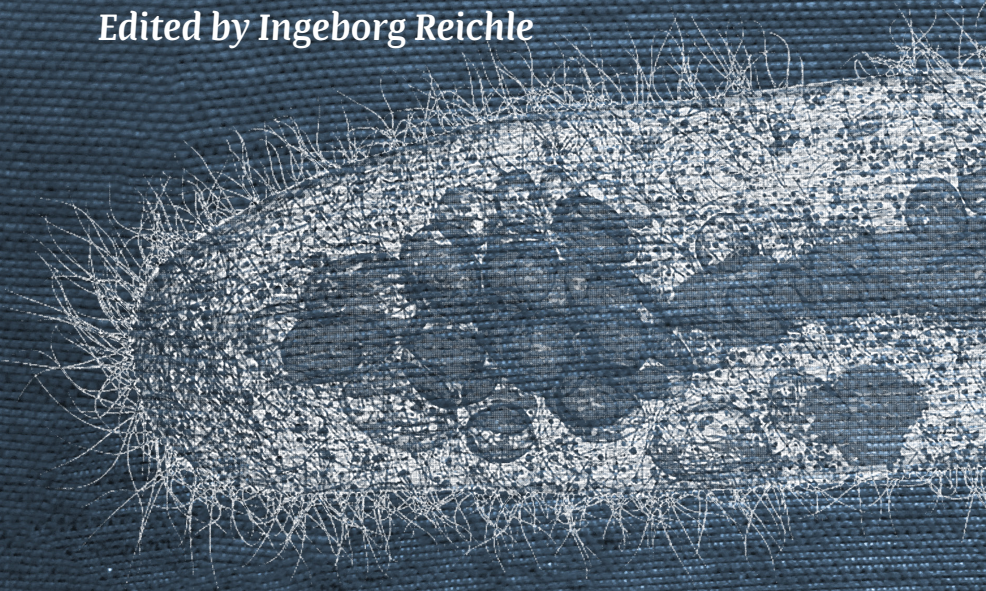
Plastic Ocean

Art and Science Responses to Marine Pollution

Edited by Ingeborg Reichle



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Plastic Ocean

Art and Science Responses to Marine Pollution

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Contents

»As I gazed from the deck at the surface of what ought to have been a pristine ocean, I was confronted, as far as the eye could see, with the sight of plastic.«

CAPTAIN CHARLES MOORE, DISCOVERER OF THE GREAT PACIFIC GARBAGE PATCH

Who lives in the *Plastisphere*? Art and Science Responses to Plastic Pollution

Introduction by Ingeborg Reichle

Poison Pills __ Plastic in the world's oceans has become a global concern as the massive accumulation of micro- and nanoplastic particles has turned into an existential crisis for marine life. These anthropogenic pollutants emerged as a by-product of modernity, but went unnoticed for a long time. However, when they were discovered in the late 1990s as the Great Pacific Garbage Patch, too little was done far too late.[1] Today it is obvious that untold trillions of micro- and nanoplastic particles floating in the world's oceans have created a novel, highly toxic ecological habitat, which threatens marine species and human health.

To describe the massive transformation of marine ecosystems when exposed to micro- and nanoplastics, scientists recently introduced the term *Plastisphere*.[2] Based on samples taken from the northern Atlantic, scientists found that new microbial reefs are emerging in the *Plastisphere*, which differ significantly from any previously known natural conditions of marine environments because toxic micro- and nanoplastic particles provide different conditions for microbes, bacteria, algae, and other micro-organisms than those offered by natural floating marine substrates like wood, feathers, or plants. Also, micro- and nanoplastic particles are highly toxic, serving both as transport medium and »poison pills« due to their ability to absorb toxic chemicals in the marine environment.[3]

Fueling Plastics __ With Bakelite the first synthetic material made from petro-chemicals (coal) was introduced in 1907; its polymer bonds do not bio-degrade and literally last forever.[4] It is the long polymer strands that make up plastic, which are responsible for the unique characteristics of this material, its durability, versatile malleability, and cost efficiency, characteristics that allowed the global plastic industry to increase its annual production from 2 million metric tons in 1950 to approximately 380 million metric tons in 2015. If former trends continue, more than half of this year's plastic production will end up as waste and will be discarded (55 percent), 25 percent will be incinerated, and 20 percent will be recycled. In 2017, the cumulative global plastic production reached estimated 8.3 billion metric tons and it is expected to increase to 34 billion metric tons by 2050.

