



Viele Daten, doch was steckt dahinter? Wie auf Grundlage von Citizen Science die Müllverschmutzung von Flüssen untersucht wird

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Ziele des Projektes

- Weiträumige Erfassung der Müllverschmutzung von Flüssen
- Identifikation von möglichen Quellen
- Stärkung des Umweltbewusstseins & Konsumverhaltens
- Einblicke in transdisziplinäre Forschungsabläufe



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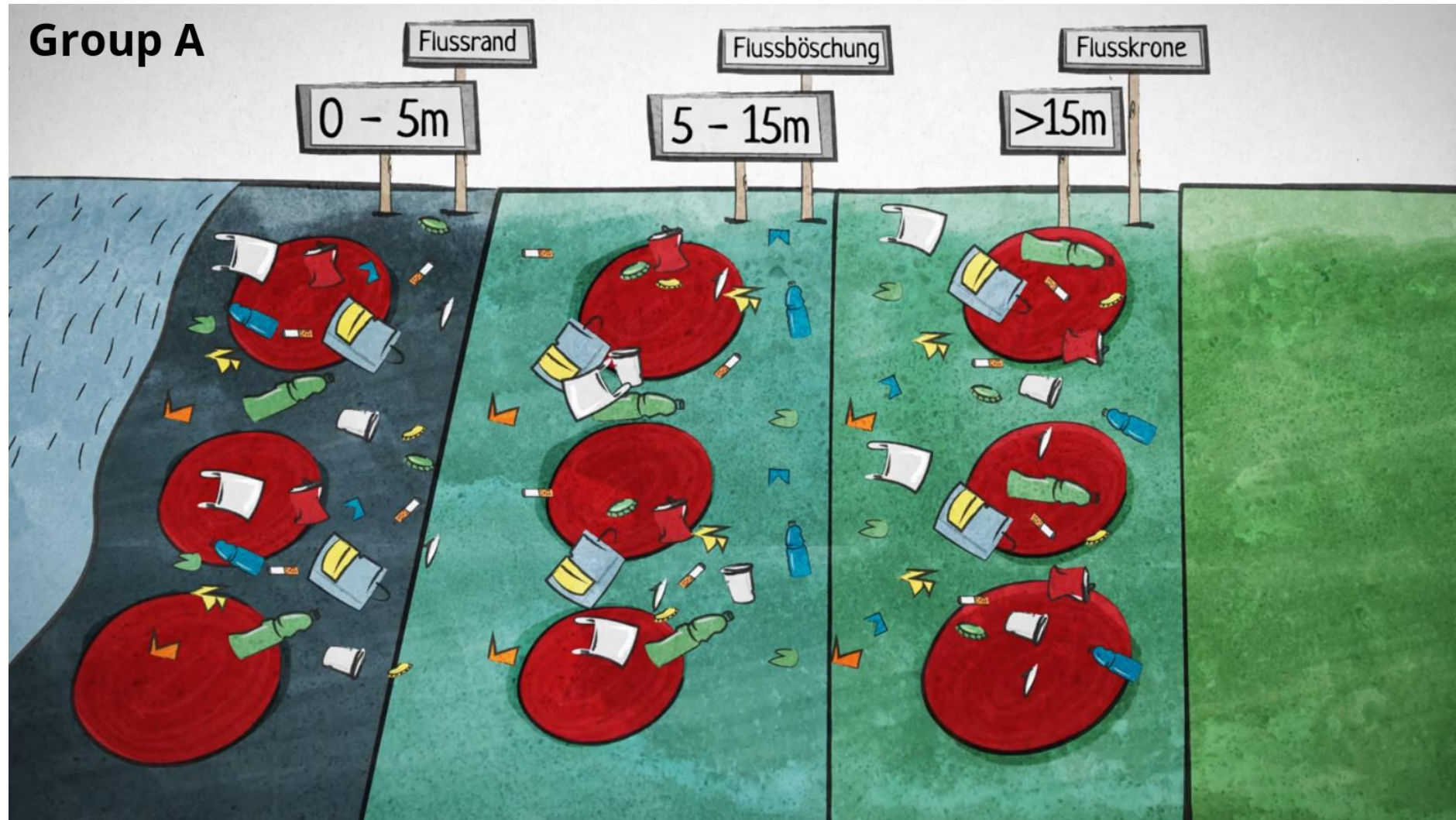
Vorgehen/ Methodik

- Standardisiertes Vorgehen während der Datenerhebung
- Anleitung der Probennahme mittels didaktisch konzipierten Lehr- und Lernmaterialien
- Lehrkräfte werden mittels Webinaren auf das Projekt vorbereitet (freiwillig)
- Komplexität der Datenerhebung reduziert → Insgesamt gibt es vier verschiedene Samplings

