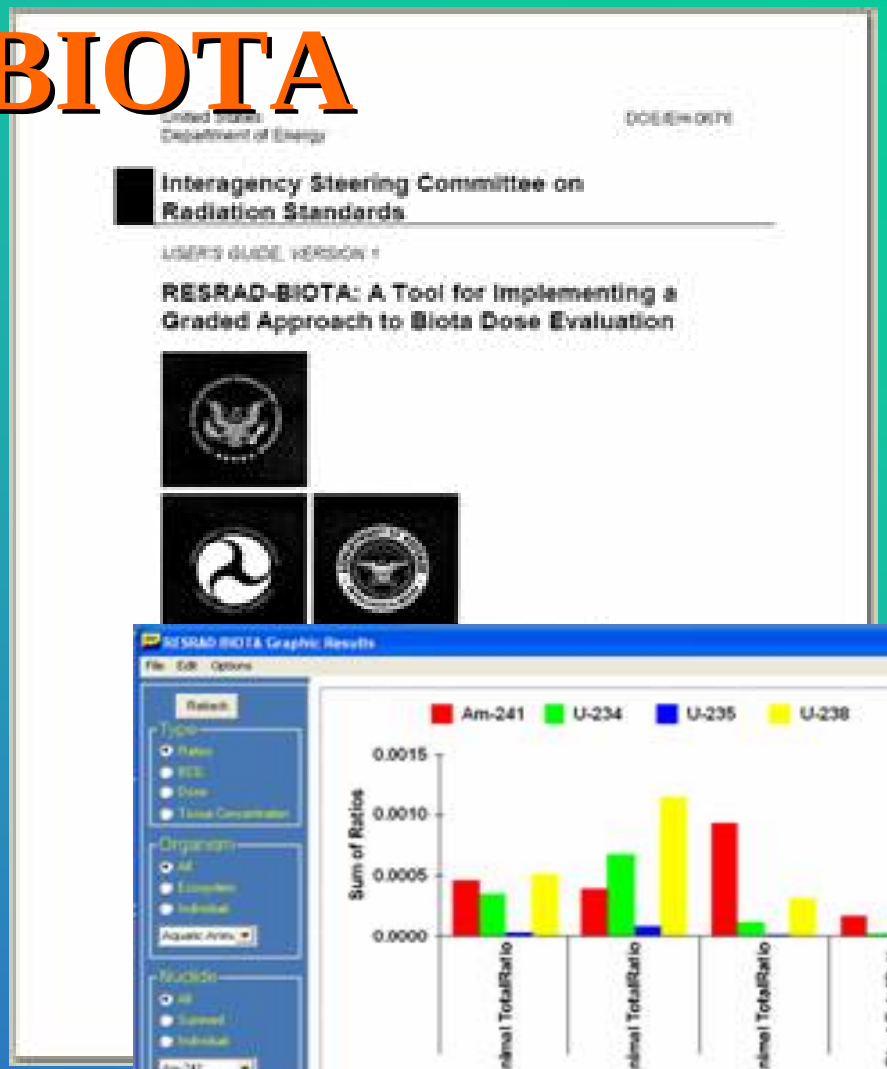
National activities

USA

- Biota protection requirements and dose rate guidelines (1 or 10 mGy d^{-1}) contained in DOE Order 5400.5, *Radiation Protection of the Public and the Environment*, and DOE Order 450.1, *General Environmental Protection Program*
- National Environmental Policy Act (NEPA) environmental impact assessments - decontamination and decommissioning, facility construction and operation, and waste management

RESRAD-BIOTA

- Developed by Argonne National Laboratory (Argonne).
- Sponsored by DOE with support from the US EPA and the US NRC
- Used by Federal agencies and several state environmental agencies
- Used at US DOE sites



http://homer.ornl.gov/oepa/public/bdac

England & Wales

- **UK: Conservation (Natural Habitats) Regulations 1994**
  Implements the EC Habitats Directive in the UK on conservation of natural habitats, flora and fauna.

