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CHEMICAL EFFECTS

Macroinvertebrate communities respond strongly but non-specifically to a toxicity gradient derived by effect-based methods

2024-06-05

Chemical pollution is one of the most important threats to freshwater ecosystems. The plethora of potentially occurring chemicals and their effects in complex mixtures challenge standard monitoring methods. Effect-based methods (EBMs) are proposed as complementary tools for the assessment of chemical pollution and toxic effects. To investigate the effects of chemical pollution, the ecological relevance of EBMs and the potential of macroinvertebrates as toxicity-specific bioindicators, ecological and ecotoxicological data were linked. Baseline toxicity, mutagenicity, dioxin-like and estrogenic activity of water and sediment samples from 30 river sites in central Germany were quantified with four in vitro bioassays. The responses of macroinvertebrate communities at these sites were assessed by calculating 16 taxonomic and functional metrics and by investigating changes in the taxonomic and trait composition. Principal component analysis revealed an increase in toxicity along a joint gradient of chemicals with different modes of action. This toxicity gradient was associated with a decrease in biodiversity and ecological quality, as well as significant changes in taxonomic and functional composition. The strength of the effects suggested a strong impact of chemical pollution and underlined the suitability of EBMs in detecting ecological relevant effects. However, the metrics, taxa, and traits associated with vulnerability or tolerance to toxicity were found to also respond to other stressors in previous studies and thus may have only a low potential as toxicity-specific bioindicators. Because macroinvertebrates respond integratively to all present stressors, linking both ecological and environmental monitoring is necessary to investigate the overall effects but also isolate individual stressors. EBMs have a high potential to separate the toxicity of chemical mixtures from other stressors in a multiple stressor scenario, as well as identifying the presence of chemical groups with specific modes of action.

Authors: Sebastian Heß, Delia Hof, Matthias Oetken, Andrea Sundermann

Full Source: Environmental pollution (Barking, Essex : 1987) 2024 Jun 5:356:124330. doi: 10.1016/j.envpol.2024.124330.

Chemical pollution is one of the most important threats to freshwater ecosystems.

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Exploring BPA alternatives - Environmental levels and toxicity review

2024-05-23

Bisphenol A alternatives are manufactured as potentially less harmful substitutes of bisphenol A (BPA) that offer similar functionality. These alternatives are already in the market, entering the environment and thus raising ecological concerns. However, it can be expected that levels of BPA alternatives will dominate in the future, they are limited information on their environmental safety. The EU PARC project highlights BPA alternatives as priority chemicals and consolidates information on BPA alternatives, with a focus on environmental relevance and on the identification of the research gaps. The review highlighted aspects and future perspectives. In brief, an extension of environmental monitoring is crucial, extending it to cover BPA alternatives to track their levels and facilitate the timely implementation of mitigation measures. The biological activity has been studied for BPA alternatives, but in a non-systematic way and prioritized a limited number of chemicals. For several BPA alternatives, the data has already provided substantial evidence regarding their potential harm to the environment. We stress the importance of conducting more comprehensive assessments that go beyond the traditional reproductive studies and focus on overlooked relevant endpoints. Future research should also consider mixture effects, realistic environmental concentrations, and the long-term consequences on biota and ecosystems.

Authors: Ondrej Adamovsky, Ksenia J Groh, Anna Białk-Bielińska, Beate I Escher, R Beaudouin, Liadys Mora Lagares, Knut Erik Tollefsen, Martina Fenske, Ewa Mulkiewicz, Nicolas Creusot, Anita Sosnowska, Susana Loureiro, Jonny Beyer, Guillermo Repetto, Alja Štern, Isabel Lopes, Marta Monteiro, Andrea Zikova-Kloas, Tina Eleršek, Marjan Vračko, Szymon Zdybel, Tomasz Puzyn, Weronika Koczur, Jane Ebsen Morthorst, Henrik Holbech, Gunnar Carlsson, Stefan Örn, Óscar Herrero, Ayesha Siddique, Matthias Liess, Georg Braun, Vanessa Srebny, Bojana Žegura, Nathalie Hinfray, François Brion, Dries Knapen, Ellen Vandeputte, Evelyn Stinckens, Lucia Vergauwen, Lars Behrendt, Maria João Silva, Ludek Blaha, Katerina Kyriakopoulou

Full Source: Environment international 2024 May 23:189:108728. doi: 10.1016/j.envint.2024.108728.