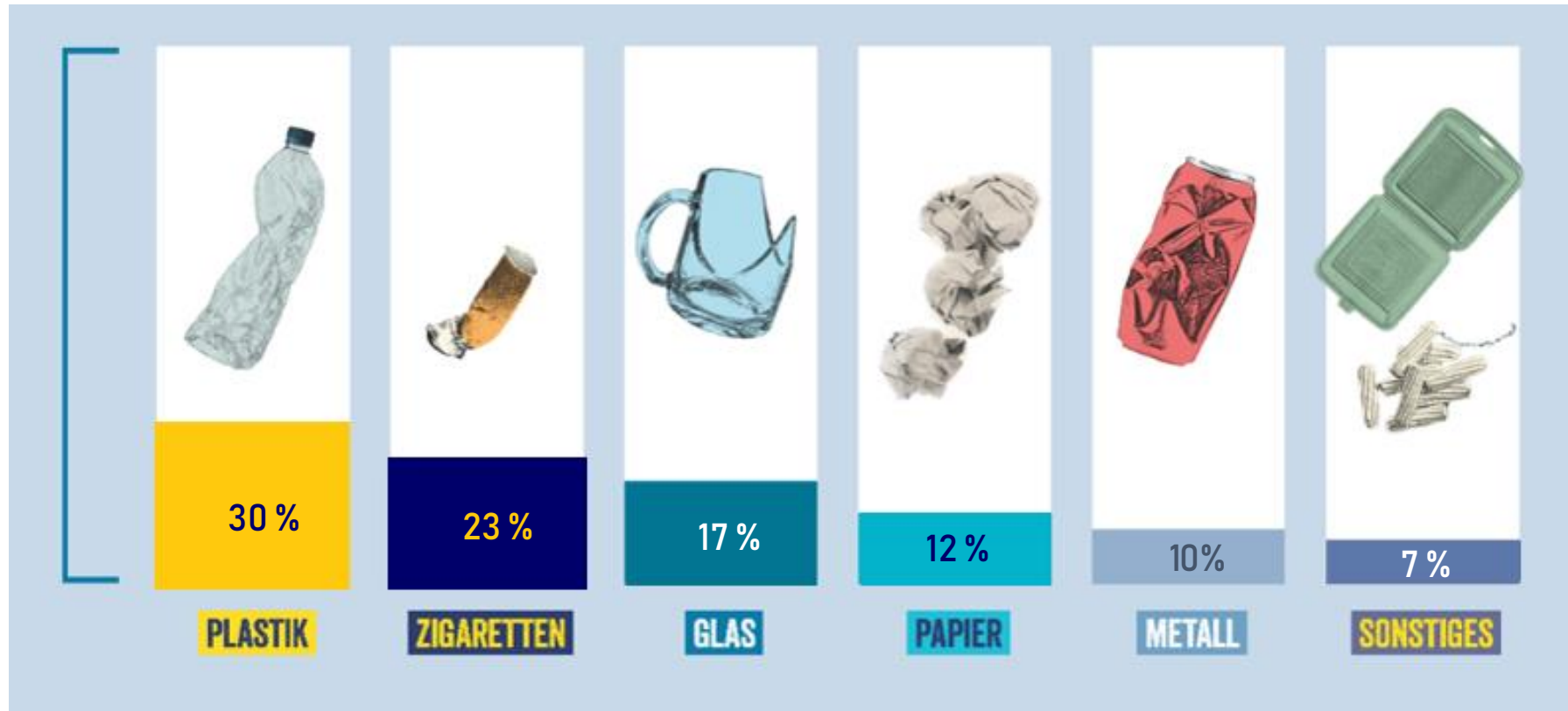


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Forschungsfrage: Wie viel Müll kann am Flussufer (pro m²) gefunden werden?