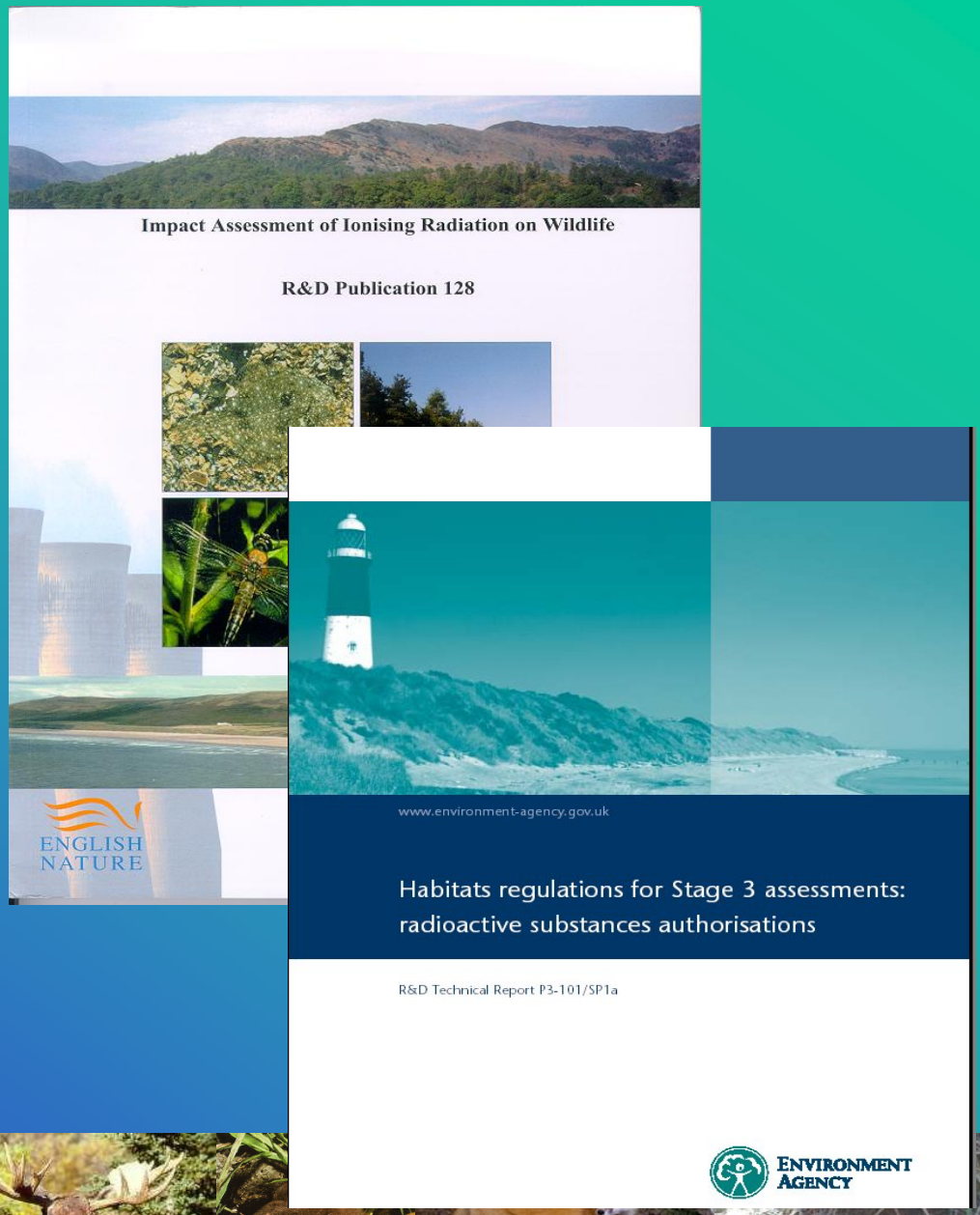
England and Wales

There is a requirement to assess the impacts of consents and authorisations affecting Natura 2000 sites under the Habitats Regulations (1994)

Environment Agency took the view, based on legal advice and with the support of statutory consultee English Nature, that this should include ionising radiation