FIG. 1
Robertina Šebjanič, underwater photo taken in 2017 near the island of Korčula, Croatia.

Plastic was first developed around 1800 but it was not until the 1960s and 1970s that plastic, made from chemicals sourced from fossil fuels like coal, natural gas, and crude oil, replaced traditional materials and became the commonest material both in daily use and in the majority of manufacturing sectors. Subsequently, plastic and its toxic chemicals became part of the waste stream. But unlike most types of solid waste, plastic takes centuries to degrade; it never fully decomposes but falls apart into smaller and smaller particles, which still exhibit all the characteristics of plastic. The traditional solid waste disposal infrastructure failed and still fails to control the ever larger amounts of plastic waste, and improperly managed plastic waste disposal has made millions of tons of plastic end up in the world's oceans.[5]

Over the course of the twentieth century, consumption became central to the dynamics of modern capitalist economies. With the rise of mass consumerism most Western countries underwent profound transformations, reorienting almost every activity of daily life toward consumption.[6] After World War II, consumer societies were driven by a system of ever-expanding goods and desires, which became key to the ideal of happiness in the Global North. The »good life« became closely linked to the consumption of material objects and *stuff* on a massive scale, many of which are made of plastic.

Plastic Ocean

As a consequence of the vast amount of plastic that has been pouring into marine habitats for decades, the world's oceans are now on the verge of collapse. Because of the urgency to foster positive change in a situation where no escape seems possible, *Plastic Ocean: Art and Science Responses to Marine Pollution* offers an interdisciplinary perspective by including the arts and a wide range of disciplines, sounding the alarm about this developing crisis. In recent decades, artists have joined forces with scientists to advance the necessary mobilization and have teamed up with environmental activists, philosophers, and curators to become ecoactivists raising awareness about this imminent environmental disaster and the future conflicts it will create.

With her artistic strategies, and by cofounding the Plastic Pollution Coalition (PPC), artist Dianna Cohen is committed to influencing the national and international political agenda concerning plastic pollution. She is particularly keen to change policy and legislation about single-use plastic items in everyday use.

Pinar Yoldas explores, in her artistic practice, how marine debris is transforming the world's oceans into a future post-human ecosystem with the goal of driving activism forward in search of environmental justice. She provides us with compelling visual narratives of highly speculative species, which will be able to adapt to the toxicological effects of plastics.

DIY/DIWO (do-it-yourself/do-it-with-others) protocols for hacking hormones are on the mind of artist and biohacker Mary Maggic when

FIG. 2
Max Liboiron, COD OBJECTS (INGESTION STUDY), 2016, digital photographs of items taken from the guts of ATLANTIC COD caught in 2015 on the island of Newfoundland, Canada. COD OBJECTS (SP141, PH66, SP31, PH85, PH67, and PH33) is part of the larger series SEEING LIKE A SCIENTIST.

critically reflecting about how gendered bodies are controlled and managed through corporate and institutional science on the one hand, and on the other hand are permanently exposed to endocrine-disrupting chemicals due to toxicity in the environment. Is there hope for disobedient bodies amongst capitalist and ecological ruins? Endocrine disruption affects not only human health but all living organisms because basic features of biology are shared across all life forms, in particular damaging sexual development and fertility. According to the latest research findings, the failure to regulate endocrine disruptors will lead to reproductive abnormalities: by 2040 most Western males will not be able to father a child in the *old-fashioned way*, which will almost certainly lead to great socio-cultural upheavals.[7]

The loss of biodiversity in the Gulf of Mexico due to the Deepwater Horizon oil spill in 2010, which is the largest environmental disaster in the history of the United States and the largest known petrochemical spill

by volume in modern history, is the focus of artist Brandon Ballengée, who seeks to promote systemic change with his collaborative eco-action and outreach events. Key to his art and action responses is the sharing of scientific knowledge about the tremendous negative impact of current oil production methods with the coastal communities affected to increase community resilience in their local ecosystems.

A different important topic is raised by artist Robertina Šebjanič: the rising level of anthropogenic noise in the world's oceans due to increasing gas and oil exploration and extraction, underwater mining, construction work on the seafloor, and shipping. The negative effects of high noise levels on marine wildlife are especially injurious to those marine organisms who communicate through sound. In close collaboration with marine biologists, the artist investigates the phenomenon of noise pollution through collecting invasive sound samples on her extensive research trips.

