

Wie Chemikalien aus Verpackung und Verarbeitungsgeräten in Lebensmittel gelangen

Dr. sc. nat. ETH
Jane Muncke



Food
Packaging
Forum

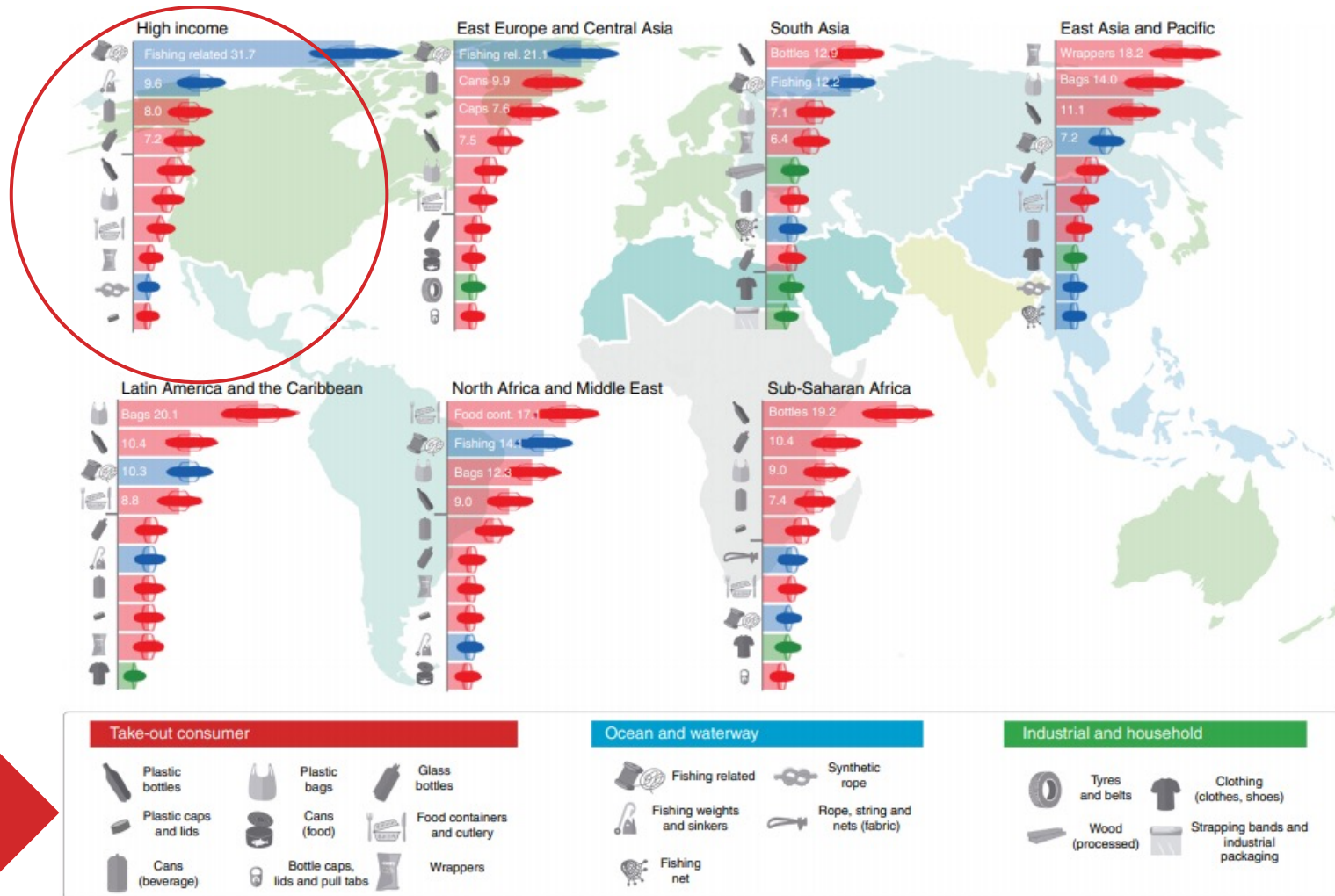
Food Packaging Matters

- Protects foodstuffs and prevent food waste
- Enables logistics, transport and sales of foodstuffs
- Supports effective communication and marketing
- Is critical for modern food supply and consumption



© Peter Charaf/Race for Water Foundation





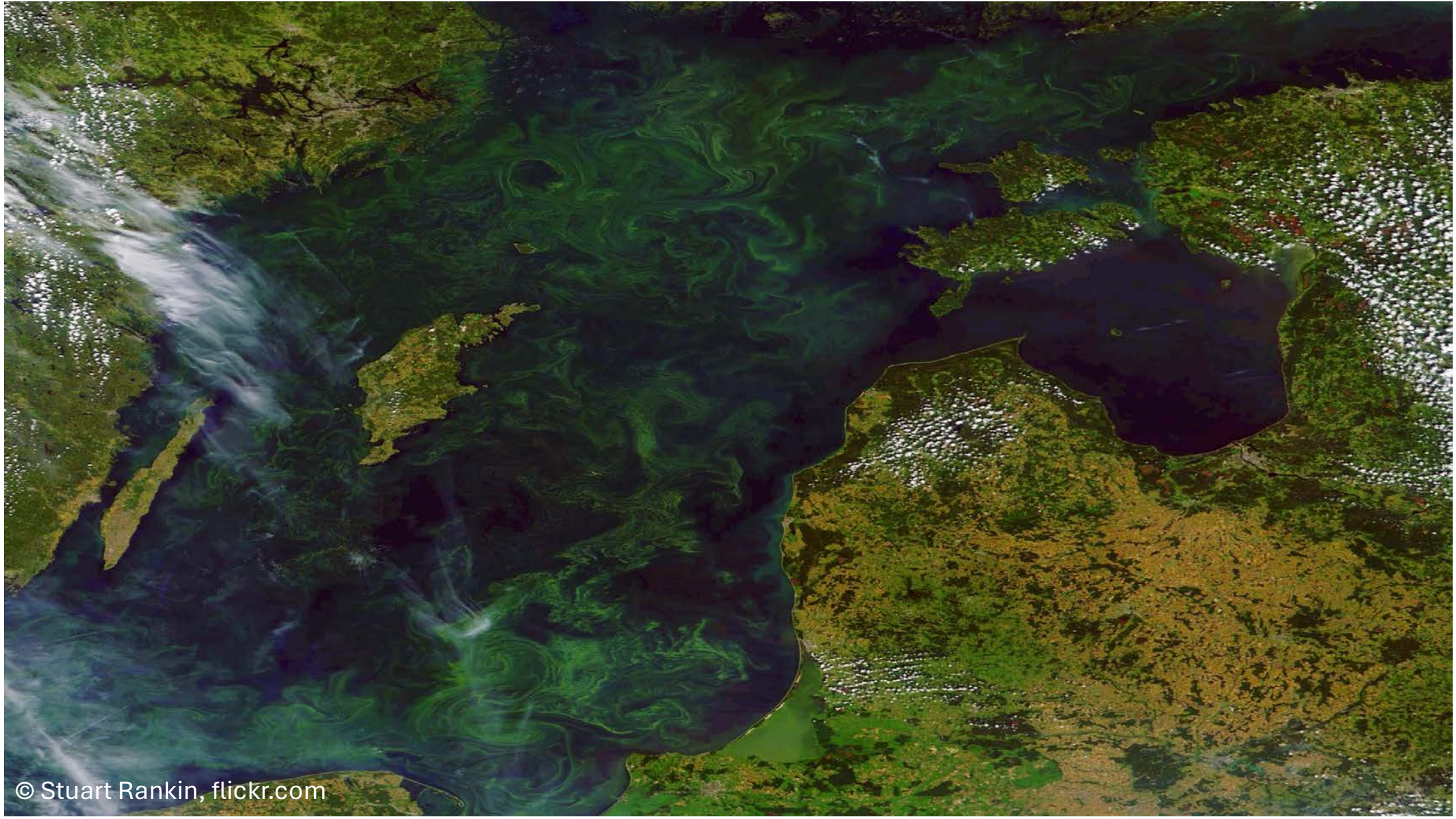
Food packaging is main source

Fig. 6 | Top ten litter items in the nearshore seafloor of the seven large world socioeconomic regions. Bars show mean percentages per region; the darker-coloured areas and lines around the means show the individual data outputs ($n=10,000$) and the distribution beanplot, respectively. Uncertainties of results were quantified through 10,000 Monte Carlo iterations in each region. Bar colour relates to potential origin. Items above the horizontal line marks in the rankings comprise, at least, 50% of the total items identified. Only identifiable items were accounted for in the rankings; high-income region ($n=247,238$), East Europe and Central Asia ($n=3,123$), East Asia and Pacific ($n=223,618$), Latin America and the Caribbean ($n=61,900$), North Africa and Middle East ($n=44,786$), sub-Saharan Africa ($n=8,507$) and South Asia ($n=6,711$).