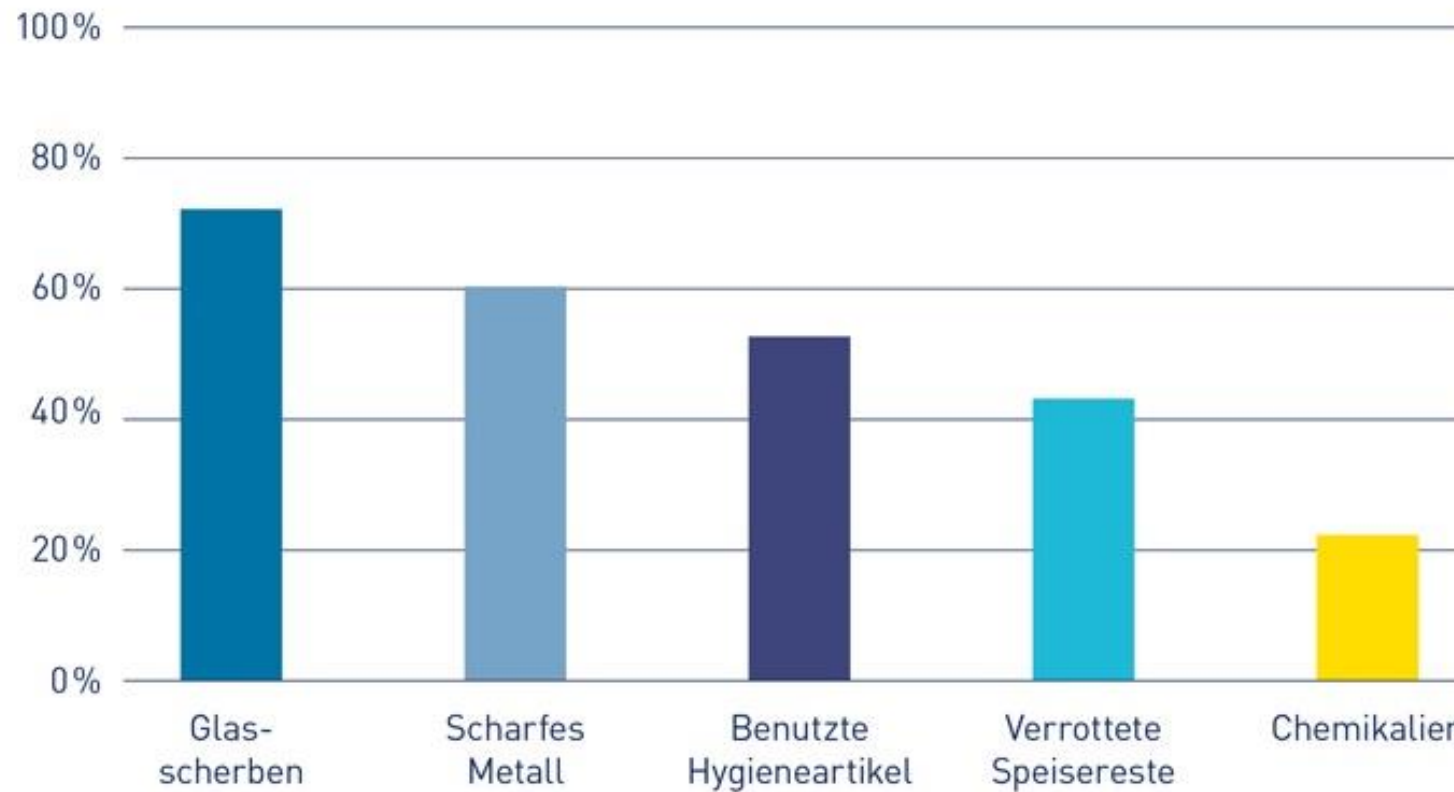


Ergebnisse 2016 bis 2020.2 Wie viel Müll kann am Flusssufer (pro m²) gefunden werden?





Ergebnisse 2016 bis 2018 Befindet sich potentiell für den Menschen gefährlicher Müll am Flussufer?





Publikationen (veröffentlicht)

Kiessling, T., Knickmeier, K., Kruse, K., Brennecke, D., Nauendorf, A., Thiel, M. (2019). Plastic Pirates sample litter at rivers in Germany - riverside litter and litter sources estimated by schoolchildren. *Environmental Pollution* 245: 545 – 557.



Plastic Pirates sample litter at rivers in Germany – Riverside litter and litter sources estimated by schoolchildren[☆]

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ABSTRACT

Rivers are an important source of marine anthropogenic litter, but the particular origins of riverine litter itself have not been well established. Here we used a citizen science approach where schoolchildren examined litter at riversides and identified possible sources at over 250 sampling spots along large and small rivers in Germany, during autumn 2016 and spring 2017. Litter densities have an overall median of 0.14, interquartile range 0–0.57 items m⁻² and an overall average ($\pm$ standard deviation) of 0.54 $\pm$ 1.20 litter items m⁻². Litter quantities differed only little by sampling year. The principal litter types found were plastics and cigarette butts (31% and 20%, respectively), followed by glass, paper, and metal items, indicating recreational visitors as the principal litter source. At many sites (85%), accumulations of litter, consisting principally of cigarettes and food packaging, have been found. At almost all sampling sites (89%), litter potentially hazardous to human health has been observed, including broken glass, sharp metal objects, used personal hygiene articles and items containing chemicals. In the search for litter sources, the schoolchildren identified mainly people who use the rivers as recreational areas (in contrast to residents living in the vicinity, illegal dumping, or the river itself depositing litter from upstream sources). These results indicate the urgent need for better education and policy measures in order to protect riparian environments and reduce input of riverine litter to the marine environment.

