Mikroplast i sjømat

18.04.2024

Plastfloken

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Politisk insentiv

- UN Bærekraftsmålene
- Marine Strategy Framework Directive (MSFD), descriptor 10 → Commission Decision on Good Environmental Status:

-quod erat demonstrantum

  - "The amount of litter and micro-litter ingested by marine animals is at a level that does not adversely affect the health of the species concerned."
  - Analyse for kjemisk identitet (e.g. FTIR) i indikatorarter (fisk, sel/hval og krepsdyr, skjell, og havskilpadder) av partikkler 20 µm - 5 mm
  - Foreslåtte protokoller, beskrevet å ha lav status av modenhet (Galgani 2023).

- UNEA: Internasjonalt bindende instrument for å redusere plastforurensing
  - INC-3 (Intergovernmental Negotiating Committee): Zero draft of Treaty, Nairobi Nov 2023:"ensuring food safety", og spesifisert at det skal ikke være skadelig for mennesker, dyre- eller plantelivet. https://wedocs.unep.org/bitstream/handle/20.500.11822/43239/ZERODRAFT.pdf
  - INC-4: revisjon: 23. – 29. April 2024, Ottawa

Risiko = Effekt x eksponering

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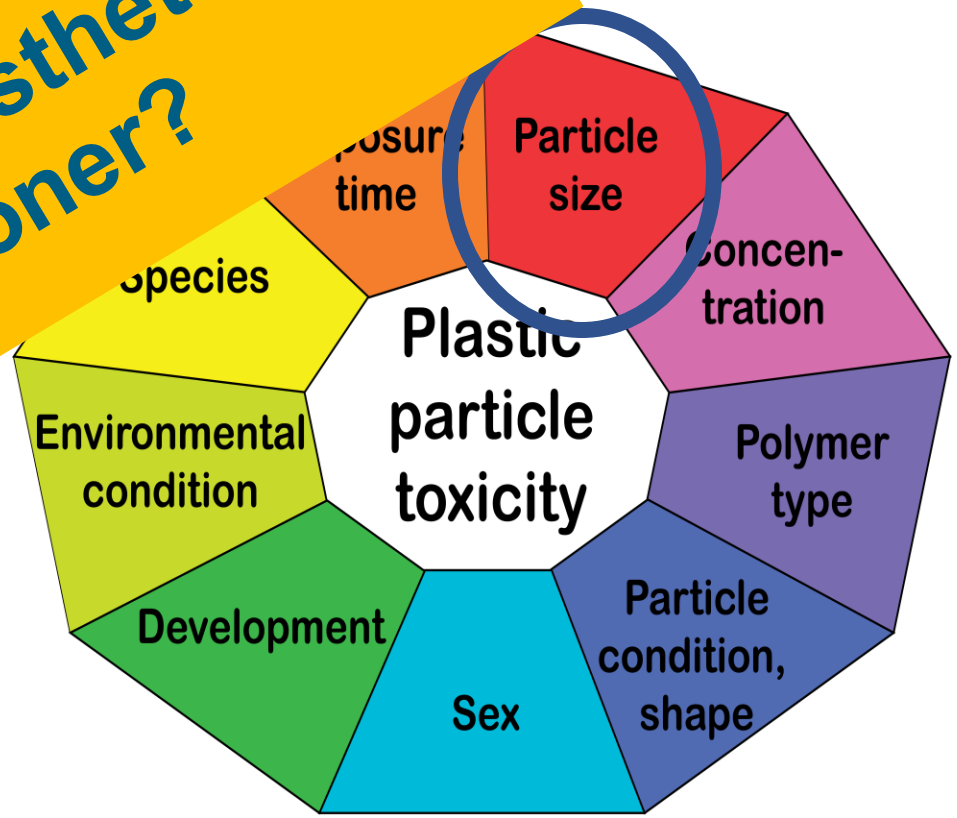
Effekter i sjømatorganismer	N >10 µm	N <10
Redusert vekst, energi, overlevelse o aktivitet		
Fysiologisk stress, hormon		
Celledød, toksisitet		11
Utvikling forst		6
Endret f	3	7

Reduserer mikroplast robustheten av sjømatart populasjoner?



