SETAC

ABSTRACT BOOK

SETAC EUROPE 34TH ANNUAL MEETING

5–9 MAY 2024 | SEVILLE, SPAIN

SCIENCE-BASED SOLUTIONS IN TIMES OF CRISIS: INTEGRATING SCIENCE AND POLICY FOR ENVIRONMENTAL CHALLENGES.

Abstract Book

SETAC Europe 34th Annual Meeting

Table of Contents

This book compiles the abstracts from the 34th annual meeting of the Society of Environmental Toxicology and Chemistry – Europe (SETAC Europe), conducted from 5–9 May 2024 in Seville, Spain.

The abstracts are reproduced as submitted by the author and accepted by the scientific committee. They appear in order of abstract code and alphabetical order per presentation type. The poster spotlight abstracts are included in the list of poster abstracts. The presenting author of each abstract is highlighted in bold.

The information in this abstract book reflects the status of the abstracts as was on 29 April 2024.

No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, electrostatic, magnetic tape, mechanical, photocopying, recording, or otherwise, without permission in writing from the copyright holder. SETAC Europe's consent does not extend to copying for general distribution, for promotion, for creating new works, or for resale. Specific permission must be obtained in writing from SETAC for such copying. Direct all inquiries to SETAC Europe.

PRINT ISSN 2309-8031 - ONLINE ISSN 2310-3043 © 2024

Society of Environmental Toxicology and Chemistry Europe (SETAC Europe)

About SETAC

In the 1970s, no forum existed for interdisciplinary communication among environmental scientists, biologists, chemists, toxicologists, managers, engineers or others interested in environmental issues. The Society of Environmental Toxicology and Chemistry (SETAC) was founded in North America in 1979 to fill the void and quickly saw dynamic growth in the Society's membership, meeting attendance and publications.

A unique strength of SETAC is its commitment to balance the scientific interests of government, academia and business. The Society by-laws mandate equal representation from these three sectors for officers of the World Council and Geographic Unit Boards of Directors and Councils, and in the composition of committees and other society activities. The proportion of members from each of the three sectors has remained nearly equal over the years.

The Society is concerned about global environmental issues. Its members are committed to Environmental Quality Through Science®, timely and effective communication of research, and interactions among professionals so that enhanced knowledge and increased personal exchanges occur. Therefore, SETAC publishes two globally esteemed scientific journals and convenes annual meetings around the world, showcasing cutting-edge science in poster and platform presentations. Because of its multidisciplinary approach, the scope of the science of SETAC is broader in concept and application than that of many other societies.

SETAC's growth is reflected in the founding of Geographic Units around the world. SETAC Europe was established in 1989 as an independent organisation, followed by SETAC Asia-Pacific in 1997 and SETAC Latin America in 1999. In 2002, the four existing organisations joined together under the governance of the SETAC World Council. SETAC Africa is the most recent Geographic Unit, which was adopted in 2012. As evidence of international acceptance of the SETAC model and of the great interest at the local level, regional chapters and branches have emerged in a number of countries.

SETAC publishes two journals, *Environmental Toxicology and Chemistry* (ET&C) and *Integrated Environmental Assessment and Management* (IEAM). ET&C is dedicated to furthering scientific knowledge and disseminating information on environmental toxicology and chemistry, including the application of these sciences to risk assessment. Integrated Environmental Assessment and Management focuses on the application of science in environmental decision-making, regulation and management, including aspects of policy and law, and the development of scientifically sound approaches to environmental problem solving. Together, these journals provide a forum for professionals in academia, business, government and other segments of society involved in the use, protection and management of the environment for the enhancement of ecological health and human welfare.

SETAC books provide timely in-depth reviews and critical appraisals on scientific subjects relevant to understanding a wide range of contemporary topics pertaining to the environment. These include any aspect of environmental chemistry, toxicology, risk assessment, risk management or environmental policy.

