A statistical approach for selecting the most appropriate PT value for long-term wildlife risk assessments

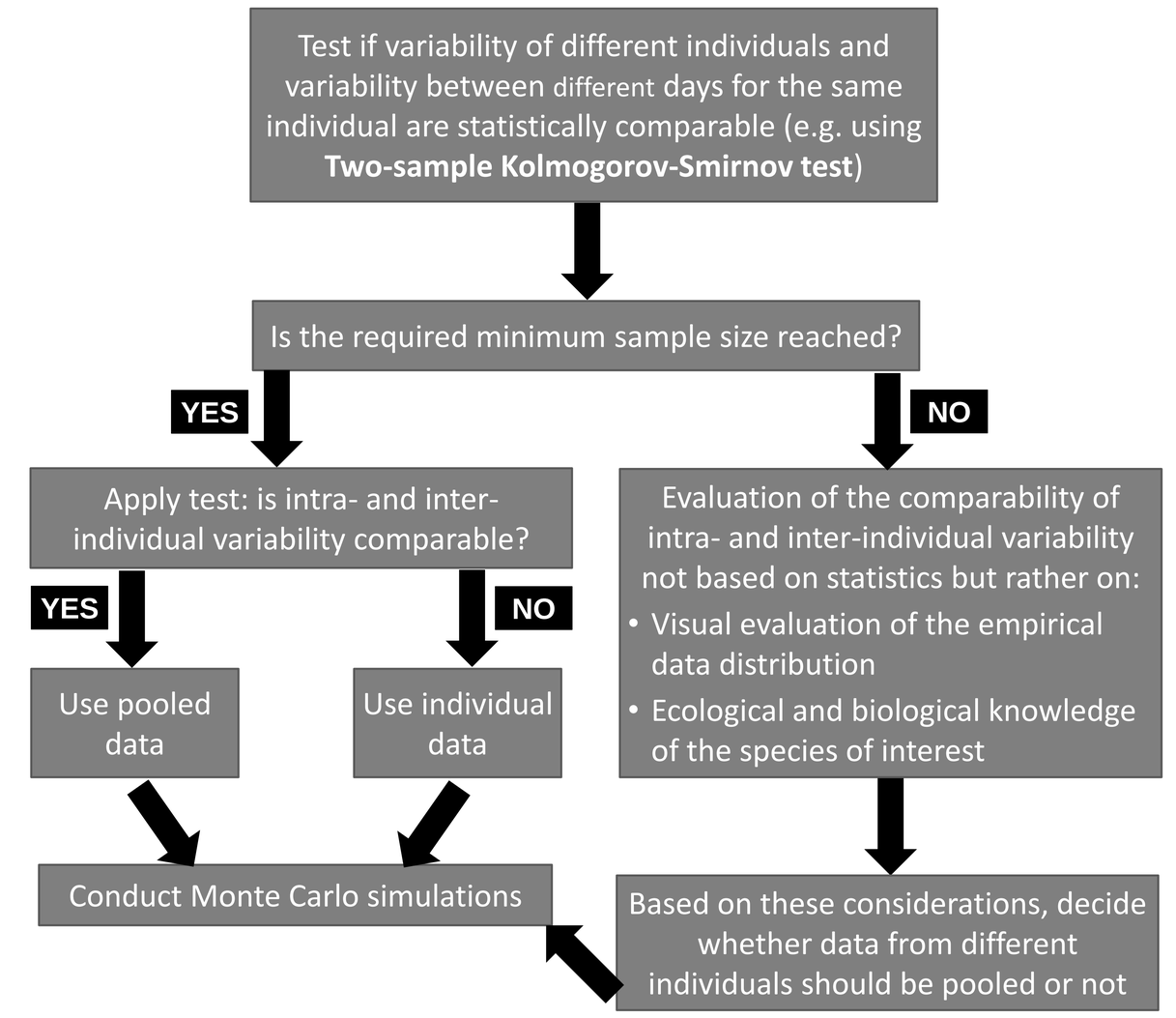
Jan-Dieter Ludwigs[1], Finn Bastiansen[1], Markus Ebeling[2], Timothy B Fredricks[3], Steven Kragten[4], Mattia Meli[1], Roger Murfitt[5]