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1. Introduction

Marine pollution by anthropogenic litter (especially plastics) has received much scientific and public attention and its impacts are well-documented (Thompson et al., 2009; Kühn et al., 2015; Newman et al., 2015). Although much litter originates from sea-based sources, like fishing and aquaculture, most marine litter has land-based sources (GESAMP, 2010; Andrady, 2011). It was estimated that up to 12.7 million tons of plastic waste entered the marine environment in 2010 from coastal sources alone, and that this number is growing (Jambeck et al., 2015). Additionally, rivers

have been suggested as important transport routes for litter to the marine environment from populations living farther inland (e.g. Willoughby, 1986; Tudor and Williams, 2004; Shimizu et al., 2008; Lagbauer et al., 2014; Rangel-Buitrago et al., 2017). Two recent global studies estimate that up to 2.8 million tons of plastic waste enter the ocean annually from rivers (Lebreton et al., 2017; Schmidt et al., 2017). According to those models, the most polluting rivers are located in Asia and Africa, accounting for about 70% of global litter input to the coastal and marine environment. However, how the litter gets into the rivers in the first place is not well known.

Potential sources of litter pollution in rivers are manifold: sewage outlets from wastewater treatment plants are known to contain microplastics (for example microbeads used in cosmetic products or clothing fibres; Browne et al., 2011; McCormick et al., 2014; Dris et al., 2015) but sewage waters can also liberate larger sanitary items (Williams and Simmons, 1999; Morritt et al., 2014). Litter floating in the river or present at a riverside can also originate from recreational activity in the vicinity (Gasperi et al., 2014;

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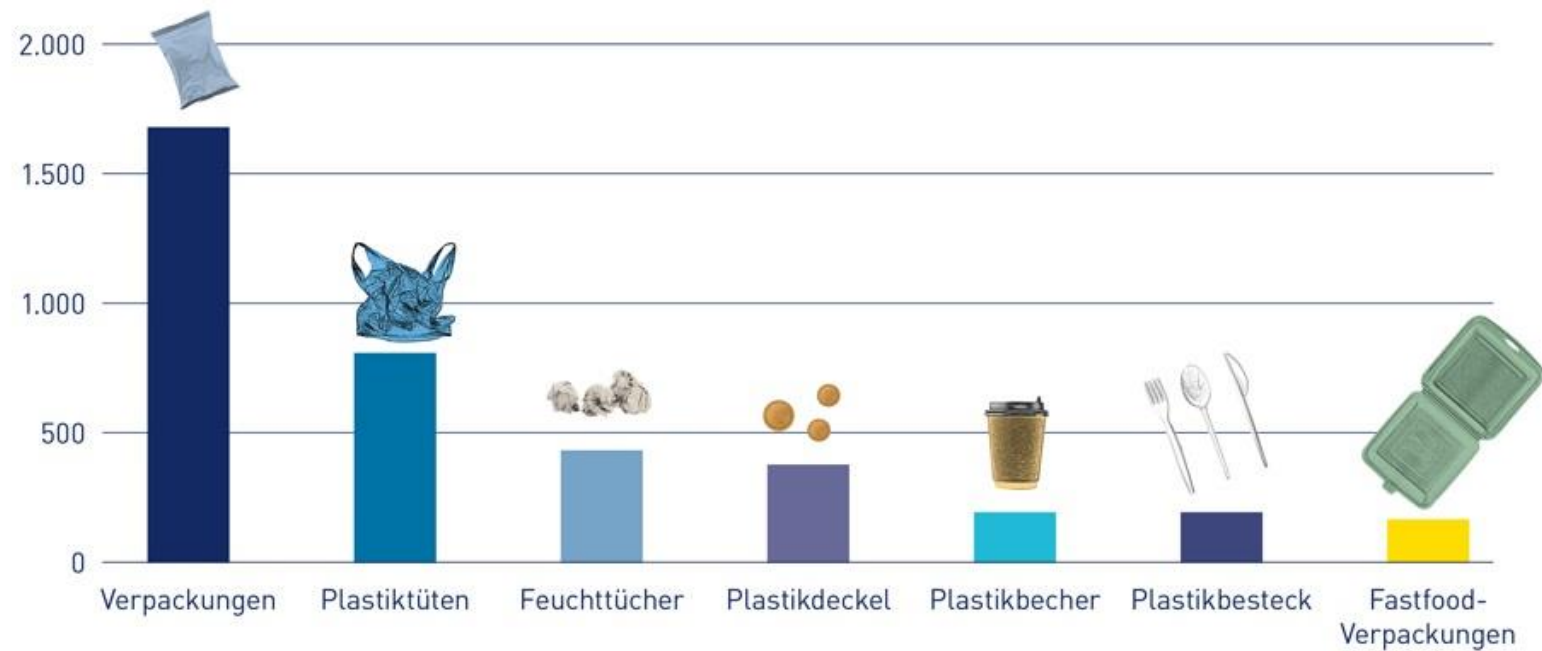
Forschungsfrage: Wie ist der Müll am Flussufer zusammen gesetzt und wie hoch ist der Anteil an Einweg-Plastikmüll?

