Improving the robustness of Derived Consideration Reference Levels for RAP

Insights from TG-99 activities

Panel Discussion

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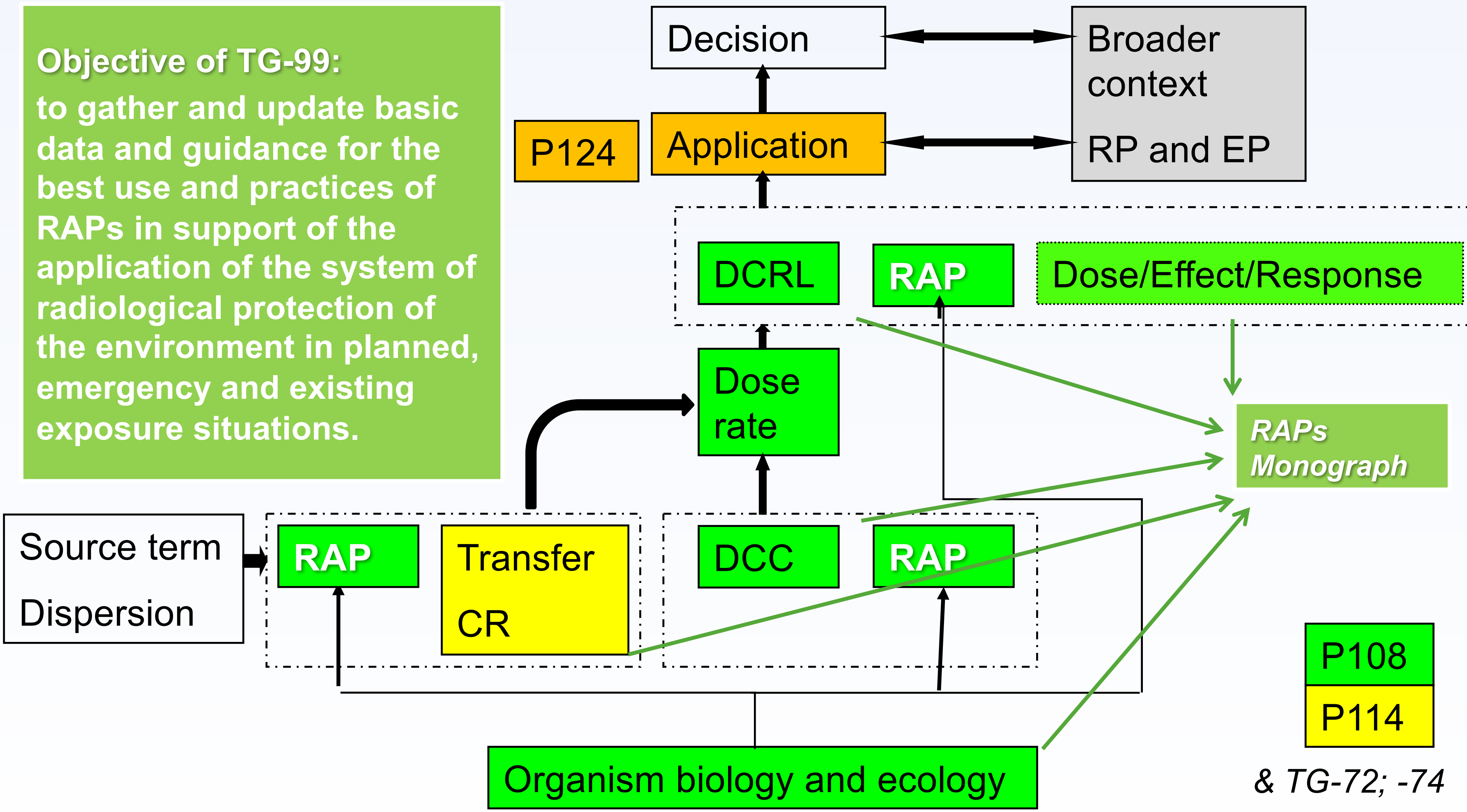
ICRP System - Protection of the environment
Our current work in TG-99

Objective of TG-99:
to gather and update basic data and guidance for the best use and practices of RAPs in support of the application of the system of radiological protection of the environment in planned, emergency and existing exposure situations.



