BIRD & MAMMAL REPRODUCTIVE ASSESSMENTS: BROODS AT RISK

ALAN LAWRENCE

CAMBRIDGE ENVIRONMENTAL ASSESSMENTS, UK ***alan.lawrence@cea-res.co.uk***

Abstract

Experiences of conducting reproductive risk assessments for birds & mammals under 91/414/EC according the to procedures outlined in EFSA (2008) are presented. Risk assessments were conducted for seed treatments intended for spring use. Breeding phase assessments were conducted, however, TERs remained below the trigger value for acceptable risk. Broods at risk was investigated as a refinement option using landscape and ecological data for appropriate focal species. Exposure to the breeding population during the reproductive period was shown to be low. Interpretation is discussed. Methods to estimate broods at risk and data types employed are discussed.

Introduction

Long term risk assessments for birds & mammals must address effects of chronic, low level exposure and effects on reproduction (from either long or short term exposure). In practice, the focus of the assessment is reproduction since this is related to population viability. Procedures outlined in EFSA (2008) were followed for two seed treatments intended for spring use. Due to the timing of the use (potential overlap with breeding period) a chronological breeding phase assessment was conducted. For this, data on onset of breeding and timing of drilling were required. Further refinement options included broods at risk, addressed through landscape and ecological data.

Methods

Breeding phase assessment

Appropriate toxicity endpoints were selected for each breeding phase. Both short term and time weighted exposure concentrations were included in an initial screening phase, as outlined in EFSA (2008)(Fig. 1).

Breeding phase	Test endpoint used as surrogate	Short-term exposure	Long-term exposure
Pair formation/ breeding site selection	1/10 of LD_{50}	1-day DDD	21-day TWA DDD[#2]
Copulation and egg laying (5 days pre-laying through end of laying)	NOAEL for the number of eggs laid per hen	1-day DDD	21-day TWA DDD
	NOAEL for mean eggshell thickness	1-day DDD	21-day TWA DDD
Incubation and hatching	1/10 of LD_{50}	1-day DDD	21-day TWA DDD
	NOAEL for proportion of viable eggs per eggs set per hen	1-day DDD	21-day TWA DDD
	NOAEL for proportion hatchling per viable eggs per hen	3-day TWA DDD	21-day TWA DDD
Juvenile growth and survival until fledging	1/10 of LD_{50} (extrinsic adult)	2-day TWA DDD	21-day TWA DDD
	1/10 of LD_{50} (extrinsic juvenile)	1-day DDD based on chick shortcut value of 3.8 and 22.7*)	21-day TWA DDD based on chick shortcut value of 3.8 and 22.7*
	NOAEL for proportion of 14-day-old juveniles per number of hatchlings per hen	3-day TWA DDD	21-day TWA DDD
Post-fledging survival	1/10 of LD_{50}	1-day DDD based on chick shortcut value of 3.8 and 22.7*	21-day TWA DDD based on chick shortcut value of 3.8 and 22.7*
	NOAEL for 14-day-old juvenile weights per hen	3-day DDD	21-day TWA DDD

Figure 1

Breeding phases, toxicity endpoints and corresponding exposure estimates for screening phase

Exposure estimates were calculated using field degradation data (Figure 2)

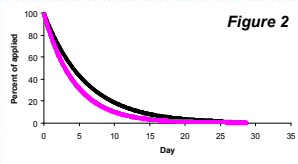


Figure 2

Screening phase results

The initial screening phase indicated potential risk (TERs <5) when both short and long term exposure estimates were included. Therefore, further refinement options were pursued (Figure 3)

Scenario	Assessment outcome		
1 to 3-day ETE (i.e. effects are based on short-term exposure)	TER ≥ 5	TER < 5	TER < 5.
21-day ETE scenarios (i.e. effects are based on long-term exposure.)	TER ≥ 5	TER ≥ 5	TER < 5.
Next steps	No further refinement required	Further refinement is required. The outcome of the risk assessment indicates that one possible refinement step is to try to determine if the effects are the result of short-term exposure.	Further refinement is required. However, the outcome of the risk assessment indicates that little will be gained by additional effects data and hence trying to determine if the effects are the result of short-term exposure. It is recommended that refinements should concentrate on refining the exposure as well as the potential consequences of effects.