Bisphenol A alternatives are manufactured as potentially less harmful substitutes of bisphenol A (BPA) that offer similar functionality.

Effects of persistent organic pollutants on telomere dynamics are sex and age-specific in a wild long-lived bird

2024-06-06

Chemical pollution is a major man-made environmental threat to ecosystems and natural animal populations. Of concern are persistent organic pollutants (POPs), which can persist in the environment for many years. While bioaccumulating throughout the lives of wild animals, POPs can affect their health, reproduction, and survival. However, measuring long-term effects of POPs in wild populations is challenging, and therefore appropriate biomarkers are required in wildlife ecotoxicology. One potential target is telomere length, since telomere preservation has been associated to survival and longevity, and stressors as chemical pollution can disrupt its maintenance. Here, we investigated the effects of different classes of POPs on relative telomere length (RTL) and its rate of change (TROC) in wild long-lived Alpine swifts (Tachymarptis melba). As both RTL and TROC are often reported to differ between sexes and with chronological age, we tested for sex- and age-specific (pre-senescent vs. senescent, ≥ 9 age of years, individuals) effects of POPs. Our results showed that senescent females presented longer RTL and elongated telomeres over time compared to pre-senescent females and males. These sex- and age-related differences in RTL and TROC were influenced by POPs, but differently depending on whether they were organochlorine pesticides (OCPs) or industrial polychlorinated biphenyls (PCBs). OCPs (particularly drins) were negatively associated with RTL, with the strongest negative effects being found in senescent females. Conversely, PCBs led to slower rates of telomere shortening, especially in females. Our study indicates diametrically opposed effects of OCPs on RTL and PCBs on TROC, and these effects were more pronounced in females and senescent individuals. The mechanisms behind these effects (e.g., increased oxidative stress by OCPs; upregulation of telomerase activity by PCBs) remain unknown. Our results highlight the importance in wildlife ecotoxicology to account for sex- and age-related effects when investigating the health effects of pollutants on biomarkers such as telomeres.

Authors: Roger Colominas-Ciuró, Francesca E Gray, Kalender Arikan, Sandrine Zahn, Christoph Meier, François Criscuolo, Pierre Bize

Full Source: The Science of the total environment 2024 Jun 6:173785. doi: 10.1016/j.scitotenv.2024.173785.

Chemical pollution is a major man-made environmental threat to ecosystems and natural animal populations.

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ENVIRONMENTAL RESEARCH

From Port to Planet: Assessing NO2 Pollution and Climate Change Effects in Maritime Zones

2024-06-06

The growing effects of climate change on Malaysia's coastal ecology heighten worries about air pollution, specifically caused by urbanization and industrial activity in the maritime sector. Trucks and vessels are particularly noteworthy for their substantial contribution to gas emissions, including nitrogen dioxide (NO2), which is the primary gas released in port areas. The application of advanced analysis techniques was spurred by the air pollution resulting from the combustion of fossil fuels such as fuel oil, natural gas, and gasoline in vessels. The study utilized satellite photos captured by the TROPOspheric Monitoring Instrument (TROPOMI) on the Sentinel-5P satellite to evaluate the levels of NO2 gas pollution in Malaysia's port areas and exclusive economic zone. Before the COVID-19 pandemic, unrestricted gas emissions led to persistently high levels of NO2 in the analyzed areas. Nevertheless, the temporary cessation of marine industry operations caused by the pandemic, along with the halting of vessels to prevent the spread of COVID-19, resulted in a noticeable decrease in NO2 gas pollution. In light of these favourable advancements, it is imperative to emphasize the need for continuous investigation and collaborative endeavours to further alleviate air contamination in Malaysian port regions, while simultaneously acknowledging the wider consequences of climate change on the coastal ecology. The study underscores the interdependence of air pollution, maritime activities, and climate change. It emphasizes the need for comprehensive strategies that tackle both immediate environmental issues and the long-term sustainability and resilience of coastal ecosystems in the context of global climate challenges.