Group B

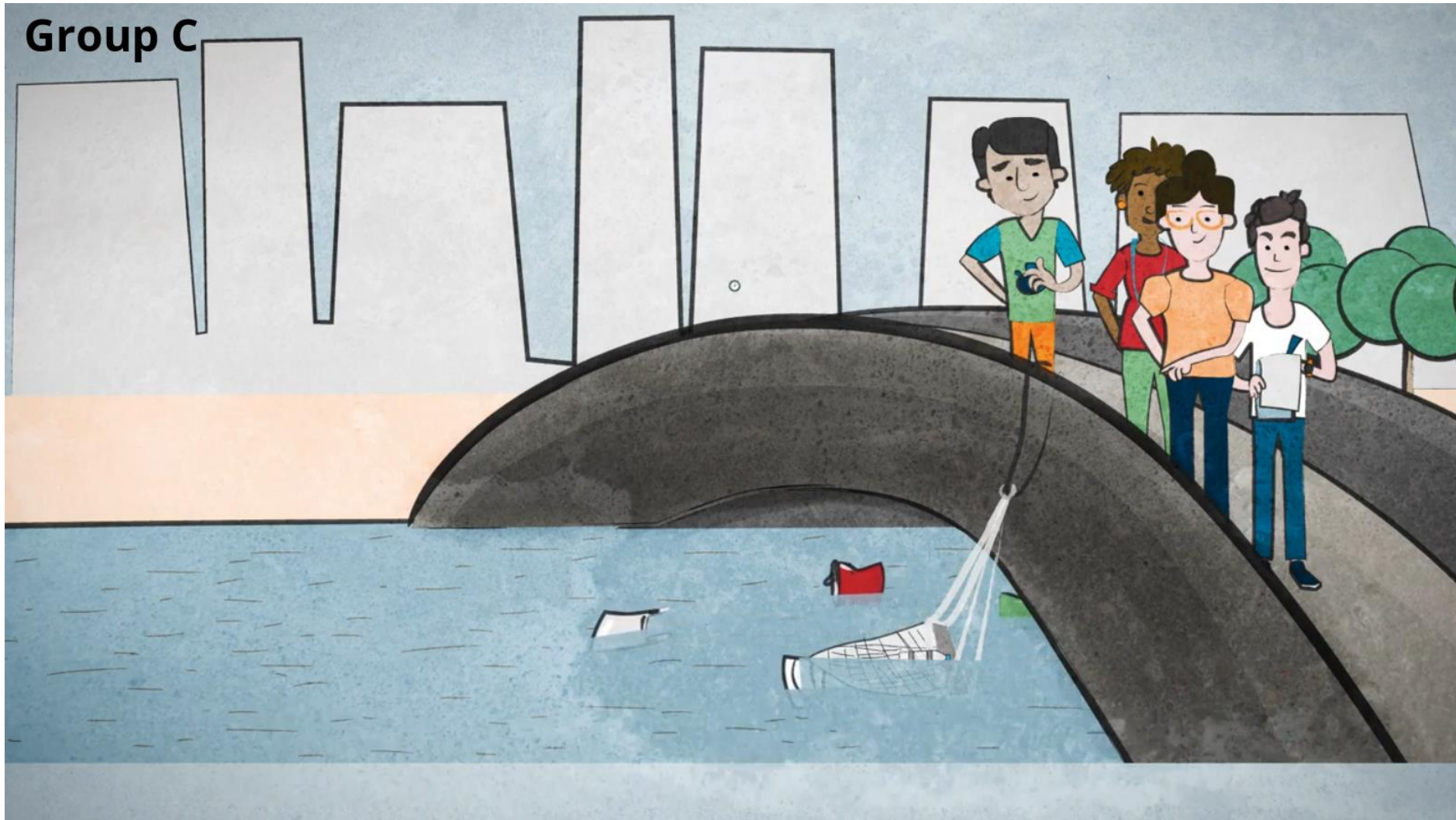


Ergebnisse 2019 bis 2020.1

Wie ist der Müll am Flusssufer zusammen gesetzt und wie hoch ist der Anteil an Einweg-Müll?



Forschungsfrage: Wie viel Mikro- und Makroplastik treibt im Fluss?





Ergebnisse 2016 bis 2017

Wie viel Mikro- und Makroplastik treibt im Fluss?

- Makroplastik: an 54 % der Standorte
- Mikroplastik: an 57 % der Standorte, sechs Proben enthielten 60 % der Plastikpartikel



Publikationen (veröffentlicht)

Kiessling, T., Knickmeier, K., Kruse, K., Gatta-Rosemary, M., Nauendorf, A., Brennecke, D., Thiel, L., Wichels, A., Parchmann, I., Körtzinger, A. Thiel, M. (2021). Schoolchildren discover hotspots of floating plastic litter in rivers using a large-scale collaborative approach. *Science of the Total Environment*, 789.