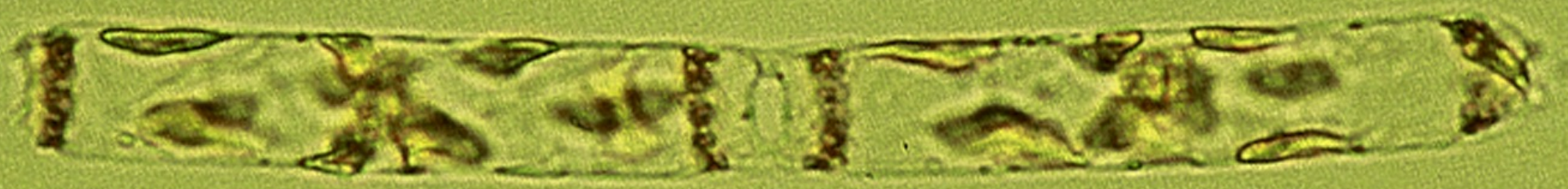
Morales-Caselles et al. 2021 nature sustainability



What are plastics?




© Stuart Rankin, flickr.com

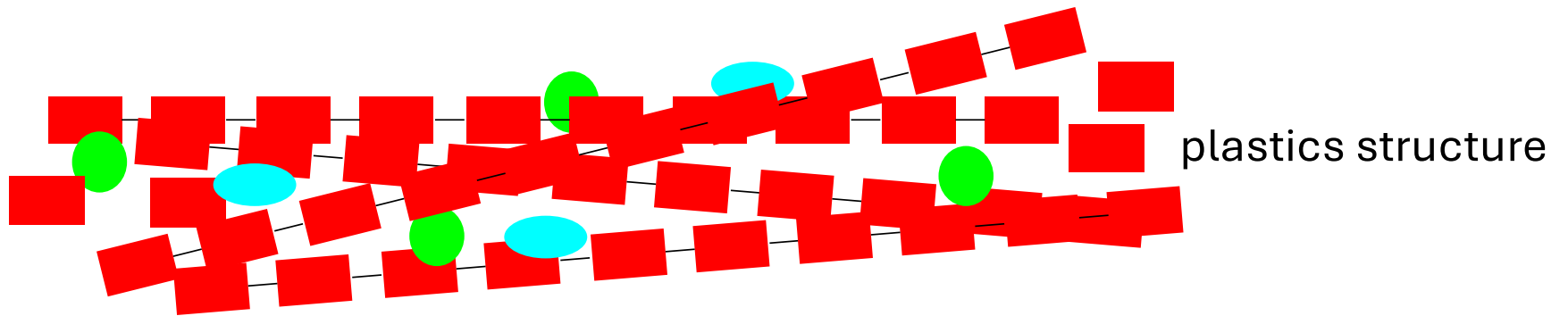


 Monomer

 Polymer

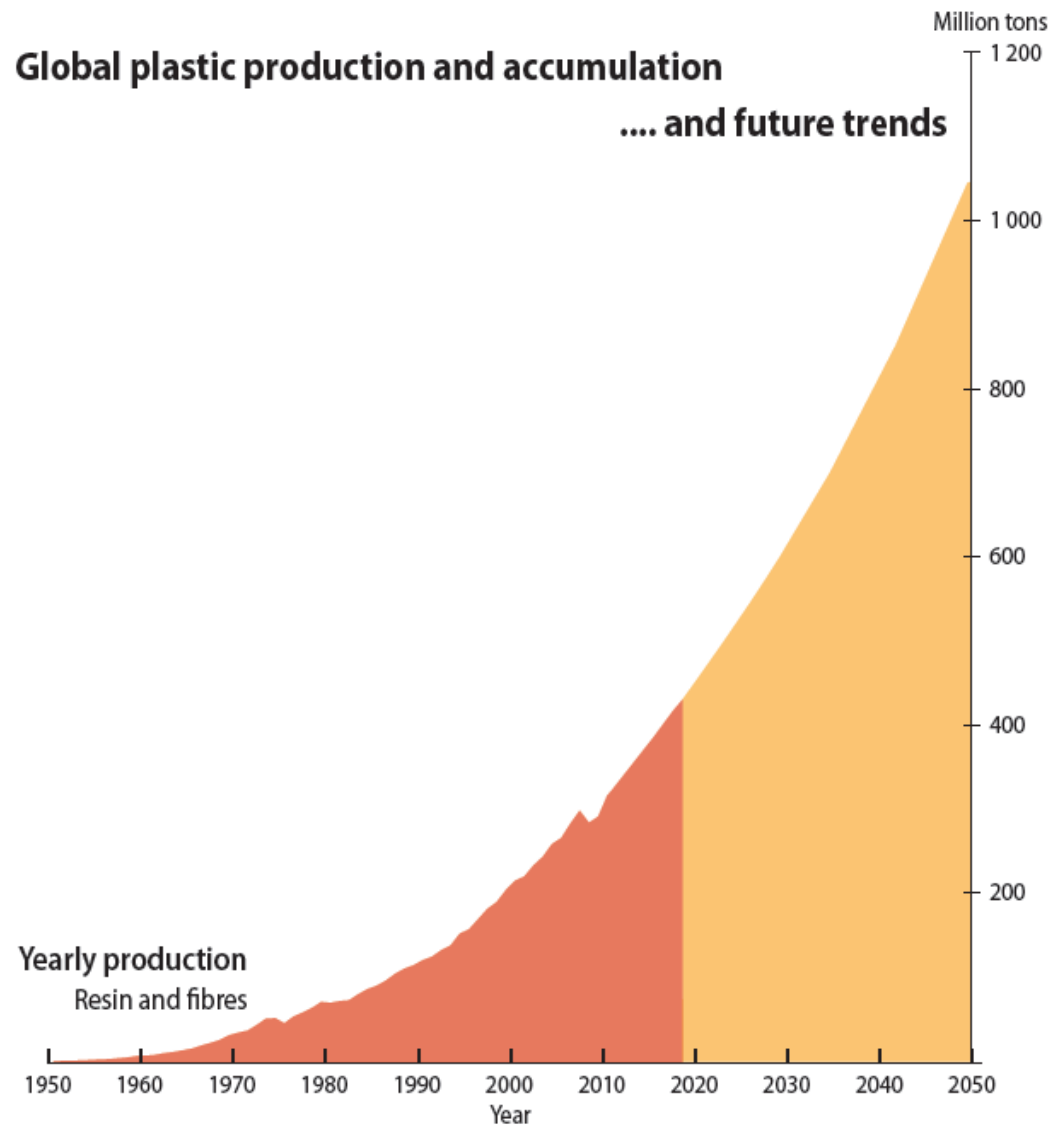
 Additives: optimization of polymer material properties