SETAC has two administrative offices, in Pensacola, Florida, USA, established in 1992, and in Brussels, Belgium, established in 1993.

www.setac.org

Environmental Quality Through Science®

breakdown of exposure by compound was: bromadiolone (n=33), brodifacoum (n=21), chlorophacinone (n=20), diphacinone (n=17), warfarin (n=12), difethialone (n=12). Of the badger liver samples, 17 contained > 0.100 µg/g ww ∑ ARs with a range of 2.14 – 0.146 µg/g ww. Six females were lactating all of which were exposed to ARs. Fishers were collected over an earlier timeframe, 2003 – 2009. They were less exposed, with 2 out of 10 individuals testing positive, one of which was exposed to warfarin (0.05 µg/g) and high levels of bromadiolone (0.528 µg/g), and the second individual tested positive for brodifacoum (0.013 µg/g). We discuss likely exposure pathways and toxicological implications of these results for badger conservation and population recovery.

1.10.P-We043 Anticoagulant Rodenticides in Birds of Prey in Switzerland – Towards an Appraisal of Threshold Values
***Sibylle Xenia Maletz*[1]*, Daniel Olbrich*[1]*, Carolin Riegraf*[1]*, Marion Junghans*[1]*, Sarah Albini*[2]*, Saskia Keller*[3]*, Petra Kunz*[4] *and Etienne Vermeirssen*[1]*, (1)Swiss Centre for Applied Ecotoxicology, Switzerland, (2)Institute for Food Safety and Hygiene, University of Zurich, Switzerland, (3)Institute for Fish and Wildlife Health, University Bern, Switzerland, (4)Biocides and Plant Protection Products Section, Federal Office for the Environment, Switzerland*
Due to their widespread use for rodent pest control, the presence of anticoagulant rodenticides (ARs) in the environment is ubiquitous. These substances, especially the second generation ARs, have persistent, bioaccumulative and toxic properties that can lead to secondary poisoning of non-target organisms. Exposure of non-target organisms, such as small predators or birds of prey, to ARs is well documented internationally. However, the situation in Switzerland had so far only been scantly investigated. To fill this gap, a reliable and sensitive analytical method (LC-MS/MS) to quantify ARs in liver samples was established and a first set of wildlife liver samples was analyzed for seven approved substances (brodifacoum, bromadiolone, coumatetralyl, difenacoum, difethialone, flocoumafen, warfarin). Samples included livers of foxes, birds of prey, hedgehogs and fish. In almost all samples analyzed, up to four different ARs were detected with maximum liver concentrations of 1100 ng/g (fox), 450 ng/g (bird of prey), 2 ng/g (hedgehog) and 40 ng/g (fish). A comparison with data collated from literature showed similar exposure in biota from surrounding countries.

To date, there is no broad consensus as to which AR concentrations lead to toxicosis and must therefore be considered problematic. Some experimental toxicity data are available from studies in which animals were fed food or prey laced with AR. However, only a few species have been studied in this way, often with low numbers of animals and only testing single substances and not mixtures. Another approach to derive threshold values involves the combination of measured AR liver burdens and the determination of the cause of death by means of pathological examinations. For this reason, we started a new project where we focus on birds of prey that died during care in bird rehabilitation centers. We aim to extend monitoring of AR exposure in Switzerland and combine it with pathological examinations of birds. The data obtained will then be fed into established models to determine AR threshold values and allow for improved risk assessment concerning non-target organisms. Additional data are also crucial to assess future trends in AR exposure and for evaluating the efficiency of possible future changes to AR application strategies.