Schoolchildren discover hotspots of floating plastic litter in rivers using a large-scale collaborative approach*

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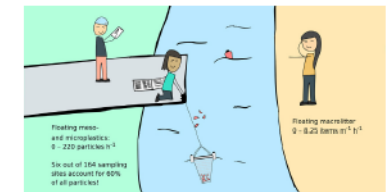
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HIGHLIGHTS

- Schoolchildren investigated litter pollution of rivers at >250 sites in Germany.
- Quantities of floating macrolitter ranged from 0 to 8.25 items m⁻¹ h⁻¹.
- Quantities of floating meso-/microplastics ranged from 0 to 220 particles h⁻¹.
- Six pollution hotspots accounted for 60% of meso-/microplastics found in the study.

GRAPHICAL ABSTRACT



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ABSTRACT

Rivers are an important transport route of anthropogenic litter from inland sources toward the sea. A collaborative (i.e. citizen science) approach was used to evaluate the litter pollution of rivers in Germany: schoolchildren within the project "Plastic Pirates" investigated rivers across the entire country during the years 2016 and 2017 by surveying floating macrolitter at 282 sites and taking 164 meso-/microplastic samples (i.e. particles 2499–5 mm, and 499–1 mm, respectively). Floating macrolitter was sighted at 54% of sampling sites and floating macrolitter quantities ranged from 0 to 8.25 items m⁻¹ h⁻¹ (average of 0.34 ± 0.89 litter items m⁻¹ h⁻¹). Floating meso-/microplastics were present at 57% of the sampling sites, and floating meso-/microplastic quantities ranged from 0 to 220 particles h⁻¹ (average of 6.86 ± 24.11 items h⁻¹). As only particles > 1 mm were sampled and analyzed, the pollution of rivers in Germany by microplastics could be a much more prevalent problem, regardless of the size of the river. We identified six plastic pollution hotspots where 60% of all meso-/microplastics collected in the present study were found. These hotspots were located close to a plastic-producing industry site, a wastewater treatment plant, at and below weirs, or in residential areas. The composition of the particles at these hotspots indicates plastic producers and possibly the construction industry and wastewater treatment plants as point sources. An identification of litter hotspots would enable specific mitigation measures, adjusted to the respective source, and thereby could prevent the release of

* Main finding: Citizen scientists investigated > 250 river sites for floating macrolitter and meso-/microplastics in Germany and discovered pollution hotspots.
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E-mail address: kiessling@leibniz-ipn.de (T. Kiessling).

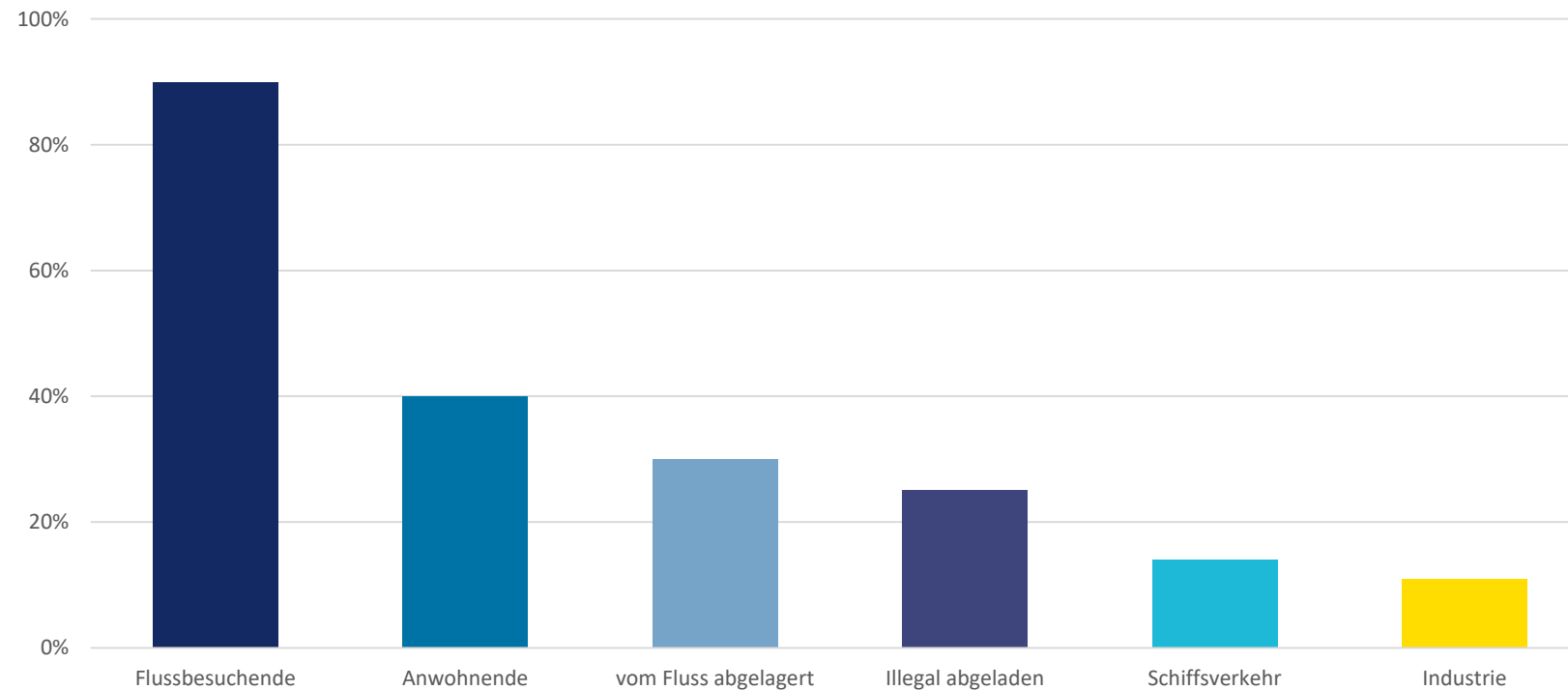
Forschungsfrage: Was könnten mögliche Müllquellen am Fluss sein?