Figure 3

Interpretation of screening phase

TERs were <5 for both short and long term exposure estimates. Note that exposure refinement is recommended

Further refinement options

The degradation of **residue** on seed surfaces had already been included in the exposure assessment. According to EFSA (2008), remaining refinement options included (with limitations):

- Refine ecological parameters (focal species) – dietary refinement (scenario specific data – cost?)
- Assess broods at risk – compare exposure to reproductive phase (data availability?)
- Field trials – assess effects on reproduction (cost?)
- Population modelling (data availability? parameterisation?)
- Further toxicity testing (animal welfare?)

The option **broods at risk** was taken. This was approached through the inclusion of data on onset of breeding, land use (area cropped) and breeding density/aggregation of focal species in relation to land use.

Broods at risk

The procedure followed in the risk assessment is outlined in Figure 4.

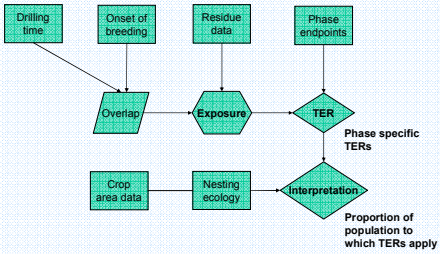


Figure 4

Risk assessment process: TERs were calculated and then contextualised in terms of the regional population

The risk assessment integrated data on land use and onset of breeding in birds. These were compared in order to determine the proportion of reproductive activity that may occur adjacent to the treatment area (distribution of birds and crop) and during the drilling period (reproductive activity during drilling). Thus, spatial and temporal elements were included to increase realism.

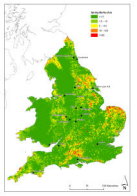


Figure 5

Data types used: land use (area under specific crops by UK region); onset of breeding (date of first clutch; percentiles shown for an example species)

Species	Region	Percentiles				No. records
		5	50	95	100	
Skylark	North West	104	126	164	180	111
Skylark	East Midlands	106	149	178	192	78
Skylark	East England	112	147	192	214	185
Skylark	South East	109	137	180	201	88

A worst-case focal region was identified – the region of GB which cropped the highest density and area of the crop in question. Region-specific data regarding onset of breeding in the appropriate focal species was included. Thus, the risk assessment was focused on the worst-case region, protective of others. The data were combined to indicate the spatial and temporal overlap. The extent of temporal overlap is shown in Figure 6.

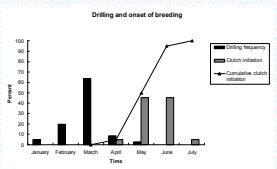


Figure 6

Temporal overlap in drilling of crop (percent drilling activity for a single crop type shown) and onset of breeding in a focal species. Ecological data showed that the selected focal species did not aggregate around the crop type in question and exhibited limited home ranges during breeding; therefore, crop incidence in the landscape would inform the proportion of breeding pairs potentially exposed.

Results

When both spatial (land use and bird distribution) and temporal (onset of breeding and drilling time) data were combined, the proportion of reproductive effort which would coincide with drilling (= exposure) was found to be low.

Month	Crop as % farmed area (region)	Breeding onset (% of first eggs laid)	Proportion of population nesting adjacent to drilled fields (to which TERs apply)	Percentage of population not exposed
January	0.41	0.0	0	100
February	1.56	0.0	0	100
March	5.02	0.0	0	100
April	0.68	5	0.03	99.97
May	0.20	45	0.09	99.91
June	0.0	45	0.0	100
July	0.0	5	0.0	100
Total	**7.90**	**100**	**0.13**	**99.874**

Figure 7

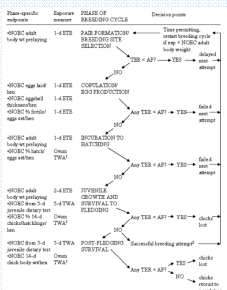
The proportion of population to which TERs apply was low

Interpretation

A scheme for interpretation was provided by Bennett *et al*. (2005) (Figure 8). TER exceedence may result in repeated reproductive efforts.

Figure 8

Interpretation of effects



Discussion

The TERs applied to a low proportion of the breeding population, indicating low overall risk to the population in the focal region. Consequences for individuals of TER exceedence in this case may include repeated attempts at reproduction, since exposure occurred at the beginning of the breeding period.

Bennett. R. S. *et al*. 2005. A New interpretation of Avian and Mammalian Reproduction Toxicity Test Data in Ecological Risk Assessment. *Ecotoxicology*, **14:** 801-815. Scientific Opinion of the Panel on Plant protection products and their Residues (PPR) on the Science behind the Guidance Document on Risk Assessment for birds and mammals. *The EFSA Journal* (2008) **734:** 1-181.