MASARYKOVA UNIVERZITA

Research centre for toxic compounds in the environment

Mikroplasty: Jsou opravdu všude?

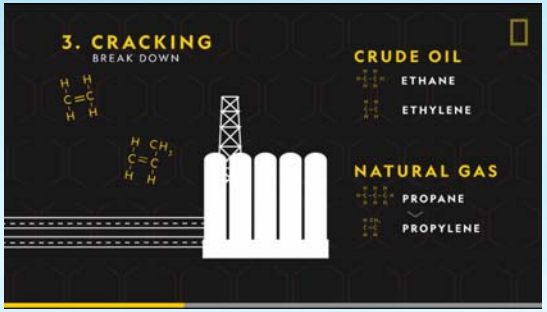
Ondřej Adamovský

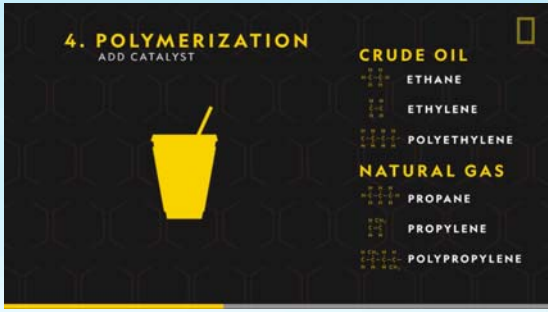
Science Party, 23.3.2021

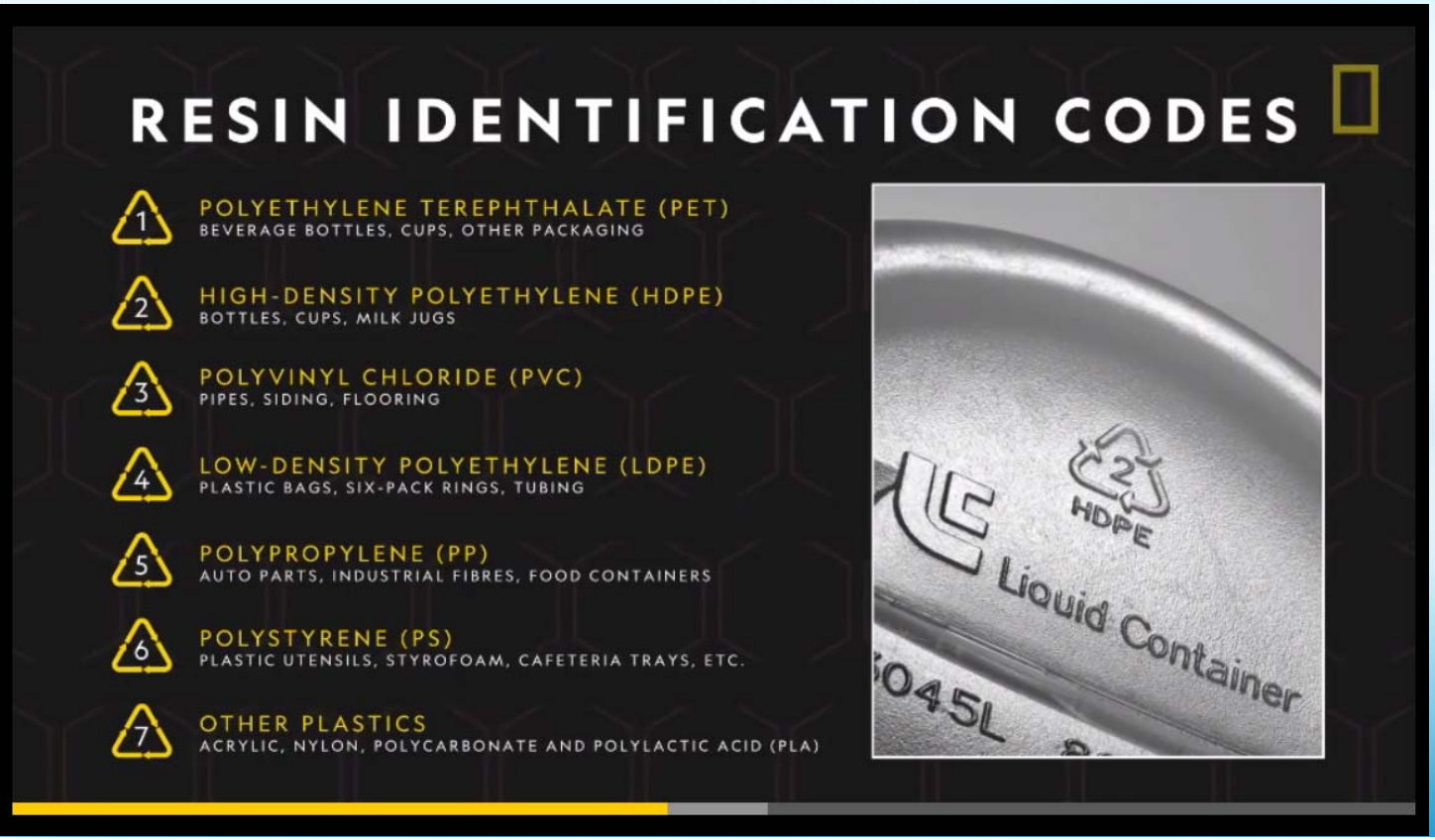
Plasty – obtížně nahraditelný materiál

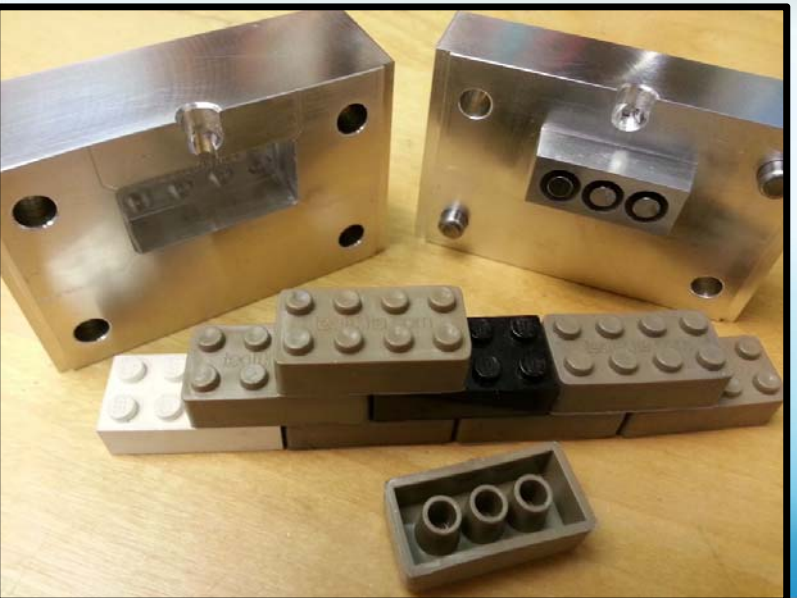
Plasty

Plasty – chemicky různorodé materiály

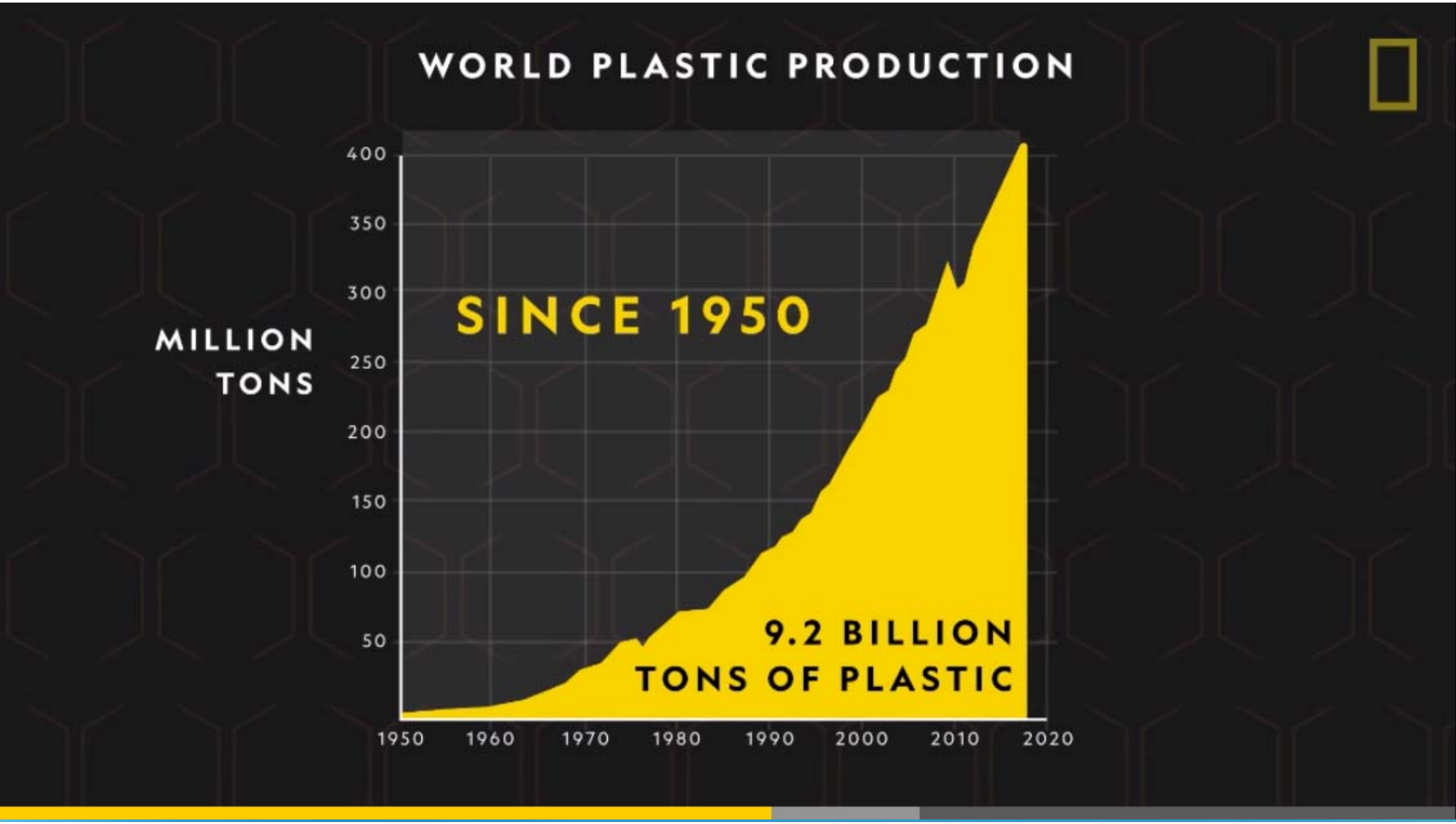




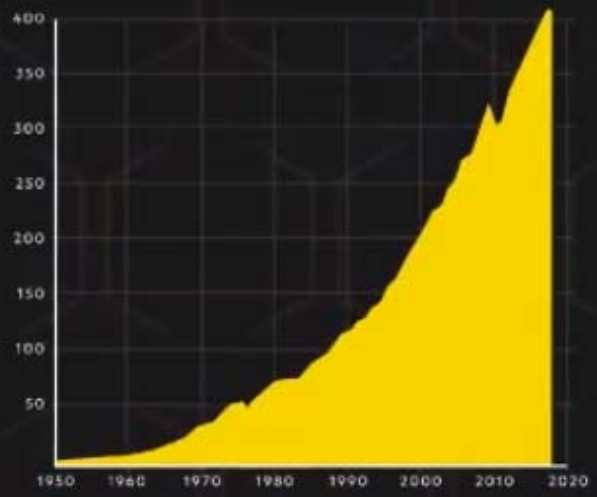




…od r.2030 LEGO nebude z plastu, ale z něčeho jiného (materiál ve vývoji)


WORLD PLASTIC PRODUCTION
MILLION TONS
400
350
300
250
200
150
100
50
SINCE 1950
9.2 BILLION TONS OF PLASTIC
1950
1960
1970
1980
1990
2000
2010
2020

