Development of a proof of concept study to test and demonstrate the European Raptor Biomonitoring Facility frameworks

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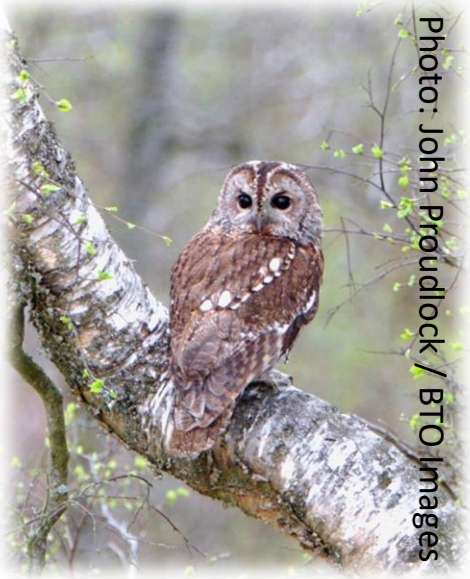


With thanks to Rafa Mateo for initial ideas and presentation, and Rui Lourenço and participants in ERBFacility Thessaloniki, Florence, Stirling and Madrid workshops for additional work on the ideas

Why does ERBFacility need to undertake a Proof of Concept study?

- It is one of the tasks we said we would deliver to fulfil the objectives agreed in the MoA for the ERBFacility COST Action

- ERBFacility is developing frameworks for a European Raptor Biomonitoring Scheme (ERBioMS), a European Raptor Specimen Bank (ERSpeB) and a European Raptor Sampling programme (ERSamP)

- We want to demonstrate the potential of ERBioMS, ERSpeB and ERsamP through the Proof of Concept study for selected focal contaminants/tissues/species

Proof of Concept: Objectives already agreed

√ to provide a quantitative measure of "recent pan-European" spatial variation in exposure to a selected small number of contaminants in one or a small number of related raptor species

√ to test and demonstrate the operation and sustainability of ERBF networks (ERBioMS, ERSpeB and ERSamP) and their value to future funders and participants

√ to identify gaps in sources and quality of samples (ERSamP)

√ to test the storage capacity, constraints and gaps identified by Working Group 3 (ERSpeB)

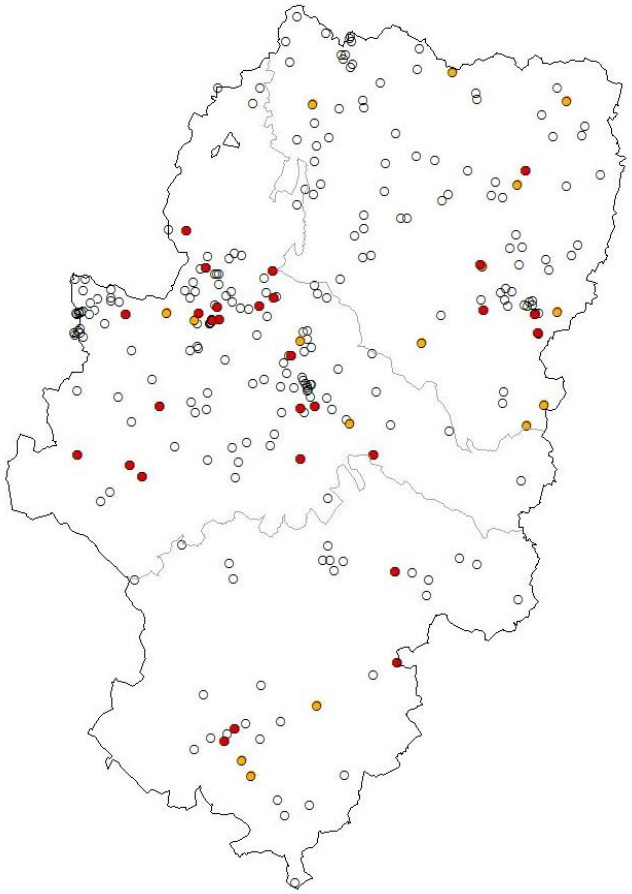
√ to identify gaps and variability in "quality" in analytical capability