[1]RIFCON GmbH, Hirschberg, Germany - [2]Bayer CropScience, Monheim, Germany – [3]Monsanto Company, Saint Louis, MO, USA - [4]BASF SE, Limburgerhof, Germany - [5]Syngenta Ltd, Bracknell, UK

BACKGROUND AND MOTIVATION

- In higher tier Risk Assessments (RAs) for Birds and Mammals, exposure takes into account the '*portion of food taken from the treated area*', addressed by the surrogate parameter *portion of time spent by birds or mammals potentially foraging in treated fields* (the so-called PT value).
- Data for refining PT are collected via radio telemetry (as recommended in EFSA 2009), in which time spent by a number of tracked individuals within full one-day activity periods (i.e. activity ranges) are recorded.
- Nowadays most regulatory authorities require using the 90th percentile of these daily PT distribution (i.e. the set of actual PT measurements) for long-term (LT) RA.
- However, as LT risk is usually assessed over a period of 21 days, using the 90th percentile of the daily PT distribution represents an unrealistic worst-case. Feeding behaviours of birds or small mammals over 21 days are diverse, and this is not reflected in the 90th percentile of the daily distribution.
- Thus, we propose using Monte Carlo (MC) simulations based on the original sample of tracking data to obtain an estimate of an overall PT distribution over 21 days: measured daily PT values, recorded over full activity period of an individual, are repeatedly sampled to obtain a set of PT values for a number of days and a large number of individuals.
- PT data include variability of different individuals as well as among different days for the same individual. Before performing MC simulations, it should be decided whether data from different individuals should be pooled or not.