Group D

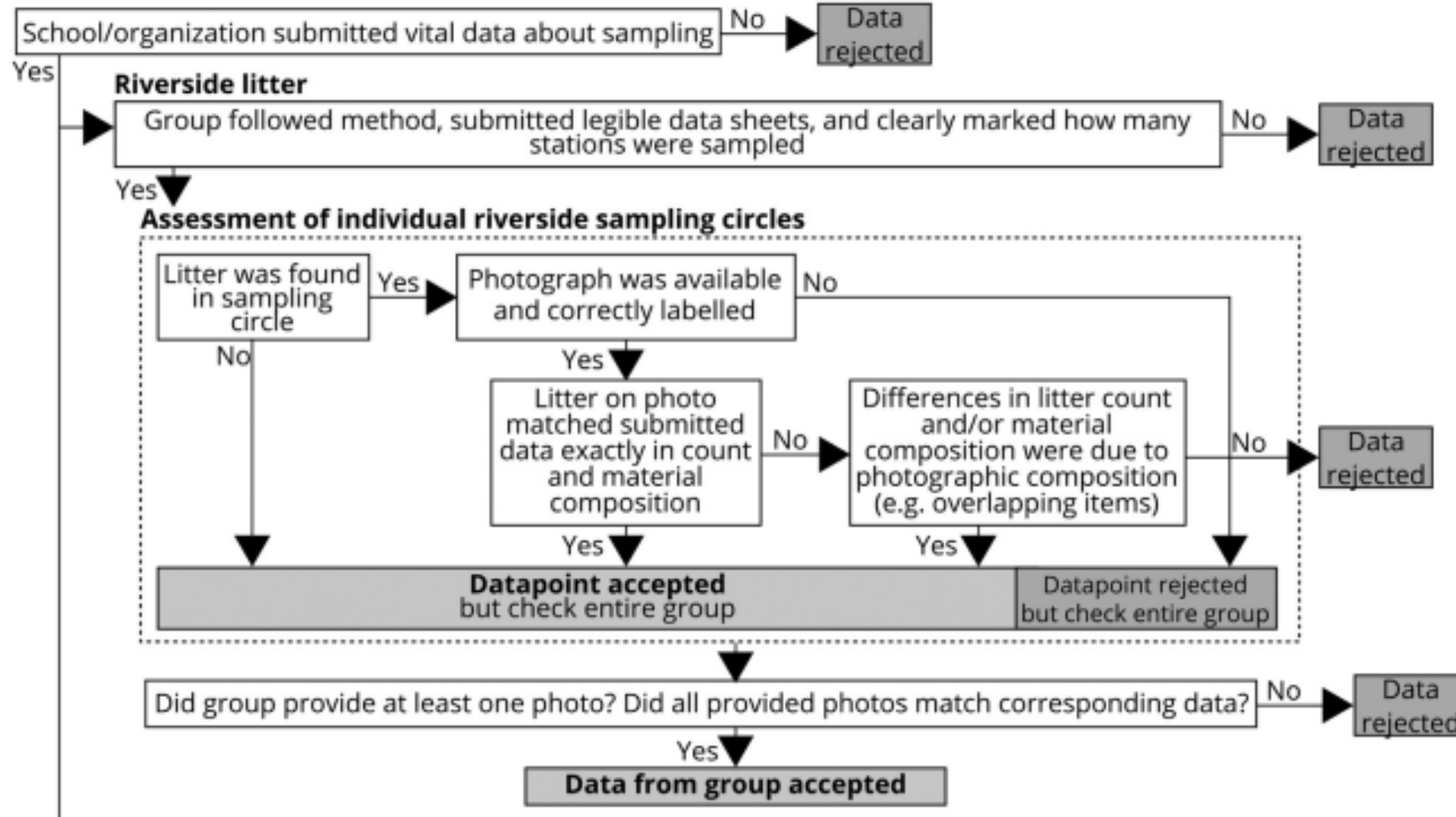


Ergebnisse 2016 bis 2020.2

Was könnten mögliche Müllquellen am Fluss sein?