√ to test pathways of movement for samples and constraints at all stages

√ to produce data to start to assess issues re-sample pooling, statistical power, uncertainty and required sample sizes for monitoring purposes

√ to test and demonstrate transfer pathways (information/data flows/feedback etc) to all parts of the network

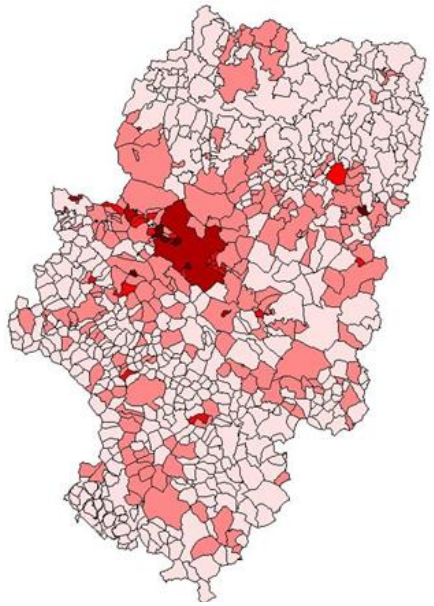
Retrospective compilation of published data (STSM)



Rodenticides in liver (ng/g)

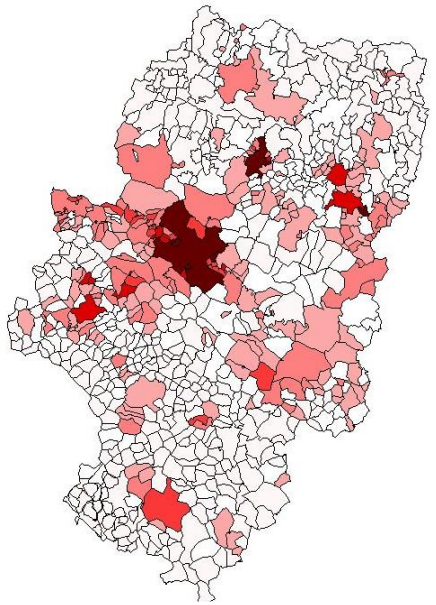
- ND
- 0.1-200
- >200

Rodenticides in wildlife from Aragón (NE Spain)



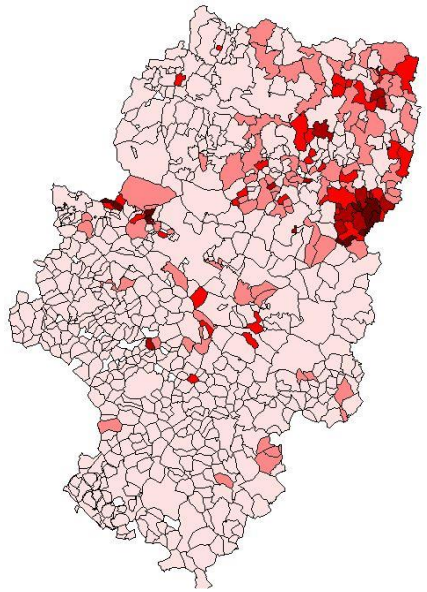
Urban Surface (%)

- <1
- 1 - 2
- 3 - 4
- 4 - 5
- >5



Human density (habitants/km²)

- <5
- 5- 10
- 10 - 20
- 20 - 50
- 50 - 100
- 100 - 300
- >300



Cattle density (individuals/km²)

- < 10
- 10 - 25
- 25 - 50
- 50 -100
- > 100

López-Perea, J.J., Camarero, P.R., Sánchez-Barbudo, I.S., Mateo, R. 2019. Urbanization and cattle density are determinants in the exposure to anticoagulant rodenticides of non-target wildlife. Environmental Pollution 244: 801-808.