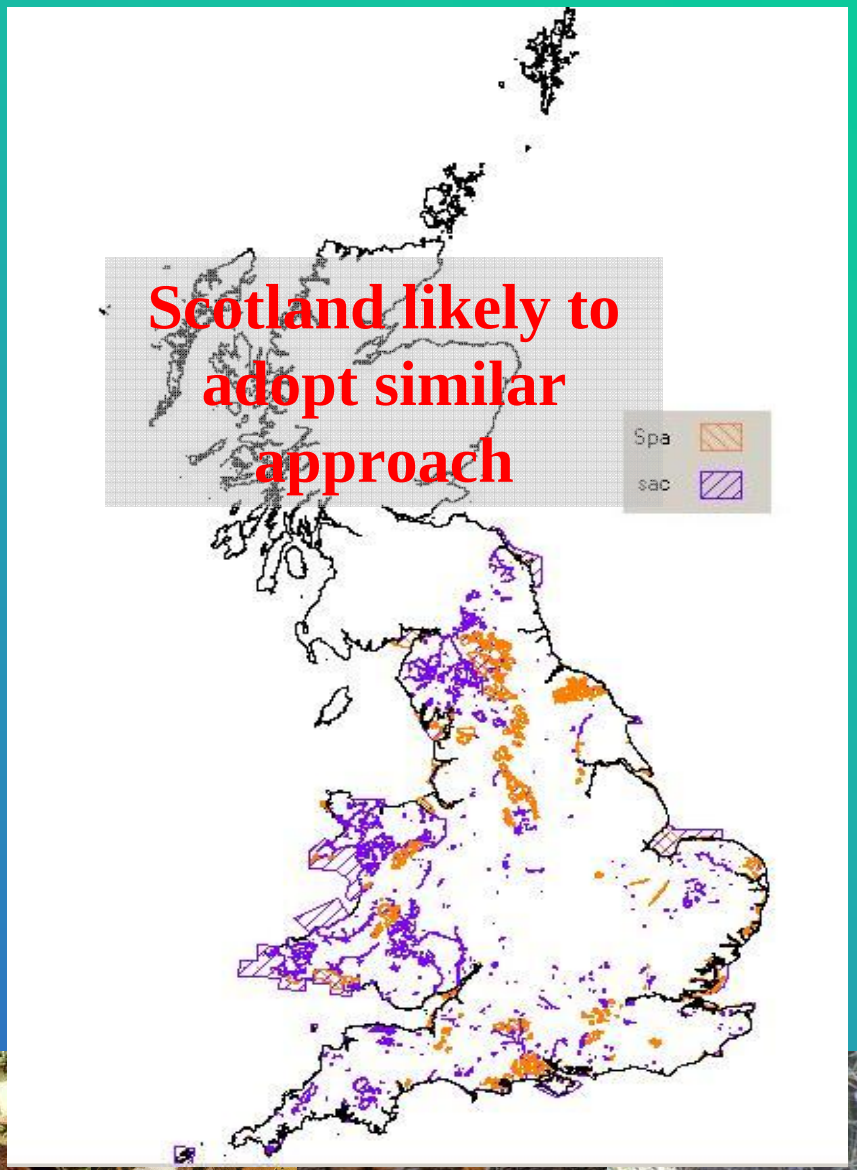
R&D 128 (2001)

- Simplified approach to determining exposure for a set of reference organisms which were representative of freshwater, marine and terrestrial ecosystems for a limited set of radionuclides
- Staged assessment approach



Habitats Directive Assessments

- About 430 Natura 2000 sites in England & Wales
- More than 50 % assessed and reported; remainder to be completed by March 2008



Some Canadian Perspectives on the Protection of the Environment

General Context

- Canadian Regulatory Agencies provide guidance on regulatory limits that would ensure the protection of the environment – including ionising radiation.
- If little information available on a given stressor - conservative regulatory limits are set for compliance purposes.
- Re-evaluated by the Regulator such that more realistic values may be assigned as scientific information becomes available.
- Industry is responsible for providing a plan in terms of how these limits will be met and for conducting environmental assessments to identify potential issues arising from activities.
- Linked to the Site Licence of a given facility and defended in a Public forum.

Canadian Regulatory Harmonization

- **Traditionally, regulation in Canada has fallen under a number of Regulatory bodies based on potential stressor (e.g. radiological versus chemical) and/or receptor (e.g. fish).**
- **Canada is working towards the development of a harmonized approach, whereby key follow-up work and activities are documented and tracked by a lead Regulatory Agency, with input from other Regulatory Agencies, as appropriate.**

International

ICRP Committee 5

- Committee 5 is concerned with radiological protection of the environment.
- It will aim to ensure that the development and application of approaches to environmental protection are:
  - compatible with those for radiological protection of man,
  - and with those for protection of the environment from other potential hazards.