GREAT PYRAMID OF GIZA



THE WEIGHT OF NEARLY
1,600 GREAT PYRAMIDS

9.2 BILLION TONS

The Lifecycle of Plastics

Plastic bag

20 years

Coffee cup

30 years

Plastic straw

200 years

6-pack plastic rings

400 years

Plastic water bottle

450 years

Coffee pod

500 years

Plastic cup

450 years

Disposable diaper

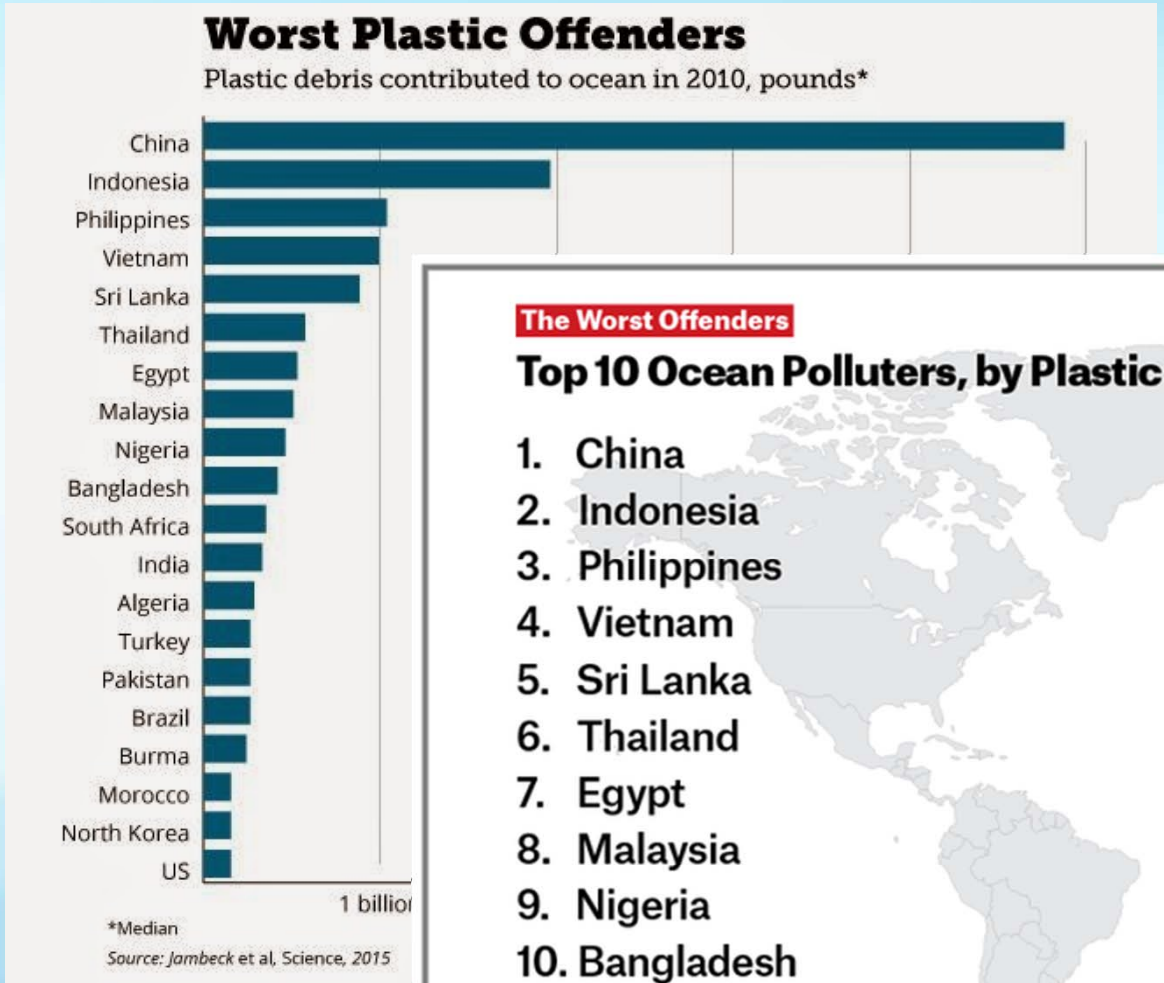
500 years

Plastic toothbrush

500 years

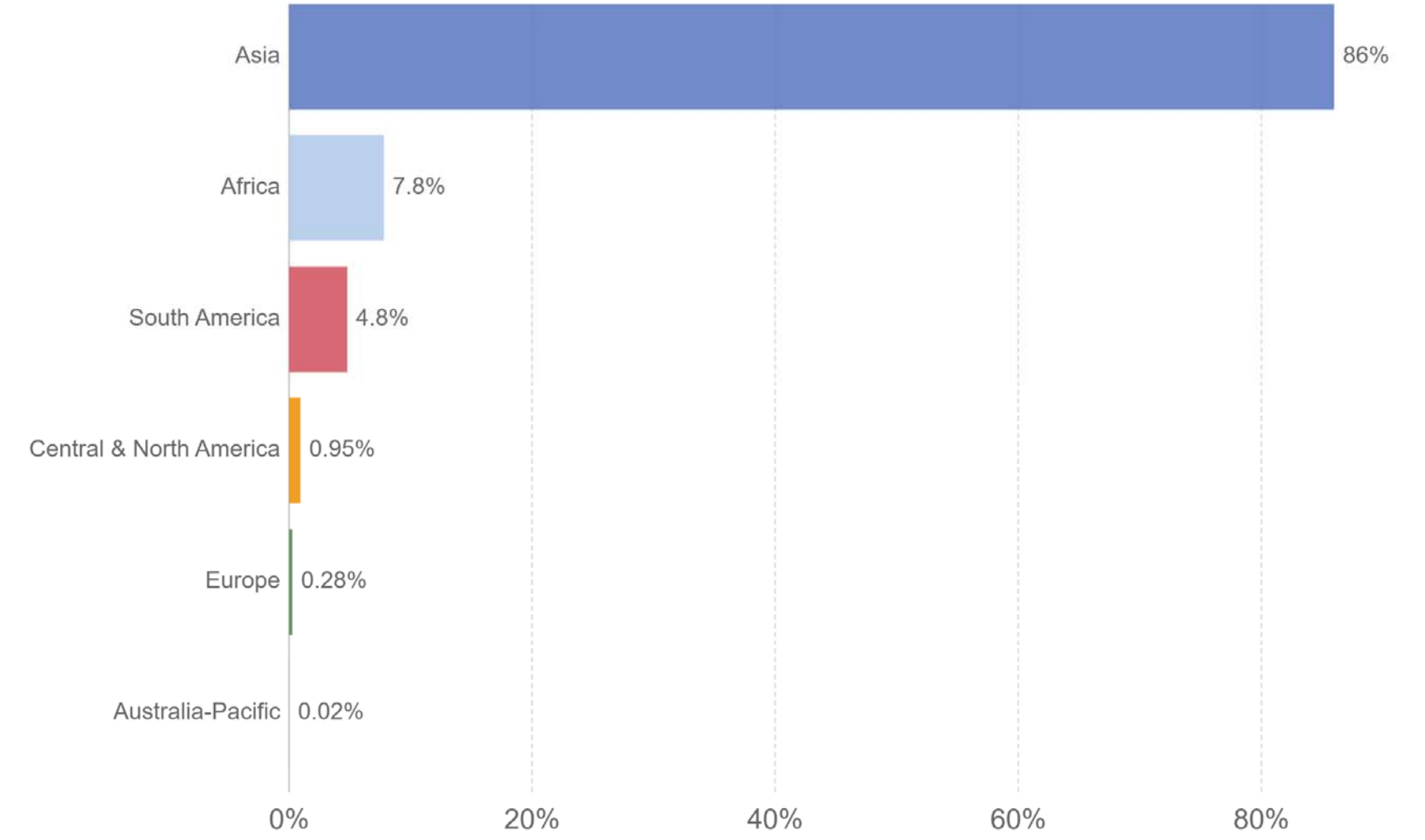
Plasty pocházejí z obydlených oblastí

…především z míst s nedokonalým odpadovým hospodářstvím



Global river plastic input to the ocean by region, 2015

Share of annual global plastic inputs from rivers into the ocean, differentiated by region.

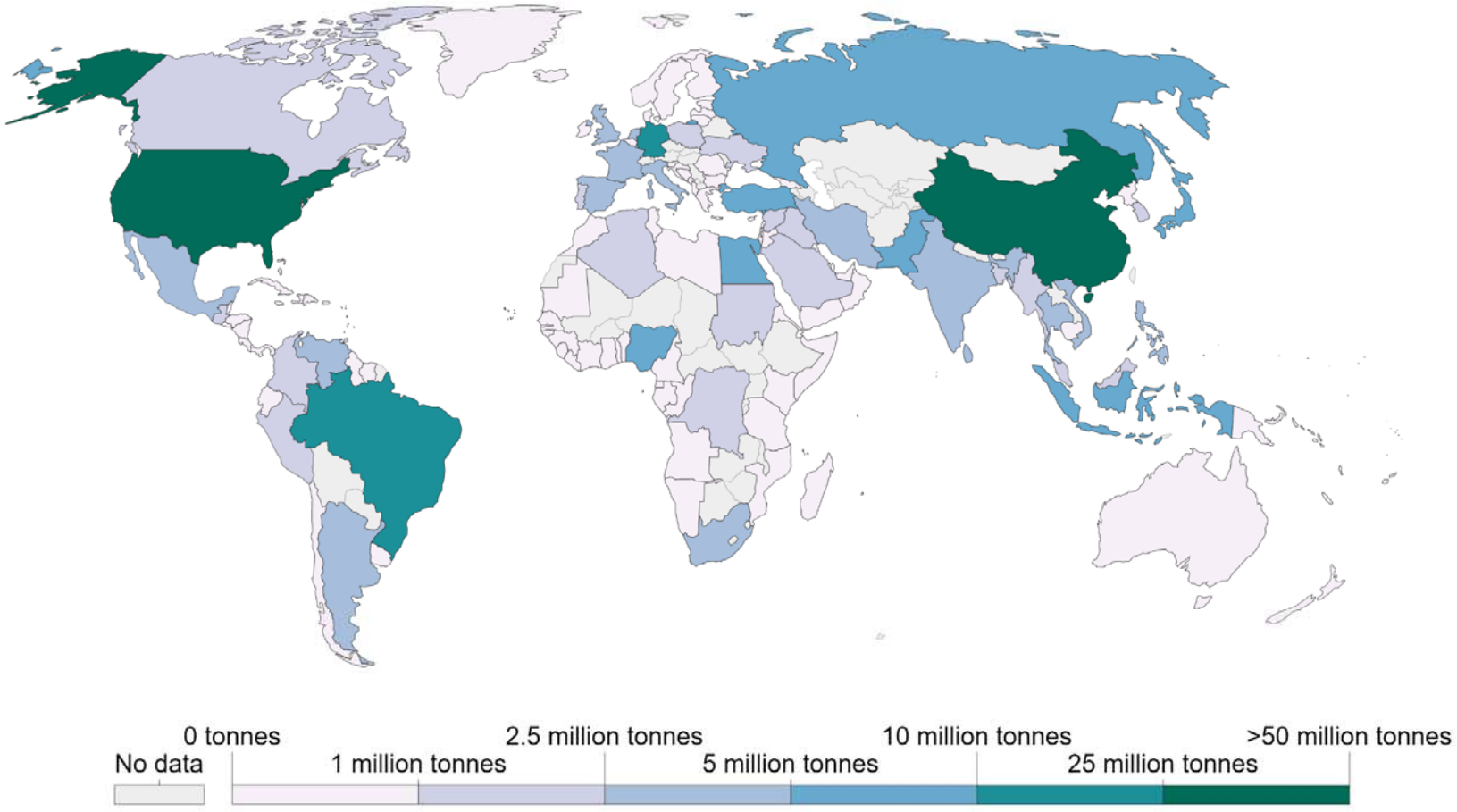


Source: Lebreton et al. (2017)

Plastic waste generation, 2010

Our World in Data

Total plastic waste generation by country, measured in tonnes per year. This measures total plastic waste generation prior to management and therefore does not represent the quantity of plastic at risk of polluting waterways, rivers and the ocean environment. High-income countries typically have well-managed waste streams and therefore low levels of plastic pollution to external environments.

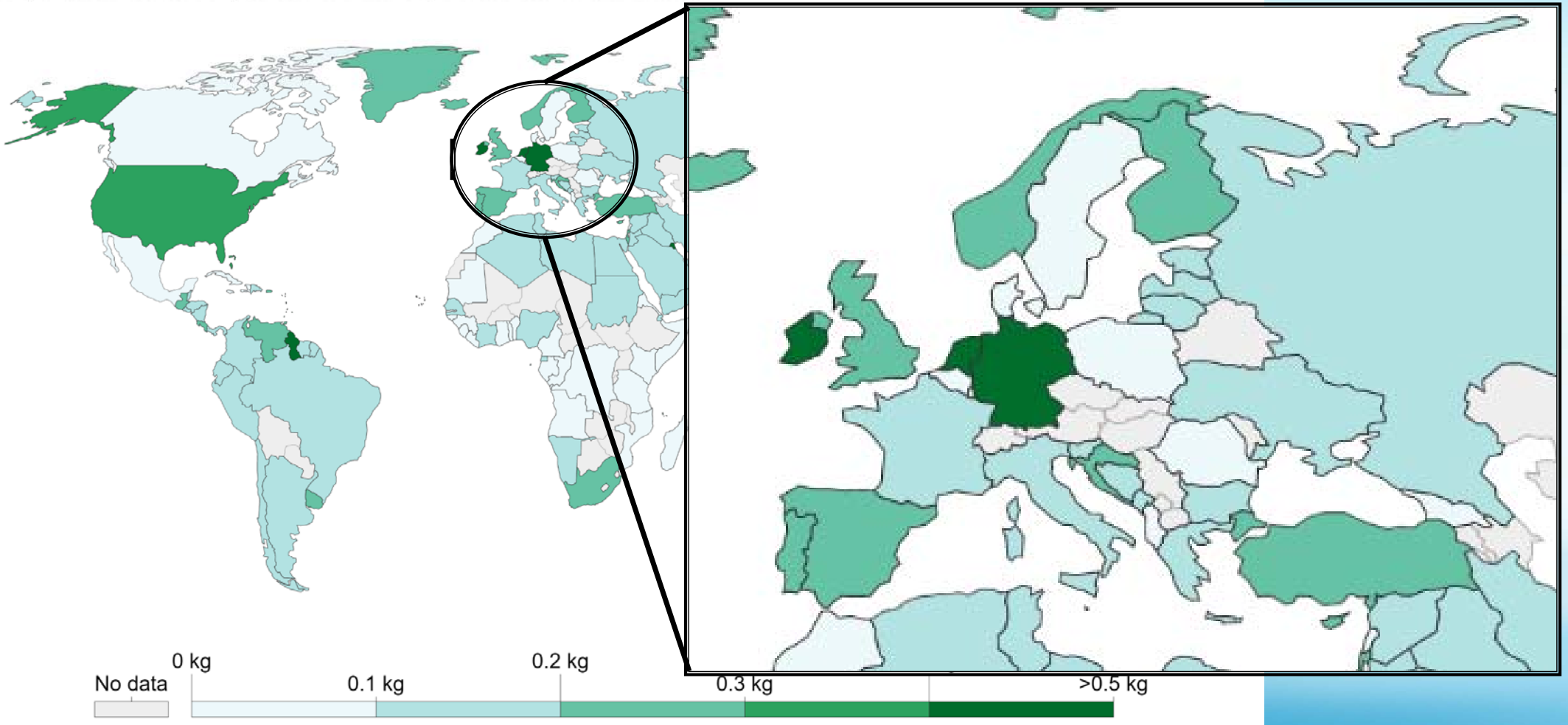


Source: OWID based on Jambeck et al. (2015) & World Bank

Plastic waste generation per person, 2010

Daily plastic waste generation per person, measured in kilograms per person per day. This measures the overall per capita plastic waste generation rate prior to waste management, recycling or incineration. It does not therefore directly indicate the risk of pollution to waterways or marine environments.

