The Rapids

US EPA's Trash Free Waters Monthly Update

August 2022

epa.gov/trash-free-waters

Introduction

Hello all,

Hope you're having a nice summer.

Last month, the General Services Administration (GSA) **announced** it will evaluate its practices for reducing the federal purchasing of unnecessary single-use plastics.

The U.S. Agency for International Development (USAID) recently announced the **Save Our Seas Initiative**, a $62.5 million effort inspired by the Save Our Seas 2.0 Act to reduce ocean plastic pollution around the world. The program will include 14 new country and regional programs in areas of the world with high recorded levels of mismanaged plastic waste.

The Council of the Great Lakes Region also released "**A Great Lakes Circular Economy Strategy & Action Plan For Plastics**," an innovative 5-year plan to forging a future without plastic packaging waste and litter in the bi-national Great Lakes region.

Please continue to share any upcoming events with Layne Marshall (**marshall.layne@epa.gov**) so that the Trash Free Waters team can advertise these opportunities.

Romell Nandi
US EPA
Trash Free Waters National Program Lead

EPA Announcements

Launch of Transboundary Commission for Environmental Change (CEC) and EPA Marine Litter Project
CEC, in collaboration with EPA, recently launched a public education pilot project to build awareness about the flow of litter downstream into oceans. Three Osprey Initiative, LLC "litter gitter" trash capture devices will be installed in Davenport, Iowa due to its location along the Mississippi River. The effort will also be rolled out in watersheds in Canada and Mexico.

Illegal Dumping - Best Practices for Addressing a Persistent and Complex Problem
Over 230 people attended the ninth event in the TFW webinar series last month, which provided an overview of the problem of illegal dumping, what we know about the underlying causes, and the challenges that communities face in responding to- and preventing illegally dumped waste. A recording of the webinar will be added to the webinar archive on the EPA's TFW website later this summer.

Trash Free Waters in Barnegat Bay
The TFW Program is providing technical assistance to the Barnegat Bay Partnership in New Jersey to implement a trash free waters campaign encouraging citizens and tourists to transition away from single-use plastics. Campaign materials, including posters, social media posts, and a radio advertisement, all use the tagline "Barnegat Bay is worth more than one use."

EPA Celebrates Plastic Free July on Social Media
The EPA's Office of Water twitter account highlighted a number of helpful **tips** and **tricks** for reducing consumption of single-use plastics under the hashtag #PlasticFreeJuly last month.

Funding Opportunities

Sea Grant Marine Debris Challenge Grant
Approximately $16 million will be available to support innovative research to application projects that will address the prevention and removal of marine debris. Approximately 5-12 projects of up to three years duration may be funded. Matching funds will not be required for this competition. Eligible applicants are Sea Grant College Programs, Sea Grant Institutional Programs, and Sea Grant Coherent Area Programs. Other interested entities must submit proposals in partnership with and through a relevant Sea Grant program. **Letters of Intent must be submitted by August 9.**

Sea Grant Marine Debris Community Action Coalitions
Approximately $3 million will be available to support the creation of coalitions and partnerships to address marine debris prevention and removal. This competition is open to Sea Grant programs only and will support approximately 10-15 Marine Debris Community Action Coalitions. **Letters of Intent must be submitted by August 16.**

EPA Small Business Innovation Research (SBIR) Program
EPA's 2022-2023 SBIR Phase I Solicitation has officially been released to develop innovative technologies that protect human health and the environment. EPA is calling for small businesses to apply for Phase I awards up to $100,000 to demonstrate proof of concept in the following topic areas: Clean and Safe Water, Air Quality and Climate, Homeland Security, Circular Economy/Sustainable Materials, Safer Chemicals, and Risk Assessment. **The deadline for submissions is August 23.**