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What are the present DCRLs?

From ICRP 108 (2008)

Wildlife group	Ecosystem[1]	RAP	DCRL, mGy d^{-1} (shaded) *μGy/h (rounded down, 1 digit)*		
			0.1-1	1-10	10-100
			4-40	*40-400*	*400-4000*
Large terrestrial mammals	T	Deer			
Small terrestrial mammals	T	Rat			
Aquatic birds	F, M	Duck			
Large terrestrial plants	T	Pine tree			
Amphibians	F, T	Frog			
Pelagic fish	F, M	Trout			
Benthic fish	F, M	Flatfish			
Small terrestrial plant	T	Grass			
Seaweeds	M	Brown seaweed			
Terrestrial insects	T	Bee			
Crustacean	F, M	Crab			
Terrestrial annelids	T	Earthworm			

DCRL band of DR within which there is likely to be some chance of deleterious effects occurring to individuals of such type of organism

[1]T, terrestrial; F, freshwater; M, marine

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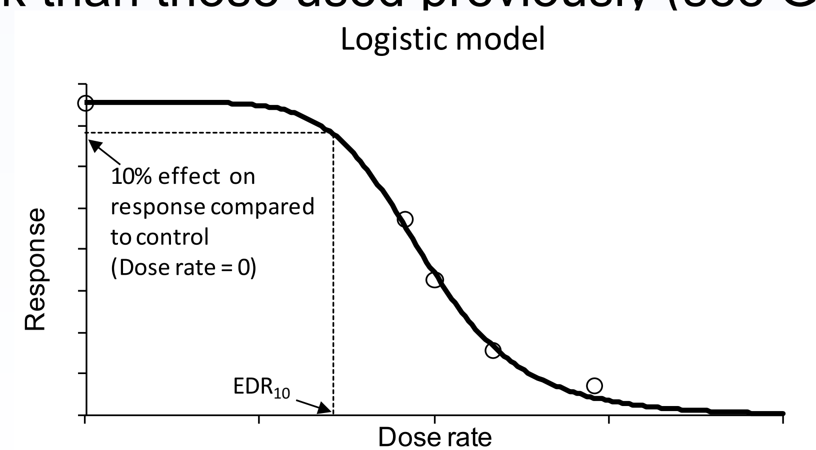
TG-99 work to consolidate DCRLs

- ICRP 108 derived DCRLs on the basis of a critical literature review.
- Our goal here is to improve the transparency of the derivation method used to obtain those DCRLs and to systematically check and report on the quality and quantity of the underlying effect data sets describing the radiosensitivity of various endpoints and species.
- TG-99 will make use of statistical inference methods and therefore need comparable effect endpoints as input data for meta-analysis.
- Dose (rate) effect relationships were reconstructed from laboratory studies (like we did under ERICA/PROTECT for ecologically relevant endpoints – we keep the same rules for data quality check than those used previously (see Garnier-Laplace et al., 2010; 2013)
- Sets of EDR_{10} and ED_{50} available



Brief reminder on the 2 methods used for data treatment

- Distributions of Sensitivity (all endpoints except mutation/all species): simply to inform transparently on the range of variation of radiosensitivity among species for a wildlife group
  - Principle: fit a statistical distribution to endpoints (of similar type) to examine the range of radiosensitivity among categories of endpoints/among species (of similar wildlife group)
  - Assumption: the data set is a representative sample in terms of radiosensitivity variation
  - Method: apply to data set constituted by all endpoints for all species of a group, weight the data in order no species is given more importance than another, fit the distribution and CI

- Acute – to- Chronic transformation (ACT):
  - Principle: use knowledge from acute exposure to infer chronic exposure effects
  - Assumption: « shift » from acute – to – chronic effects is similar among species of the same taxonomic class
  - Method:

    (i) search for the best regression model between the statistical distribution parameters (μ, s) defining acute radiosensitivity and chronic radiosensitivity for all classes // compare observed to predicted chronic parameters to judge the global adequation of the regression