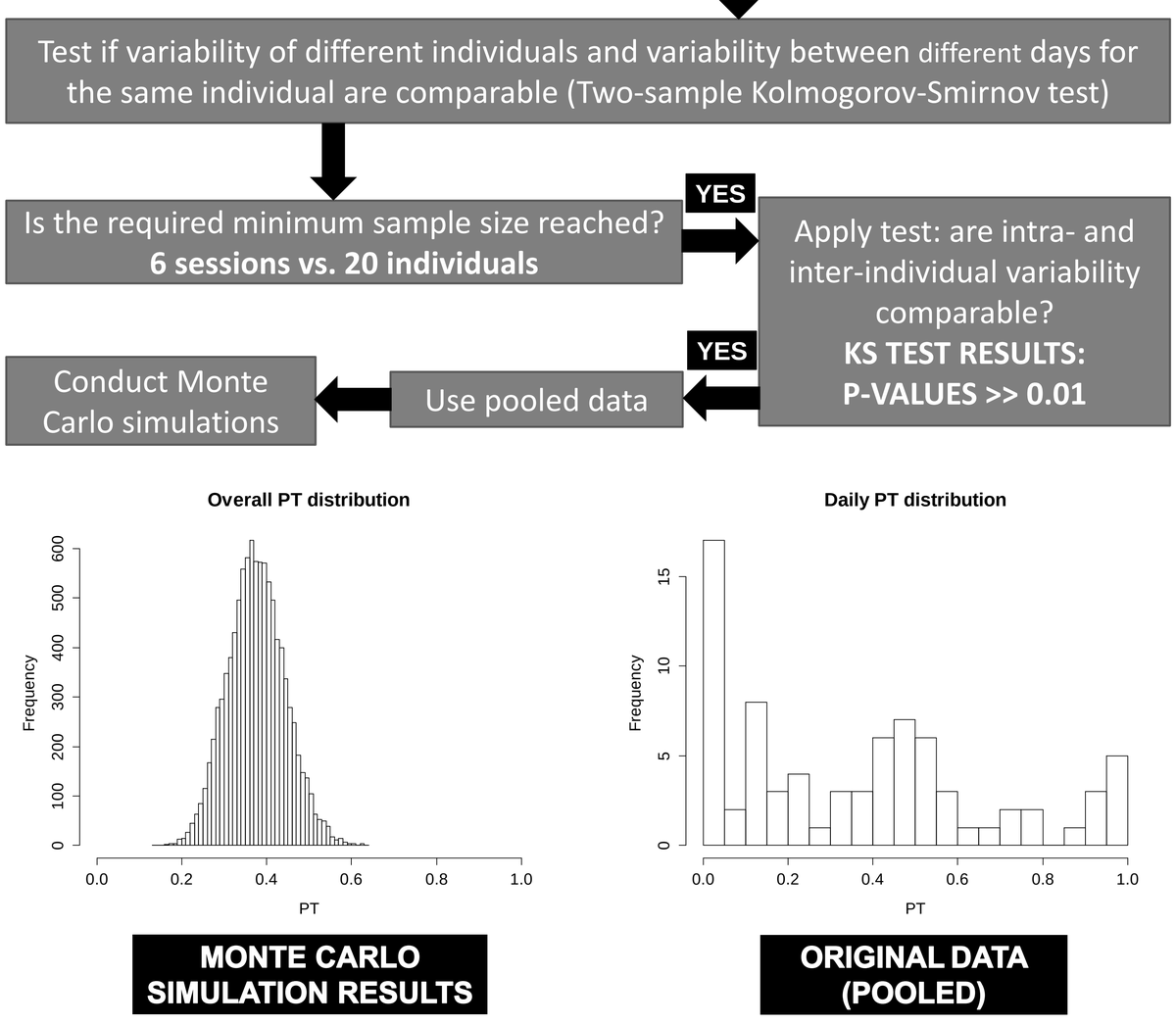
OUTLINE OF PROPOSED APPROACH



APPLICATION OF THE APPROACH TO A REAL DATASET

WP #	Session 1	Session 2	Session 3	Session 4	Session 5	Session 6
2b	0.546	0.355	1.000			
3c	0.054	0.465	0.110	0.211	0.000	0.000
4d	0.335	0.603	0.254	0.000	0.000	0.000
5e	0.486	0.626	0.217			
6f	*0.000*	*0.000*	*0.119*	*0.000*	*0.000*	*0.000*
7g	0.374	0.052	0.584	0.719	0.158	0.541
8h	0.175	0.263	0.479			
9i	1.000	0.526	0.967	0.444	0.429	0.435
10j	0.933	0.459	0.113			
11k	0.478	0.114	0.140			
12l	0.497	0.794	0.530			
14n	0.513	1.000	0.708			
15o	0.118	0.314	0.233			
16p	0.452	0.000	0.102			
17q	0.447	1.000	0.923	0.438	0.542	0.487
18r	0.140	0.000	0.000			
19s	0.150	0.000	0.171			
20t	0.399	0.691	0.924			
21u	0.778	0.878	0.572			
23w	0.366	0.000	0.069			

- Woodpigeon (*Columba palumbus*) radio-tracking data (20 individuals, max. 6 sessions)
- Time spent potentially foraging was recorded, PT for 'stubble fields' calculated
- The tests below showed comparable variability for all individuals except "6f"



DISCUSSION

- Results of the PT analysis based on woodpigeons radio tracked in stubble fields show that the 90th percentile of the overall PT distribution over 21 days is much closer to the median and the mean of the daily PT distribution, rather than to its 90th percentile:

Parameter	Value
90th percentile of daily PT distribution (empirical data)	0.981
Median of daily PT distribution (empirical data)	0.370
Mean of daily PT distribution (empirical data)	0.381
90th percentile of overall PT distribution over 21 days (MC data)	**0.464**
Median of overall PT distribution over 21 days (MC data)	0.375

- This is due to the intrinsic variability in the feeding behaviour shown by the radio-tracked birds: daily PT values for single individuals vary from 0 to 1. This variability is not taken into account by the 90th percentile of the daily distribution, while it is reflected in the overall distribution. Therefore, using the 90th percentile of this distribution is a more accurate estimate of the assumed PT for the species over 21 days, while still being conservative for 90% of the population.
- The use of this **21-d 90th percentile PT** value for long-term RAs represents the same conservative level of protection similar to what is applied in the acute risk assessment for birds and mammals.
- In the EFSA opinion on birds & mammals (2008), an approach for PT calculation is also provided (Appendix 29). However, the opinion only offers a method which is suitable to calculate PT for acute/short-term RAs, while our approach is more suitable for long-term/reproductive RAs.
- Analyses of previously collected radio-tracking data can encounter the problem of 'too small sample sizes'. By combining visual evaluation of the data (e.g. to identify and exclude outliers) and knowledge on the ecology of the species of interest the decision can be made to use pooled or individual data for PT estimations.
- **Therefore we encourage further discussion around the proposed new risk assessment parameter: the 21-d 90th percentile PT.**

Contact: Jan-Dieter.Ludwigs@rifcon.de