1.10.P-We044 Anticoagulant Rodenticide Contamination and Coagulation Capacity Assessment in Long-Eared Owls (Asio otus) from a Mediterranean Agricultural Landscape
***Livia Spadetto*[1]*, Pilar Gomez-Ramirez, PhD*[1]*, José Manuel Zamora-Marín*[2,3,4]*, Mario León-Ortega*[3]*, Antonio Zamora-López*[2,3]*, Sarah Díaz-García*[3]*, Fernando Tecles-Vicente*[5]*, José F. Calvo PhD*[6]*, José Fenoll-Serrano*[7]*, Juana Cava-Artero*[7] *and Antonio Juan Garcia-Fernandez, DVM, PhD*[8]*, (1)Toxicology Research Group, Faculty of Veterinary Medicine, University of Murcia, Spain, (2)Department of Zoology and Physical Anthropology, Faculty of Biology, University of Murcia, Spain, (3)Ulula Research Group, Spain, (4)Department of Applied Biology, Miguel Hernández University of Elche, Spain, (5)Interdisciplinary Laboratory of Clinical Analysis (Interlab-UMU), Faculty of Veterinary Medicine, University of Murcia, Spain, (6)Department of Ecology and Hydrology, Faculty of Biology, University of Murcia, Spain, (7)Instituto Murciano de Investigación y Desarrollo Agrario y Alimentario (IMIDA), Spain, (8)Toxicology Research Group, Faculty of Veterinary Medicine, Universidad de Murcia-IMIB, Spain*
Anticoagulant rodenticides (ARs) are chemical compounds widely employed for rodent population control in various anthropogenic landscapes. These highly toxic substances, known for their bioaccumulative nature in the tissues of consuming individuals, not only induce mortality in target rodents but also pose a threat to the populations of predators and scavengers that feed on these contaminated prey. Here, the long-eared owl (*Asio otus*) is used as a biomonitoring species to assess the presence and distribution of ARs in different agricultural landscapes within a Mediterranean semiarid region of southeastern Spain. Blood samples were extracted from 69 nestlings belonging to 38 nests in the Region of Murcia and analysed using HPLC/MS/MS. Additionally, plasma samples were obtained to evaluate clotting function through prothrombin time (PT) testing as a biomarker of exposure and effect. Our analysis revealed an almost absolute prevalence (98.6%), with no variation across different agricultural landscapes and multiple ARs detected in most samples (82.6%). The most commonly detected ARs were second-generation compounds (SGARs), particularly flocoumafen (88.4%). Total concentration (ΣARs) ranged from 0.06 to 34.18 ng mL^{-1} and the highest levels were found in a study site dominated by intensive agriculture. However, no correlation was found between ΣARs and the different land uses calculated within 1 and 1.5-km buffers around each nest, which was established as a proxy of the adults' home range. Furthermore, blood ΣAR levels showed a positive correlation with PT values measured in the corresponding plasma samples (Rho= 0.547, p= 0.000), highlighting the presence and quantifiable effects of these compounds even at low blood concentrations. These findings underscore the widespread presence of ARs across the study area, indicating early exposure in long-eared owl nestlings. Our results also suggest that exposure in this owl species is chronic, which could potentially lead to medium or long-term toxic effects due to the progressive accumulation of

ARs in the organism. Moreover, the long-eared owl proved to be an excellent sentinel species for monitoring environmental contamination in agricultural landscapes, suggesting that other wildlife from the same area may also be exposed and affected by the detrimental effects of AR compounds. This study emphasizes the urgent need for effective strategies to mitigate the impact of ARs on ecosystems and protect non-target wildlife.

1.10.P-We045 Environmental Factors Influencing Anticoagulant Rodenticide Exposure in Common Kestrels (Falco tinnunculus) and Barn Owls (Tyto alba) from Southeastern Spain

Livia Spadetto[1]*, Antonio Juan Garcia-Fernandez, DVM, PhD*[2]*, Antonio Zamora-López*[3,4]*, José Manuel Zamora-Marín*[3,4,5]*, Mario León-Ortega*[4]*, Sarah Díaz-García*[4]*, José Fenoll-Serrano*[6]*, Juana Cava-Artero*[6]*, José F. Calvo PhD*[7] *and Pilar Gomez-Ramirez, PhD*[1]*, (1)Toxicology Research Group, Faculty of Veterinary Medicine, University of Murcia, Spain, (2)Toxicology Research Group, Faculty of Veterinary Medicine, Universidad de Murcia-IMIB, Spain, (3)Department of Zoology and Physical Anthropology, Faculty of Biology, University of Murcia, Spain, (4)Ulula Research Group, Spain, (5)Department of Applied Biology, Miguel Hernández University of Elche, Spain, (6)Instituto Murciano de Investigación y Desarrollo Agrario y Alimentario (IMIDA), Spain, (7)Department of Ecology and Hydrology, Faculty of Biology, University of Murcia, Spain*