 NIAS (non-intentionally added substances): side products, impurities



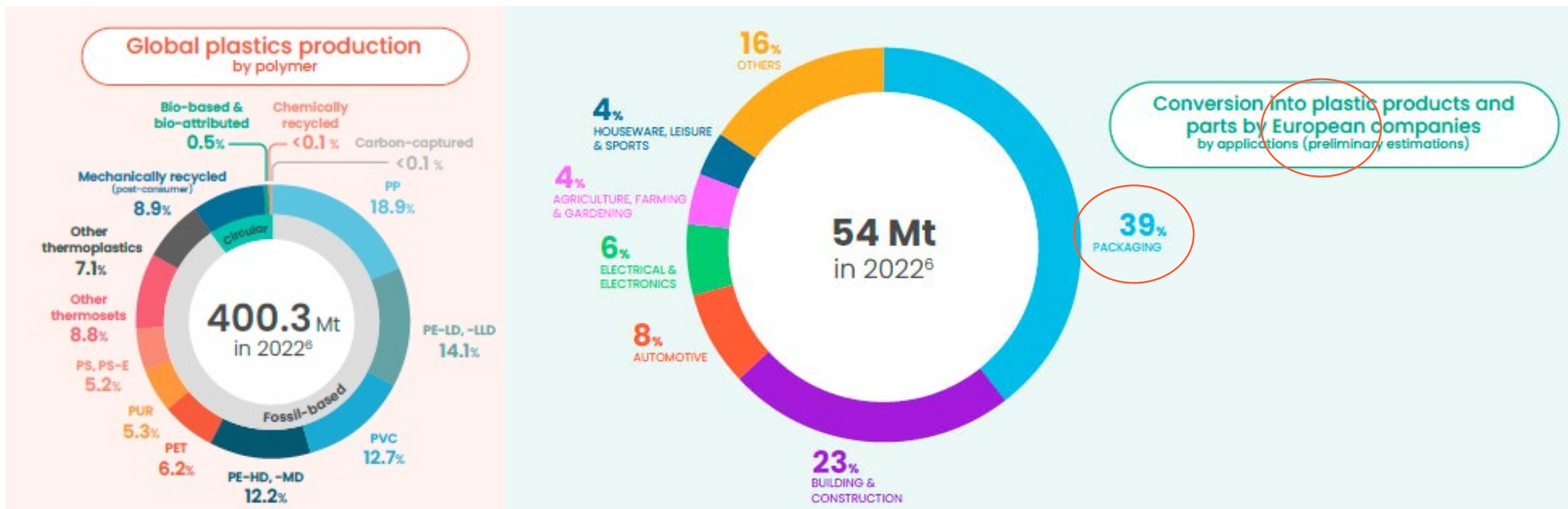
→Plastics are always **complex**
mixtures of many different
chemcials

Global plastic production and accumulation and future trends



Sources: UNEP 2021, adapted from Jambeck et al. 2018; PlasticsEurope 2019; Geyer 2020.

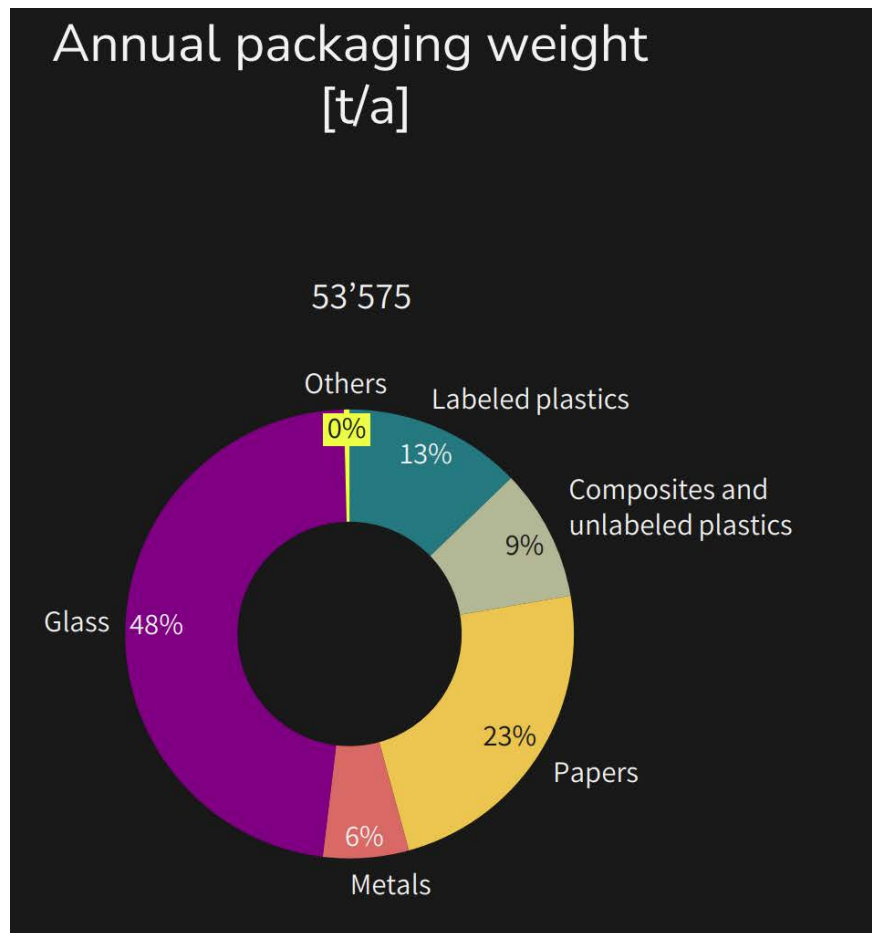
Illustrated by GRID-Arendal



Plastic Europe 2024: Plastics the facts 2023.

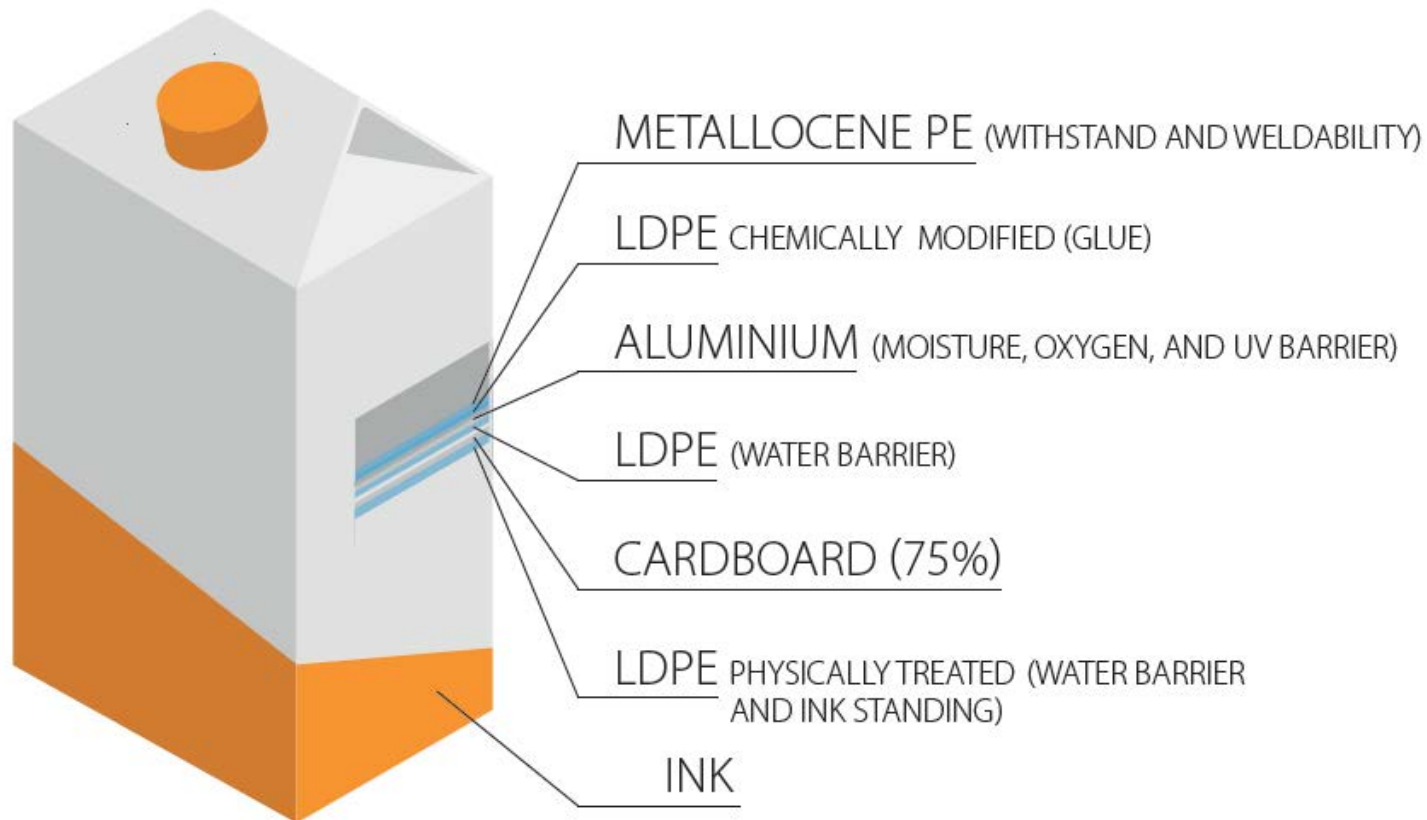
**Die meisten Lebensmittelverpackungen sind aus PLASTIK
oder haben eine plastik(artige) Schicht.**