    (iii) validate the ACT model and use it to predict EDR10

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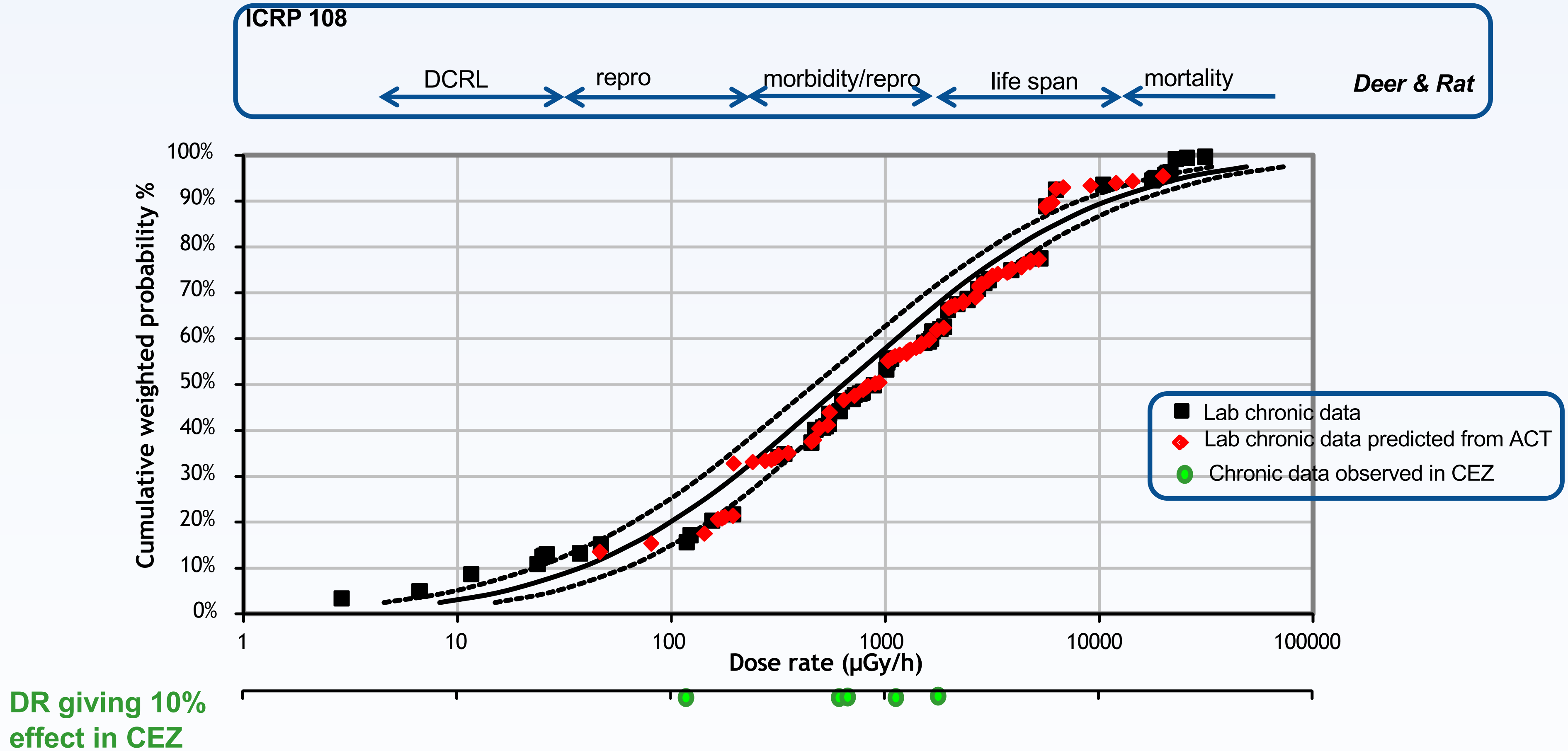
Mammals – distribution of chronic radiosensitivity among species for all endpoints (all data)



Other papers published dealing with CEZ or Fukushima area to be incorporated in the analysis but primary ecological data are not always accessible

