

## Supplementary Information

### Pesticide contamination patterns in Montagu's harrier (*Circus pygargus*)

#### chicks

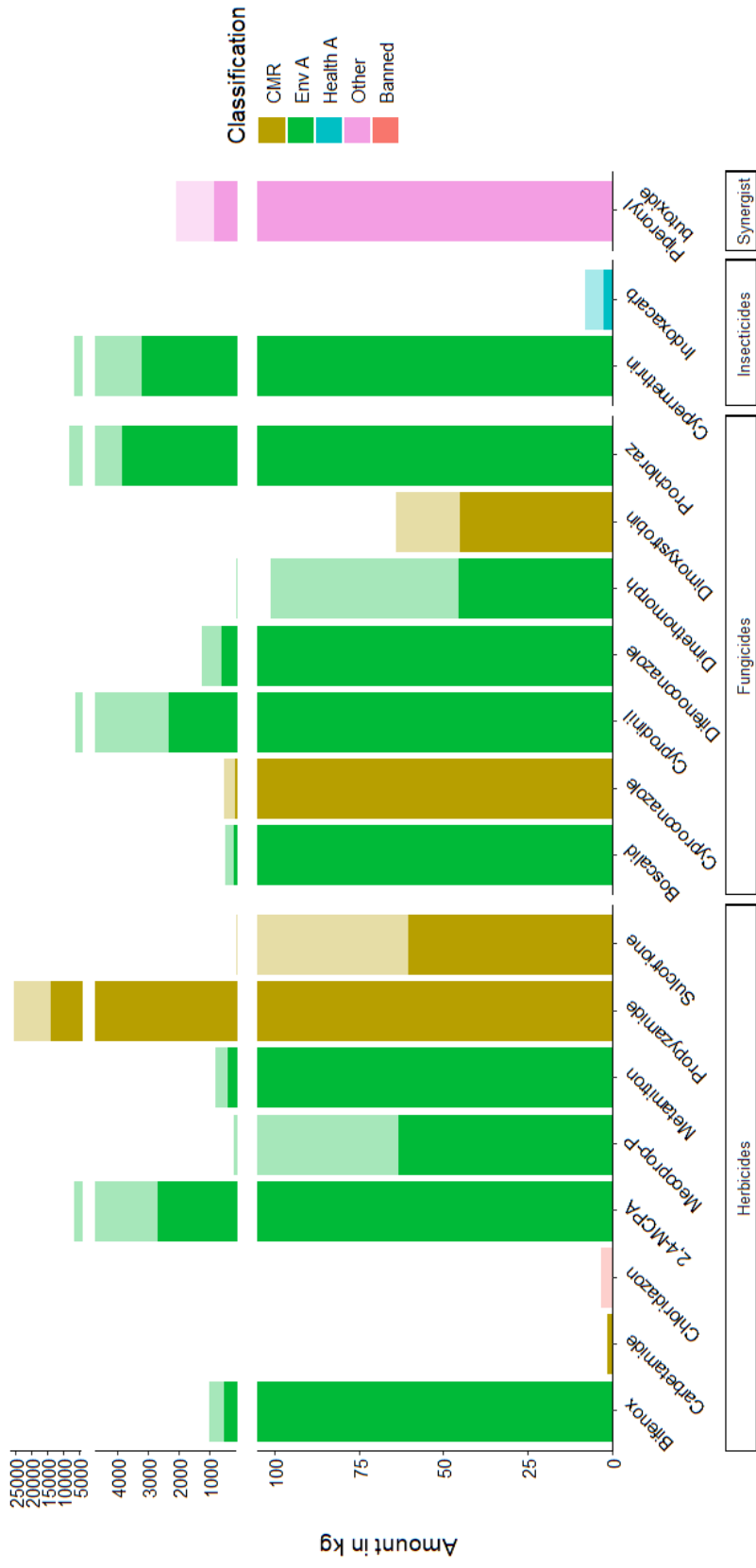
Fuentes Elva (1), Moreau Jérôme (1,2), Rodrigues Anaïs (3), Millet Maurice (3), Bretagnolle Vincent (1,4) & Monceau Karine (1)

(1) UMR 7372, Centre d'Études Biologiques de Chizé, La Rochelle Université & CNRS, 79360 Villiers en Bois, France – [elva.fuentes@cebc.cnrs.fr](mailto:elva.fuentes@cebc.cnrs.fr) – [karine.monceau@univ-lr.fr](mailto:karine.monceau@univ-lr.fr)

(2) Biogéosciences, UMR 6282 CNRS, Université de Bourgogne, 6 Boulevard Gabriel, 21000 Dijon, France – [jerome.moreau@u-bourgogne.fr](mailto:jerome.moreau@u-bourgogne.fr)

(3) Université de Strasbourg, CNRS-UMR 7515, ICPEES, 67087 Strasbourg cedex 2, France – [Anais.Rodrigues@uliege.be](mailto:Anais.Rodrigues@uliege.be) – [mmillet@unistra.fr](mailto:mmillet@unistra.fr)

(4) LTSER "Zone Atelier Plaine & Val de Sèvre", CNRS, 79360 Villiers-en-Bois, France – [vincent.bretagnolle@cebc.cnrs.fr](mailto:vincent.bretagnolle@cebc.cnrs.fr)



**Figure S1. Quantities of substances bought in 2020 (faded stacked bars) and 2021 (coloured stacked bars) in areas surrounding nests.** Quantities of substances bought in kg were summed from postal codes within a 14 km radius around nests, which corresponds to the average foraging range for Montagu's harriers in the study area (Salamolard 1997) and were compiled from a database of the national sales bank of distributors of plant protection products (BNVD, 2023; see Table S1). Substances were classified according to their danger level following the nomenclature of legislation on substances relating to the fee for diffuse pollution (Order of 22<sup>nd</sup> December 2022; Table S2). Banned = substances banned for sale and use in France before 2021. Ten of the substances detected are not included in the graphic because they were banned and/or not sold in 2020 or 2021.