2022 South Florida Program
The EPA South Florida Program provides competitive grants to address the immediate and emerging ecological pressures and threats to south Florida waters. Examples of eligible projects include: Developing environmental education programs to address land-based sources of pollution; analyzing and quantifying the volume and composition of nutrients, emerging contaminants, marine debris, and other pollutants in stormwater runoff; Investigating the cost and effectiveness of stormwater regulations, treatment, and disposal methodologies for reducing pollutant loadings; Developing innovative programs for trash prevention and removal; and more. EPA Region 4 anticipates awarding $8 million to approximately twenty applicants with funding ranging from a minimum of $200,000 to a maximum of $750,000 per application. **The deadline for submissions is August 29.**

Translating Coastal Research into Application
The U.S. Coastal Research Program (USCRP) is a multi-agency led effort to coordinate Federal activities, strengthen academic programs, and address coastal community needs. Proposals should address the needs or gaps that have been identified by or are evident from USCRP-funded projects, to move research project findings toward application (i.e., the translation of societally-relevant coastal and estuarine physical processes science to science-based solutions that address coastal community needs related to resilience). Approximately $4 million will be available through this opportunity with individual awards between $150,000 and $500,000. **The deadline for submissions to NOAA is August 30.**

Youth Innovation Challenge
The Youth Innovation Challenge is a program of the Global Environmental Education Partnership. Young people (ages 15–30) around the world can use this opportunity to share innovative, feasible, and research-informed solutions to tackling marine debris, using environmental education as a key strategy. Winning solutions will receive global recognition and a $1,000 USD prize. An **applicant webinar** was held in July. **The deadline for submissions is September 1.**

Environmental Justice Data Fund
The Environmental Justice Data Fund (EJDF or "the Fund") is an $8 million fund, created and seeded by Google.org, that aims to help frontline communities that have been historically underserved and disproportionately impacted by climate change and environmental injustice. The Fund will enable frontline communities in the United States to use data to unlock resources, increase their access to Justice40 benefits and federal infrastructure funding, and advocate for new policies that empower communities to address past environmental harm and pave the way to a more sustainable, climate-resilient future. **Applications are being accepted on a rolling basis, but the final deadline for submissions is September 16.**

San Francisco Bay Water Quality Improvement Fund (SFBWQIF)
EPA is currently accepting applications via two separate Requests for Applications (RFAs) for SFBWQIF. **EPA's Bipartisan Infrastructure Law (BIL)-SFBWQIF RFA** aims to broaden the EPA's reach to focus on inequities in the access to Federal funding and implementation of projects and climate resilience in underserved communities. The total estimated available FY22 funds is approximately $5 million and awards will range from approximately $200,000 to $1 million. The second opportunity, **EPA's SFBWQIF RFA**, is accepting applications for approximately $24 million to protect and restore San Francisco Bay watersheds and wetlands. Selected projects will receive between $1 million and $3 million to focus on water quality results, such as restoration of impaired waters and enhancement of wetland habitat. **The submission deadline for both opportunities is September 20.**

FY22 NOAA Marine Debris Removal under the Infrastructure Investment and Jobs Act
The NOAA Marine Debris Program will award up to $56 million through funding provided by the Bipartisan Infrastructure Law. This competition focuses on two priorities: removing large marine debris and using proven interception technologies to capture marine debris throughout the coastal United States, Great Lakes, territories, and Freely Associated States. These two priorities will be reviewed as separate, parallel tracks with different application requirements. Federal requests for Priority 1 must be between $1 million to $15 million. Federal requests for Priority 2 must be between $100,000 to $1 million. **The deadline for submissions is September 30.**

PADI AWARE Mission Hub Community Grants
This grant is open to funding projects that align with PADI's Blueprint for Ocean Action, in direct support of the United Nations Decade of Science for Sustainable Development. Project proposals should focus on the following areas: Marine Debris, Vulnerable Species Protection, Coral Reefs, Climate Change, and Marine Protected Areas. Grantees will be selected based on conservation need, community feedback and budget. The maximum grant amount is $10,000. **The deadline for submissions is October 22.**

Other Opportunities…

Call for Submissions for Marine Policy Special Issue: Equity & Justice in Marine Plastic Pollution Governance and Management