Our World in Data

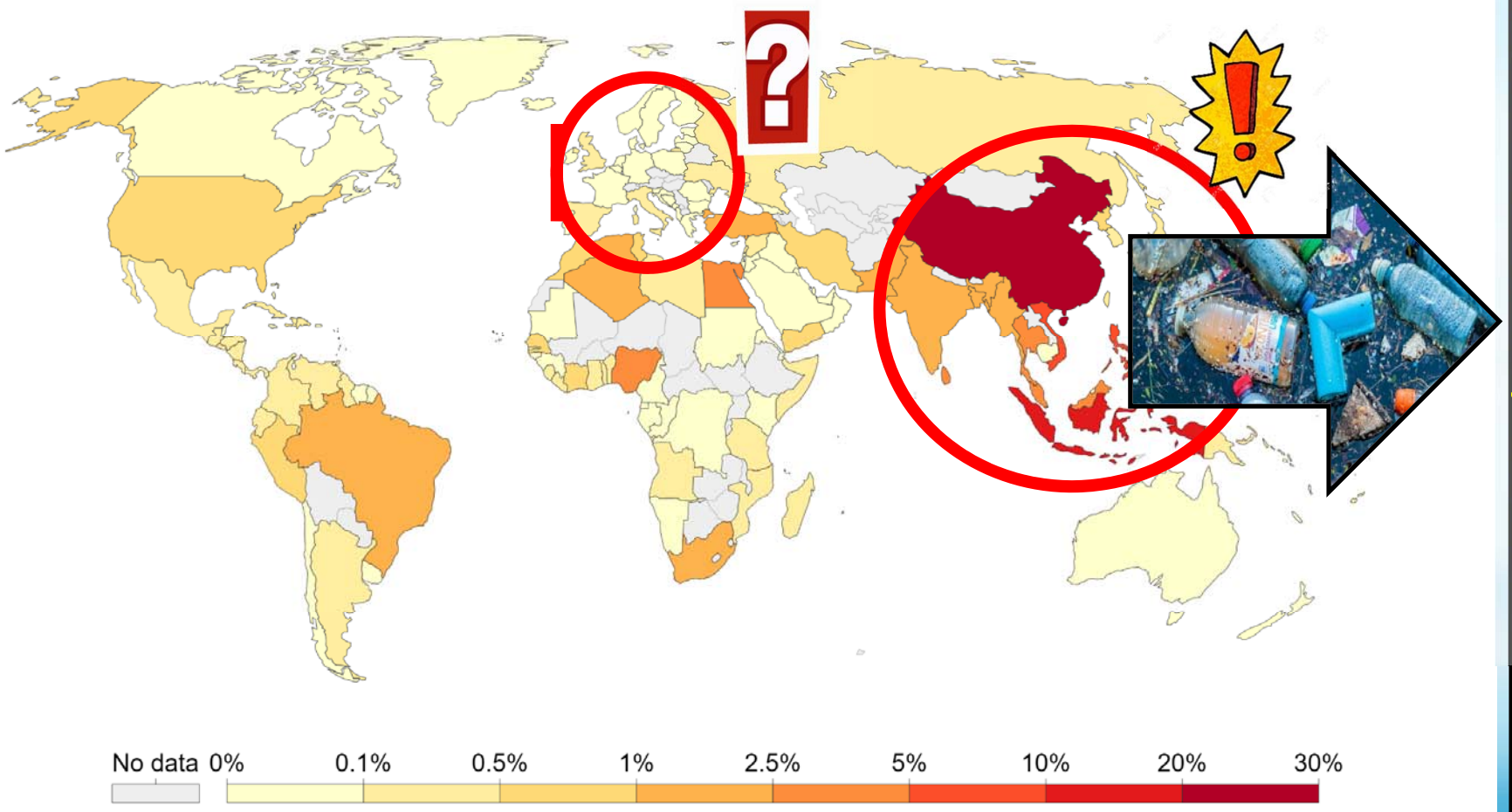


Source: Jambeck et al. (2015)

Share of global mismanaged waste, 2010

Our World in Data

Global share of mismanaged plastic waste derived from a given country. Mismanaged waste is the sum of littered or inadequately disposed waste. Inadequately disposed waste is not formally managed and includes disposal in dumps or open, uncontrolled landfills, where it is not fully contained. Mismanaged waste could eventually enter the ocean via inland waterways, wastewater outflows, and transport by wind or tides.



No data | 0% | 0.1% | 0.5% | 1% | 2.5% | 5% | 10% | 20% | 30%

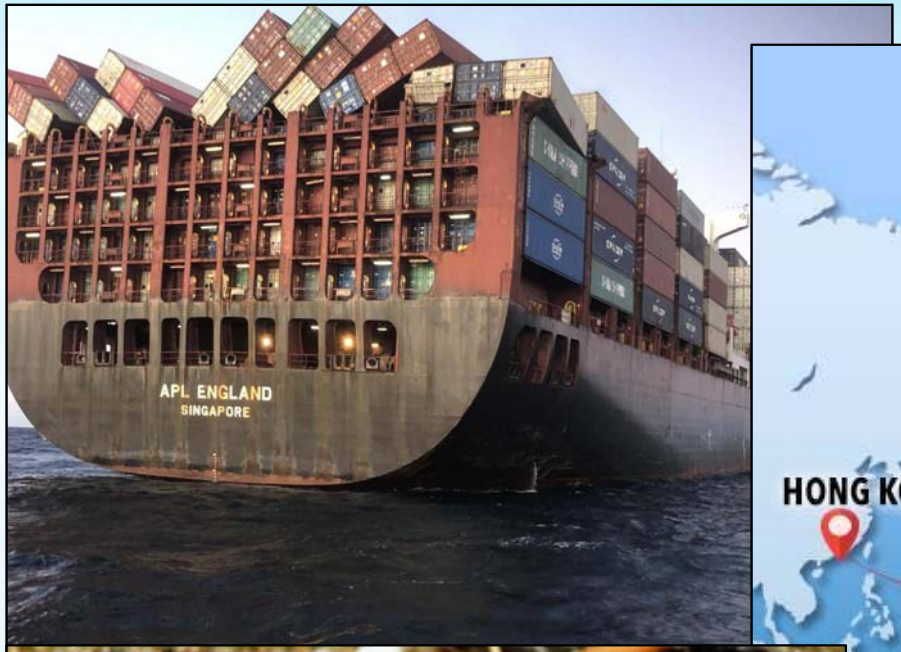
Source: Jambeck et al. (2015)

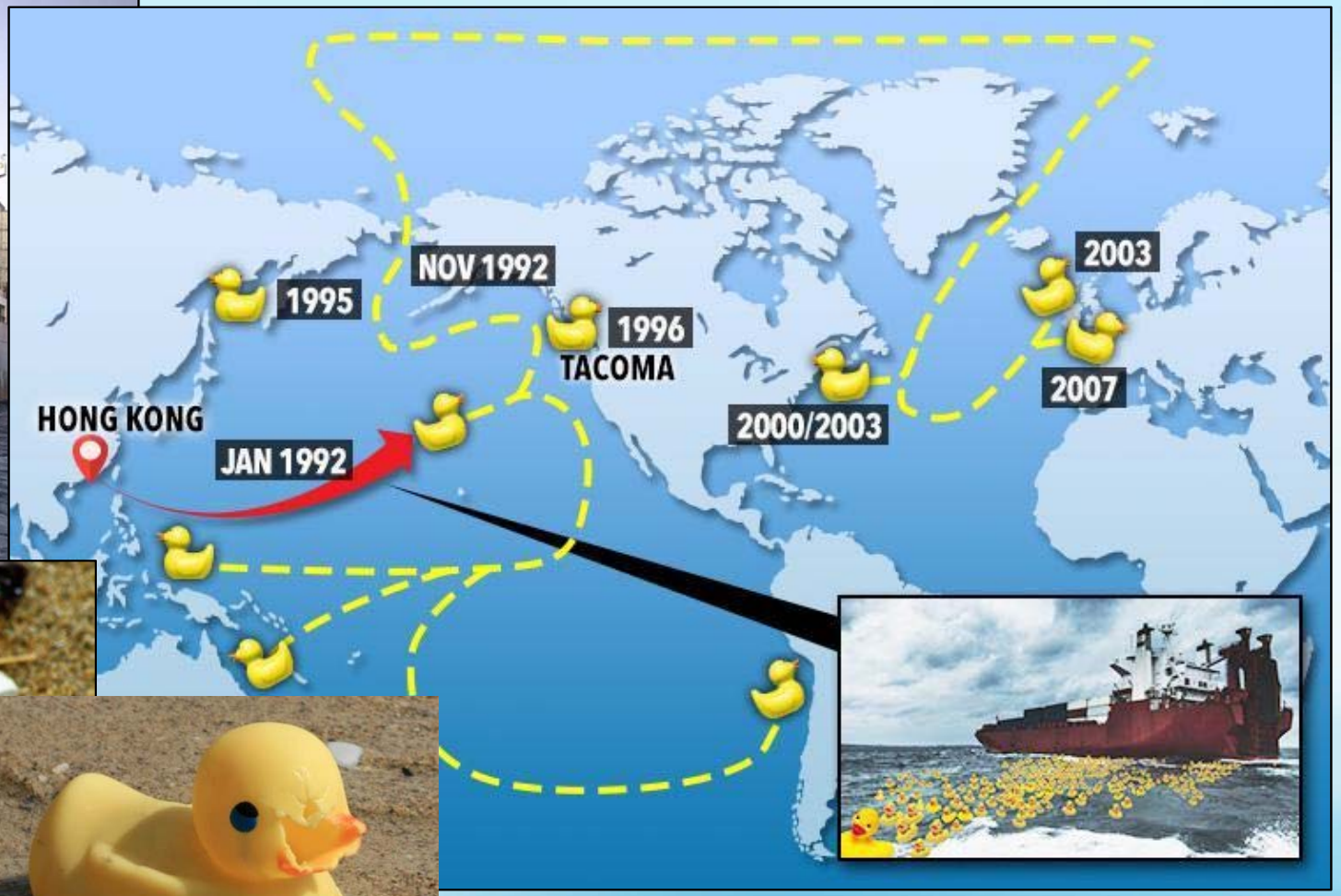
CC BY

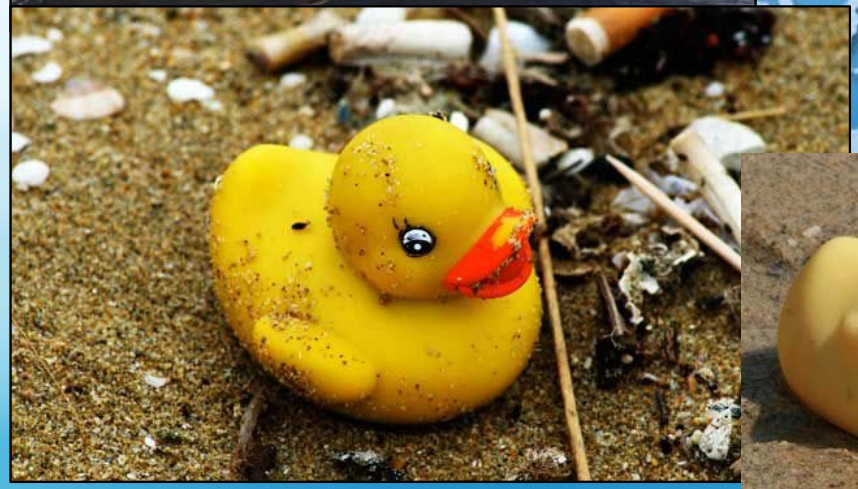
Emise plastového odpadu do prostředí.

JV Asie – **proč by nás to mělo zajímat?!**

Únik 29.000 kachniček z Čínské nákladní lodě v r.1992







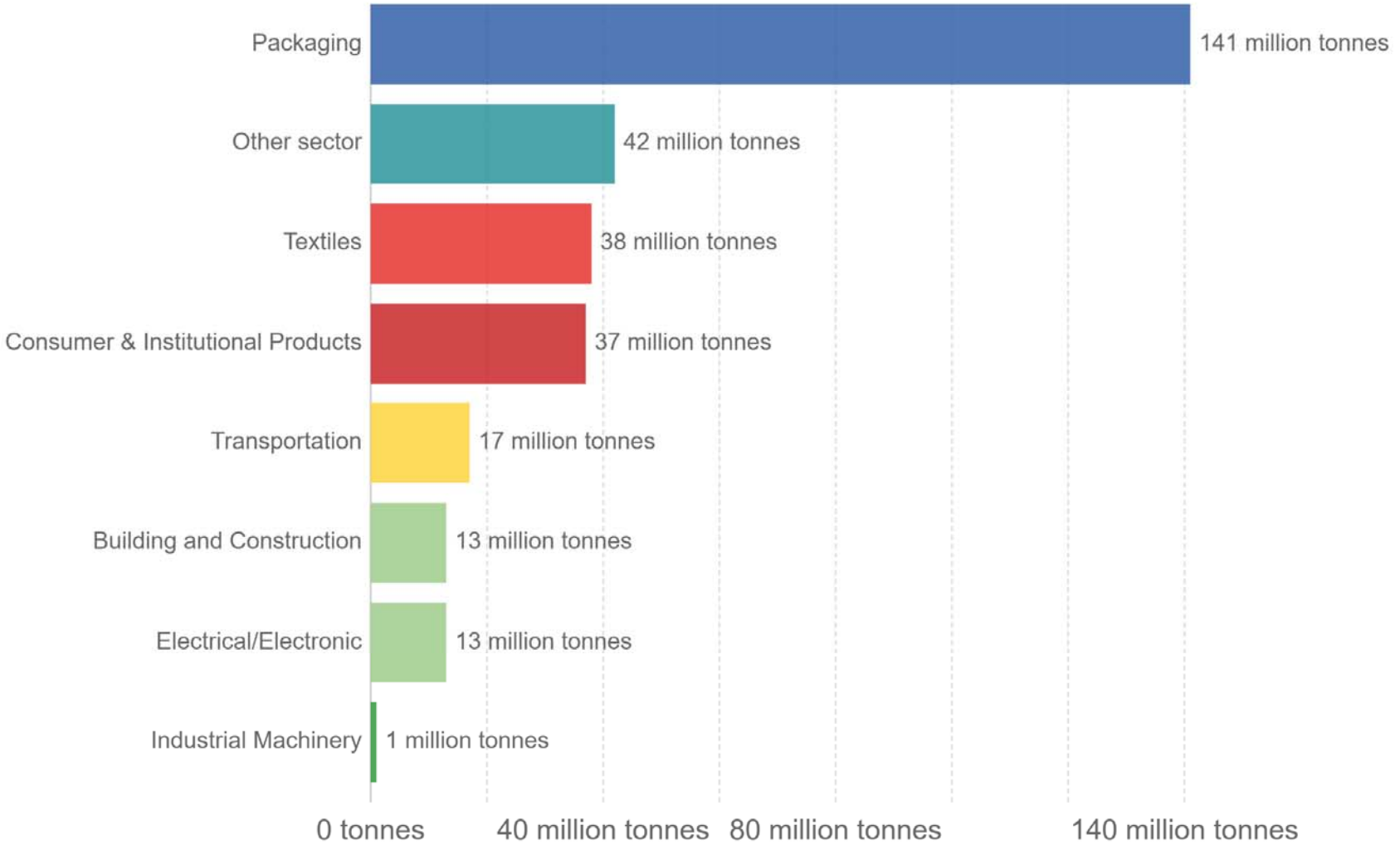
Ostrovy plastů v oceánech

- Pobřežní státy: emise **4.8– 12.7 milónů tun plastu do oceánu v r. 2010**

Ostrovy plastů v oceánech – plastový smog - MIKROPLASTY

Plastic waste generation by industrial sector, 2015

Global plastic waste generation by industrial sector, measured in tonnes per year.