**Table S1. Criteria for classification of substances in acute and environmental/health toxicity hazards categories based on EC Regulation No. 1272/2008 and Order of 22<sup>nd</sup> December 2022.**

Type	Classification	Criteria
Acute toxicity	1	LD50 ≤5 mg.kg <sup>-1</sup>
	2	5 <LD50 ≤50 mg.kg <sup>-1</sup>
	3	5 <LD50 ≤300 mg.kg <sup>-1</sup>
	4	300 <LD50 ≤2000 mg.kg <sup>-1</sup>
	-	LD50 >2000 mg.kg <sup>-1</sup>
Environmental/ Health toxicity	CMR	Carcinogenic, mutagenic in germ cells, or toxic for reproduction
	Health A	Acute toxicity of category 1, 2 or 3, or specific toxicity toward target organs of category 1 after single or repeated exposure, or due to their effects on breast-feeding.
	Env A	Acute toxicity to aquatic environments of category 1 or chronic toxicity to aquatic environments of category 1 or 2.
	Other	Other substances

**Table S2. Classification in acute and environmental/health toxicity hazard categories for the 28 substances detected in Montagu's harrier chicks.** Categories of toxicity are explained in Table S2. Substances banned before 2021 are in bold italics.

Substances	Acute toxicity hazard	Environmental/Health toxicity hazard
<b>Herbicides</b>		
Bifenox	-	Env A
Carbetamide	-	CMR
<b><i>Chloridazon</i></b>	-	-
2,4-MCPA	4	Env A
Mecoprop-P	4	Env A
Metamitron	4	Env A
<b><i>Oxadiazon</i></b>	-	-
Propyzamide	-	CMR
Sulcotrione	4	CMR
<b><i>Tebutam</i></b>	-	-
<b>Fungicides</b>		
Boscalid	-	Env A
<b><i>Carbendazim</i></b>	-	-
Cyproconazole	3	CMR
Cyprodinil	4	Env A
Difenoconazole	-	Env A
Dimethomorph	-	Env A
Dimoxystrobin	-	CMR
<b><i>Epoxiconazole</i></b>	-	-
<b><i>Flusilazole</i></b>	<b>4</b>	-
Myclobutanil	4	x
Prochloraz	4	Env A
<b><i>Quinoxyfen</i></b>	-	-
<b>Insecticides</b>		
<b><i>Bifenthrin</i></b>	<b>4</b>	-
<b><i>Clothianidin</i></b>	<b>4</b>	-
Cypermethrin	-	Env A
Indoxacarb	3	Health A
<b><i>Thiacloprid</i></b>	<b>2</b>	-
<b>Synergist</b>		
Piperonyl butoxide	-	Other

**Table S3. Compounds detected in fur of small mammals (Fritsch et al. 2022) and blood of Montagu's harrier chicks (this study) in the study area.** Maximum concentrations are given in  $\text{pg}\cdot\text{mg}^{-1}$ . The increase factor indicates the number of times small mammal concentrations are multiplied to reach chick concentrations.

<b>Compounds</b>	<b>Small mammals</b>	<b>Montagu's harrier chicks</b>	<b>Increase factor</b>
2,4-MCPA	428.000	2144.98	5
Boscalid	355.000	2307.00	6
Carbendazim	200.000	258.29	1
Chloridazon	0.766	563.10	735
Clothianidin	1.140	2394.32	2100
Cypermethrin	1.340	237.49	177
Cyproconazole	77.800	148.13	2
Cyprodinil	14.600	71.68	5
Difenoconazole	0.157	1213.55	7730
Flusilazole	0.107	137.63	1286
Mecoprop-P	133.000	1144.79	9
Metamitron	5.240	88.34	17
Oxadiazon	0.054	71.68	1327
Prochloraz	22.000	1292.89	59
Propyzamide	270.000	339.07	1
Thiacloprid	2.670	87.48	33

## References

- BNVD (2023). Pesticide purchases by postcode. <https://www.data.gouv.fr/fr/datasets/achats-de-pesticides-par-code-postal/>. Accessed 16 November 2023 (in French).
- Fritsch, C., Appenzeller, B., Burkart, L., Coeurdassier, M., Scheifler, R., Raoul, F., ... & Pelosi, C. (2022). Pervasive exposure of wild small mammals to legacy and currently used pesticide mixtures in arable landscapes. *Scientific Reports*, 12, 15904. <https://doi.org/10.1038/s41598-022-19959-y>
- Order of 22<sup>nd</sup> December 2022 establishing the list of substances defined in article L. 213-10-8 of the Environment Code relating to the fee for diffuse pollution. *Journal officiel électronique authentifié n° 0301 du 29/12/2022*. <https://www.legifrance.gouv.fr/eli/arrete/2022/12/22/TREL2235282A/jo/texte>. Accessed 16 November 2023 (in French).
- Regulation (EC) No 1272/2008 of the European parliament and of the council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006. *Official Journal of the European Union*. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32008R1272>. Accessed 16 November 2023.
- Salamolard, M. (1997). Utilisation de l'espace par le Busard Cendré *Circus pygargus*, superficie et distribution des zones de chasse. *Alauda*, 65, 307–320 (in French).