Swiss retailer's packaging use (2020)



<https://www.suslab.ch/projects-1/denner%E2%80%99s-packaging-baseline>

Plastic «functionalises» packaging materials

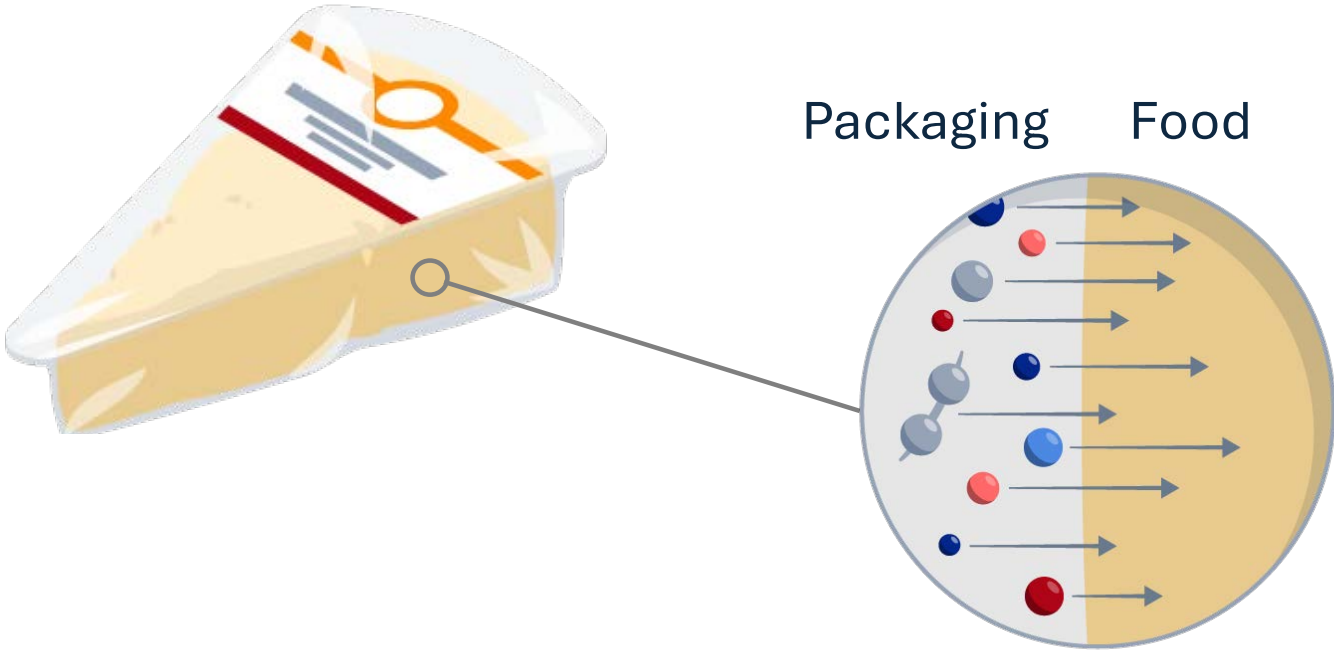




<https://www.youtube.com/watch?v=xBQEnVR7y9k>

→Plastics and plastified single-use food packaging **enables** the modern food supply

Migration of food contact chemicals (FCCs)



→ Chemicals **migrate** from plastic packaging and processing equipment into foodstuffs

WHAT INFLUENCES MIGRATION OF CHEMICALS INTO FOOD?



...at high temperature



...when using small portion sizes



...after long contact times



...of fat-soluble chemicals into fatty foods

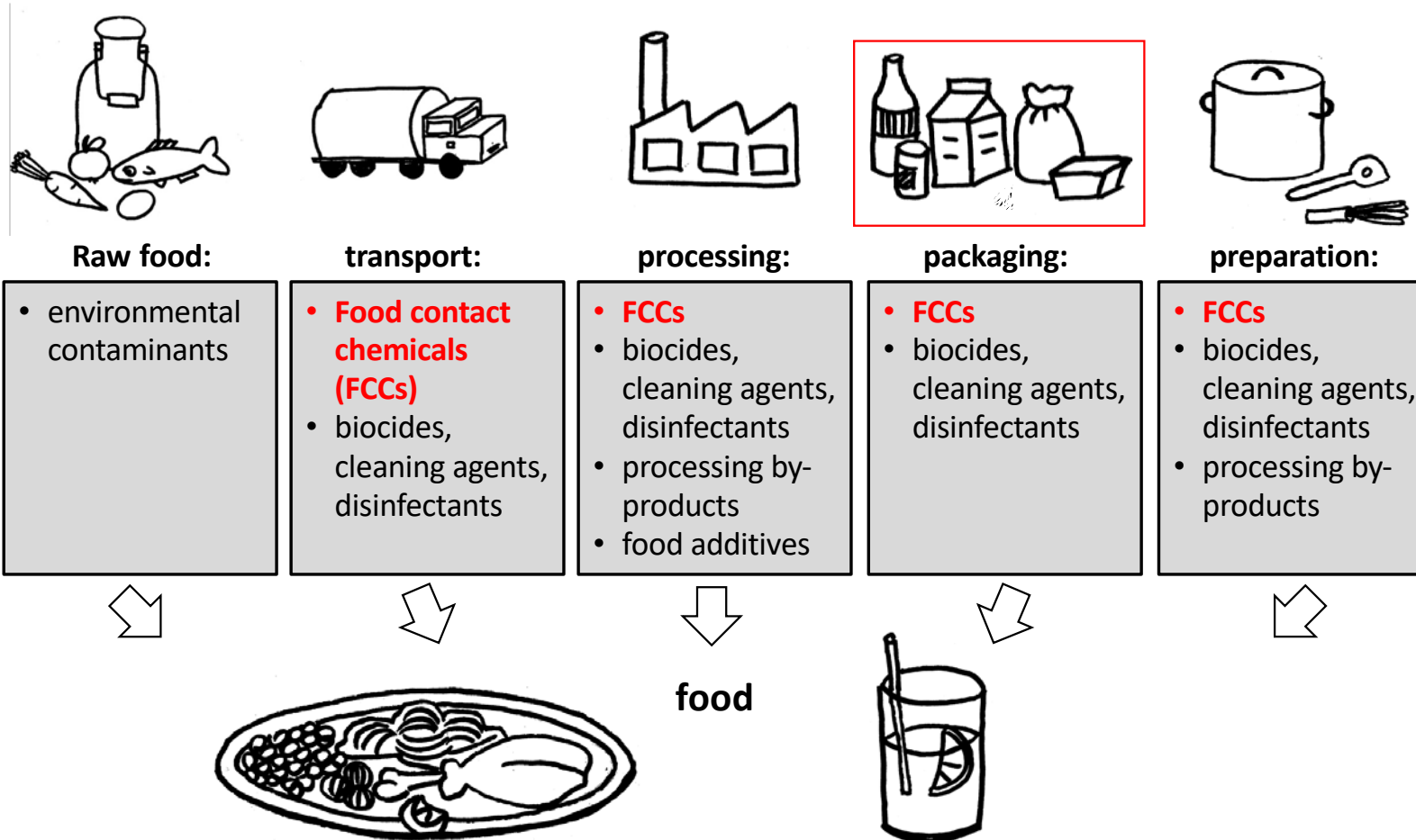


Find out more: bit.ly/fpf-factsheet



Food
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Chemicals in foodstuffs: What are the sources?



Legal situation in the EU (and CH):

Framework Regulation (EC) No 1935/2004

Art. 3.1 (a):

“Materials and articles [...] shall be manufactured [...] so that, under normal or foreseeable conditions of use, they do not transfer their constituents to food in quantities which could endanger human health [...].”