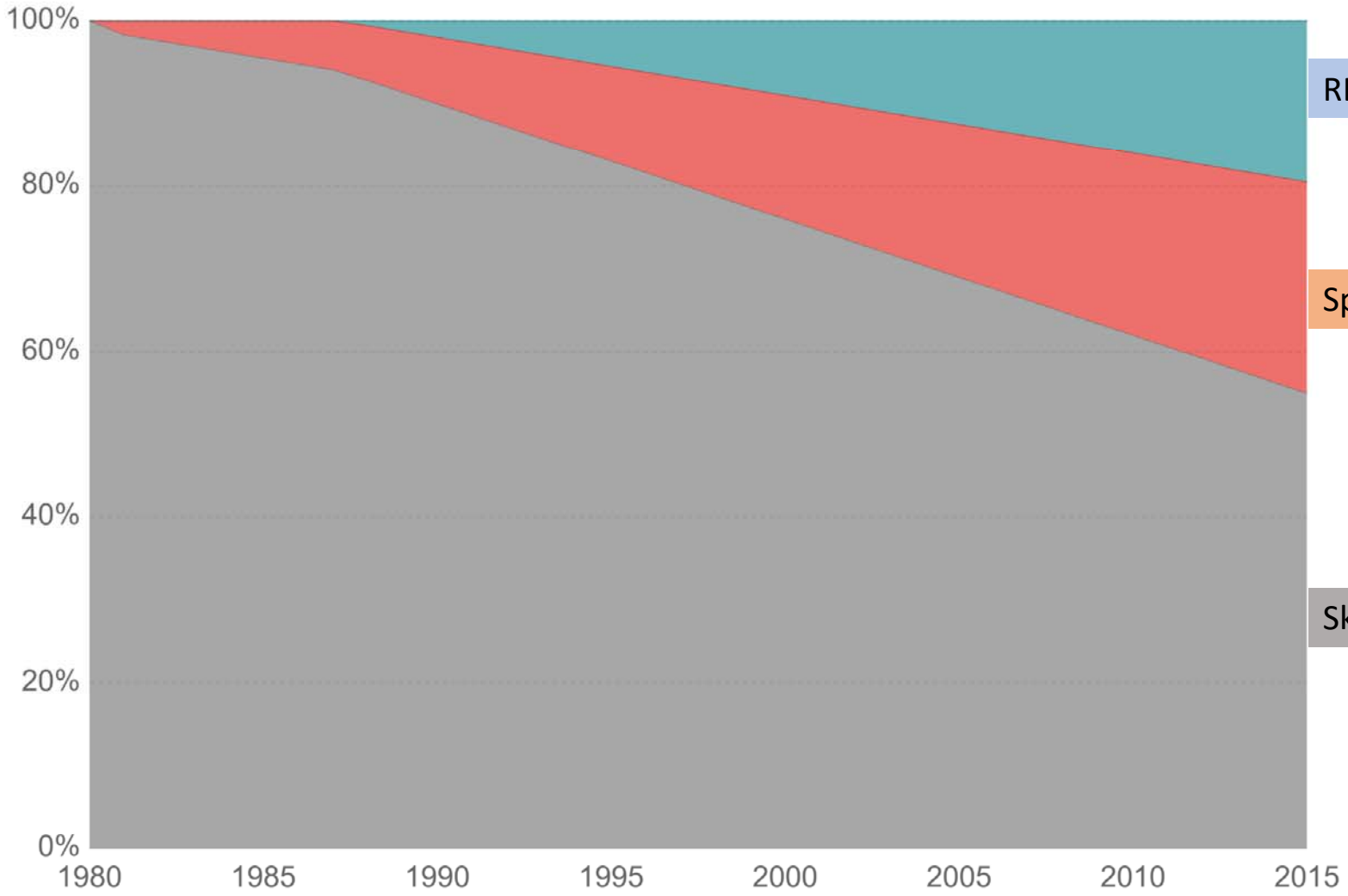


Source: Geyer et al. (2017)


OTHER
AGRICULTURE
ELECTRONICS
AUTO
BUILDING AND CONSTRUCTION
SINGLE USE PLASTICS

Global plastic waste by disposal

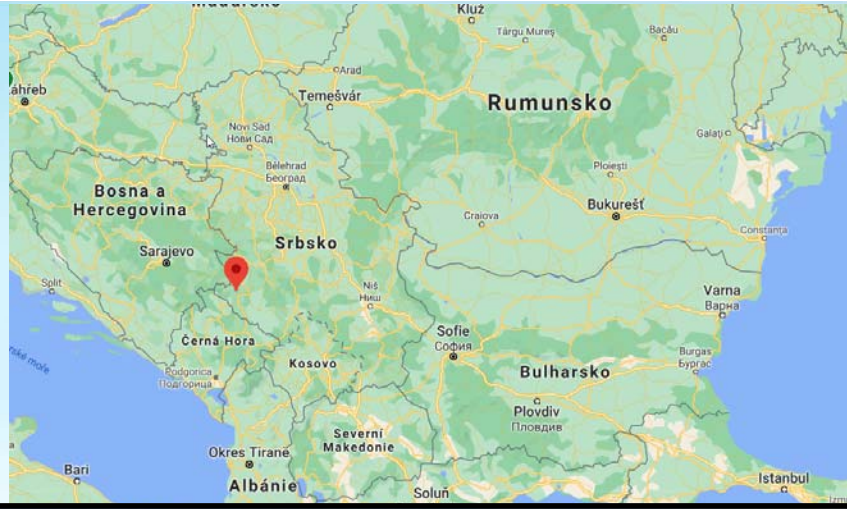
Estimated share of global plastic waste by disposal method.



Source: Geyer et al. (2017)

Plastový odpad ve vnitrozemských vodách

JZ Srbsko, jezero Potpecko 22.1.2021,

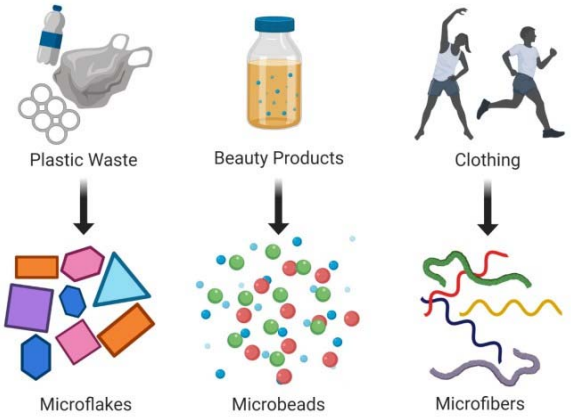


Plasty-> **Mikroplasty** -> Nanoplasty

Mikroplasty

Nanoplasty

Mikroplasty (MP)



- Definice >5 mm
- Sférické částice, vlákna, granule, vločky
- 1. identifikace problému – 70.léta
- směs různých polymerů (PP, PVC, PE..) a jejich specifických **aditiv**

- **primární** (!) x **sekundární (rozpad plastů)**
- MP potvrzeny v 690 druzích mořských živočichů
- Všudypřítomné (Akrtický ledovec, Antarktika, Vysokohorské lokality, Hlubokomořské příkopy…)

Primární mikroplasty- Mikropelety v kosmetice

Pasty…. 1-3% mikropelet (PE)
Gely ….. 0,4 - 10,5 % (PE)

Emise primárních mikroplastů

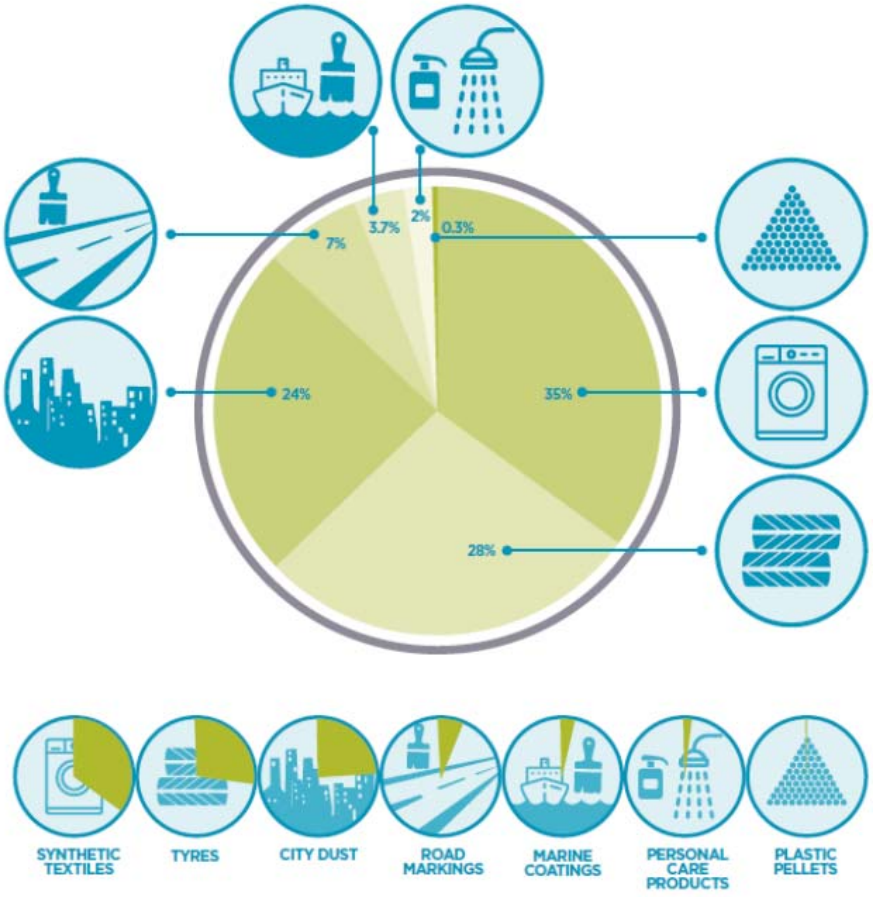
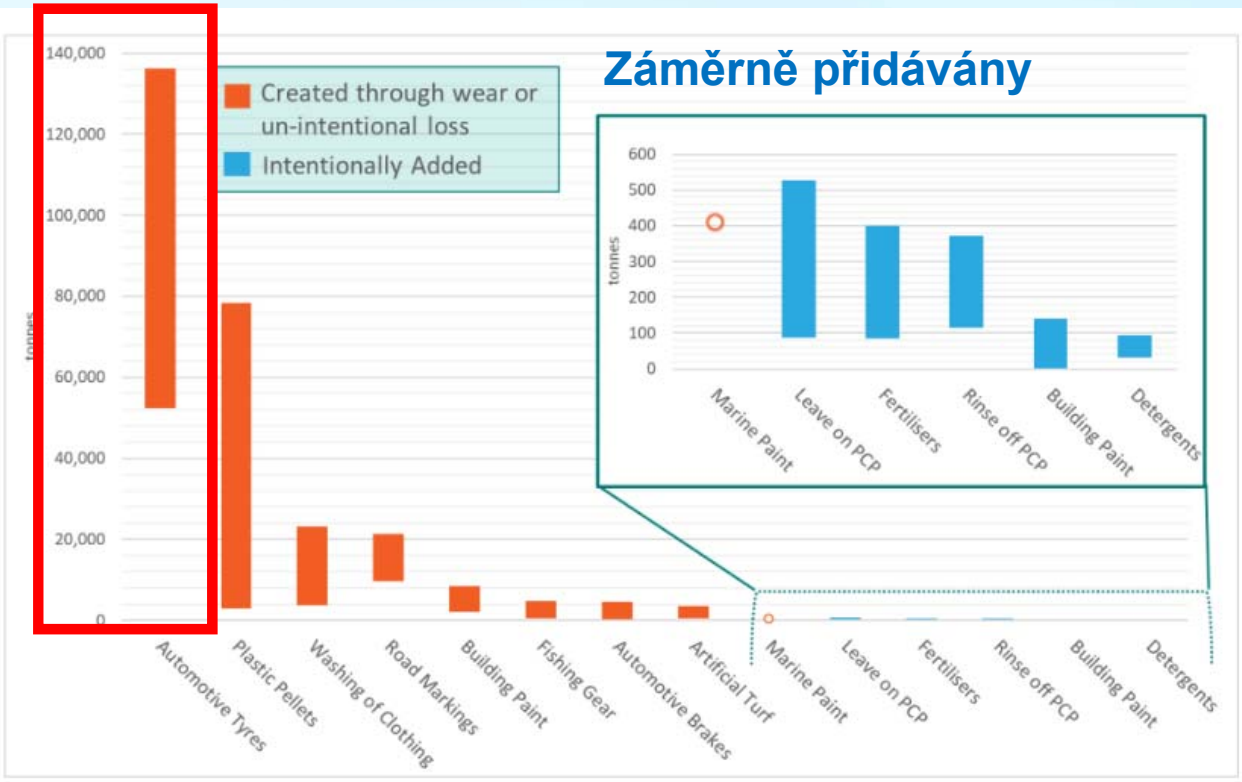


Figure 2 – Global releases of primary microplastics to the world oceans (Boucher et al., 2017)

~700,000 vláken z 6 kg domácího praní

Emise mikroplastů

Nezáměrně tvořeny



Záměrně přidávány

Figure 3 - Annual Emissions of Microplastics to Surface Water (Upper and Lower Ranges) – taken from (Hann et al., 2018)

Mikroplasty v prostředí

- V EU ~170 000 tun mikroplastu v prostředí ročně.
  Z toho ~42 000 tun primárních MPs
- Mikroplasty nalezeny v bezobratlých, rybách, ptácích, savcích…
- Mikroplasty nelezeny v biotě, půdě, vodě, sedimentu, vzduchu, prachu…
- Mikroplasty v mořské vodě v tisících až stovky tisíc na m3 vody
- Mikroplasty jak v mořích tak sladkovodních ekosystémech
- Mikroplasty mohou porůstat biofilmem -> chutnější pro organismy, sedimentace

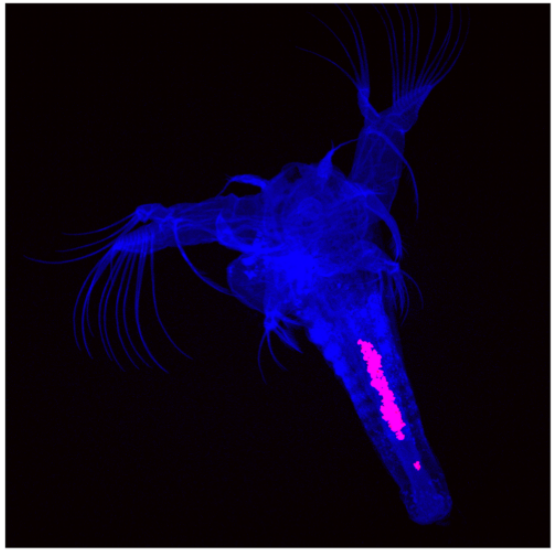
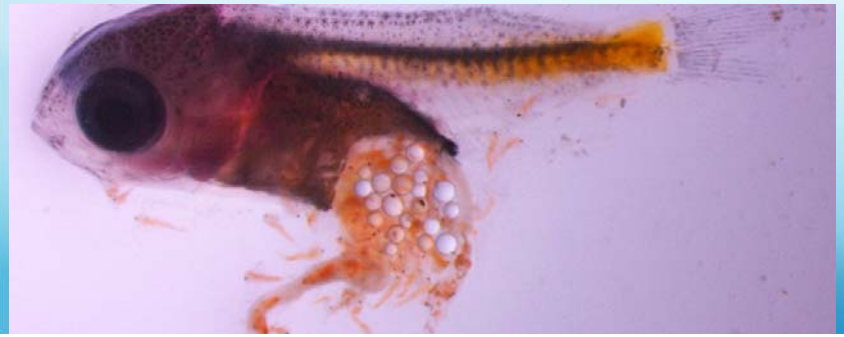