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Publikationen (in Bearbeitung)

Forschungsfrage: Können Ursachen für mehr oder weniger Müllverschmutzung am Fluss ausgemacht werden? (Gruppe A & 3)

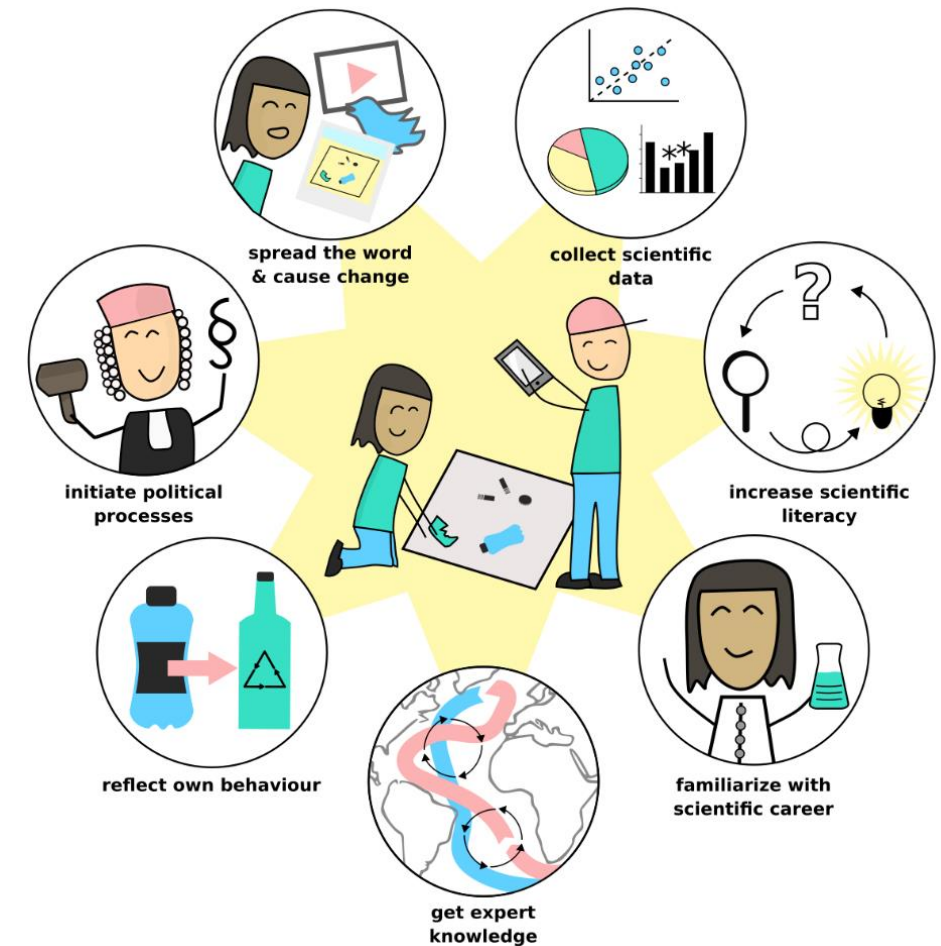
Ergebnis Gruppe D: Der Großteil des Mülls am Fluss stammt von Flussbesucher:innen

Analyse folgender Faktoren:

- Einfluss der Bevölkerungsdichte auf die Menge an Müllfunden für verschiedene Radien
- Einfluss an Besucherfrequenz eines Flussabschnittes (Vorhandensein und Größe der angrenzenden Parkplätze)
- Einfluss der Infrastruktur am Fluss (verfügbare Mülleimer, Entfernung zu Hauptverkehrswegen, Landnutzungstypen)

Chancen und Herausforderungen

- Große Datenmengen in kurzer Zeit
- Identifikation von möglichen Quellen
- Einblicke in den Alltag eines Wissenschaftlers
- Teil der Lösung des Müllproblems
- Verifizierung sehr zeitaufwändig
- Stetiger Kontakt zu teilnehmenden Schulen





Ausblick

- Verlängerung des Projektes bis März 2023
- Durchführung von 2 Probennahmen in 2022 (Frühjahr und Herbst)
- Im Herbst Probennahme mit zehn weiteren EU-Ländern



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Vielen Dank!



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Literatur

Kiessling, T., Knickmeier, K., Kruse, K., Brennecke, D., Nauendorf, A., Thiel, M. (2019). Plastic Pirates sample litter at rivers in Germany - riverside litter and litter sources estimated by schoolchildren. *Environmental Pollution* 245: 545 – 557.

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Schneider, Falk; Kunz, Alexander; Hu, Chieh-Shen; Yen, Ning; Lin, Hsin-Tien (2021): Rapid-Survey Methodology to Assess Litter Volumes along Large River Systems—A Case Study of the Tamsui River in Taiwan. In: *Sustainability* 13 (16), S. 8765. DOI: 10.3390/su13168765.