ABSTRACT BOOK

SETAC EUROPE 34TH ANNUAL MEETING

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

Abstract Book

SETAC Europe 34th Annual Meeting

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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.

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Society of Environmental Toxicology and Chemistry Europe (SETAC Europe)

1.10.P-We051 The Red-billed Chough (Pyrrhocorax pyrrhocorax) as a Sentinel Species for the Input of Heavy Metals from the Tajogaite Volcano into the Environment of La Palma, Canary Islands

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Geothermal activities, such as volcanic eruptions, represent one of the most important natural sources of metal emissions. These events can have an impact on the health of ecosystems incorporating large amounts of different pollutants.

On September 19th of 2021, in Cumbre Vieja (La Palma, Canary Islands), began the most recent volcanic eruption in Spain (Tajogaite volcano), which ended on December 25th of the same year. Being such a recent event, the effects of ash exposure on wildlife and humans have been scarcely studied.

The red-billed chough (*Pyrrhocorax pyrrhocorax*) is considered a symbol or "flagship species" of the island's natural values. Knowledge of the impact that the Tajogaite volcano may have had on its population is essential to assess the present and future conservation status of this species.

The main objective of this study is to evaluate the exposure to levels of contamination by heavy metals in wildlife in the area after the eruption.

To this end, the red-billed chough (*Pyrrhocorax pyrrhocorax*), named locally as “graja” has been considered as a monitoring species by using moulted wing feathers as monitoring tool of heavy metals exposure. Feathers collected before and after the eruption were used to compare both pollution scenarios.

Twenty-nine red-billed chough feathers were sampled (15 before and 14 after the eruption), on which the following metals were analyzed by IPC-MS: Al, Sr, Fe, Cu, Zn, Co, Ni, Cr, As, Cd, Pb, V, Se, Hg. Samples of ashes from the volcano eruption were also analyzed.

Most of the metals except of Cu, Zn, As and Pb, showed significant lower concentrations before than after the eruption, suggesting a common origin for most of the metals studied, which could be directly related to the recent eruption. Moreover, the metal and mineral profiles in feathers and volcanic ashes were very similar.

As a complement, a study of the levels of the same metals in internal organs of chough carcasses found dead before and after the eruption is being carried out in order to obtain more information on the possible consequences not only for the health of this species, but also for other species, including humans.

1.10.P-We052 Why are flamingo eggs not good indicators of environmental pollution?

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We present the first report on metallic element concentrations in egg contents of any flamingo species worldwide. Lesser Flamino Eggs *Pheoniconaias minor* were sampled at Kamfers Dam, Kimberley, South Africa. As one of the longest-lived bird groups (up to 50 years), we expected birds of the Family Phoenicopteridae to accumulate metals from the highly saline waters where they feed and transfer them to their eggs. However, the concentrations of metals were lower than expected when compared with shorter-lived large aquatic birds from the same region, possibly indicating maternal physiological processes that protects the embryo. Large inter-egg variations reflect their wide-ranging nomadic movements. Strontium concentrations in eggshells exceeded toxic reference values, and copper concentrations in egg contents may cause reproductive stress. Although there was no molar association between selenium and mercury, selenium was in excess. We identified various mechanisms by which flamingos have evolved to potentially remove metals from their bodies, such as excretion through feathers, salt glands, uropygial glands, and crop milk. In many respects, they could be considered marine birds. While embryonic flamingos chicks may be protected *in ovo*, we identified post-hatching routes of uptake by the chicks not previously recognised. Chicks consume their eggshells to an amazing extent, and the parents feed them crop milk akin to breast milk in mammals. We consider neither *P. minor* egg contents nor eggshells as good indicators of environmental metallic pollution. Our findings suggest a more nuanced approach to monitoring and protecting Phoenicopteridae from pollution.

1.10.P-We053 Compound-specific Stable Isotope Analyses of Amino Acids Reveal Drivers of Mercury Concentrations in Steller Sea Lions and their Prey

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Total mercury concentrations ([THg]) exceed thresholds of concern in some Steller sea lion (*Eumetopias jubatus*) tissues from certain portions of the Aleutian Islands, Alaska (USA). We applied compound-specific stable isotope analyses (CSIA-AA) of both carbon and nitrogen in amino acids from fish muscle tissue to quantify the proportional contributions of primary production sources and trophic positions of eight prey species (n = 474 total) that are part of Steller sea lion diets. THg analyses of fish muscle, coupled with monomethylmercury analyses of a subset of samples, substantiated previous findings that fishes from the west of Amchitka Pass, a discrete oceanographic boundary of the Aleutian Archipelago, have higher muscle Hg concentrations relative to fishes from the east. The $\delta^{13}C$ values of essential amino acids (EAAs) in fish muscle demonstrated that although most fishes obtained their EAAs primarily from algae, some species varied in the extent to which