Schweiz: Bedarfsgegenständeverordnung 817.023.21

<https://www.fedlex.admin.ch/eli/cc/2017/164/de>

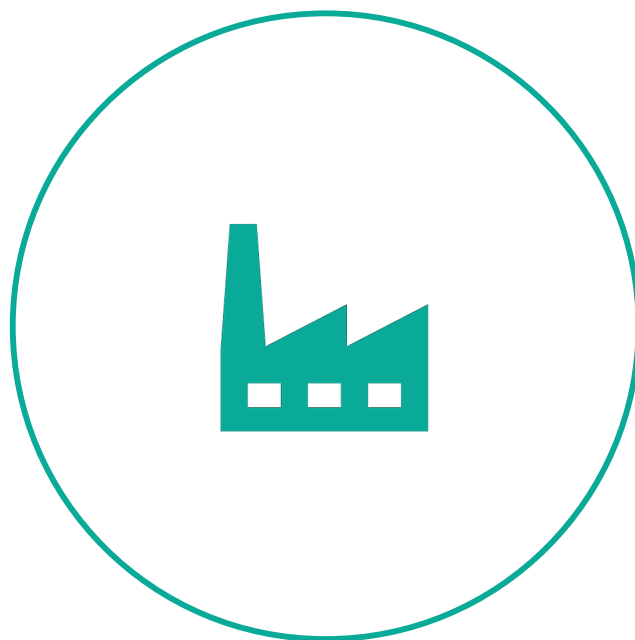
Food Contact Materials are an underestimated source of chemical food contamination



	PESTICIDES	FOOD CONTACT MATERIALS (FCMS)
Number of Substances	~1,500	Possibly 100,000
Level of food contamination	µg/kg (ppb)	mg/kg (ppm)
Toxicological evaluation	yes	mostly no

Source: presentation by Dr. Gregor McCombie, Official Food Control Authority Zurich, January 26, 2016, [EU Parliament Workshop](#).

>12,000
chemicals may
be used in the
production of
food contact
materials



≈4000 chemicals
have been
detected in
extracts and/or
migrates of food
contact materials



Food Contact Chemicals database
(FCCdb)
Groh K et al. (2021)



Database on Migrating and Extractable
Food Contact Chemicals (FCCmigex)
Geueke B et al. (2022)



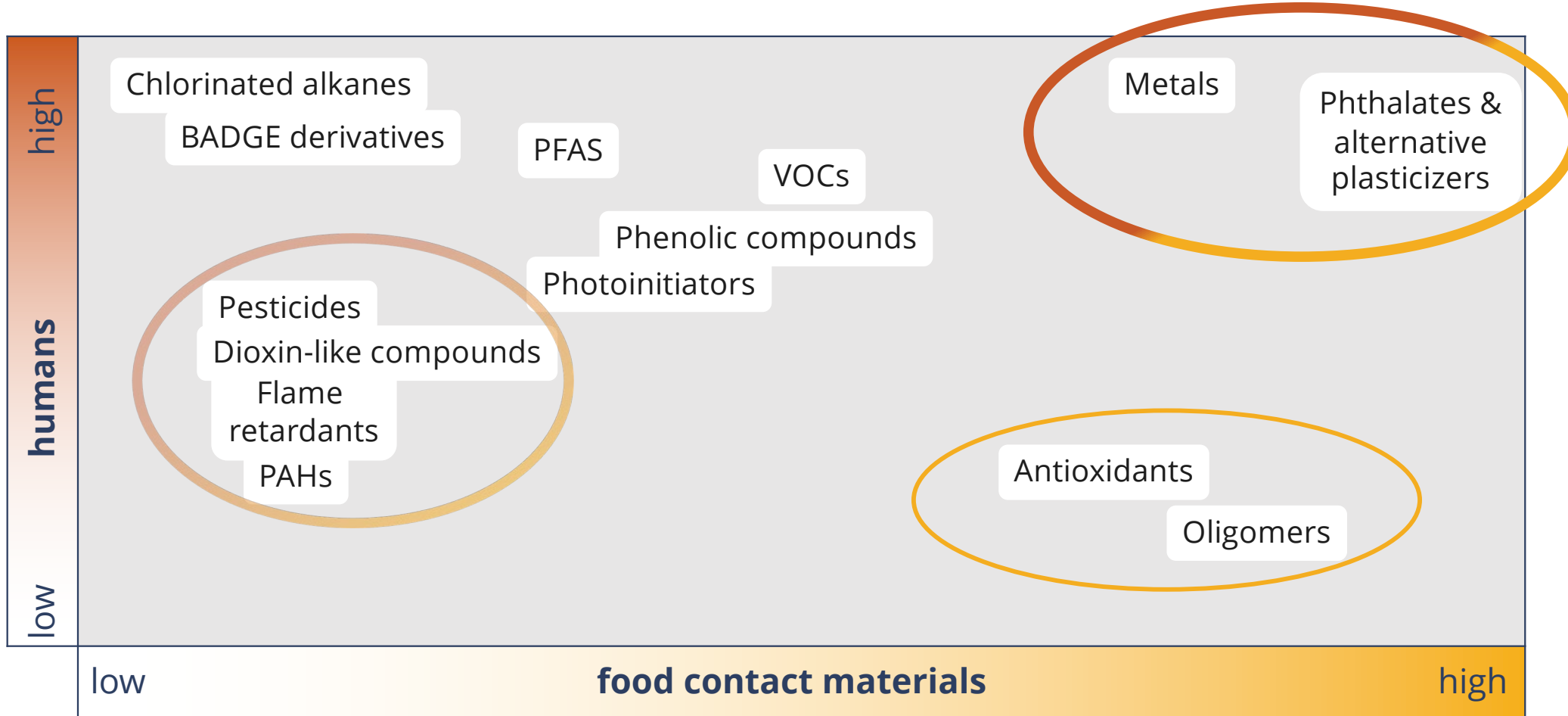
>**14,000** known food contact chemicals
for at least **1'822** evidence for migration



at least 3'601 food contact chemicals
detected in human samples

(Geueke et al. under review)

410 FCCs from **biomonitoring programs** and the **systematic evidence map**



Migration für 97 Chemikalien nachgewiesen

Food Contact Materials (FCMs)



Wieviele
Chemikalien
davon sind
bedenklich



Was sind
deren
Gefahren?

388 bedenkliche Essenskontaktchemikalien (schädlich laut der Chemikalien Strategie für Nachhaltigkeit)

352 CMRs
(krebserregend, mutagen,
oder
fortpflanzungsgefährdend)

**32 anhaltend,
bioakkumulierbar**



3 STOT
(spezifische
Zielorgantoxizität)

22 EDCs
(endokrin wirkende
Chemikalien)



Journal of Hazardous Materials

journal homepage: www.elsevier.com/locate/jhazmat

Research Paper

Implementing the EU Chemicals Strategy for Sustainability: The case of
food contact chemicals of concern

Lisa Zimmermann^{a,*}, Martin Scheringer^b, Birgit Geueke^a, Justin M. Boucher^a,
Lindsey V. Parkinson^a, Ksenia J. Groh^c, Jane Muncke^a

→ Humans are **widely exposed** to food contact chemicals, including known hazardous chemicals that are intentionally used



low levels of migrating chemicals
≠
safe

Safe exposure level for bisphenol A was lowered in 2023 20'000x ↓



The screenshot shows the top part of the EFSA website. At the top left is the EFSA logo, which consists of a stylized green leaf inside a blue circle, followed by the text 'efsa' in a bold, lowercase sans-serif font. To the right of the logo is the European Union flag (a blue rectangle with twelve yellow stars in a circle) and the text 'EUROPEAN FOOD SAFETY AUTHORITY' in a smaller, uppercase sans-serif font. Below the logo and text is a horizontal navigation bar with a light blue background. It contains five items: 'About', 'Newsroom', 'Topics', 'Resources', and 'Publications', each followed by a small downward-pointing chevron. The 'Newsroom' item is underlined. Below the navigation bar is a breadcrumb trail: 'Home / All contents / Bisphenol A in food is a health risk'. Below the breadcrumb trail is a thick horizontal line. Below the line is the main title of the article: 'Bisphenol A in food is a health risk' in a large, bold, dark blue sans-serif font. Below the title is the publication information: 'Published: 19 April 2023 | 4 minutes read' in a smaller, dark blue sans-serif font.



Health costs of (some few) plastic chemicals in US: 249 bio \$ p.a.