Figure 6. Image of polyurethane microplastics (<53 μm) ingested by brine shrimp nauplii (*Artemia sp.*, length ~500 μm). Microplastics were present



A water flea with microplastic particles in its gut (white spots). Credit: Saskia Rehse/IGB

Mikroplasty efekty na organismy

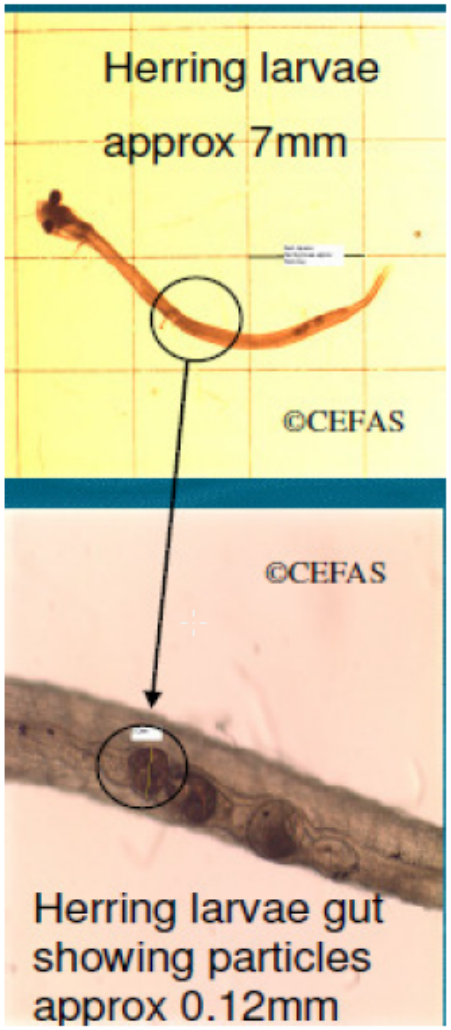
- Oxidativní stress
- Změny **střevního mikrobiomu**
- Změny v metabolismu
- Fyzické blokování trávícího traktu
- Změny v chování
- Vznik zánětů

- Vliv na zdraví ryby
- Slabší ryby
- Vliv na zvladnutí nemocí a parazitů
- Únik před predátory

- **Populace**
- **Biodiverzita**

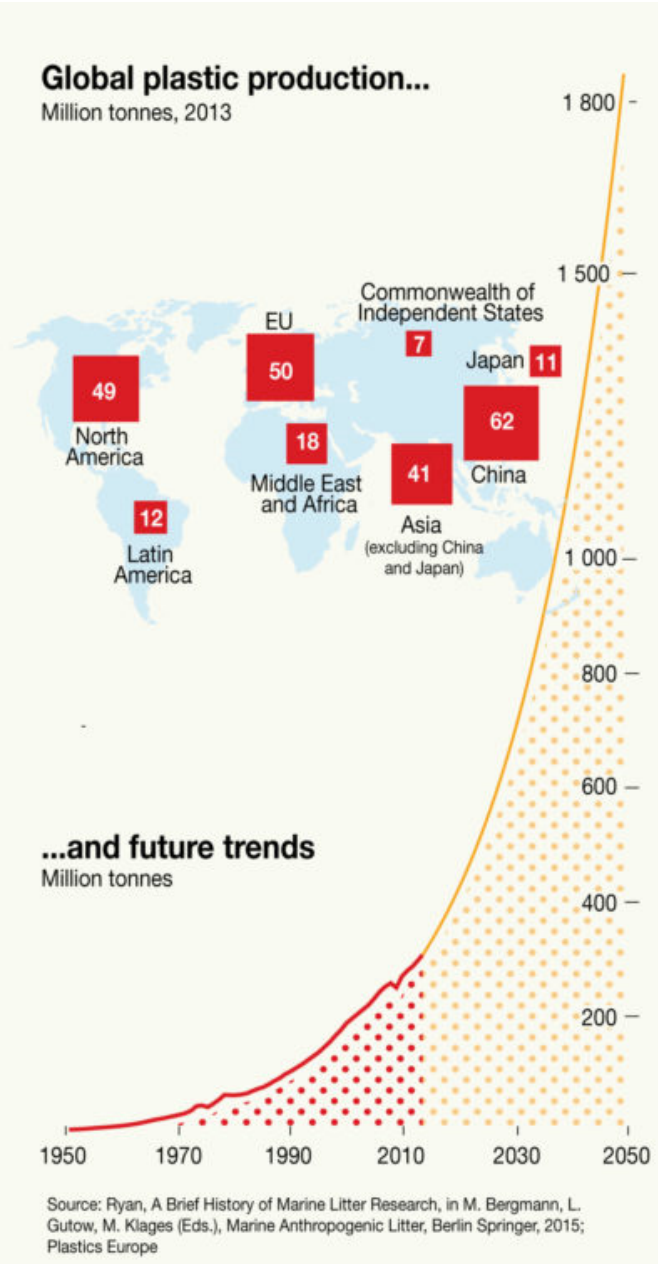
Mikroplasty v rybách

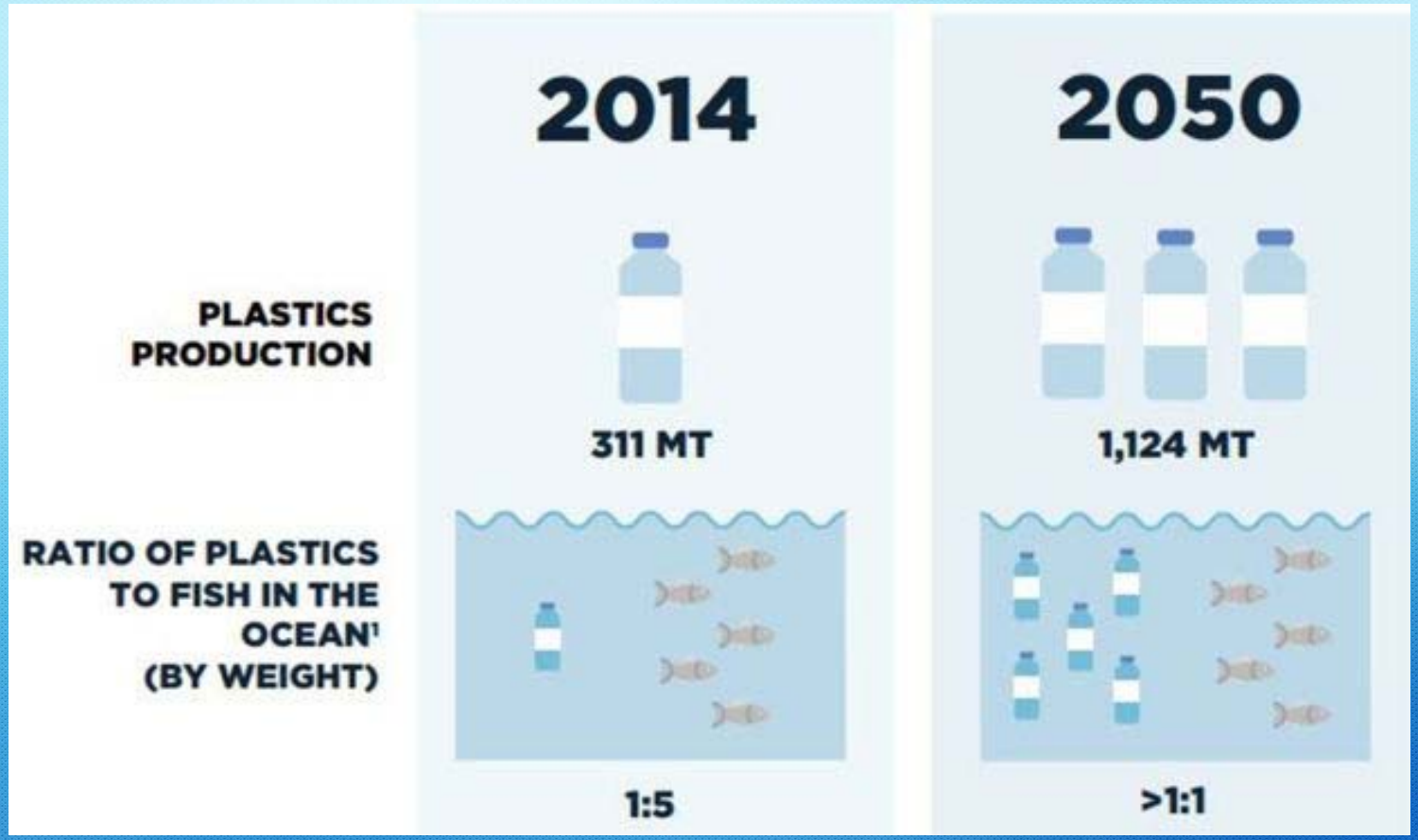
Fish larvae



Vodní Ekosystém – vodu filtrující organismy

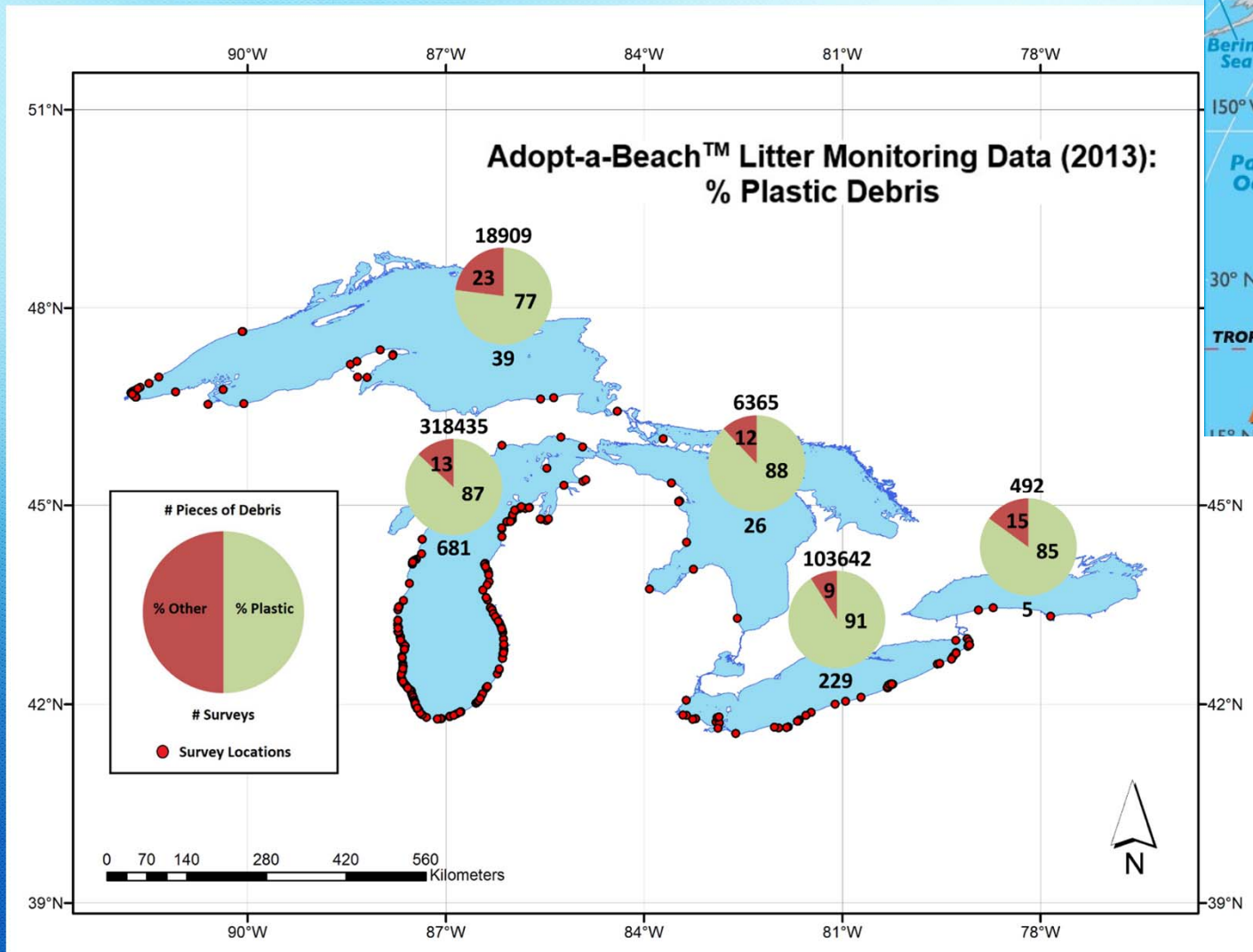
Plastový odpad v moři





V r.2050 stejný váha plastu v mořích jako váha ryb

Mikroplasty ve sladkých vodách



Aditiva v plastech a mikroplastech(!)