With her participatory art projects, Victoria Vesna explores how to immerse her audience in an act of deep listening, foregrounding the importance of making the invisible and inaudible aspects of marine life accessible. Using the most compelling science visualizations, which were produced in a laborious process by digital artist Martina Fröschl and scientist Alfred Vendl, based on accurate digital 3D models from live images of planktonic organisms and processed by biologist Stephan Handschuh and zoologist Thomas Schwaha, Vesna transforms scientific data into an art-science based experience to render the effects of anthropogenic noise on plankton accessible to the human senses. While the effects of the infiltration of plastic-associated toxins into marine food webs, given the key role played by plankton in ocean ecosystems, is a huge concern of current scientific research, noise pollution is as yet a minor subject that has been largely neglected so far. Both artist and scientists are anxious to draw attention to the fact that planktonic organisms are absolutely vital for ocean food web dynamics, and they also play an integral role in regulating the global climate.

Another perspective on planktonic organisms is offered by artist Reiner Maria Matysik. He uses microscopic images of unicellular diatoms, which live in the oceans, waterways, and soils of the world, to design complex three-dimensional forms while at the same time reflecting on the characteristics of form solutions presented by natural systems. Matysik works in collaboration with biologists who are particularly interested in investigating diatom micro- and nanostructures in the field of functional morphology.

Curators Regine Rapp and Christian de Lutz have, in recent years, mounted a number of exhibitions that focus on artistic responses to the severe consequences of climate change and the huge crisis the world's oceans are facing due to massive plastic pollution. At the same time they also promote new performative artistic strategies like *doing it with others*

(DIWO) actions by artists or participatory hands-on workshops. Performing philosophy through art is evident in the installation discussed by philosophers María Antonia González Valerio and Rosaura Martínez Ruiz, in which art deconstructs the biological category of species to encourage the development of transdisciplinary thinking about problems of ontology, biopolitics, taxonomy, epigenetics, and evolution.

The last chapter of *Plastic Ocean: Art and Science Responses to Marine Pollution*, by industrial microbiologist Michael Sauer, is devoted to laying out alternatives to long-established fossil-based plastic. Bioplastic, for example, which is produced through synthetic biology applications, would not harm marine ecosystems in the same disastrous way. However, his key argument points out that it is not so much the development of new materials which is the stumbling block to creating environmentally benign plastics, but the fact that we still do not know how to define and test, in a comprehensive way, whether a material is environmentally benign or not.

This anthology aims to rethink ocean plastic pollution through the lens of art and science to foster a critical debate about whether this urgent global challenge should be regarded as an epistemological, sociopolitical, or technical problem. If we do not seriously reevaluate the destructive effects of mass consumerism on the environment, the impact of irresponsible use of valuable resources on future generations—if we fail to foster and promote green science and do not raise awareness and show commitment to performing real actions—it will become increasingly difficult to live a more sustainable life to avert the collapse of our marine ecosystems. For it is expected that the amount of plastic pouring into the world's oceans will nearly triple by 2040 to 29 million metric tons every year. Plastic is everywhere, it is in the air, water, soil, and inside us, too; therefore, it seems appropriate to extend the term *Plastisphere* to the entire planet. Who will be able to live in the Plastisphere in years to come—which species will be able to adapt remains an open question.

1 See Charles G. Moore and Cassandra Phillips, *Plastic Ocean. How a Sea Captain's Chance Discovery Launched a Quest to Save the Oceans*, New York: Avery (2011).

2 Erik R. Zettler, Tracy J. Mincer, and Linda A. Amaral-Zettler, »Life in the ›Plastisphere‹: Microbial Communities on Plastic Marine Debris,« *Environmental Science & Technology* 47: 13 (2013): 7137–7146 and see Linda A. Amaral-Zettler, Erik R. Zettler, and Tracy J. Mincer, »Ecology of the Plastisphere,« *Nature Reviews Microbiology* 18 (2020): 139–151.

3 Max Liboiron, »The Plastisphere and Other 21st Century Waste Ecosystems,« *Discard Studies Blog*, July 22, 2013.

4 Esther Leslie, *Synthetic Worlds: Nature, Art and the Chemical Industry*, London: Reaktion Books (2005).

5 Max Liboiron, *Redefining Pollution: Plastics in the Wild*, PhD dissertation, New York University (2012).

6 David Banash, *Collage Culture: Readymades, Meaning, and the Age of Consumption*, Amsterdam: Rodopi (2013), 11.

7 Shanna H. Swan, *Count Down: How Our Modern World Is Threatening Sperm Counts, Altering Male and Female Reproductive Development, and Imperiling the Future of the Human Race*, New York: Scribner (2021).

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