Draft version - Work in progress under TG99 – ICRP C5

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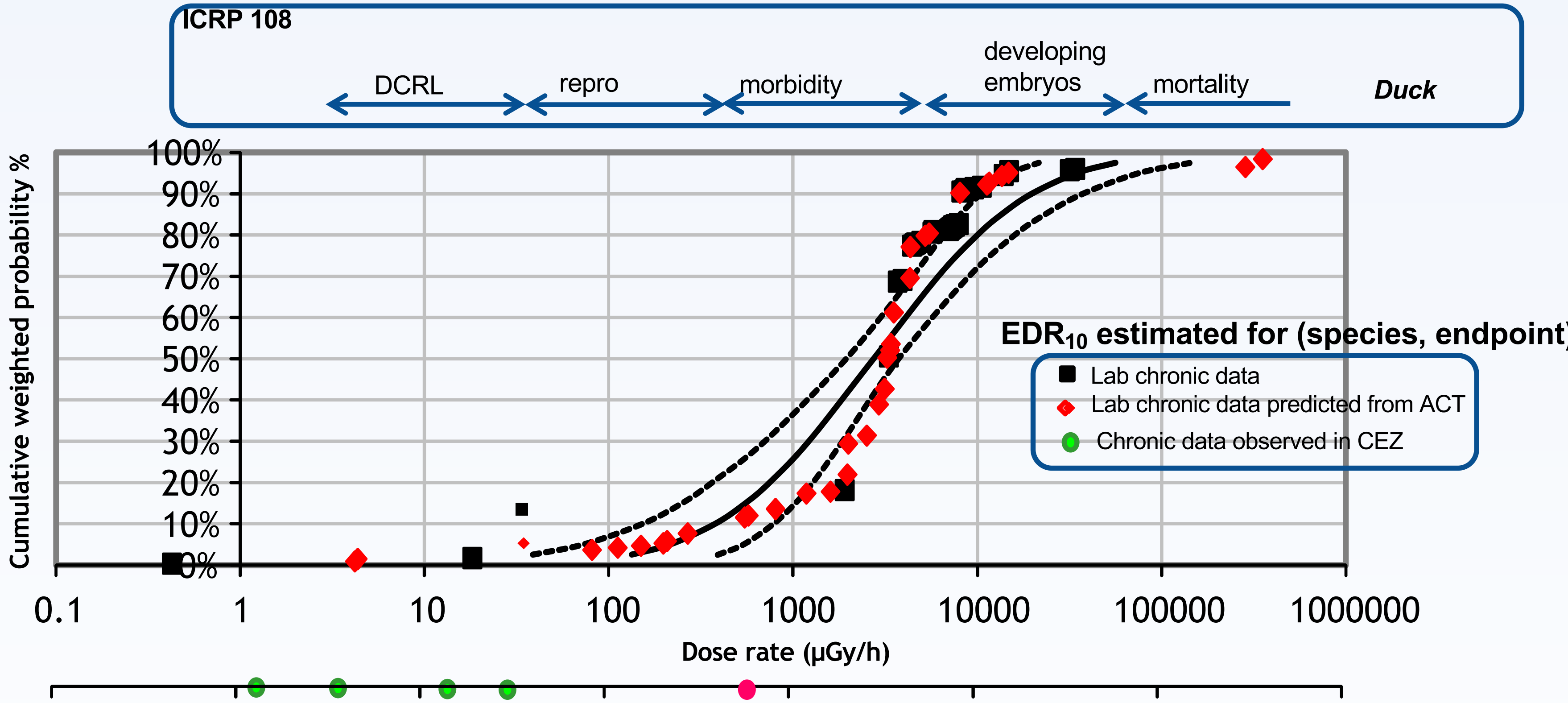
Birds – distribution of chronic radiosensitivity among species for all endpoints (all data)



DR giving 10% effect in CEZ (reconstructed from Moller & Mousseau (2007), several reasons may explain their very left-hand position in the distribution (see Garnier-laplace et al., 2013)

DR giving 50% effect in the 50 km NW Fukushima area 2011-2014 (reconstructed from Moller & Mousseau data – Garnier-Laplace et al., 2015)

To finish...

- Even though various methods can be applied to make the best use of existing effect data, research must go on to improve our understanding of the mechanisms underlying the variation of radiosensitivity among living organisms (e.g., transgenerational effects)

- A number of interesting papers dealing either with CEZ or Fukushima impacted area has been published in the last 5 years. They are based on ecological data that are rarely accessible for several reasons (see a discussion in Mills et al., TEE 2015). A meta-analysis of all these data would be of more than great added value to identify the main environmental/ecological/biological drivers and to deeply investigate the relevancy of effect benchmarks

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