Authors: Mohd Azhafiz Abdullah, L F Chuah, Samsuri Bin Abdullah, Awais Bokhari, Asad Syed, Abdallah M Elgorban, Muhammad Saeed Akhtar, Hind A Al-Shwaiman, Saira Asif

Full Source: Environmental research 2024 Jun 6:119328. doi: 10.1016/j.envres.2024.119328.

The growing effects of climate change on Malaysia's coastal ecology heighten worries about air pollution, specifically caused by urbanization and industrial activity in the maritime sector.

Eco-health risks and main sources of persistent pollutants bound by bus stops dust in Qingyang city, an important energy base on the west side of the Ziwuling primitive Forest

2024-06-06

In this study, we examined the persistent pollutant contents [harmful elements (HEs), cadmium (Cd, 0.1 mg/kg) barium (Ba, 881.1 mg/kg)] and polycyclic aromatic hydrocarbons [PAHs; Acenaphthylene (Acy), Acenaphthene (Ace), Fluorene (Flu), Benzo(k)fluoranthene (BkF), Benzo(a) pyrene (BaP) (0 mg/kg) BaP (10.2 mg/kg)] in bus stop dust (BSD) from Qingyang, Northwest China. The Nemerow composite pollution index of the eight types of PAHs and ∑16PAHs indicated severe pollution. The carcinogenic risk of the persistent pollutant in BSD to adults was 1.6 times greater than the acceptable upper limit for the human body, while the noncarcinogenic risk was small to five daily bus passenger groups. Clustering and principal component analysis showed that 12 kinds of HEs were mainly derived from coal and fuel combustion and 16 kinds of PAHs were mainly derived from biomass combustion, organic matter decomposition, and chemical applications.

Authors: Yongfu Wu, Lianglu Hao, Han Zhang, Tao Zeng, Yuan Meng, Dongbo Li, Yan Shi, Ni Qiao, Tongjun Wang

Full Source: Marine pollution bulletin 2024 Jun 6:204:116536. doi: 10.1016/j.marpolbul.2024.116536.

High-throughput screening of 222 pesticides in road environments in a megacity of northern China: A new approach to urban population exposure

2024-06-06

A large number of pesticides have been widely manufactured and applied, and are released into the environment with negative impact on human health. Pesticides are largely used in densely populated urban environments, in green zones, along roads and on private properties. In order to characterize the potential exposure related health effects of pesticide and their occurrence in the urban environment, 222 pesticides were screened and quantified in 228 road dust and 156 green-belt soil samples in autumn and spring from Harbin, a megacity in China, using GC-MS/MS base quantitative trace analysis. The results showed that a total of 33 pesticides were detected in road dust and green-belt soil, with the total concentrations of 650 and 236 ng/g (dry weight = dw), respectively. The concentrations of pesticides in road dust were significantly higher than

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that in green-belt soil. Pesticides in the environment were influenced by the seasons, with the highest concentrations of insecticides in autumn and the highest levels of herbicides in spring. In road dust, the concentrations of highways in autumn and spring (with the mean values of 94.1 and 68.2 ng/g dw) were much lower than that of the other road classes (arterial roads, sub-arterial roads and branch ways). Whereas in the green-belt soil, there was no significant difference in the concentration of pesticides between the different road classes. A first risk assessment was conducted to evaluate the potential adverse health effects of the pesticides, the results showed that the highest hazard index (HI) for a single pesticide in dust and soil was 0.12, the hazard index for children was higher than that for adults, with an overall hazard index of less than 1. Our results indicated that pesticide levels do not have a significant health impact on people.

Authors: Ye Zhang, Jin-Nong Li, Jian-Xin Wang, Yi-Fan Li, Roland Kallenborn, Hang Xiao, Ming-Gang Cai, Zhong-Hua Tang, Zi-Feng Zhang

Full Source: Environmental research 2024 Jun 6:257:119379. doi: 10.1016/j.envres.2024.119379.