A special issue of *Marine Policy* aims to address a gap in the existing literature on marine plastic pollution and to advance this scholarship by inviting inter- and transdisciplinary contributions that demonstrate the multifaceted interplay between marine plastics, the environment and society and how these entanglements produce inequities. Submissions that demonstrate just and equitable responses with the potential to reduce the burdens experienced by communities most impacted by marine plastic pollution are also encouraged. **The deadline for submissions is August 31.**

Upcoming Events

24th Biennial Conference on the Biology of Marine Mammals

August 1st - 5th, West Palm Beach, FL and virtual

The Society for Marine Mammalogy (SMM) holds its conference every two years to promote science, collaboration, and improve the quality of research on marine mammals around the globe. SMM2022 is a hybrid conference under the theme, "A Sea Change: Transforming Science into Stewardship." The conference will highlight the value of diversity in all forms in marine mammal science, from our multidisciplinary approaches to the improvement of diversity in our field.

2022 Resource Recycling Conference

August 15-17th, Austin, TX

The 2022 Resource Recycling Conference, hosted in collaboration with The Recycling Partnership, will include sessions that bring critical market insight and analysis to the stage, giving local recycling officials and other stakeholders the knowledge and perspective they need to boost materials recovery. This year's agenda includes material-specific sessions on cardboard and plastics, workshops on market development, and multiple chances to talk policy with Eunomia Research and Consulting. Registration closes August 11.

NAWM Annual State/Tribal/Federal Coordination Meeting

August 15-19th, Shepherdstown, WV

The National Association of Wetland Managers (NAWM) is hosting their annual coordination meeting focusing on "Protecting Waters in a Time of Rapid Change." The purpose of this annual meeting is to support state and tribal wetland program managers and other wetland professionals as they respond to challenges in the coming year. Focus areas for this year's meeting include: Engaging Under-resourced Communities in Wetland Protections, Continuity and Mentorship for Staffing Changes, Finding Funding for Climate Resiliency, Recent Regulatory Changes and Updates, Advances in Tools and Technology, and Effective Outreach and Communications.

World Water Week

August 23rd - September 1st, Stockholm, Sweden and virtual

World Water Week is the leading annual event on global water issues, organized by Stockholm International Water Institute since 1991. Together with organizations from all sectors and all regions of the world, we find solutions to the world's greatest water-related challenges. Within the overall theme of "Seeing the unseen: The value of water", conference sessions will be grouped under three theme headings: the value of water for people and development, the financial and economic value of water, and the value of water for nature and climate change.

Save the dates for future months...

Beyond Plastic Pollution Virtual Class – Fall 2022
September 7th - October 19th, virtual
This in-depth seven-week online masterclass on all things plastic pollution is offered by the founder and President of Beyond Plastic Pollution, Judith Enck, via Bennington College's Center for the Advancement of Public Action. The class is open to anyone, from high school student to concerned community member. The cost of enrollment is $100. Advance registration is required.

International Coastal Cleanup Day
September 17th, worldwide
Join concerned citizens from around the world in celebrating International Coastal Cleanup 2022 by conducting a solo or small trash cleanup in your community.

7th International Marine Debris Conference
September 18th - 23rd, Busan, Republic of Korea
7IMDC will build on the momentum of past IMDCs by bringing together governments, industry, academia, civil society, and all relevant stakeholders, to discuss the latest science, strengthen collaborations, find solutions and catalyze action to address the urgent global problem of marine litter and plastic pollution. Technical session tracks range from monitoring and research to circularity and international collaboration.

International Solid Waste Association World Congress 2022
September 21st - 23rd, Marina Bay Sands, Singapore
The 2022 ISWA World Congress will be hosted by the Waste Management & Recycling Association of Singapore. The Congress has an overall theme of "Don't Waste Our Future" and will include keynote and plenary sessions by invited speakers, and concurrent sessions with oral and poster presentations by the participants. This will serve as an opportunity and platform for business leaders and entrepreneurs, technology developers, solutions providers, and policy makers to gather and discuss key trends and the opportunities.