Qualitative Analysis of Additives in Plastic Marine Deb New Products

Manviri Rani[1] · Won Joon Shim[1,2] · Gi Myung Han[1] · Mi Jang[1,2] · Najat Ahmed Al-Odaini[1] · Young Kyong Song[1,2] · Sang Hee Hong[1,2]

h Environ Contam Toxicol (2015) 69:352–366

Table 2 Chemicals found in new plastic items and marine debris

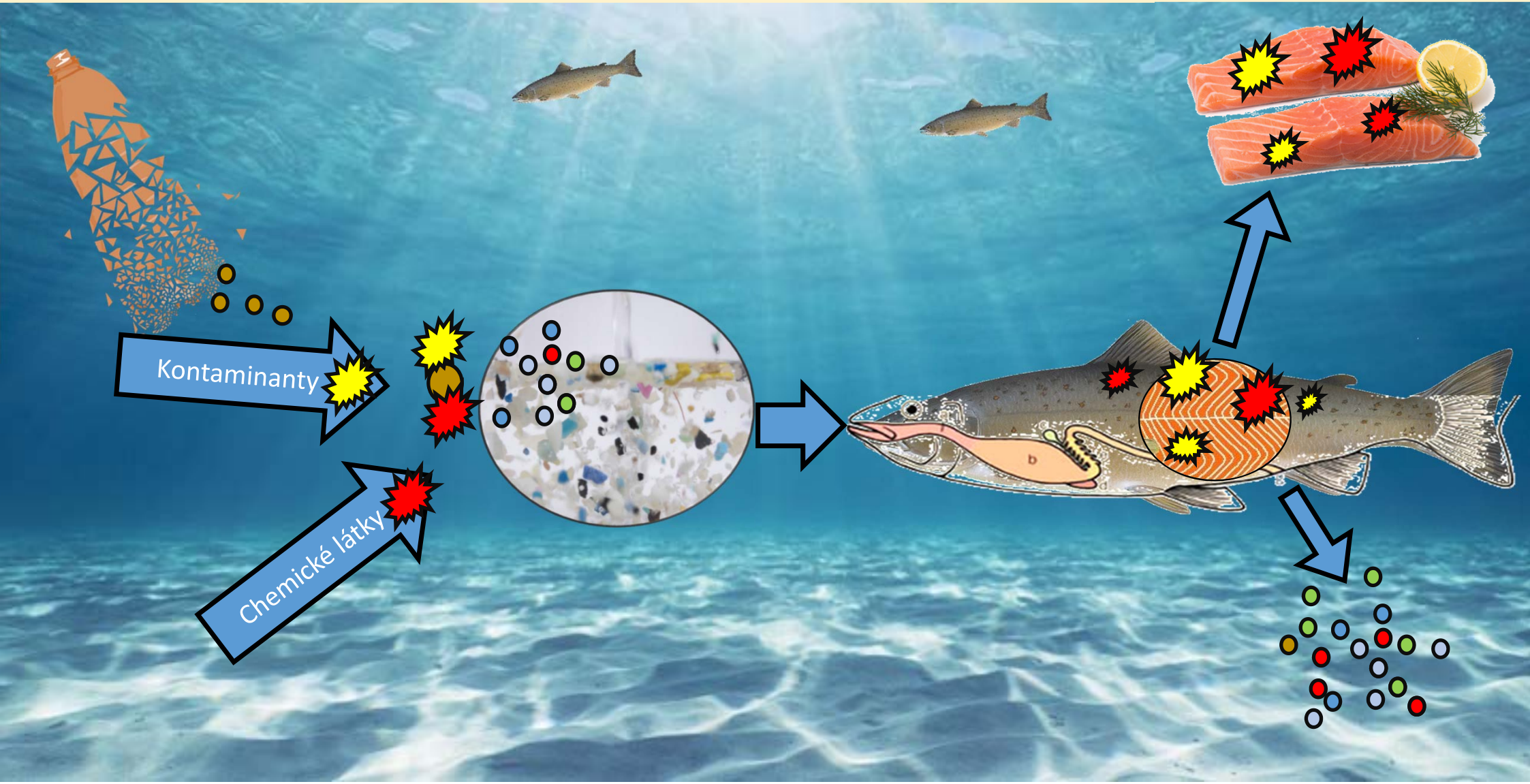
Category	ID*	Chemical	M. W.	Cas no.	Freq. (N)	Plastic ID		
						Both	Only new products	Only debris
Hydrocarbon	3	Tetradecane	198	629-59-4	18	3, 5, 10	6, 8, 9, 13, 14, 21, 22(1), 22(3)	1, 17, 24
	5	Hexadecane	226	544-76-3	19	1, 3, 5, 10, 17, 22(1), 24	8, 14, 21, 22(2), 22(3)	n.d.
	6	Heptadecane	240	629-78-7	13	10, 24	8, 9, 11, 15, 21, 22(2), 22(3)	1,3
	7	Octadecane	254	593-45-3	20	1, 3, 5, 10, 21, 19(1), 17	5,8, 11, 15, 22(2), 24	n.d.
	9	Eicosane	282	112-95-8	18	1, 3,10, 19(1), 21,22(2)	13, 17, 16(1), 22(3)	5,8
	14	Heptacosane	380	593-49-7	14	21	3, 6, 8, 9, 11, 15, 22(2), 24	1, 5, 16(1),17
Substituted hydrocarbon	25	Tetradecane, 2,6,10-trimethyl-	240	14905-56-7	10	21	6, 9, 15, 22(1), 24	10, 16(1), 17
	32	Heptadecane, 3-methyl-	254	6418-44-6	6	3,5	19(1)	10
	54	Squalene	410	7683-64-9, 111-02-4	16	8, 9, 21	1, 2, 3, 4, 5, 6, 10, 14, 16(1), 22(2)	n.d.
UV stabilizer	63	UV320	323	3147-75-9	15	22(2), 22(3), 24	10, 17	2, 3, 5, 18, 19(1), 20, 23
	64	UV326	315	3896-11-5	17	2, 3, 5	6,10	4, 5, 18, 19, 20, 22(2), 22(3), 23, 24
	65	UV327	358	3864-99-1	21	2, 11, 17,24	1, 6, 7, 19(2), 21, 22(1)	3, 4, 5, 16(1), 18, 22(2), 22(3)
	66	UV328	352	25973-55-1	10	17	16(1), 16(2), 21	18, 20, 24, 22(2), 22(3)
	67	Uvinual MC80	290	5466-77-3	10	n.d.	5, 6, 7, 9, 10, 21,15	1, 3, 4
	68	Octabenzone	326	1843-05-6	2	n.d.	17	16(1)
	69	*UV360*	*323*	n.a.	*3*	n.d.	*16(2)*	*16(1), 22(2)*
Antioxidant	71	Irganox 1076	530	2082-79-3	12	16(1), 1	9, 11, 13, 16(2),19(2)	4, 19(2), 21
	72	BHT	220	128-37-0	5	n.d.	10, 15, 17, 22(1)	21
	73	Phenol, 2,6-bis(1,1-dimethylethyl)-4-ethyl-	234	4130-42-1	4	17	22(2)	21
	74	Phenol, 2,4-bis(1,1-dimethylethyl)-(Antioxidant No 33, 2,4-DTBP)	206	96-76-4	22	5, 8, 9, 10, 17, 22(3)	6, 7, 13, 14, 15, 16(2), 22, 24	1, 22(2)
	76	Phenol, p-*tert*-butyl-	150	98-54-4	3	n.d.	16(1), 16(2), 22(1)	n.d.
Plasticizer	84	DIOP (diisooctyl phthalate)	390	27554-26-3	24	4, 9, 19(1), 22(2), 24	5, 7, 11, 13, 14, 15, 16(1), 22(1)	1, 8, 10, 17, 21, 22(3)
	86	DOIP (di-*n*-octylisophthalate)	390	137-89-3	13	17	3, 5, 6, 7, 8, 12, 14, 19(1), 21, 24	10
	85	DEHP	390	117-81-7	10	10,17	12, 19(2), 21, 24	16(2), 19(1)

Aditiva v plastech udávají vlastnost plastu

- Flame retardants
- Plasticizers
- Colorants / Pigments
- Slippers
- Anti-shrinking agents
- Antioxidants
- Antistatics
- Flow addtitives
- Anti Counterfieting
- Antimicrobials / Biostabilisers
- Biodegradable Plasticisers
- Blowing Agents
- External Lubricants
- Fragrances
- Heat Stabilisers
- Impact Modifiers
- Internal Lubricants
- Light/UV Stabilisers
- Pigments
- Process Aids
- Reinforcements
- *…among others*

PES, PET, PE, HDPE, PVC, PVDC, LDPE, PP, PS, HIPS, PA, ABS, PC,

Sorbce chemických látek (toxikantů v prostředí) na mikroplasty



Great Pacific Garbage Patch.

This is all bad news because it's surreptitious, hidden plastic pollution, rather than obvious pollution

Forbes

Microplastics Found In The Ocean And In Human Poop

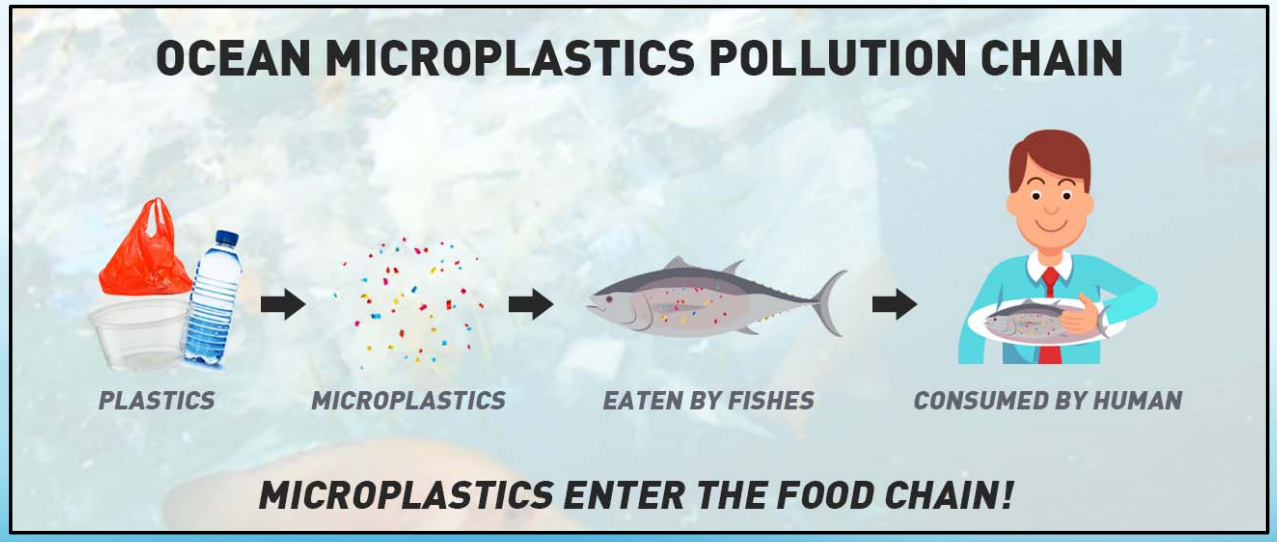
Bruce Y. Lee Senior Contributor ⓘ
Healthcare

Scientists estimate the average American may be eating 50,000 tiny plastic particles a year, and inhaling around the same amount again, although the potential health effects of this are not yet clearly understood.

Mikroplasty v potravinách ?!

MPs v potravinách

- USA, odhad příjmu MPs : **39-52 000 částic za rok / osobu**
- Mořské plody a ryby – mlži (0.2-4 **částic/g**), krevety (0.75), ryby (1-7)
- Nápoje (balená voda), pivo, sůl, konzervované potraviny,



Toussaint, B. *et al.* (2019) '**Review of micro- and nanoplastic contamination in the food chain**',. doi: 10.1080/19440049.2019.1583381.

MPs v potravinách

Kontaminace výrobním procesem

- Pivo: 2-79 vláken/L
  - 12-109 fragmentů /L
  - 2-66 granulí/L
  - 0-14,3 částic/L
- Minerální voda:
  - 2-44 částic/L lahve na jedno použití
  - 28-241 č./L znova použitelné lahve
  - 4-156 č./L skleněné lahve
  - 5-20 č./L Tetrapac
- Mořská sůl:
  - 1-681 č./kg

Table 2
Summary of studies reporting the occurrence of microplastics in other food items and drinking water.

Item	Levels of mp		Size range	Types of debris	Location	Source
Other food items						
Beer	24; 100%	2–79 fibers L^{-1}, 12–109 fragments L^{-1} 2–66 granules L^{-1}	Not specified	Fibers, fragments, granules	Germany *From local supermarkets*	Liebezeit and Liebezeit (2014)
	12; 100%	0–14.3 particles/L	100–5000 µm	Fibers, fragments	USA *Purchased from Minneapolis, Duluth, Alpena, Michigan and Rochester (liquor stores, breweries)*	Kosuth et al. (2018)
Honey	19; 100%	166 ± 147 fibers/kg of honey 9 ± 9 fragments/kg of honey	10–20 µm	Fibers, fragments	Germany, France, Italy, Spain and Mexico *From local supermarkets or producers*	Liebezeit and Liebezeit (2013)
Sugar	5; 100%	217 ± 123 fibers/kg of sugar 32 ± 7 fragments/kg of sugar	10–20 µm	Fibers, fragments	*From local supermarkets*	
Salt	15; 100%	550–681 particles/kg of sea salts 43–364 particles/kg of lake salts 7–204 particles/kg of rock/well salts	45–4300 µm	Fragments, fibers, pellets, sheets	China *From local supermarkets*	Yang et al. (2015)
	17; 94%	1–10 particles/kg of salt	> 149 µm	Fragments, filaments, films	Australia, France, Iran, Japan, Malaysia, New Zealand, Portugal, South Africa *From local supermarkets*	Karami et al. (2017b)
	21; 100%	50–280 particles/kg of salt	10–3500 µm	Fibers	Spanish salt producers	Iñiguez et al. (2017)
	16; 100%	16–84 item/kg in sea salt 8–102 item/kg in lake salt 9–16 item/kg in rock salt	20–5000 µm	Fibers, fragments, films	Turkish *From local supermarkets*	Gündoğdu (2018)
	12; 100%	46.7–806 particles/kg of salt	100–5000 µm	Fibers, fragments	USA *Purchased from grocery stores and specialty shops in* Minneapolis (Salt ID – North Sea Salt; Celtic Sea salt; Sicilian Sea Salt; Mediterranean Sea Salt; Utah Sea Salt; Himalayan Rock Salt; Hawaiian Sea Salt; Baja Sea Salt; Atlantic Sea Salt; Pacific Sea Salt)	Kosuth et al. (2018)
Canned sardines and sprats	20; 20%	not specified	190–3800 µm	Fragments, filaments, films	Purchased from Australian and Malaysian markets and manufactured in Canada, Germany, Iran, Japan, Latvia, Malaysia, Morocco, Poland, Portugal, Russia, Scotland, Thailand, and Vietnam	Karami et al. (2018)
Drinking water						
Mineral water	38, 100%	2–44 particles/L in single-use plastic bottles 28–241 particles/L in returnable plastic bottles 4–156 particles/L in glass bottles 5–20 particles/L in beverage cartons	1–500 µm	Fragments	Grocery stores from Germany	Schymanski et al. (2018)
Tap water and bottle water*	159; 81%	0–61 particles/L	100–5000 µm	Fibers, fragments, films	Cuba, Ecuador, England, France, Germany, India, Indonesia, Ireland, Italy, Lebanon, Slovakia, Switzerland, Uganda, USA *From USA	Kosuth et al. (2018)

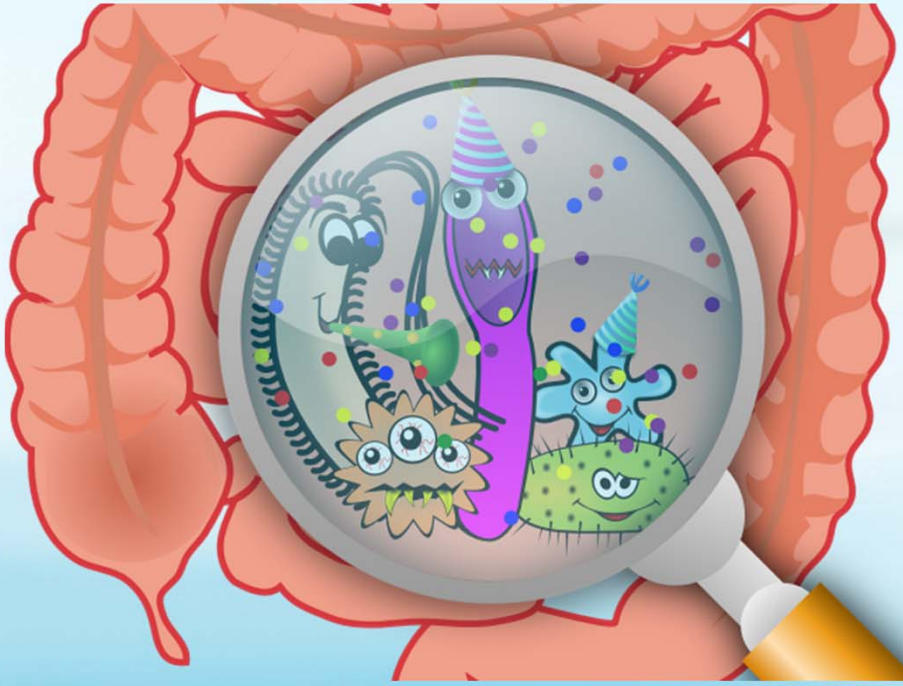
Barboza, L. G. A. *et al.* (2018) '**Marine microplastic debris: An emerging issue for food security, food safety and human health**', *Marine Pollution Bulletin*, 133, pp. 336–348. doi: 10.1016/j.marpolbul.2018.05.047.