The Proof of Concept study will not be designed to:

X	Demonstrate the best species for European contaminant monitoring or to monitor specific contaminant types
X	Analyse for all contaminants
X	Demonstrate the effects of contaminant(s)
?	Demonstrate temporal trends in contamination levels (unless the information obtained turns out to have sufficient temporal coverage) – the aim is to collect analysis results/samples relating to 2015-2019 initially in an attempt to get good <u>spatial</u> coverage

Choice of contaminants and matrix types

Metals

Contaminant	Justification for selection	Possible disadvantages	Suitable (and ideal) matrix type
Hg, Pb	• Lots of labs have capacity; • Relatively cheap to analyse; • Established certified reference materials; • Could do both Hg and Pb simultaneously in most labs; • Both Pb (UNEP call to remove lead from ammunition and shot) and Hg (Minamata) are related to international conventions which means governments should be interested in levels in the environment; • Large numbers of existing studies with results; • If analysed by ICPMS then would get results for a whole suite of metals (lab provision for this would be widespread but they may not have the expertise in -house); • Some labs may also be able to do Pb isotope analyses	**Uncertainty:** (a) would we expect pan-European spatial variation that could be demonstrated? We suggest for Pb that levels could be very variable. (b) also consider levels and % exposure of individuals - e.g. Hg found (at low levels) in blood of all vultures sampled. Hg deposited from atmosphere, so is likely to be more ubiquitous? **Stakeholders**: EFSA will not be interested - not their remit. ECHA - regulatory authority over both metals. Uncertainty over how high a priority these metals are for ECHA. Lead ammunitions are still under review.	Ideal LIVER/KIDNEY/BLOOD (only from active sampling in general). **Bones** for Pb (lifetime exposure proxy measure). **Liver** exposure over ca. 1 month . **Feathers** also possible (exposure over period of growth?).Reference materials not available for feathers compared to other tissues. Need to standardise which feather tract to use. Couldn't do ICP techniques for feathers (at least for Hg). **PASSIVE** - LIVER or KIDNEY (BONES not ideal for Hg). **ACTIVE** - blood; feathers. LIVER is the requirement additional information from bone (Pb) and kidney (Hg) FROM THE SAME ANIMAL.