Virtual Island Summit - VIS2022
September 26th - October 2nd, virtual
The theme of VIS2022 is "Sharing Knowledge For Resilient, Sustainable And Prosperous Islands Worldwide." Conference themes include: Climate Action & Adaptation; Clean Energy: Blue Economy, Conservation & the Ocean; Agriculture & Food Security; Health, Education, Diversity & Inclusion; Circular Economy; Sustainable Tourism; and Blockchain & Cryptocurrency.

Virginia Marine Debris Summit 2022
September 27-28th, Virginia Beach, VA
The Virginia Coastal Zone Management Program and Clean Virginia Waterways will host the fourth Virginia Marine Debris Summit in September 2022 at the Virginia Aquarium and Marine Science Center. This summit will provide attendees with a face-to-face opportunity to build new partnerships and learn from the latest research in crafting successful behavior change campaigns, research about plastic pollution, and how to get involved in implementing actions found in the VA Marine Debris Reduction Plan.

Aquaculture Europe Conference 2022
September 27-30th, Rimini, Italy

The theme of this year's Aquaculture Europe Conference is "Innovative Solutions in a Changing World." It will feature a Microplastics and Litter session to call attention to the importance of studying this issue, creating solutions, and implementing measures that help to tackle it.

Reuse Minnesota's REUSE22 Conference
October 3-4th, Minneapolis, MN
REUSE22 educates, inspires, and connects professionals in the reuse, repair, and rental sectors. The event offers informative keynotes, breakout sessions, and networking opportunities geared toward strengthening and expanding the reuse economy. REUSE22 will bring together thought leaders and experts across multiple disciplines, including business professionals, nonprofit agencies, government workers, and students.

Sustainable Packaging Coalition Advance 2022
October 3-5th, Atlanta, GA
Sustainable Packaging Coalition's Advance 2022 Conference will feature collaboration examples from a range of leaders in environmental sustainability, showcasing better manufacturing practices, responsible sourcing, forest and water conservation, climate strategies, more efficient recovery and composting practices and systems and packaging technology and production. Workshop themes include reuse/refill systems, compostable packaging, flexible packaging and circularity, chemical recycling, and more.

North American Association for Environmental Education (NAAEE) Conference and Research Symposium
October 11-15th, Tucson, AZ and virtual
NAAEE's 2022 Conference (Oct 12-15) will focus on the powerful role education can play in creating healthier communities and tackling today's complex environmental and social issues. The conference will cover vital topics such as climate change education and climate justice, the benefits of connecting to nature, building a green workforce, protecting biodiversity, and centering equity in our work. This year's NAAEE Research Symposium (Oct 11-12) brings together new and experienced researchers from around the globe to explore the current state and future directions of environmental education research and advance the use of practices proven to be effective.

2022 Keep Florida Beautiful Annual Conference and Awards Social
October 19th-21st, New Port Richey, FL
Keep FL Beautiful is excited to be working alongside host affiliate Keep Pasco Beautiful to bring you an innovative and engaging conference experience. This conference is for affiliates, board members, community partners, local governments, state agencies, elected officials, businesses, and like-minded organizations.

17th Annual Chesapeake Watershed Forum
November 4-6th, Shepherdstown, WV
The Alliance for the Chesapeake Bay is hosting this 17th annual watershed forum, a watershed-wide event reaching over 400 restoration and protection practitioners to inspire and empower local action towards clean water. Attendees can expect to learn about successful tools and techniques from on-the-ground examples as well as how to build capacities of local organizations, foster partnerships, and incorporate new initiatives and emerging practices into their work.

74th Annual Gulf & Caribbean Fisheries Institute Conference
November 8-12th, virtual
The theme of this year's Gulf and Caribbean Fisheries Institute (GCFI) conference is "A Changing Time: Interactions between Science and Governance." The meeting will bring together regional stakeholders to share experiences and present success stories from around the Gulf and Caribbean. Several conference

presentations will be dedicated to marine litter, including microplastics research and Abandoned, Lost and Discarded Fishing Gear (ALDFG).