ICRP Committee 5







The Common ICRP approach

Normal situations, accidents and existing exposure

Environmental radionuclide concentration(s)

Reference Man

Reference Animals and Plants

Dose limits, constraints

Derived Consideration Levels

Decision-making regarding public health and environment for the same environmental situation

ICRP

A system is currently being developed which comprises the following elements:

- a set of 12 *reference animals and plants* (RAPs) (draft document 2005)
- a set of dose conversion coefficients that enable estimation of external and internal dose (rate) per unit activity concentration (draft in progress)
- information on background radiation doses to the RAPs
- information on biological radiation effects in the RAPs and related organisms.

IAEA

- Stockholm conference 2003: "*the time is ripe for launching a number of international initiatives to consolidate the present approach to controlling radioactive discharges to the environment by taking explicit account of the protection of species other than humans*"
- In response IAEA develop Plan of Activities on Radiation Protection of Environment (approved by Board of Governors Sept 2005)

IAEA Plan of Activities - Aims

- Promoting collaborative work that enhances current approaches in radiation protection by taking explicit account of non-human species
- Providing assistance to Agency Members States in their efforts to protect the environment by:
  - Development of a framework and methodologies
  - Review of radiation safety standards

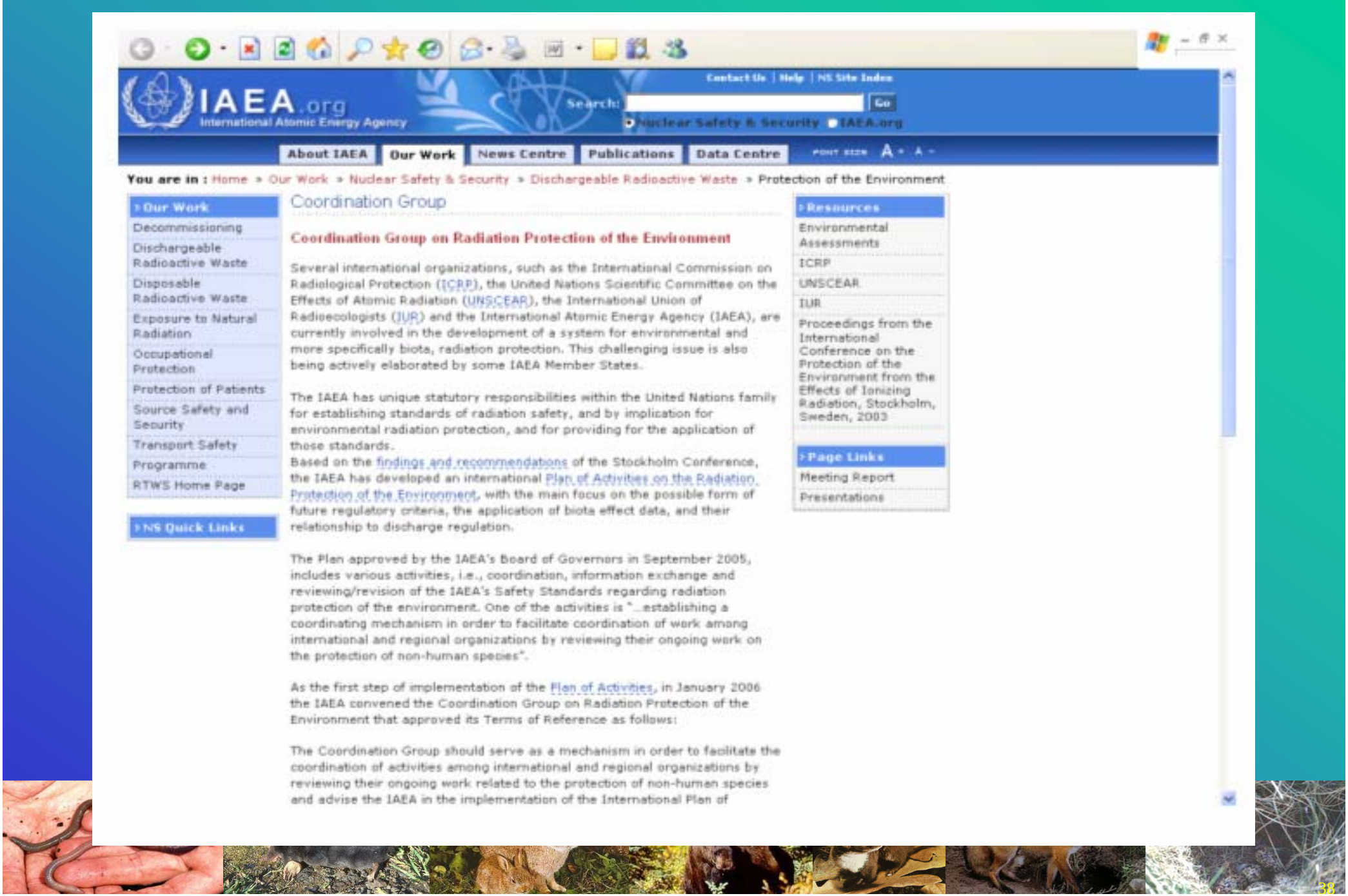
IAEA Plan of Activities - Activities

- Co-ordination
- Information exchange
- Reviewing/revising Agency Safety Standards

IAEA Coordination Group on Radiation Protection of the Environment

Information exchange

- **Website**
- **Glossary**
- **First meeting acknowledged a continued need for further research to facilitate an understanding of 'what' is to be protected, the modelling and transport of materials through the environment, and the rationale for levels at which protection should be provided**
- **Major IAEA meeting on environmental radiation protection – 2009/10**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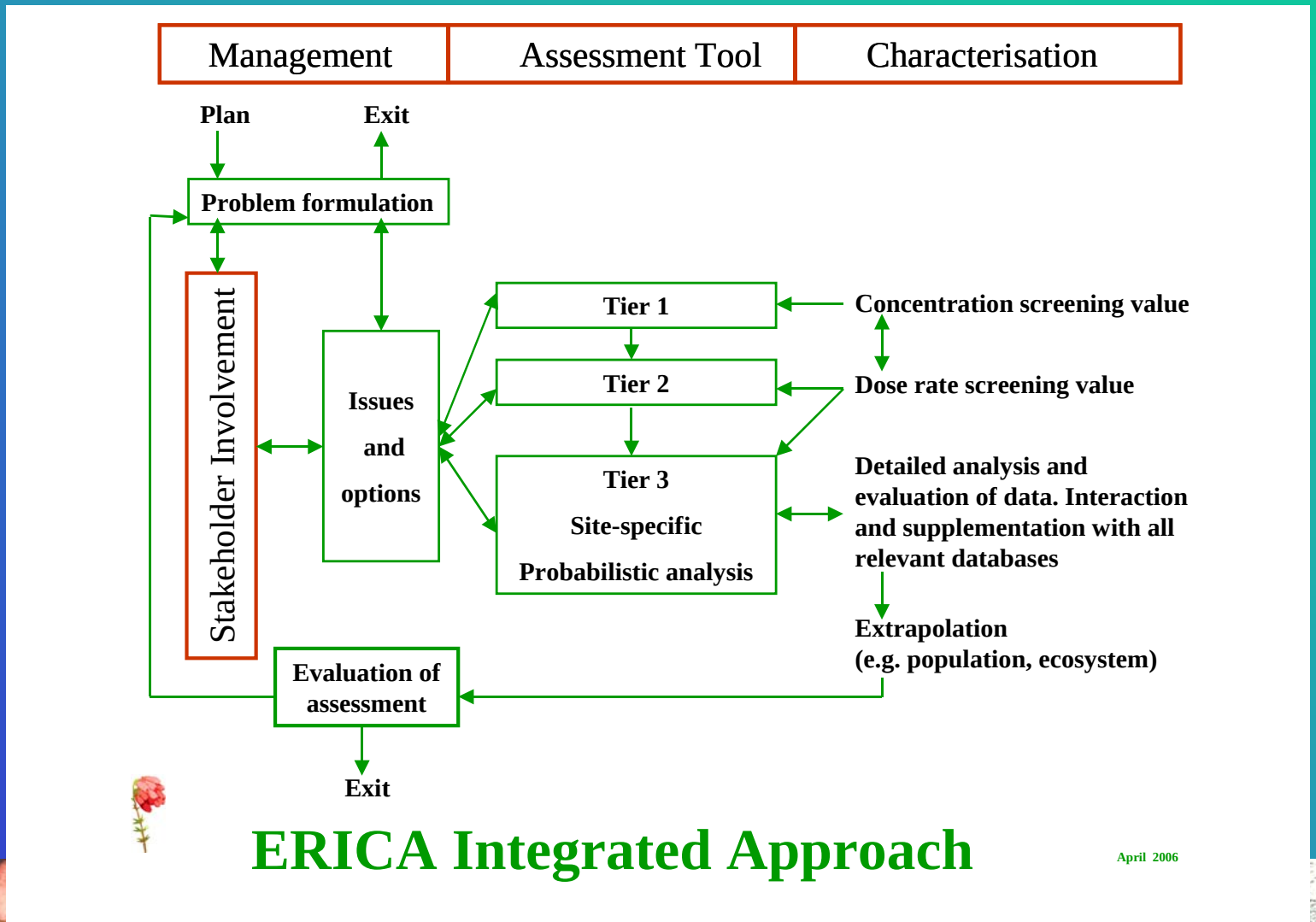
Coordination Group
Coordination Group on Radiation Protection of the Environment
Several international organizations, such as the International Commission on Radiological Protection (ICRP), the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), the International Union of Radioecologists (IUR) and the International Atomic Energy Agency (IAEA), are currently involved in the development of a system for environmental and more specifically biota, radiation protection. This challenging issue is also being actively elaborated by some IAEA Member States.
The IAEA has unique statutory responsibilities within the United Nations family for establishing standards of radiation safety, and by implication for environmental radiation protection, and for providing for the application of those standards.
Based on the findings and recommendations of the Stockholm Conference, the IAEA has developed an international Plan of Activites on the Radiation Protection of the Environment, with the main focus on the possible form of future regulatory criteria, the application of biota effect data, and their relationship to discharge regulation.
The Plan approved by the IAEA's Board of Governors in September 2005, includes various activities, i.e., coordination, information exchange and reviewing/revision of the IAEA's Safety Standards regarding radiation protection of the environment. One of the activities is "...establishing a coordinating mechanism in order to facilitate coordination of work among international and regional organizations by reviewing their ongoing work on the protection of non-human species".
As the first step of implementation of the Plan of Activities, in January 2006 the IAEA convened the Coordination Group on Radiation Protection of the Environment that approved its Terms of Reference as follows:
The Coordination Group should serve as a mechanism in order to facilitate the coordination of activites among international and regional organizations by reviewing their ongoing work related to the protection of non-human species and advise the IAEA in the implementation of the International Plan of
Resources
Environmental Assessments
ICRP
UNSCEAR
IUR
Proceedings from the International Conference on the Protection of the Environment from the Effects of Ionizing Radiation, Stockholm, Sweden, 2003
Page Links
Meeting Report
Presentations