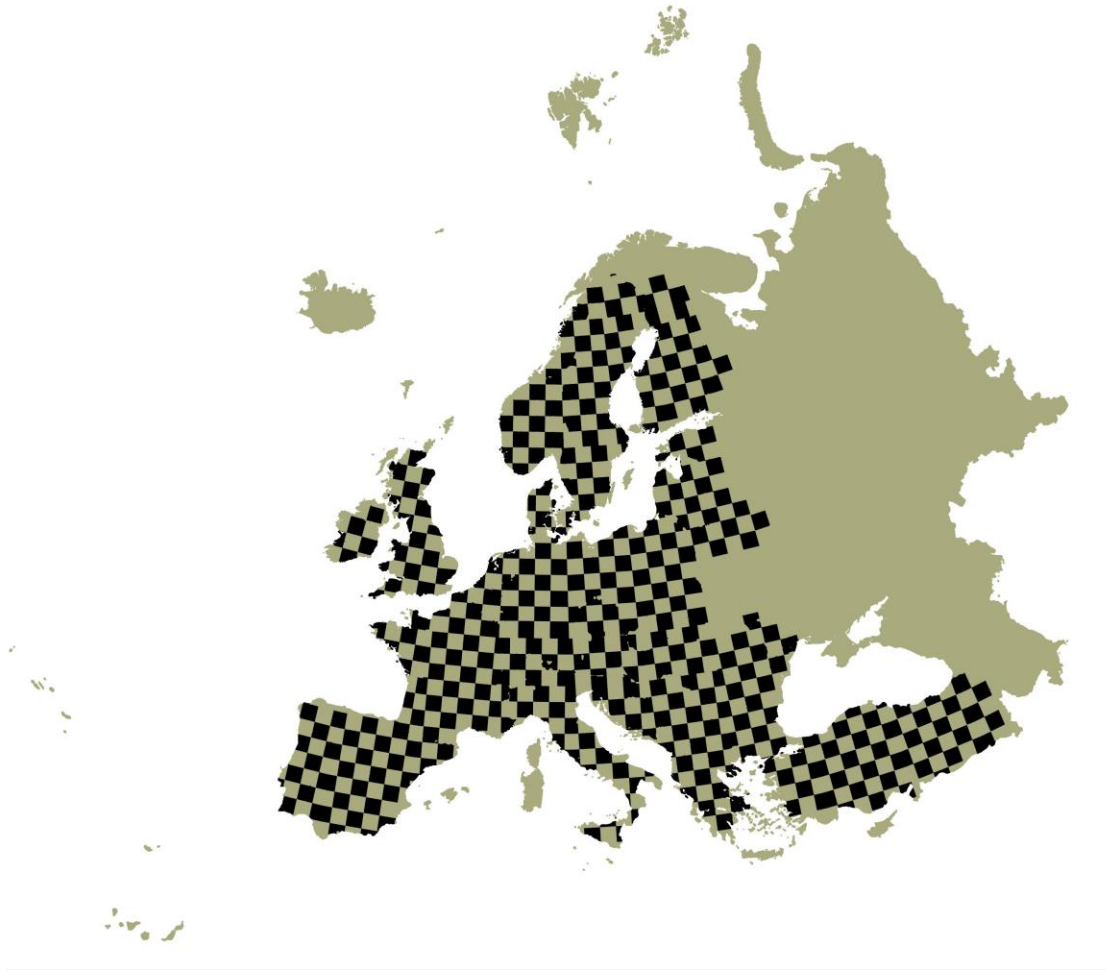
Choice of contaminants and matrix types

Second generation anti-coagulant rodenticides

Contaminant	Justification for selection	Possible disadvantages	Suitable (and ideal) matrix type
SGARs	• Some labs have capacity (less than for metals) • Large numbers of existing studies with results (but perhaps less than for metals) • Can analyse for 5 SGARs simultaneously. • ECHA (falls under biocides directive) very interested (to contribute to periodic review of compounds by EU) and recent mitigation options suggested to reduce risk of primary poisioning (but currently have no knowledge of secondary poisioning) • Member states vary widely in mitigation measures and therefore might expect much variation in levels across Europe	• Relatively expensive to analyse; • No established certified reference materials • Challenges of standardising techniques for analysis • Limits of quantification • Much variation in sample weights required for analysis • Marked variation with age expected	**LIVER**. Possible with blood but would result in much higher % negative results because of rapid turnover time

Selected 7 compounds (Madrid workshop): coumatetralyl; bromadiolone; brodifacoum; difenacoum; difethialone; flocoumafen; and chlorophacinone.