Journal of the Endocrine Society, 2024, **8**, 1–9
<https://doi.org/10.1210/endo/bvad163>
Advance access publication 11 January 2024

Research Article



Chemicals Used in Plastic Materials: An Estimate of the Attributable Disease Burden and Costs in the United States

Leonardo Trasande,^{1,2,3}  Roopa Krithivasan,⁴ Kevin Park,⁵ Vladislav Obsekov,⁶ and Michael Belliveau⁴

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³NYU Wagner Graduate School of Public Service, New York, NY 10012, USA

⁴Defend Our Health, Portland, ME 04101, USA

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⁶Children's Hospital of Philadelphia, Philadelphia, PA 19104, USA


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COMMENTARY

Open Access


Impacts of food contact chemicals on human health: a consensus statement




Jane Muncke^{1*} , Anna-Maria Andersson², Thomas Backhaus³, Justin M. Boucher⁴, Bethanie Carney Almroth³, Arturo Castillo Castillo⁵, Jonathan Chevrier⁶, Barbara A. Demeneix⁷, Jorge A. Emmanuel⁸, Jean-Baptiste Fini⁷, David Gee⁹, Birgit Geueke¹, Ksenia Groh¹, Jerrold J. Heindel¹⁰, Jane Houlihan¹¹, Christopher D. Kassotis¹², Carol F. Kwiatkowski¹³, Lisa Y. Lefferts¹⁴, Maricel V. Maffini¹⁵, Olwenn V. Martin¹⁶, John Peterson Myers^{17,18}, Angel Nadal¹⁹, Cristina Nerin²⁰, Katherine E. Pelch¹³, Seth Rojello Fernández²¹, Robert M. Sargis²², Ana M. Soto²³, Leonardo Trasande²⁴, Laura N. Vandenberg²⁵, Martin Wagner²⁶, Changqing Wu²⁷, R. Thomas Zoeller²⁸ and Martin Scheringer^{4,29}

Source: <https://ehjournal.biomedcentral.com/articles/10.1186/s12940-020-0572-5>






Plastic food packaging as a source of MNPs to food: Systematic evidence map



Science of The Total Environment
Volume 854, 1 January 2023, 158606



Release of microplastics from disposable cups in daily use

Huier Chen , Liheng Xu , Kuai Yu , Fang Wei , Ming Zhang 

SCIENTIFIC REPORTS
nature research

Microplastics generated when opening plastic packaging

Zahra Sobhani , Yongjia Lei^{1,2}, Youhong Tang , Liwei Wu^{3,4}, Xian Zhan⁵, Ravi Naidu^{1,6}, Mallavarapu Megharaj^{1,6} & Cheng Fang^{1,6*}

Open Access Review

Honey Quality and Microplastic Migration from Food Packaging: A Potential Threat for Consumer Health?

by  Klytiamnitra Katsara ^{1,2}  George Kenanakis ²  Eleftherios Alissandrakis ^{1,3}  and Vassilis M. Papadakis ^{2,3,4,*} 

COMMUNIQUÉS DE PRESSE

ÉTUDE EXCLUSIVE : 78% DES EAUX EN BOUTEILLE ANALYSÉES CONTAMINÉES PAR DES MICROPLASTIQUES

Water Research 166 (2019) 115082

Contents lists available at ScienceDirect




Water Research

journal homepage: www.elsevier.com/locate/watres




Does mechanical stress cause microplastic release from plastic water bottles?

Anna Winkler ^a, Nadia Santo ^b, Marco Aldo Ortenzi ^c, Elisa Bolzoni ^a, Renato Bacchetta ^{a,*}, Paolo Tremolada ^a



Journal of Hazardous Materials

Volume 417, 5 September 2021, 126074



Research Paper

Migration of (non-) intentionally added substances and microplastics from microwavable plastic food containers

Ying-jie He ^{a,1,2}, Yan Qin ^{a,1}, Tie-Li Zhang ^a, Yan-Yan Zhu ^a, Zhao-jie Wang ^a, Zhong-Shun Zhou ^a, Tian-Zhen Xie ^a, Xiao-Dong Luo ^{a,b,2,3}

Results

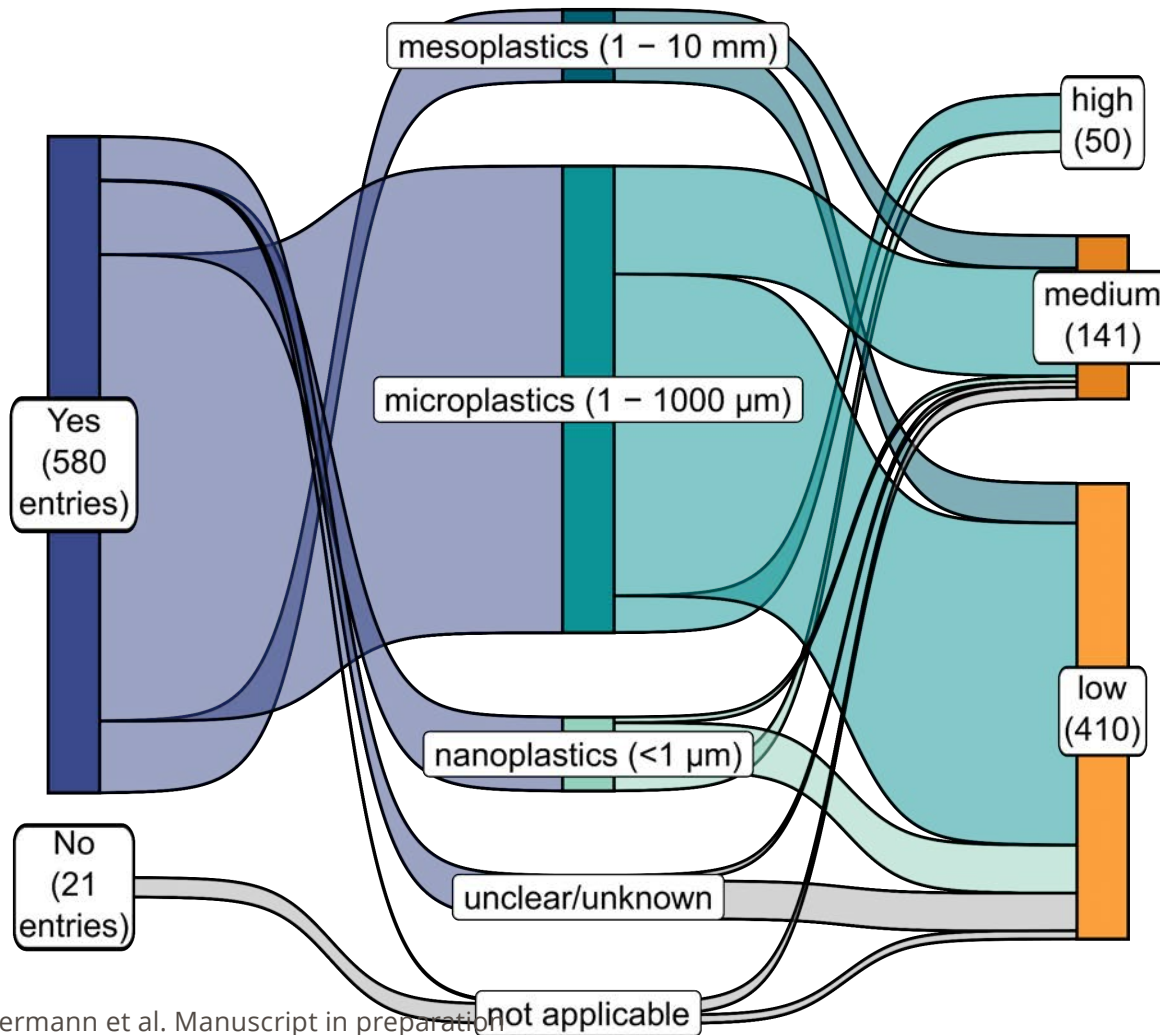
- 104 eligible studies → 601 database entries
- **Food Contact Articles (FCAs)**
 - plastic bottles
 - other containers
 - tea bags
- **Food/food simulant**
 - 43% food simulants
 - 35% liquid foodstuff
 - 20% solid foodstuff
 - 2% FCA surface



Detection of MNPs

Particle size

Reliability





- Nearly all reliable entries **demonstrate FCA as MNP source**

→ The **normal and intended use** of plastic food packaging leads to the generation of **micro- and nanoplastics**

Way forward?