Other International Activities

- UNSCEAR – report on authoritative scientific basis for future international efforts in international radiation protection
- Nuclear Energy Agency (NEA-OECD) – assisted ICRP with stakeholder interaction
- IUR – biota task group

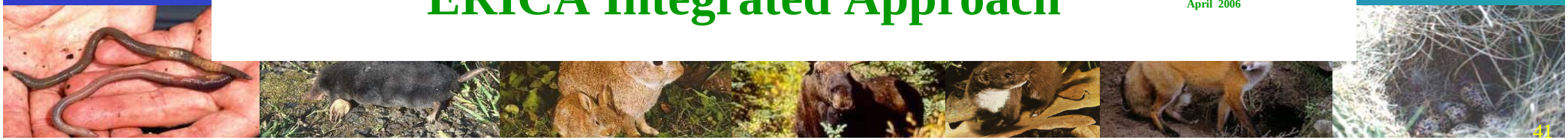
EC projects

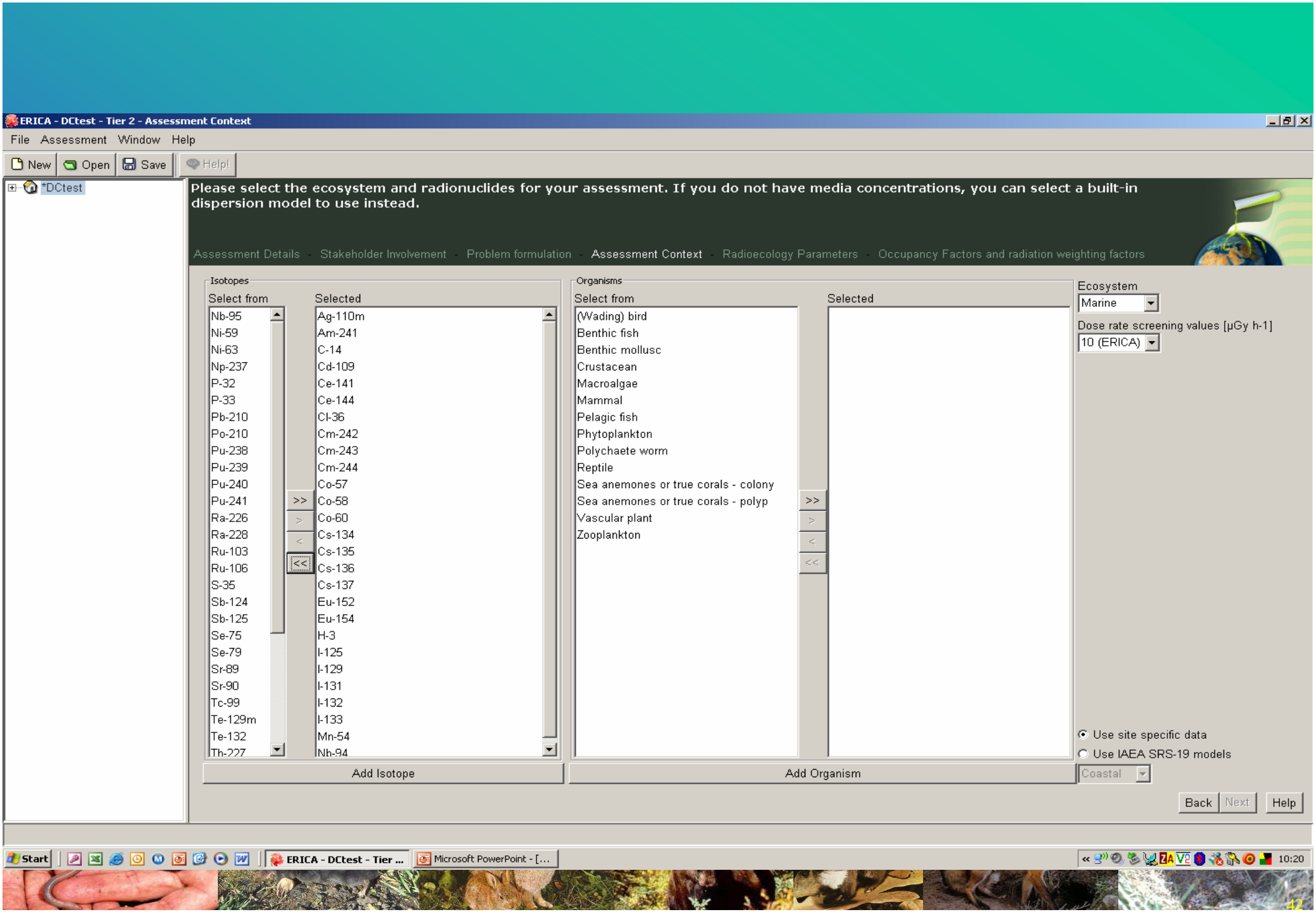
The ERICA Integrated Approach



ERICA Integrated Approach

April 2006




ERICA - DCtest - Tier 2 - Assessment Context
File Assessment Window Help
New Open Save Help!
*DCtest
Please select the ecosystem and radionuclides for your assessment. If you do not have media concentrations, you can select a built-in dispersion model to use instead.
Assessment Details - Stakeholder Involvement - Problem formulation - Assessment Context - Radioecology Parameters - Occupancy Factors and radiation weighting factors
Isotopes
Select from
Nb-95
Ni-59
Ni-63
Np-237
P-32
P-33
Pb-210
Po-210
Pu-238
Pu-239
Pu-240
Pu-241
Ra-226
Ra-228
Ru-103
Ru-106
S-35
Sb-124
Sb-125
Se-75
Se-79
Sr-89
Sr-90
Tc-99
Te-129m
Te-132
Th-227
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Selected
Ag-110m
Am-241
C-14
Cd-109
Ce-141
Ce-144
Cl-36
Cm-242
Cm-243
Cm-244
Co-57
Co-58
Co-60
Cs-134
Cs-135
Cs-136
Cs-137
Eu-152
Eu-154
H-3
I-125
I-129
I-131
I-132
I-133
Mn-54
Nb-94
Add Isotope
Organisms
Select from
(Wading) bird
Benthic fish
Benthic mollusc
Crustacean
Macroalgae
Mammal
Pelagic fish
Phytoplankton
Polychaete worm
Reptile
Sea anemones or true corals - colony
Sea anemones or true corals - polyp
Vascular plant
Zooplankton
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Selected
Add Organism
Ecosystem
Marine
Dose rate screening values [µGy h-1]
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Use site specific data
Use IAEA SRS-19 models
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Reference ID Number	Article Type	QC Score	
1	Journal		