Sampling design



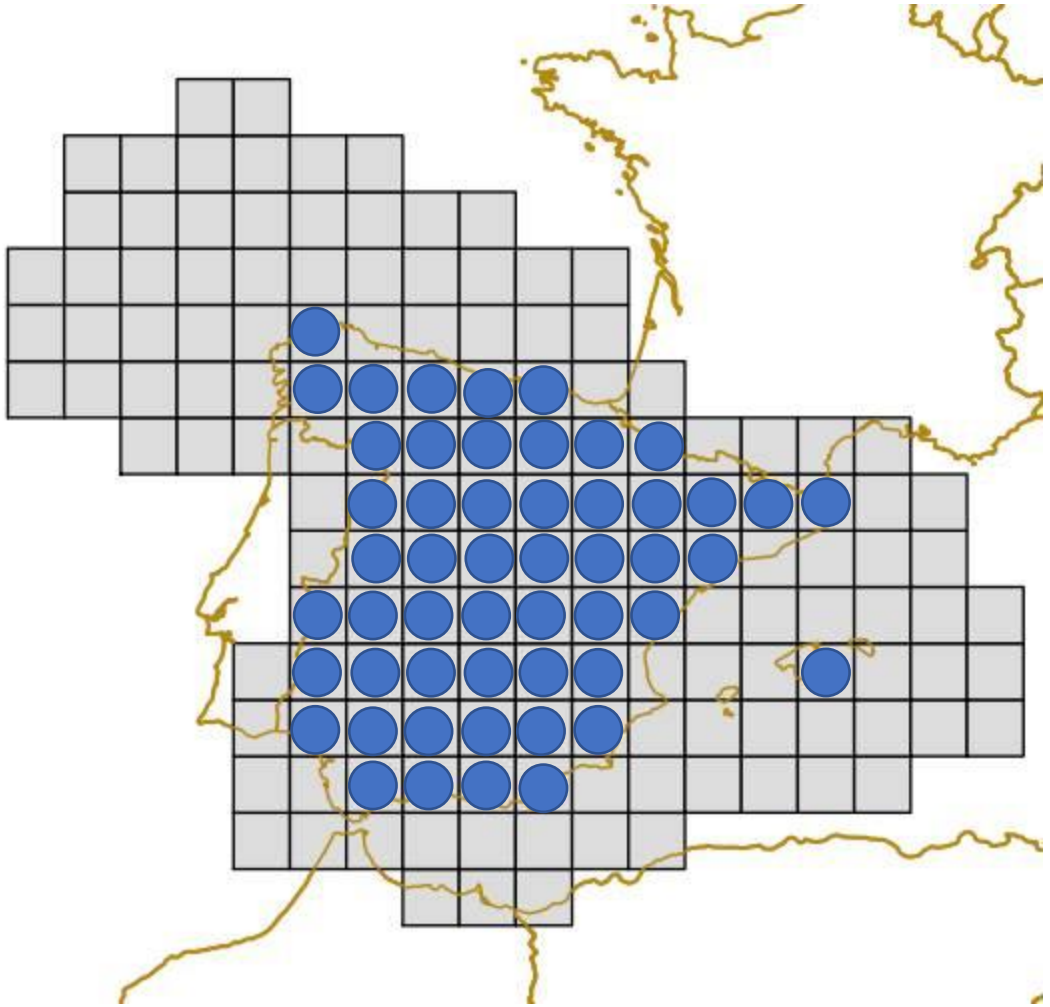
Feature	Rationale for selection of feature	Disadvantages of suggested approach
Base on 100 x 100 km grid squares	Provides a framework for obtaining a practical number of samples for analysis from across Europe, setting target sample sizes to obtain according to land area of each country - good design for testing possibilities of obtaining samples from across Europe	Sampling not stratified by e.g. spatial variation in abundance of focal species but this is less important for proof of concept study objectives
Select grid compatible with 50 x 50 km grid of EBCC Bird Atlas	Access to contextual data on species populations	
Sampling period 2014-2019	Sufficient period to demonstrate capacity to retreive samples and data	Retrospective survey, no standardised analytical technique and/or inter-laboratory comparison

Spain (example)

1 bird per 10,000 km^2

= 1080 birds for Europe

= **439** birds for EU



N=52

Note the importance of being able to demonstrate visually the coverage of sample collection as it is achieved, and to show remaining gaps to fill

Species selection criteria

- One or a small number of species (limited resources)
- Widely distributed across Europe or with close relatives
- Easy to obtain appropriate samples
- Already samples available in banks/collections
- Species traits in relation to contaminants/matrices of interest

Species selection




	Tawny Owl (*Strix aluco*)	Common Kestrel (*Falco tinnunculus*)	Common Buzzard (*Buteo buteo*)	Barn Owl (*Tyto alba*)
Distribution (Range)	Pan-European except very far north (but still in S of northern countries). Absent in Ireland and Iceland	Pan-European (not Iceland)	Pan-European (not Iceland)	Missing from NE countries and mountains
Migratory status	Always resident over whole range	Partially migratory (particularly N Europe and part of E)	Partially migratory (particularly N Europe and part of E)	Mostly resident but some regional and altitudinal movements
Dietary comments (rodenticides)	Generally a rodent specialist but some birds (to S of range and/or bad seasons)	Rodent specialist (except S of range - insects and reptiles)	Generalist diet /scavenger (variable proportion of rodents/individual specialisms)	Generally a rodent specialist with some local exceptions
Dietary comments (metals)	Earthworm eater		Scavenger - more likely to ingest Pb shot. Earthworm eater.	Eats shrews which eat earthworms
Habitat comments	Very broad. Anywhere with trees including urban areas	Farmland and urban	Very broad. Anywhere with trees	Quite broad. Farmland, open woodland and rural settlements
Advantages of this species			Size = large organs!	
Disadvantages of this species	Few nest box studies in southern part of range	Partially migratory	Partially migratory	