In case you missed it...

Coalition Building in Seattle
This podcast was hosted as part of UPSTREAM's Indisposable Podcast series. It provides insight on Reuse Seattle, a public-private partnership among the City of Seattle, the city's major sports and entertainment venues, and restaurants and businesses working to move from single-use to reuse. Guest speakers included Stephanie Thomas of Cascadia Consulting and Pat Kaufman of Seattle Public Utilities.

Expanding Frontline Communities' Access to Federal Funding
This WaterNow Alliance virtual seminar details state revolving funds and pathways for innovative water infrastructure. Representatives from River Network, PolicyLink and the Pacific Institute serve as guest speakers during the event.

Environmental Justice in Waste and Recycling
Environmental justice has become a major talking point in the waste and recycling industry in recent years. This WasteWise webinar explores environmental justice from a policy and trends perspective and understands how environmental justice is often approached by non-profits.

The Microplastics Breakdown

MICROPLASTICS AND HUMAN HEALTH

"How do cells react to micro- and nanoplastics? Research team examines possible health effects of plastic particles." *German Federal Institute for Risk Assessment. ScienceDaily. 12 July 2022.*
This article summarized a study conducted by researchers at the German Federal Institute for Risk Assessment (BfR) and published in the journal of *Microplastics and Nanoplastics*. The study focused on the effects of submicrometre [sic] and nanoplastic particles on human small intestine and liver cells. Cells were exposed to various plastic types that are used in plastic tableware and cutlery or in food packaging. The most significant result was that the smaller plastic particles are, the more easily they can be taken up by cells. In addition, the type of particle, shape, surface and chemical properties play an important role in how the particles affect human tissue. The cells of the small intestine, which serve as a natural barrier between the intestinal contents and the organism, were found to be relatively resistant to penetration by microplastics. The even smaller particles in the submicrometre range, on the other hand, could be measured in larger quantities in intestinal and liver cells. Areas that were identified as needing further investigation included the possibility that plastic particles could bind potentially harmful substances to themselves and introduce them into the cell as a "Trojan horse" and the potential health effects of submicrometre and nanoplastics and the extent of these effects, i.e., inflammatory effects. Additionally, this study was conducted in a laboratory, so it is not yet possible to say whether the results are valid in human systems.

Effects of Frying on Microplastics Load in Fish and Implications on Health
Fatima Eshun, Abigail Naa Adjorkor Pobee
The authors observed that there are limited studies on the effects of the method of cooking on microplastics (MPs) in seafood. To address this knowledge gap, this study focused on the effects of frying on MPs in fish. Levels of MPs in eighteen raw fish samples and 18 fried fish samples from three different species (Sardinella madeirensis, Decapterus rhonchus, and Mugil cephalus) were compared. MP filaments, films, and fragments and cylindrical, disc-like, or beady pieces of plastic (like granules) were

found in the fish. Higher levels of MPs were found in the fresh fish than in the fried fish. After frying the various species of fish, MPs were found in the oil as well; in fact, higher levels of MPs were found in the leftover oil used in frying than in the raw oil. The authors observed that in spite of the fact that this study did not engage in laboratory analysis of the direct effects of MPs on human health, it has unveiled that frying reduces the MPs in fish. According to the researchers, study results can inform the development of health policies and strategies to help build good health practices regarding the cooking methods for fish.