they relied on this EAA source. The $\delta^{15}N$ values of phenylalanine (0.9 to 7.8 ‰), an indicator of the isotopic baseline of a food web, varied widely within and among fish species. Trophic position estimates, accounting for this baseline variation, were higher from the west relative to the east of the pass for some fish species. Trophic magnification slopes using baseline-corrected trophic position estimates indicated similar rates of Hg biomagnification to the east and west of Amchitka Pass. Multiple linear regression models revealed that trophic position was the most important driver of fish muscle [THg] with less variation explained by other parameters. Thus, higher trophic positions but not the rate of Hg biomagnification to the west of Amchitka Pass may play a role in the regional differences in both fish and Steller sea lion [THg]. Although, differences in Hg contamination and uptake at the base of the east and west food webs could not be excluded. To better identify the drivers of observed temporal patterns in Steller sea lion [THg], we also performed CSIA-AA of nitrogen on Steller sea lion whiskers. Results indicate cyclical variation in the isotopic baseline along whiskers (i.e., over time), suggesting Steller sea lions are foraging and obtaining Hg from different locations seasonally. The application of CSIA-AA to Steller sea lions and their prey is allowing for a more nuanced perspective of Hg pathways in this remote region of Alaska.

1.10.P-We054 Dietary shift in Southeast Alaskan wolf populations leads to increased mercury exposure

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Although all wolves (Canis lupus) express a high degree of dietary plasticity, the coastal wolves in Southeast Alaska, USA (*Canis lupus ligoni*) have demonstrated an extremely diverse diet dominated by ungulates but including marine resources opportunistically throughout their range. Recent studies have shown a drastic dietary shift towards sea otters (*Enhydra lutris*) in the region near Glacier Bay National Park and Preserve (GLBA), specifically for the wolves inhabiting Pleasant Island and the Gustavus Forelands. Sea otter populations were decimated by the fur trade prior to their protection in 1911. Following their reintroduction to Southeast Alaska in the 1960s, sea otters have since increased in numbers, especially near GLBA. This recovery has allowed the ranges of sea otters and wolves to overlap, resulting in a shift in wolf diet from terrestrial herbivores (ungulates such as deer and moose) to a marine predator (sea otters). As monomethylmercury is produced and biomagnifies mainly in aquatic food webs, we expected to find higher concentrations of total mercury in wolves with strong connectivity to marine food webs. To determine baseline contamination and identify the trophic transfer of mercury, we measured total mercury concentrations and the stable carbon and nitrogen isotope ratios ($\delta^{13}C$ and $\delta^{15}N$ values) in fur from wolves and sea otters, as well as in the tissues of intertidal fishes and invertebrates from Pleasant Island and the Gustavus forelands. We also compared stable isotope and total mercury concentrations of Pleasant Island/Gustavus wolves with data from wolves (n=118) across Southeast Alaska. Our results indicate substantial variation in fur total mercury concentrations (0.05 to 17.1 ppm) and $\delta^{13}C$ (-26.4 to -14.6‰) and $\delta^{15}N$ (4.5 to 14.0‰) values. Both $\delta^{13}C$ and $\delta^{15}N$ values were tightly correlated with fur total Hg concentrations demonstrating that dietary reliance on marine resources is a major driver of Hg exposure for wolves across Southeast Alaska. Due to their predation of sea otters, wolves from Pleasant Island had the highest total Hg concentrations, which may ultimately affect their health.

1.10.P-We055 Uncovering Effects with Molecular Techniques and Primer Design: Chronic Mercury Exposure and gene expression in Svalbard Reindeer

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Despite its remote Arctic location, Svalbard has significant levels of Mercury contamination, (Hg). Hg travels to the Arctic via long-range atmospheric transport, from industrialised areas all over the world. As a result, the Arctic cryosphere is the second-largest sink of legacy mercury on Earth. As temperatures rise in the Arctic, historically stored mercury may remobilise to other environmental compartments. The Svalbard reindeer (*Rangifer tarandus platyrhynchus*) is the largest herbivore of the archipelago, and an essential part of the terrestrial ecosystem. They consume vascular vegetation, moss, and lichen, which take up Hg from air and water. Top predators include humans, polar bears, and Arctic foxes.

This project investigates low-level, chronic effects in Svalbard reindeer following a life-long exposure to environmental concentrations of mercury. This is done by assessing the regulation of genes associated with oxidative stress and mercury detoxification in liver and muscle samples from Svalbard reindeer. Genes of interest include metallothionine, selenoprotein, glutathione reductase and hepcidin. The project includes primer design development and thus the creation of new primers that can be used for further research. The results from the genetic expression will be compared to the mercury concentration in these tissue samples.

To extend the project and support assumptive expression results, bioassays and blood smear analyses will also be included.

1.10.P-We056 The Chemical Load of Pilot Whales in Arctic Waters

Halla Weihe Reinert *and Katrin Hoydal, Environmental Protection, Faroese Environment Agency, Faroe Islands*

Long-finned pilot whales in the North Atlantic Ocean are burdened by vast quantities of chemicals transported by air and water from distant places. Due to its position in the food web, these chemicals are bioaccumulated to a high degree. The pilot whale has been a staple diet of the Faroese people for centuries, yet concerns have been raised about its chemical profile for decades.