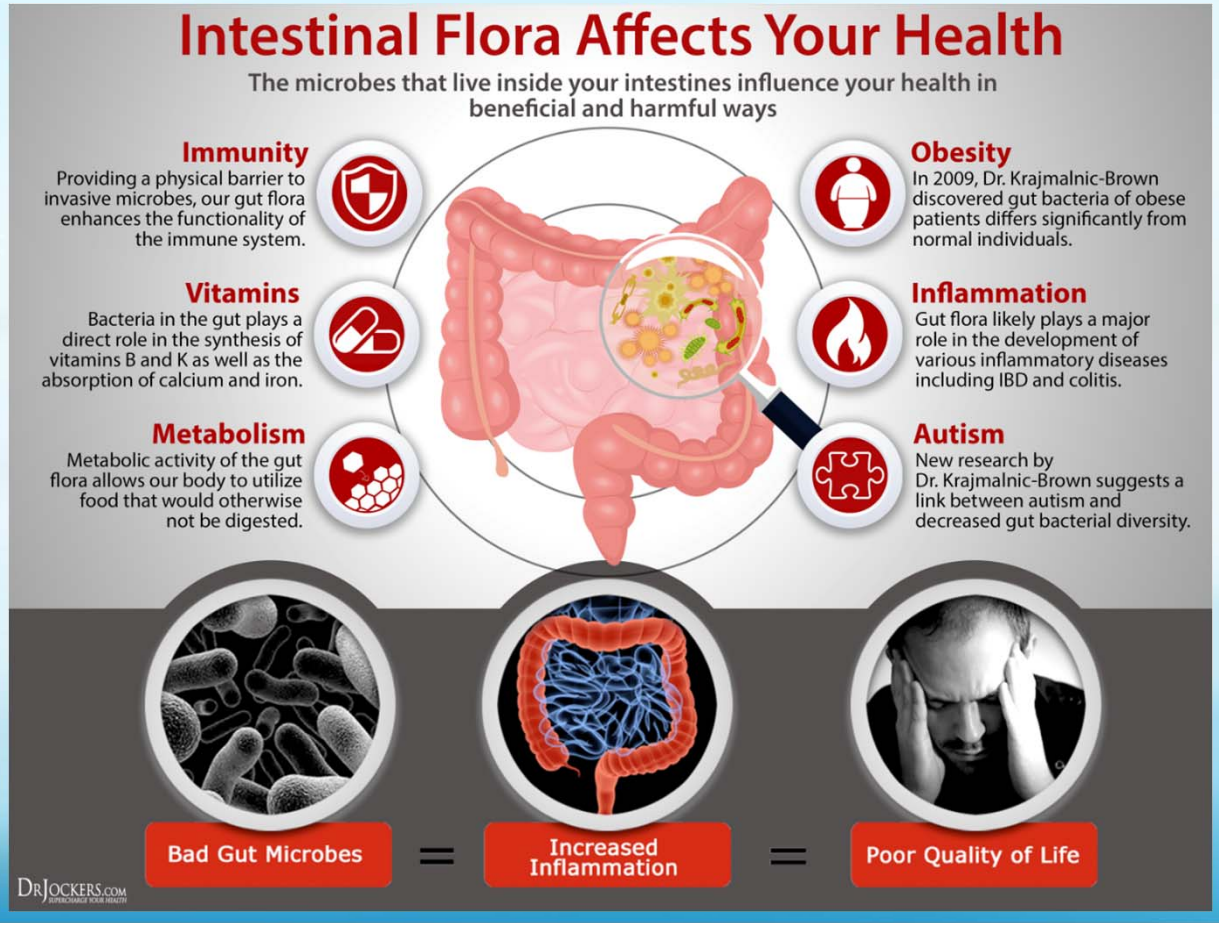
Rakousko

Dobrovolníci - 33 - 65 let

20 mikroplastů na 10 g 💩

Nejčastěji polypropylene a polyethylene a terephthalate





Mikroplasty mohou migrovat v těle

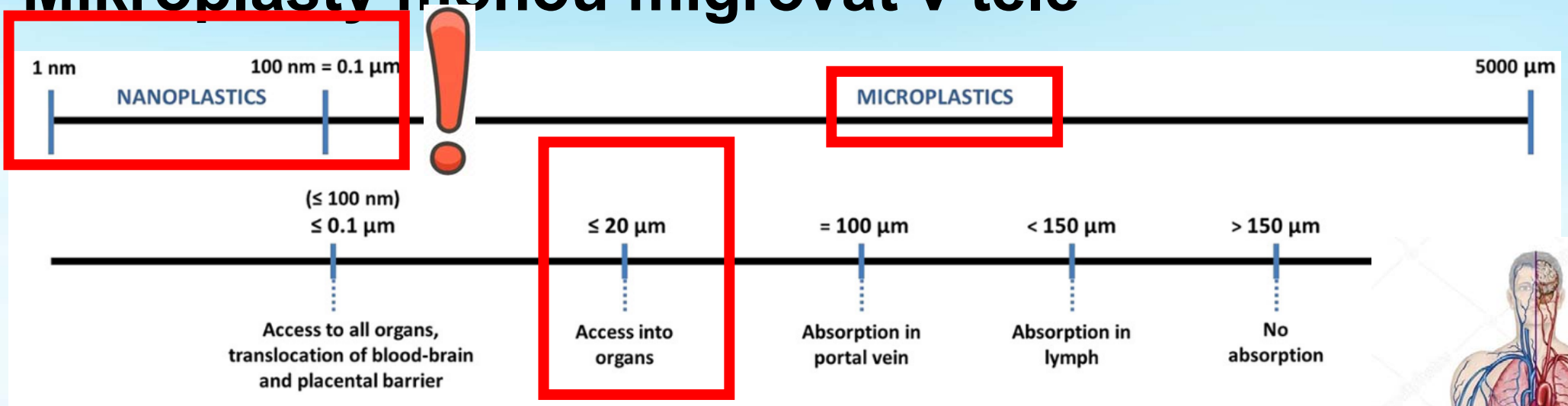
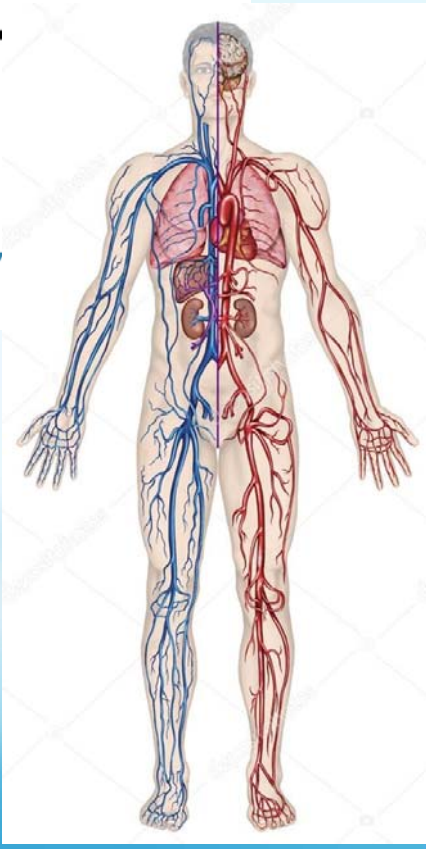
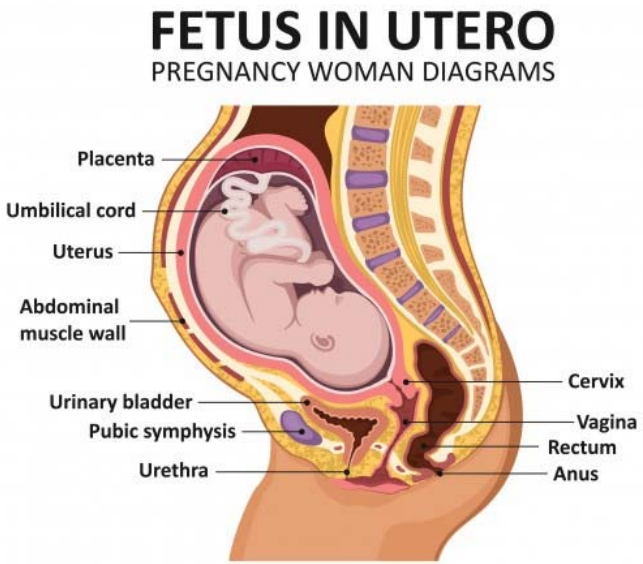
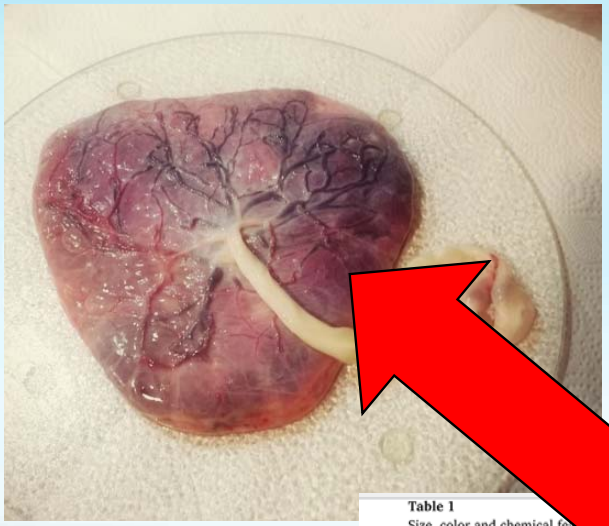


Fig. 1. Fate of micro- and nanoplastics in mammalian bodies (adapted from Lusher et al., 2017



Mikroplasty mohou migrovat v těle.





Částice vdechnuty? Jídlem?
Analyzováno 4% placenty

4 z 6 placent pozitivní na MPs, - 12 MPs fragmentů

Ragusa, A. *et al.* (2021) '**Plasticenta: First evidence of microplastics in human placenta**', *Environment International*. Elsevier Ltd, 146, p. 106274. doi: 10.1016/j.envint.2020.106274.

Table 1
Size, color and chemical fea… …ected microplastics and relative pigments, together with information regarding the placenta portion in which they were found (fetal side FS; maternal s… …d chorioamnio membrane CAM; not defined n.d.; Hit Quality Index HQI).

Particle	Placenta Portion	Microparticles			Pigment		
		Size	Color	Polymer matrix	Generic name	Molecular formula and IUPAC name	HQI
#1	FS	~10 μm	Orange	n.d.	Iron hydroxide oxide yellow (Pigment Yellow 43; C.I. Constitution 77492)	FeO(OH) iron(III) oxide hydroxide	89.97
#2	CAM	~10 μm	Blue	Polypropylene	Copper phthalocyanine (Pigment Blue 15; C.I. Constitution 74160)	$C_{32}H_{16}CuN_8$ (29H,31H-phthalocyaninato(2 −)-N29,N30,N31,N32)copper(II)	82.86
#3	FS	~10 μm	Blue	n.d.	Phthalocyanine Blue BN (Pigment Blue 16; C.I. Constitution 74100)	$C_{32}H_{18}N_8$29H,31H-phthalocyanine	89.16
#4	MS	~10 μm	Dark blue	n.d.	Violanthrone (Pigment Blue 65; C. I. Constitution 59800)	$C_{34}H_{16}O_2$Anthra[9,1,2-cde]benzo[rst]pentaphene-5,10-dione	86.44
#5	MS	~5 μm	Blue	Polypropylene	Copper phthalocyanine (Pigment Blue 15; C.I. Constitution 74160)	$C_{32}H_{16}CuN_8$ (29H,31H-phthalocyaninato(2−)-N29,N30,N31, N32)copper(II)	86.15
#6	MS	~10 μm	Red	n.d.	Diiron trioxide (Pigment Red 101/102; C.I. Constitution 77491)	Fe_2O_3 Oxo(oxoferriooxy)iron	83.65
#7	MS	~10 μm	Red	n.d.	Diiron trioxide (Pigment Red 101/102; C.I. Constitution 77491)	Fe_2O_3Oxo(oxoferriooxy)iron	89.80
#8	CAM	~5 μm	Dark blue	n.d.	Pigment Direct Blue 80	$C_{32}H_{14}Cu_2N_4Na_4O_{16}S_4$ Dicopper,tetrasodium,3-oxido-4-[[2-oxido-4-[3-oxido-4-[(2-oxido-3,6-disulfonatonaphthalen-1-yl)diazenyl] phenyl]phenyl] diazenyl]naphthalene-2,7-disulfonate	84.55
#9	CAM	~10 μm	Dark blue	n.d.	Ultramarine Blue (Pigment Blue 29; C.I. Constitution 77007)	$Al_6Na_8O_{24}S_2Si_6$ Aluminium Sodium orthosilicate trisulfane-1,3-diide	91.96
#10	FS	~10 μm	Blue	Polypropylene	Copper phthalocyanine (Pigment Blue 15; C.I. Constitution 74160)	$C_{32}H_{16}CuN_8$ (29H,31H-phthalocyaninato(2−)-N29,N30,N31, N32)copper(II)	80.60
#11	FS	~10 μm	Violet	Polypropylene	Hostopen violet (Pigment Violet 23; C.I. Constitution 51319)	$C_{34}H_{22}Cl_2N_4O_2$ 8,18-Dichloro-5,15-diethyl-5,15-dihydrodiindolo(3,2-b:3′,2′-m) tri- phenodioxazine	80.92
#12	FS	~10 μm	Pink	n.d.	Novoperm Bordeaux HF3R (Pigment Violet 32; C.I. Constitution 12517)	$C_{27}H_{24}N_6O_7S$ 4-[(E)-2-[2,5-dimethoxy-4-(methylsulfamoyl)phenyl]diazen-1-yl]-3-hydroxy-N-(2-oxo-2,3-dihydro-1H-1,3-benzodiazol-5-yl) naphthalene-2-carboxamide	84.57