Environment International 180 (2023) 108161

Contents lists available at [ScienceDirect](#)

 **Environment International** 

journal homepage: www.elsevier.com/locate/envint

Full length article

A vision for safer food contact materials: Public health concerns as drivers for improved testing 

Jane Muncke^{a,*}, Anna-Maria Andersson^b, Thomas Backhaus^c, Scott M. Belcher^d, Justin M. Boucher^a, Bethanie Carney Almroth^c, Terrence J. Collins^e, Birgit Geueke^a, Ksenia J. Groh^f, Jerrold J. Heindel^g, Frank A. von Hippel^h, Juliette Leglerⁱ, Maricel V. Maffini^j, Olwenn V. Martin^k, John Peterson Myers^{e,1}, Angel Nadal^m, Cristina Nerinⁿ, Ana M. Soto^{o,p}, Leonardo Trasande^q, Laura N. Vandenberg^r, Martin Wagner^s, Lisa Zimmermann^a, R. Thomas Zoeller^r, Martin Scheringer^{t,u,*}

Fazit

- Die meisten Verpackungen für Lebensmittel enthalten bedenkliche Chemikalien und sind daher nicht “gesund”
- Regulationen sind nicht auf dem neuesten Stand der Wissenschaft und sollten verbessert werden
- Eine ganzheitliche Betrachtung von Verpackungen und Lebensmitteln ist nötig, um tatsächliche Nachhaltigkeit und Gesundheit zu bewerten





ANNUAL WORKSHOPS

WEBINARS

recordings online



DAILY NEWS

NEWSLETTER



FACT SHEET

BACKGROUND ARTICLES

DOSSIERS

SCIENTIFIC PUBLICATIONS

DATABASE FCCs

VIDEO BLOG

BRAND & RETAILER INITIATIVES DATABASE

ALL INFORMATION FREELY AVAILABLE:
www.FoodPackagingForum.org



🌻 THANK YOU TO THE FABULOUS FPF TEAM ❤️

Siedlungsabfälle CH in 2022 [kg / per capita]

- 671
 - 321 verbrannt/deponiert
 - 350 separat gesammelt (Papier, Karton, manche Verpackungen)

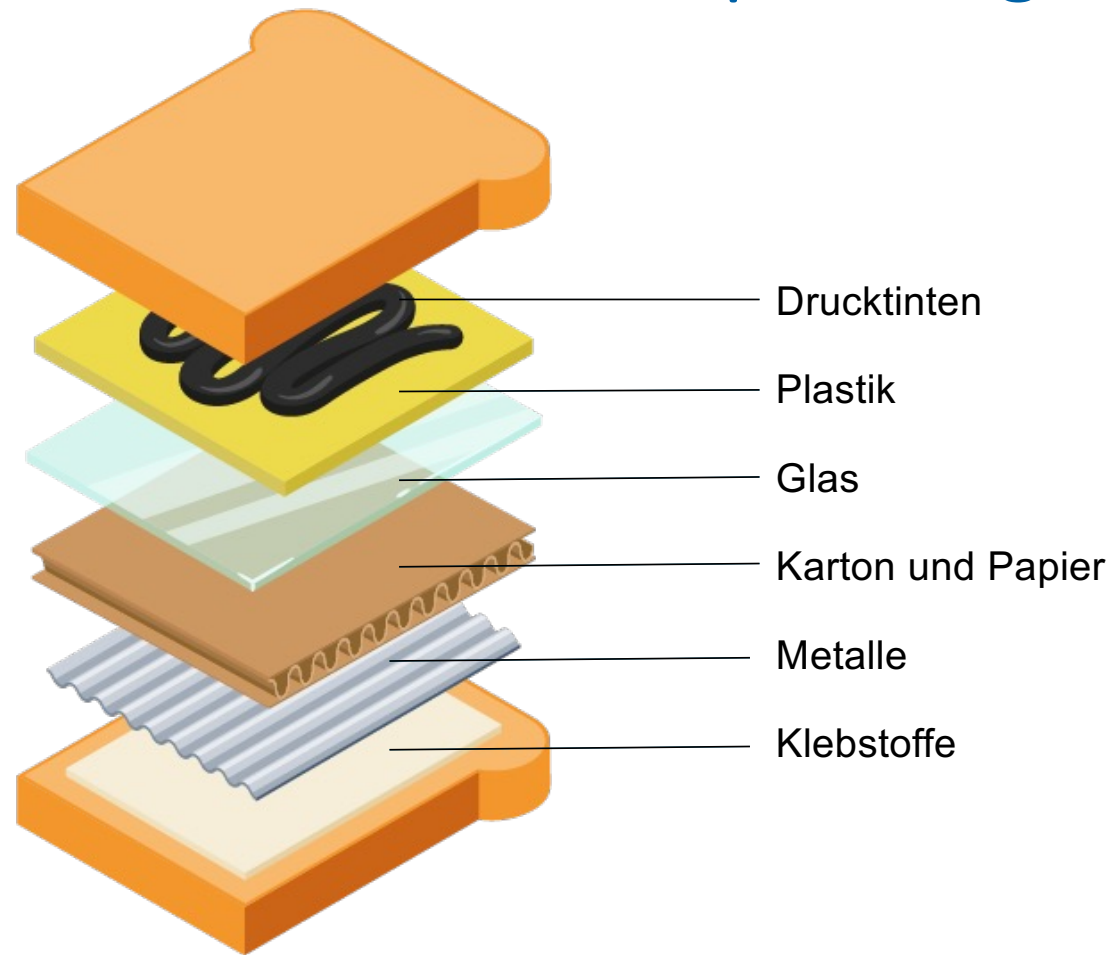
→ ca. **40% [270 kg/per capita] ist Verpackungsabfall**

→ Beinhaltet auch Industrieabfälle, sekundäre Verpackungen

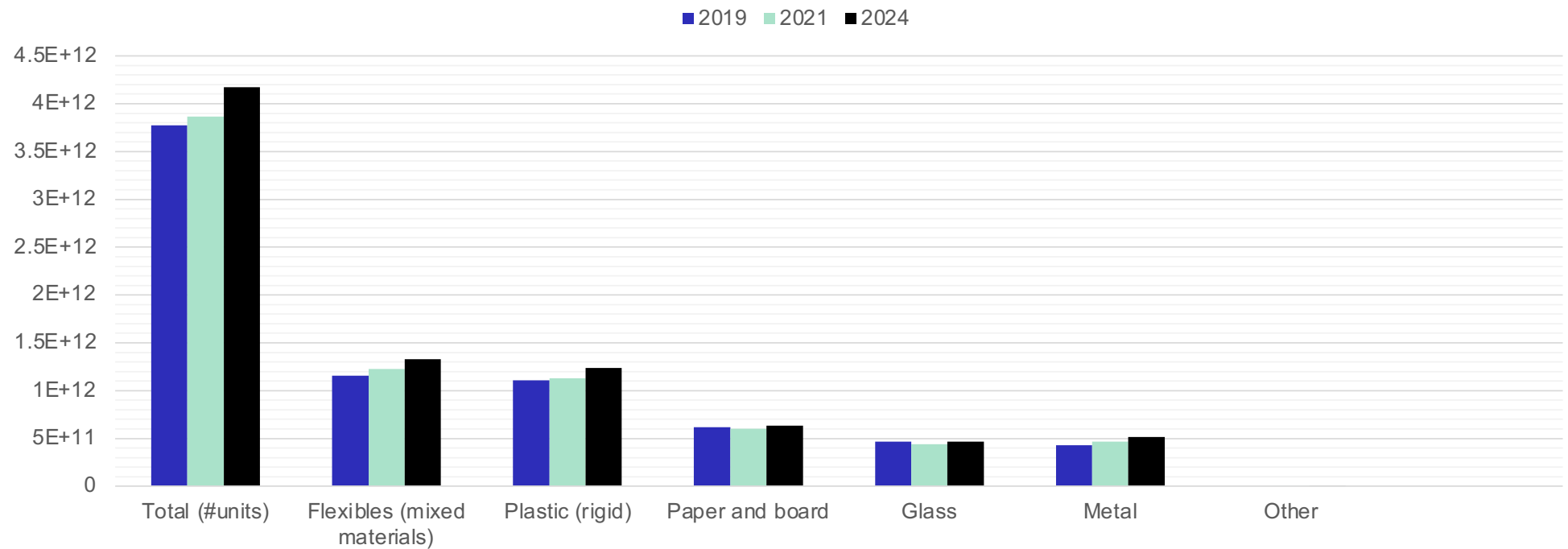
Data:

1. CH Siedlungsabfälle <https://www.bfs.admin.ch/bfs/de/home/statistiken/querschnittsthemen/wohlfahrtsmessung/alle-indikatoren/umwelt/siedlungsabfaelle.assetdetail.30645407.html>
2. Eurostat Packaging waste by waste management, Germany 237 kg/pc https://ec.europa.eu/eurostat/databrowser/view/env_waspac/default/bar?lang=en&category=env.env_was.env_wasst
3. Eurostat total municipal waste, Germany 593 kg/pc (237/593 = 40%) https://ec.europa.eu/eurostat/databrowser/view/env_wasmun/default/bar?lang=en&category=env.env_was.env_wasst

Woraus bestehen Lebensmittelverpackungen?