Samples per country
(numbers of grid squares with candidate species)

Country	100x100km squares	Tawny owl	Buzzard	Kestrel	Barn owl
Turkey	74	40	68	70	31
France	54	54	54	54	54
Sweden	47	17	35	47	0
Spain	44	44	44	44	44
Germany	35	35	35	35	35
Italy	30	30	30	30	26
Poland	30	30	30	30	28
Finland	30	17	28	30	0
UK	24	23	24	24	24
Romania	23	23	23	23	12
Norway	21	14	12	21	0
Greece	13	13	13	13	13
Portugal	11	11	11	11	11
Bulgaria	10	10	10	10	10
Hungary	10	10	10	10	10
Serbia	8	8	8	8	7
Latvia	8	8	8	8	0
Austria	7	7	7	7	2
Czechia	7	7	7	7	7
Bosnia and Herzegovina	7	7	7	7	6
Ireland	6	0	6	6	6
Croatia	6	6	6	6	4
Slovakia	6	6	6	6	6
Lithuania	6	6	6	6	2
Switzerland	5	5	5	5	5
Denmark	5	5	5	5	4
Estonia	4	4	4	4	0
Belgium	3	3	3	3	3
Netherlands	3	3	3	3	3
Albania	3	3	3	3	3
Macedonia	3	3	3	3	3
Slovenia	2	2	2	2	2
Montenegro	2	2	2	2	2
TOTAL	**547**	**456**	**518**	**543**	**363**
Percentage		**83**	**95**	**99**	**66**

ERBFacility Proof of Concept study

Progress so far

- Agreement on objectives, contaminant and matrix types, sampling design, short-listed species (Rui's talk to follow)
- Scientific study design (in phases of increasing ambition)
- Start with 'quick wins' = existing analyses and samples already available and then try to fill gaps in coverage
- Start with PASSIVE SAMPLING (carcasses) but introduce ACTIVE SAMPLING (e.g. blood) later if resources allow
- Pledges of resource (e.g. lab capacity) and use of STSMs to provide staff time (starting soon = final choice of species)
- Review of possible additional sources of funding
- Reports from ERBF Stirling and Madrid workshops available on the website soon (including outline proposal)

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Relevant Short-term Scientific Missions so far (STSMs)

Photos: Edmund Fellowes,
John Proudlock,
Moss Taylor / BTO Images

- Review of existing samples held in collections – Gloria Ramello with Rene Dekker and Paola Movalli (GP2)
- Selection of priority contaminants and related matrices and species selection – Alex Badry with Richard Shore (GP3)
- Review of existing Pb monitoring data – Laura Monclús Anglada with Oliver Krone (GP2)
- STSM – trends in exposure and poisoning due to SGARs (GP3)
- STSM – communication with labs/collections to assess sample sizes already available for analysis and source samples for the proof of concept study (GP3)

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Input required from Working Group 4 'Field Arena'

Working Group 4 STSMs in GP3

1. Best practice on collecting samples and contextual monitoring data for focal species (guidance and protocols) – 2 possible missions

2. Development of a plan for capacity building and training and appropriate guidance on how to do this

3. Review of existing contextual population data for the focal species to provide context for the spatial patterns of exposure to contaminants (variation in population trends/breeding success/survival rates across Europe)

Currently advertised until the end of September

ERBFacility Proof of Concept study

What do we need to do in our Slovenia workshop?

- Consider the focal species and samples required and how they can be obtained from across Europe
- Understand existing capacity in the different groups of ‘actors’ who need to be involved (tomorrow’s talks)
- Consider how to build more capacity in the different groups where this is needed across Europe (how to obtain “the right samples from the right places”)
- Work further on the guidance and protocols needed to support development of the ERSamP and specifically for the proof of concept work