Nanoplasty

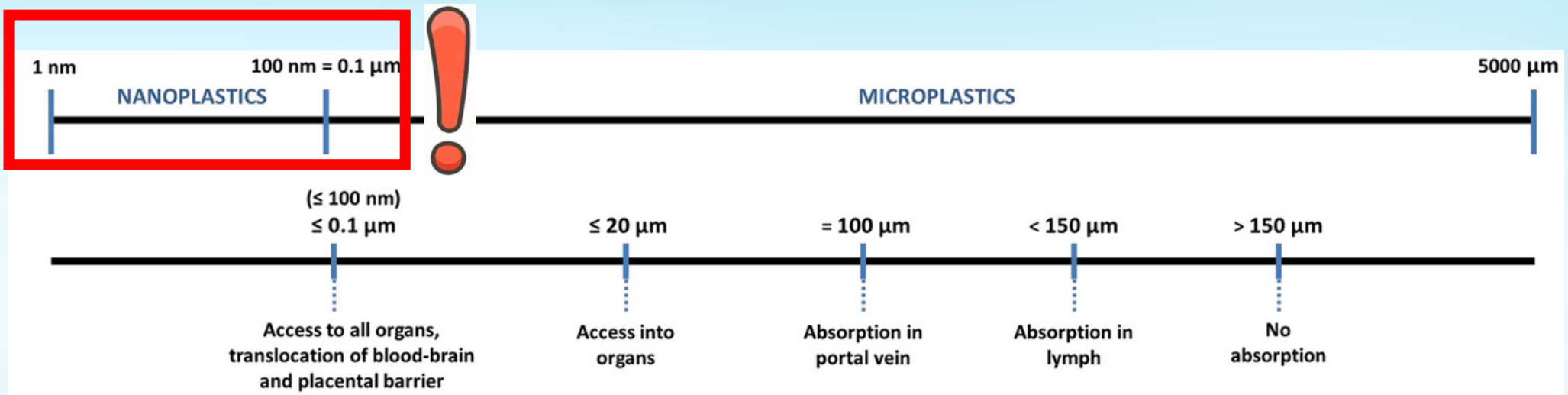
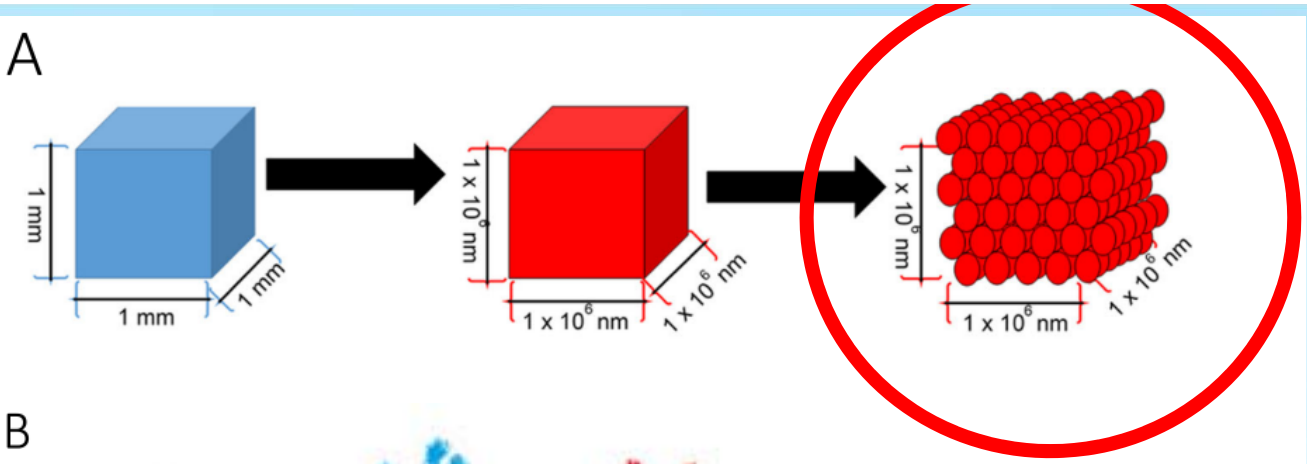
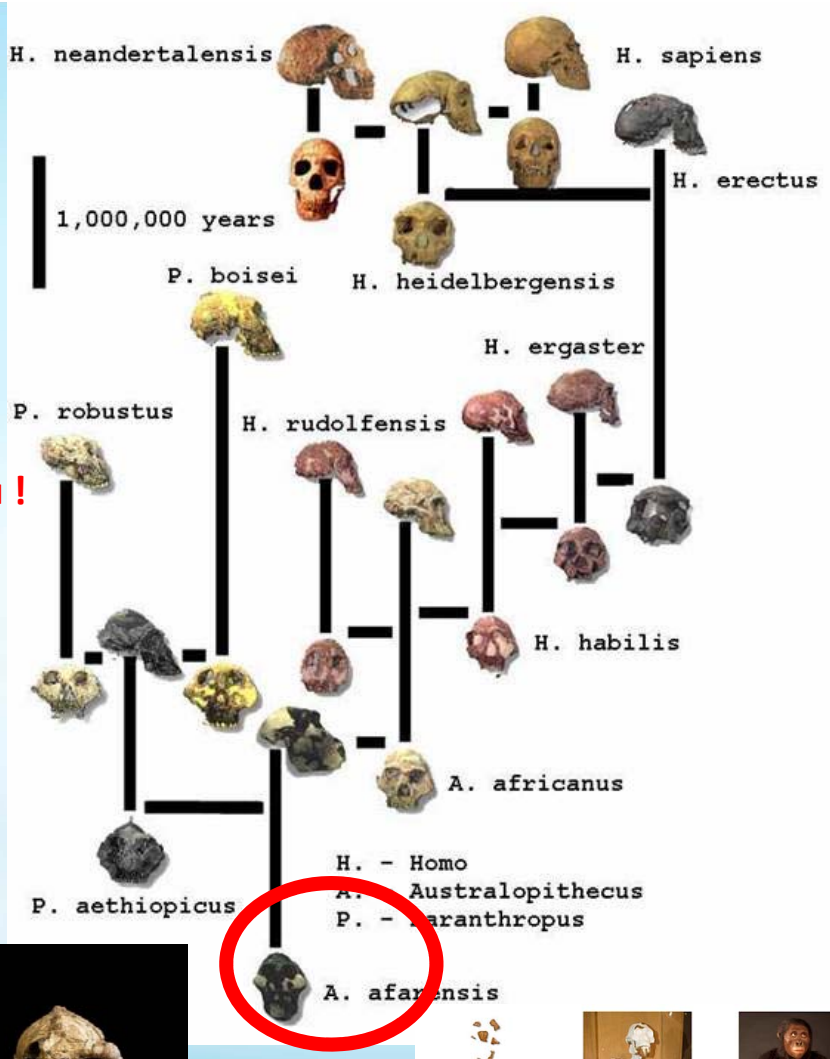


Fig. 1. Fate of micro- and nanoplastics in mammalian bodies (adapted from Lusher et al., 2017).



Ilustrační obrázek není v měřítku !

Krychle 1.000.000 x 1.000.000 x 1.000.000 částic



10^{14} Sekund - jak dlouhá doba to je?

10^{14} Sekund = ~3.2 miliónu let

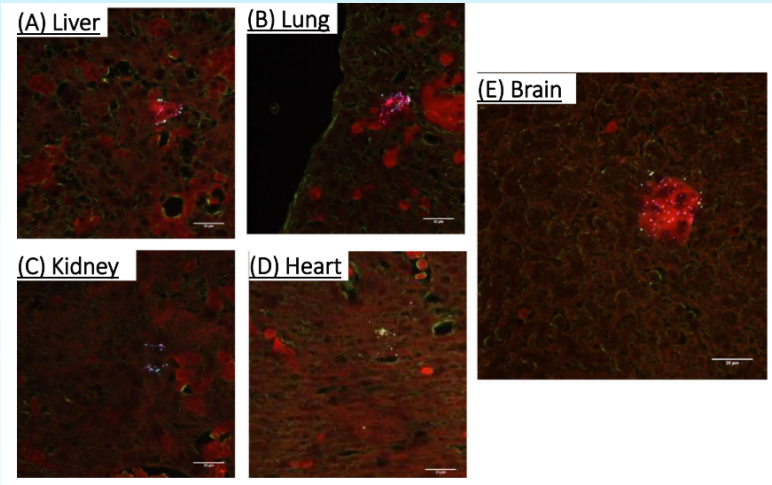
Nanoplasty mohou procházet biologické bariéry

Fournier, S. B. *et al.* (2020) '**Nanopolystyrene translocation and fetal deposition after acute lung exposure during late-stage pregnancy**', *Particle and Fibre Toxicology*, 17(1), p. 55. doi: 10.1186/s12989-020-00385-9.

Inhalace 20 nm nanopolystyrene beads (2.64 × 10^{14} particles), Gravidní samice (19.den)

…za 24 hodin

V plodu:



- Nanopolystyrene: **matka** – Plíce, srdce, slezina. **Plod** - placenta, játra, plíce, srdce, ledvina, mozek.
- **Placenta neblokuje přechod nanoplastů do plodu !**
- Exponované plody - menší porodní váha

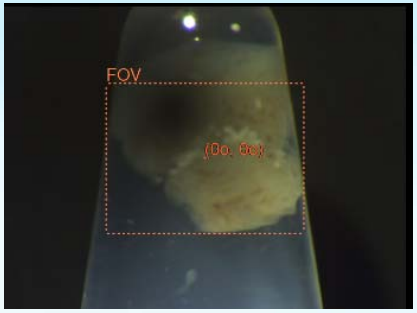
Prof Phoebe Stapleton, at Rutgers University, who led the rat research, said: "***We found the plastic nanoparticles everywhere we looked – in the maternal tissues, in the placenta and in the foetal tissues. We found them in the foetal heart, brain, lungs, liver and kidney.***"

Analýza MP počítačovou tomografií (MU, VUT CEITEC)

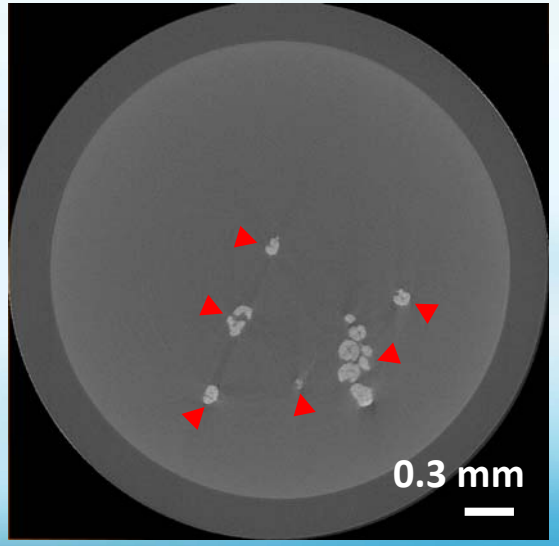
- High resolution X-ray computed tomography for analysis of MPs in human tissues
- Unique CT system Rigaku nano3DX with minimal pixel size 270 nm
- Analysis of the whole 3-D sample volume

Rigaku nano3DX

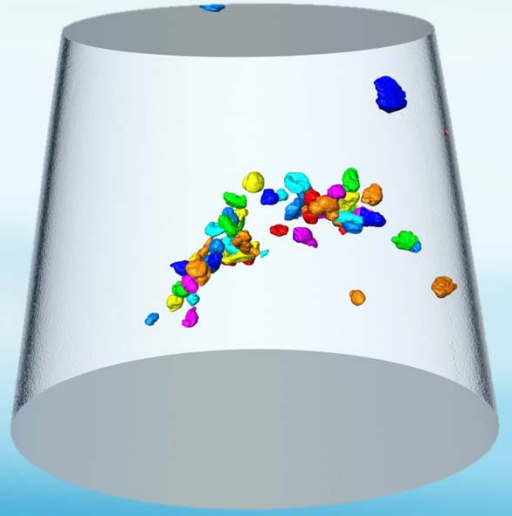
MPs in tissue



Tomographic slice



3-D render of the MPs



CEITEC

CTLAB X-ray Computed Tomography

More about the lab at:

http://ctlab.cz/

Regulace MP, plánovaná opatření

- USA, Kanada, Nový Zéland, Taiwan, J. Korea, Francie – omezení MP v kosmetice

ECHA
EUROPEAN CHEMICALS AGENCY

- ECHA- Evropská agentura pro chemické látky
  - od r.2019 příprava regulace MPs
  - **r.2022 omezení MP v výrobcích uváděných na trh EU** (kosmetika, detergenty, čistící prostředky, barviva, v ropném průmyslu….)

U.S. the Microbeads Free Waters Act, **r.2015**

- **Jenom "rinse-off"** kosmetika, vše ostatní povoleno např. opalovací krémy…..

	Timing
Intention to prepare restriction dossier	17 January 2018
Call for evidence	1 March - 1 May 2018
Stakeholder workshop	30 - 31 May 2018
Submission of restriction dossier	11 January 2019
Public consultation of the Annex XV dossier	20 March 2019 – 20 September 2019
RAC opinion	June 2020
Draft SEAC opinion	June 2020
Consultation on draft SEAC opinion	1 July - 1 September 2020
Combined final opinion submitted to the Commission	February 2021
Draft amendment to the Annex XVII (draft restriction) by Commission	Within 3 months of receipt of opinions
Discussions with Member State authorities and vote	2021
Scrutiny by Council and European Parliament	Before adoption (3 months)
Restriction adopted (if agreed)	2021 or 2022 (transition periods are proposed for certain applications)

Závěrem.....

.....není plast jako plast

Vše co je plast, bude jednou mikroplast, nanoplast.....

European Commission

MASARYKOVA UNIVERZITA

Research centre for toxic compounds in the environment

Děkuji za pozornost