Microplastics Detected in Cirrhotic Liver Tissue

Thomas Horvatits, Matthias Tamminga, Beibei Liu, Marcial Sebode, Antonella Carambia, Lutz Fischer, Klaus Püschel, Samuel Huber, Elke Kerstin Fischer

This study explored whether MPs accumulate in the human liver, and if liver cirrhosis favors this process. Seventeen tissue samples (11 liver, 3 kidney and 3 spleen) were taken and analyzed from 6 patients with liver cirrhosis and 5 individuals without underlying liver disease. This study used a reliable method for detection of MP particles from 4 to 30 µm in human tissue: chemical digestion of tissue samples, staining with Nile red, followed by fluorescent microscopy and Raman spectroscopy. The morphology, size and composition of MP polymers were assessed. MPs were found in the liver of individuals with liver cirrhosis, but not in those without underlying liver disease. Particle sizes of detected MPs did not differ significantly within different tissues. Six different MP polymers ranging from 4 to 30 µm in size could be identified: polystyrene, polyvinyl chloride, polyethylene terephthalate, polymethyl methacrylate, polyoxymethylene, and polypropylene. The research team concluded that their results indicate chronic liver disease is a key driver in MP accumulation in human liver. Additionally, they also identified a need to evaluate whether hepatic MP accumulation represents a potential cause in the pathogenesis of fibrosis, or whether it is a consequence of cirrhosis and portal hypertension.

MICROPLASTICS REMOVAL

Microplastics and Heavy Metals Removal from Fresh Water and Wastewater Systems Using a Membrane

Simphiwe Dineo Nkosi, Soraya Phumzile Malinga, Nonhlangabezo Mabuba

This study focused on the characterization and quantification of MPs in water and proposes a method of addressing this emerging pollutant in various aqueous environments. Water samples were taken from three places in South African cities: influent and effluent from the Daspoort Wastewater Treatment Plant Daspoort in Pretoria; an urban stream leading out of the Sterkfontein Lake in Johannesburg; and tap water from Doornfontein, Johannesburg. MPs were separated from the samples via polyvinylidene difluoride (PVDF) and PVDF modified with carbon nano-onions (CNOs) along with a vacuum pump. Heavy metals that were attached onto the MPs were also extracted and characterized. The highest concentration of MPs was found in the wastewater influent as compared to the effluent, followed by tap water and then lake water. High concentrations of toxic heavy metals such as arsenic, copper and zinc were attached to the MPs. The highest concentrations of heavy metals were obtained in most samples filtered by PVDF. The researchers concluded that their work is beneficial to the development of a MP monitoring protocol for various municipalities - for example, treatment plants could include the removal of MPs in the influent and the monitoring of the effluent before the water is released back into the environment. Furthermore, since the PVDF membrane successfully removed MPs from both wastewater and freshwater systems, the authors suggested that their work could support the development of monitoring protocols to ensure adherence to water quality and management practices.

MICROPLASTICS TRANSPORT AND ECOSYSTEM IMPACTS

A Critical Review on Interaction of Microplastics With Organic Contaminants in Soil and Their Ecological Risks on Soil Organisms

Jianning Chang, Wei Fang, Jinsong Liang, Panyue Zhang, Guangming Zhang, Haibo Zhang, Yajie Zhang, Qingyan Wang

This review focused on the interaction of microplastics MPs with organic contaminants in soil and the combined risks to the soil environment. The goals of this review were to: (1) present the analytical methods, sources and distribution characteristics of MPs in soil, (2) discuss the sorption mechanisms and influencing factors of organic pollutants on MPs in the soil system, (3) clarify the effects of MPs on the sorption, degradation, and transport behaviors of organic pollutants in soil, (4) review the potential ecological risks caused by the co-existence of MPs and organic pollutants, and (5) to point out current challenges and propose future research. The authors observed that soil is a huge sink for MPs in terrestrial ecosystems, and 4 to 23 times more MPs are released into the soil than into the ocean each year. The authors found that the presence of MPs changes the sorption – an important process to control the conversion of organic pollutants at soil-water interface, which affects the migration process and bioavailability of organic pollutants in soil. Plants and soil microorganisms were also found to be impacted through synergistic or antagonistic effects. Source control, policy implementation, and plastic removal were identified as the main preventive and control measures to reduce soil MP pollution.