Anticoagulant rodenticides (ARs) act by disrupting blood clotting and causing fatal haemorrhages in target rodents. Previous studies have demonstrated their widespread occurrence in the environment, moving through the food chain and accumulating in top predators such as birds of prey. These predatory birds also display higher sensitivity to ARs compared to other avian species, raising concerns about their potential impact on raptor populations, particularly for species inhabiting agricultural landscapes near human activities. Here, we aimed to assess the exposure to second-generation ARs (SGARs) in two farmland bird of prey species with different foraging habits. For that purpose, we blood-sampled barn owl (*Tyto alba*, *n*=54) and common kestrel (*Falco tinnunculus*, *n*=70) nestlings in the Region of Murcia (southeastern Spain), during the breeding seasons of 2021 and 2022. Samples analyzed using HPLC/MS/MS revealed high prevalence in both species - 50% in *T. alba* and 68% in *F. tinnunculus* - with the presence of multiple ARs in 16% and 32.9% of the individuals, respectively. Flocoumafen was predominant in kestrels, while bromadiolone in barn owls, with SGAR levels (ΣSGARs) ranging from 0.07 to 11.52 ng mL^{-1} in the kestrel and 0.03 to 3.75 ng mL^{-1} in the barn owl. Environmental variables that could affect the prevalence (study site, land uses, livestock farms, and human population density) were analysed within a 1-km buffer around each nest. This study revealed that SGAR prevalence in kestrels was related to the extension of artificial surfaces (roads, buildings, industrial areas, parkings, etc.), with no significant differences observed among study sites. In contrast, barn owls showed the higher prevalence in the most densely inhabited study site, with human population density emerging as the most explanatory factor. Hence, it seems that the kestrel - with a more generalist and flexible diet - frequently forages near buildings and urban centers where it would be prone to come into contact with AR contaminated prey. Conversely, the barn owl, although primarily feeding on rodents, often hunts in open spaces away from settlements. Therefore, contamination risk would be greater for owl nests located near urban areas, with higher presumed AR use and presence of target rodents such as rats (*Rattus sp.*). Our findings emphasize the need for responsible application practices and conservation efforts to safeguard raptor populations in Mediterranean agricultural regions.

1.10.P-We046 Impact of Changes in Governance for Anticoagulant Rodenticide Use on Non-target Exposure in Buzzards (Buteo buteo)

Elizabeth Ann Sharp[1]*,* ***Megan Galloway***[1]*, Louise Ann Mocogni*[1]*, Laura Marie Melton*[1]*, Steve Campbell*[2] *and Sheila George*[2]*, (1)Chemistry Section, SASA, United Kingdom, (2)Wildlife Management Unit, SASA, United Kingdom*

Birds of prey are susceptible to non-target exposure to anticoagulant rodenticides (ARs) used in pest management. An industry-led stewardship scheme introduced new rules on the use and sale of rodenticide products across the UK in 2016, with the aim of reducing this risk. To determine if this intervention was effective, exposure to second generation anticoagulant rodenticides (SGARs) was measured in buzzards. Liver samples from 790 buzzards collected between 2005 and 2022 were analysed and the percentage presence and concentrations of SGARs from pre-stewardship and post-stewardship samples were compared.

There was no statistically significant change in the percentage of buzzards exposed to bromadiolone, difenacoum or summed SGAR residues after the introduction of stewardship. The percentage of buzzards exposed to brodifacoum increased significantly post-stewardship, from 8% to 27%. There were no significant changes in the concentrations of individual SGARs post-stewardship but concentration of summed SGARs increased significantly post-stewardship. Buzzards were significantly more likely to be exposed to multiple SGARs post-stewardship.

These findings echo similar findings in other wildlife monitoring studies and suggest that the industry-led stewardship scheme has not yet had the intended impact of reducing SGAR contamination in non-target wildlife.

1.10.P-We047 Exposure of piscivorous avian predators to second-generation anticoagulant rodenticides

Julia Regnery[1]*, Hannah Schmieg*[2]*, Hannah Schrader*[2]*, Olaf Zinke*[3]*, Julia Bachtin*[1]*, Christel Möhlenkamp*[1]*, Stefanie Jacob*[4] *and Anton Friesen*[4]*, (1)Federal Institute of Hydrology (BfG), Germany, (2)Bavarian Environment Agency (LfU), Germany, (3)Museum of the Westlausitz Kamenz, Germany, (4)German Environment Agency (UBA), Germany*

Exposure of wildlife to anticoagulant rodenticides (ARs) has been extensively monitored worldwide for a variety of terrestrial species directly or indirectly linked to pest rodents via the terrestrial food web. In recent years, the scientific focus of environmental AR monitoring extended to AR emissions to the aquatic environment, demonstrating the relevance of aquatic