PHARMACEUTICAL/TOXICOLOGY

Carbon and Metal Based Magnetic Porous Materials - Role in Drug Removal: A Comprehensive Review

2024-06-05

Development of effective adsorbents for the removal of contaminants from wastewater is indispensable due to increasing water scarcity and a lack of pure drinking water, which are prevailing as a result of rapid industrialization and population growth. Recently, the development of new adsorbents and their effective use without generating secondary waste is receiving huge consideration. In order to protect the environment from primary and secondary pollution, the development of adsorbents from wastes and their recycling have become conventional practices aimed at waste management. As a result, significant progress has been made in the synthesis of new porous carbon and metal organic frameworks as adsorbents, with the objective of using them for the removal of pollutants. While many different kinds of pollutants are produced in the environment, drug pollutants are the most vicious because of their tendency to undergo significant structural changes, producing metabolites and residues with entirely different properties compared to their parent compounds. Chemical reactions involving oxidation, hydrolysis, and photolysis transform drugs. The resulting compounds can have detrimental effects on living beings that are present

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in soil and water. This review stresses the development of adsorbents with adjustable porosities for the broad removal of primary drug pollutants and their metabolites, which are formed as a result of drug transformations in environmental matrices. This keeps adsorbents from building up in the environment and prevents them from becoming significant pollutants in the future. Additionally, it stops secondary pollution caused by the deterioration of the used adsorbents. Focus on the development of effective adsorbents with flexible porosities allows for the complete removal of coexisting contaminants and makes a substantial contribution to wastewater management. In order to concentrate more on the development of flexible pore adsorbents, it is crucial to comprehend the milestones reached in the research and applications of porous magnetic adsorbents based on metal and carbon, which are discussed here.
Authors: Supriya Subrahmanian, Sathish Sundararaman, Govindaraju Kasivelu
Full Source: Chemosphere 2024 Jun 5:142533. doi: 10.1016/j.chemosphere.2024.142533.

OCCUPATIONAL

Response of a simulated aquatic fungal community to nanoplastics exposure and functional consequence on leaf decomposition

2024-06-06

Nanoplastics pose a potential threat to a wide variety of aquatic organisms. Despite the awareness of this existing hazard, the impact of nanoplastics on natural fungal communities remains a research gap. In this study, five dominant fungi species, isolated from a stream ecosystem, were used to explore the effects of different nano-polystyrene (nano-PS) particles concentrations on a simulated fungal community. Specifically, the evaluation was conducted regarding the fungal growth, reproductivity, structural composition, and ecological function in leaf litter decomposition. A 15-day exposure experiment showed that 100 μg/L nano-PS significantly reduced the microcosm pH. The extracellular enzyme activities of β-glucosidase, leucine-aminopeptidase, and peroxidase were significantly promoted by nano-PS exposure for 5 days or 15 days. Total sporulation rate significantly decreased after the 15-day exposure to 1 and 100 μg/L nano-PS and significantly increased under 10 μg/L nano-PS. In contrast, nano-PS concentrations had no effects on fungal biomass. In addition, the reduced relative abundance of Geotrichum candidum

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lowered its contribution to leaf decomposition, resulting in a decreased litter decomposition rate of a 24.5 to 27.9 % after exposure. This suggests that 1-100 μg/L nano-PS inhibited leaf decomposition by inhibiting fungal reproduction and reducing the contribution of specific fungal species. In addition, the findings highlight the importance of exploring the potential mechanisms of the interaction between nanoplastics and fungal species.
Authors: Jingjing Du, Tianying Tao, Mengxi Gao, Xueting Zhang, Xilin Wang, Qian Zhang, Yuanqian Xu, Baodan Jin, Lan Wang, Xia Cao
Full Source: Environmental pollution (Barking, Essex : 1987) 2024 Jun 6:124342. doi: 10.1016/j.envpol.2024.124342.