Microplastics in the Coastal Environment of Mediterranean and the Impact on Sustainability Level
Georgia Chatziparaskeva, Iliana Papamichael, Antonis A. Zorpas
This review paper analyzed existing data on the abundance, the marine contamination, and accumulation of MPs in the Eastern Mediterranean (Cyprus, Greece, Lebanon, Turkey, Israel, Egypt, Algeria, Tunisia, Morocco) and Western Mediterranean (France, Italy, Spain, Malta, Croatia, Slovenia, Bosnia and Herzegovina, Montenegro, and Albania). The estimated inputs of MPs into the Mediterranean Coastal belt and impacts on the economic and environmental sectors were presented by country as well as the general health and marine life implications of marine pollution. The viability of existing monitoring tools (KPIs) is introduced to provide knowledge regarding the necessity of strategy development to combat marine plastic pollution. The leading coastal countries found to be dumping a significant amount of plastics were Turkey (144 tons/day), Spain (126 tons/day), Italy (90 tons/day), Egypt (77 tons/day), and France (66 tons/day). No significant data were found for Syria, Libya, and Jordan. The article described some of the economic implications (e.g., the discouragement of tourism due to polluted beaches leading to the reduction of jobs and increase cost of harbor and coast cleanups); human health risks and environmental risks associated with MPs and their toxic contaminants.

Microplastics Can Aggravate the Impact of Ocean Acidification on the Health of Mussels: Insights from Physiological Performance, Immunity and Byssus Properties
Xizhi Huang, Jonathan Y.S. Leungde, Menghong Hu, Elvis Genbo Xu, Youji Wang
The potential adverse effects of ocean acidification may be exacerbated by MP pollution and this study evaluated the impact of ocean acidification and MPs on the health of a mussel species (*Mytilus coruscus*). Mussels were collected from a mussel raft at Shengsi Island, China, which is described as a relatively pristine area with limited human activity. The researchers assessed mussel physiological performance, immunity, and byssus (strength and extensibility) properties. They found that ocean acidification and MPs not only reduced hemocyte (cells containing hemoglobin, playing a key role in invertebrate's immune system) concentration and viability due to elevated oxidative stress, but also undermined phagocytic activity of hemocytes due to lowered energy budget of mussels, which was in turn caused by the reduced feeding performance and energy assimilation. Byssus quality production were also reduced. To increase the chance of survival with these stressors, the mussels prioritized the synthesis of some byssus proteins to help maintain adhesion to substrata. Nevertheless, the researchers asserted that the co-occurrence of ocean acidification and MP pollution would increase the susceptibility of bivalves to infectious diseases and dislodgement risk, thereby threatening their survival and undermining their ecological contributions to the community.

RESEARCH GAPS IN UNDERSTANDING HUMAN AND AQUATIC IMPACTS

Research Recommendations to Better Understand the Potential Health Impacts of Microplastics to Humans and Aquatic Ecosystems

Leah M. Thornton Hampton, Hans Bouwmeester, Susanne M. Brander, Scott Coffin, Matthew Cole, Ludovic Hermabessiere, Alvine C. Mehinto, Ezra Miller, Chelsea M. Rochman, Stephen B. Weisberg
An international group of experts in MP research was convened in 2020–2021 by the State of California to identify critical thresholds at which MPs found in drinking and ambient waters present a health risk to humans and aquatic organisms. Specifically, experts were tasked with identifying which MP characteristics (e.g., size, morphology, polymer, etc.) contribute most to toxicity and developing health-based thresholds for both the aquatic environment and drinking water. However, the authors of this article asserted that the experts' findings were limited by notable data gaps in the literature. They presented four categories of research recommendations needed to address these gaps: 1) adequate particle characterization and selection for toxicity testing; 2) appropriate experimental study designs that allow for the derivation of dose-response curves; 3) establishment of adverse outcome pathways for MPs; and 4) a clearer understanding of MP exposure, particularly for human health. This article concluded that by addressing these gaps, researchers will gain a better understanding of the key drivers of MP toxicity and the concentrations at which adverse effects may occur, which would in turn help determine the potential risks that MP exposure might pose to human and aquatic ecosystems.

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