Author

Sun, X.Z., Inouye, M., Yamamura, H. and Fukui, Y.

Article Title

Effects of prenatal treatment with tritiated water on the developing brain in mouse.

Journal title

International Journal of Radiation Biology.

Year	Volume	Part	Page Nos
(1997)	71	(3),	309-313.

Keywords

Reference Language	Translation into English available
English	

Record 1 of 1186

Type of study being assessed	Radionuclide reported	Radiation type (alpha,beta.etc)	Type of exposure
Laboratory	H-3	Beta	Acute
Internal/External exposure	**Wildlife group**	**Ecosystem Type**	**Umbrella effect**
Mixed	Mammals	Terrestrial (Generic)	Reproduction
Species name(common)	**Species name(latin)**	**Methods used to determine dose**	
Mouse		Calculated	
Can the study be used to determine RBE values			
No			

Please describe how/why the results reported can be used to determine RBE

Notes section (freeform)	Specific endpoint description
Radiation administered by injection. Injection on embryonic day 13. Dose dependent effects were observed. 0.2 Gy was sufficient to significantly reduce cerebral pyramidal cells, 0.4 Gy significantly reduced brain but not body weight whilst 0.8 Gy inhibited both brain and body development The number of pyramidal cells was the most sensitive indicator for developmental disturbance of the cerebral cortex following treatment of embryonic mice. The time in which the insult occurs during development was an important factor in determining abnormalities.	Mean Body Weight (g) in 8 week old mice (Effects value = mean, Uncertainty = standard deviation)

Record 1 of 5

Gy	uGyh	Conc. in biota	Bq/kg	Conc. in media	Bq/kg	Media	Notes	Duration	Units	Effect value	Uncertainity(%)	LOEDR	HNEDR	Background?	Dose	Units	Dose rate	Units
0	0						Male	0		40.2	2.6	✗	✗	✓	0	Gy	0	µGy/h
0	0						Female	0		37.3	3.2	✗	✗	✓	0	Gy	0	µGy/h
0.1	0						Male	0		38.6	2.5	✗	✗	✗	0.1	Gy	0	µGy/h
0.1	0						Female	0		35.7	1.9	✗	✗	✗	0.1	Gy	0	µGy/h
0.2	0						Male	0		38.6	3.8	✗	✗	✗	0.2	Gy	0	µGy/h
0.2	0						Female	0		36.1	2.9	✗	✗	✗	0.2	Gy	0	µGy/h
0.4	0						Female	0		36.8	1.8	✗	✗	✗	0.4	Gy	0	µGy/h
0.4	0						Male	0		37.9	3.6	✗	✗	✗	0.4	Gy	0	µGy/h
0.8	0						Male	0		32.1	4.3	✓	✗	✗	0.8	Gy	0	µGy/h
0.8	0						female	0		31.6	4	✓	✗	✗	0.8	Gy	0	µGy/h

Relevant web site addresses:

www.erica-project.org

www.frederica-online.org

Paris 14-15 Feb 2007 – open meeting and hands on experience

Protection of the Environment from Ionising Radiation in a Regulatory Context

PROTECT

CEH

SSI

IRSN

NRPA (+ UMB)

EA

Objectives

WP	Deliverable	Draft	Due
1	D3: A review of approaches to protection of the environment from chemicals and ionising radiation – requirements & recommendations for a common framework		Nov 07
2	D4: Evaluation of the practicability of different approaches for protecting the environment from ionising radiation in a regulatory context and their relative merits		Jul 08
3	D5: Aims and associated secondary numerical targets, for protecting biota against radiation in the environment A: Recommendations for further actions B: Proposed levels and underlying reasoning C: Records of end users' views on feasibility of proposed targets	Jan 08	Sept 08