Co-exposure to cadmium and triazophos induces variations at enzymatic and transcriptional levels in Opsariichthys bidens

2024-06-06

Heavy metals and pesticides are significant pollutants in aquatic environments, often leading to combined pollution and exerting toxic effects on aquatic organisms. With the rapid growth of modern industry and agriculture, heavy metal cadmium (Cd) and pesticide triazophos (TRI) are frequently detected together in various water bodies, particularly in agricultural watersheds. However, the combined toxic mechanisms of these pollutants on fish remain poorly understood. This experiment involved a 21-day co-exposure of Cd and TRI to the hook snout carp Opsariichthys bidens to investigate the toxic effects on liver tissues at both enzymatic and transcriptional levels. Biochemical analysis revealed that both individual and combined exposures significantly increased the content or activity of caspase-3 (CASP-3) and malondialdehyde (MDA). Moreover, the impact on these parameters was greater in the combined exposure groups compared to the corresponding individual exposure groups. These findings suggested that both individual and combined exposures could induce mitochondrial dysfunction and lipid peroxidation damage, with combined exposure exacerbating the toxicological effects of each individual pollutant. Furthermore, at the molecular level, both individual and combined exposures upregulated the expression levels of cu-sod, cat, and erβ, while downregulating the expression of il-1. Similar to the patterns observed in the biochemical parameters, the combined exposure group exhibited a greater impact on the expression of these genes compared to the individual exposure groups. These results indicated that exposure to Cd, TRI, and their combination induced oxidative stress, endocrine disruption, and immunosuppression in fish livers, with more severe effects observed in the combined exposure group.

Heavy metals and pesticides are significant pollutants in aquatic environments, often leading to combined pollution and exerting toxic effects on aquatic organisms.

Overall, the interaction between Cd and TRI appeared to be synergistic, shedding light on the toxic mechanisms by which fish livers responded to these pollutants. These findings contributed to the understanding of mixture risk assessment of pollutants and were valuable for the conservation of aquatic resources.
Authors: Yancen Lou, Xiaojun Xu, Lu Lv, Xinfang Li, Zhangjie Chu, Yanhua Wang
Full Source: Chemosphere 2024 Jun 6:142561. doi: 10.1016/j.chemosphere.2024.142561.

Preservative contact allergy in occupational dermatitis: a machine learning analysis

2024-06-08
Occupational dermatoses impose a significant socioeconomic burden. Allergic contact dermatitis related to occupation is prevalent among healthcare workers, cleaning service personnel, individuals in the beauty industry and industrial workers. Among risk factors, the exposure to preservatives is frequent, since they are extensively added in products for occupational use. The goal of this study is to investigate the contact allergy patterns in order to understand the linkage among hypersensitivity to preservatives, occupational profiles, patients' clinical and demographic characteristics. Patch test results were collected from monosensitized patients to Formaldehyde 2%, KATHON 0.02%, thimerosal 0.1%, and MDBGN 0.5%; information was also collected for an extended MOAHLFA (Male-Occupational-Atopic-Hand-Leg-Face-Age) index. To assess the relationship between allergen group and occupational-related ACD, the chi-square test for independence was utilized. To uncover underlying relationships in the data, multiple correspondence analysis (MCA) and categorical principal components analysis (CATPCA), which are machine learning approaches, were applied. Significant relationships were found between allergen group and: occupation class, atopy, hand, leg, facial, trunk, neck, head dermatitis, clinical characteristics, ICDRG 48 h and ICDRG 72 h clinical evaluation. MCA and CATPCA findings revealed a link among allergen group, occupation class, patients' demographic and clinical characteristics, the MOAHLFA index, and the ICDRG scores. Significant relationships were identified between the allergen group and

Occupational dermatoses impose a significant socioeconomic burden.

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various manifestations of dermatitis. The utilization of machine learning techniques facilitated the discernment of meaningful patterns in the data.
Authors: Aikaterini Kyritsi, Anna Tagka, Alexandros Stratigos, Vangelis Karalis
Full Source: Archives of dermatological research 2024 Jun 8;316(7):372. doi: 10.1007/s00403-024-03101-1.