Marktanteile verschiedener Verpackungsmaterialien (global)



Plastikverpackungen für Food in CH (2017)

Total: 123,140 t (Klotz und Haupt, 2022)

→ 8.452 million capita CH

→ → 15 kg /p.c. ???

Packaging waste by waste management operations

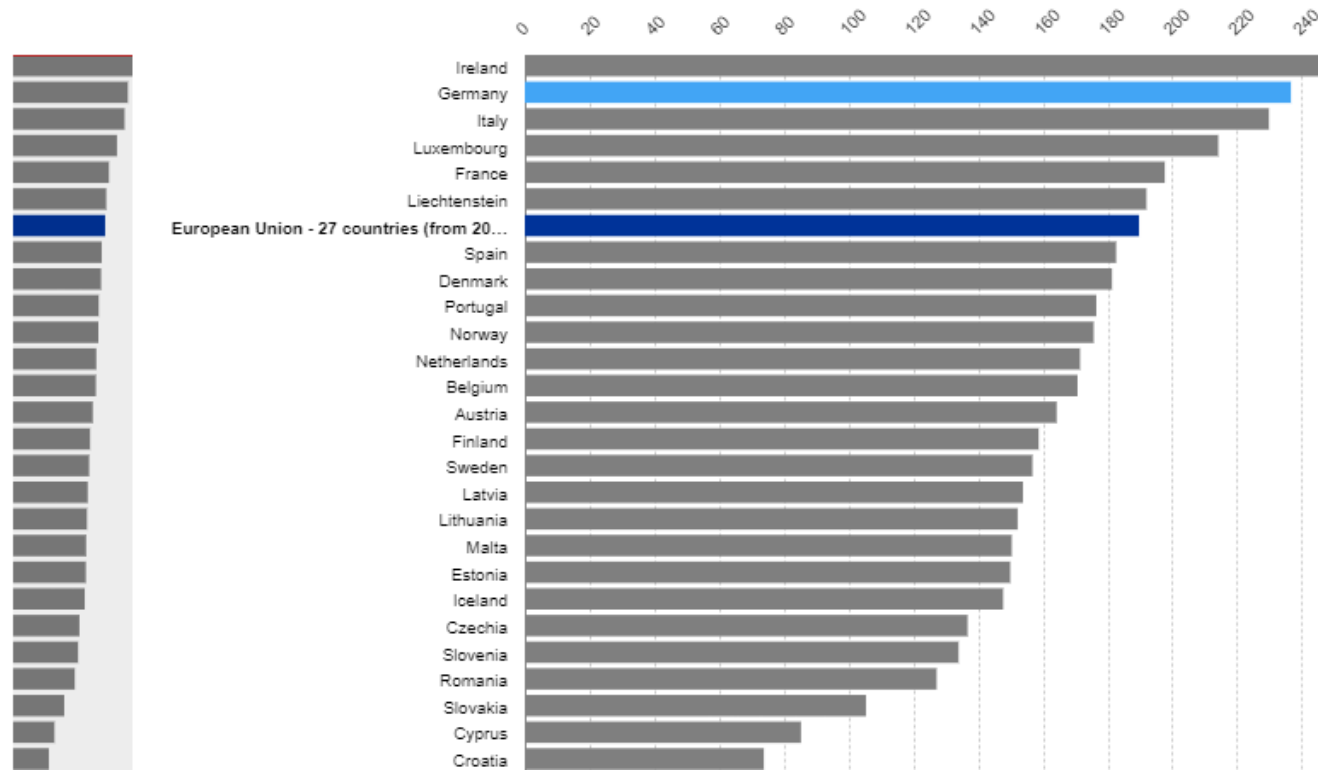
(online data code: env_waspac)

Source of data: Eurostat

Settings: Default presentation

Table Line **Bar** Map

Germany 2021
Annual, Packaging, Waste generated,
Kilograms per capita
236.69

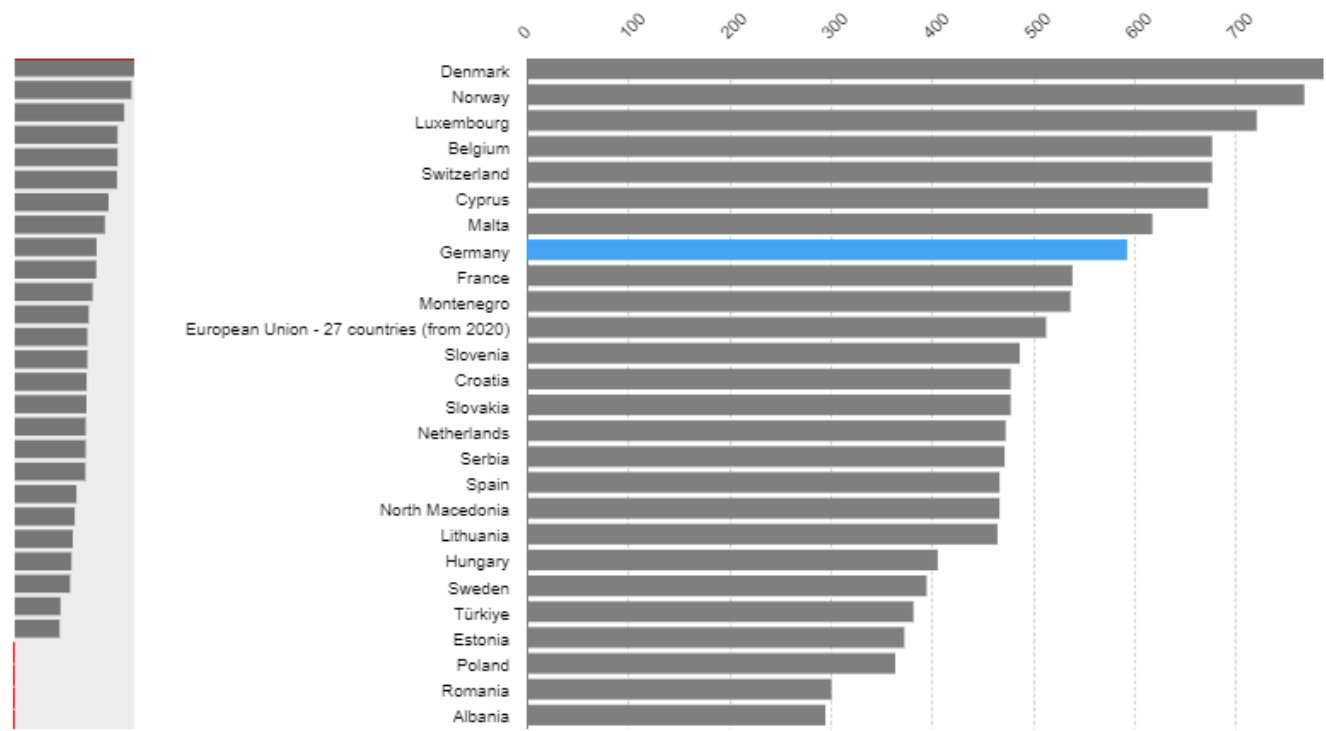


Municipal waste by waste management operations
 (online data code: env_wasmun)
 Source of data: Eurostat

Settings: Default presentation

Table | Line | **Bar** | Map

Germany 2022
 Annual, Waste generated, Kilograms per capita
593
(e: estimated)





**EU Definition
für
“sichere
Materialien”**

Regulation (EC) No 1935/2004, Art. 3.1.(a)

”Materialien und Gegenstände, [...],
müssen [...] so hergestellt werden,
dass sie unter normalen oder
vorhersehbaren
Verwendungsbedingungen ihre
Bestandteile nicht in **Mengen auf
Lebensmittel übertragen**, die die
**menschliche Gesundheit gefährden
könnten**”

U.S. Government Accountability Office (2022)

«Food processing and packaging can introduce non-food substances [...] into food. Some of these substances **may pose health risks.**»

<https://www.gao.gov/products/gao-23-104434>



United Nations

UN News

Global perspective Human stories

19 May 2023 | Health

Chronic diseases taking ‘immense and increasing toll on lives’, warns WHO



Unsplash/Gabin Vallet | Physical activity contributes to preventing and managing noncommunicable diseases such as cardiovascular diseases, cancer and diabetes.