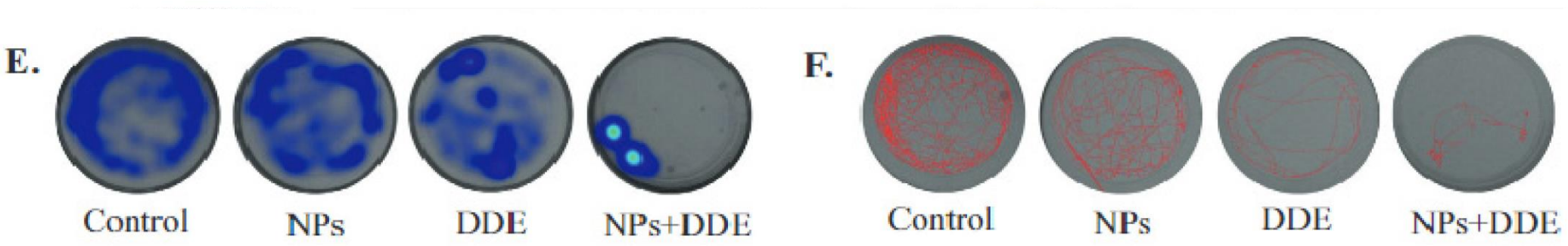
Kögel et al. 2020 Micro-and nanoplastic toxicity on aquatic life: Determining factors, STOTEN.

Eksponering av lakseyngel

Med PP, størrelsesfordeling omtrent som funnet i miljøet

Shubham Vashney, André Bienfait, Tanja Kögel, Pål Olsvik, Alice Refosco, Kiron Viswanath, Robin Ørnsrud: Samarbeid HI, Nord-Universitet

Ingen effekt av nanopolystyren (nPS) alene, men nPS øker DDE toksisitet. Ny effekt: DDE kombinert med nPS: Redusert bevegelse! DDE=nedbrytningsprodukt av DDT, opphopet i naturen.



Polystyrene nanoplastics enhance the toxicological effects of DDE in zebrafish (*Danio rerio*) larvae

Shubham Varshney [a], Adnan H. Gora [a], Viswanath Kiron [a], Prabhugouda Siriyappagouder [a], Dalia Dal
Tanja Kögel [b,c], Robin Ørnsrud [b], Pål A. Olsvik [a,b,*]

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[b] *Institute of Marine Research, Bergen, Norway*
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6-PPD-q, PCB…

Science

REPORTS

Cite as: Z. Tian *et al.*, *Science* 10.1126/science.abd6951 (2020).

A ubiquitous tire rubber–derived chemical induces acute mortality in coho salmon

Zhenyu Tian[1,2], Haoqi Zhao[3], Katherine T. Peter[1,2], Melissa Gonzalez[1,2], Jill Wetzel[4], Christopher Wu[1,2], Ximin Hu[3], Jasmine Prat[4], Emma Mudrock[4], Rachel Hettinger[1,2], Allan E. Cortina[1,2], Rajshree Ghosh Biswas[5], Flávio Vinicius Crizóstomo Kock[5], Ronald Soong[5], Amy Jenne[5], Bowen Du[6], Fan Hou[3], Huan He[3], Rachel Lundeen[1,2], Alicia Gilbreath[7], Rebecca Sutton[7], Nathaniel L. Scholz[8], Jay W. Davis[9], Michael C. Dodd[3], Andre Simpson[5], Jenifer K. McIntyre[4], Edward P. Kolodziej[1,2,3]*

[1]Center for Urban Waters, Tacoma, WA 98421, USA. [2]Interdisciplinary Arts and Sciences, University of Washington Tacoma, Tacoma, WA 98421, USA. [3]Department of Civil and Environmental Engineering, University of Washington, Seattle, WA 98195, USA. [4]School of the Environment, Washington State University, Puyallup, WA 98371, USA. [5]Department of Chemistry, University of Toronto, Scarborough Campus, 1265 Military Trail, Toronto, ON M1C1A4, Canada. [6]Southern California Coastal Water Research Project, Costa Mesa, CA 92626, USA. [7]San Francisco Estuary Institute, 4911 Central Avenue, Richmond, CA 94804, USA. [8]Environmental and Fisheries Sciences Division, Northwest Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Seattle, WA 98112, USA. [9]United States Fish and Wildlife Service, Washington Fish and Wildlife Office, Lacey, WA 98503, USA.

***Corresponding author. Email: koloj@uw.edu**

In U.S. Pacific Northwest coho salmon (*Oncorhynchus kisutch*), stormwater exposure annually causes unexplained acute mortality when adult salmon migrate to urban creeks to reproduce. By investigating this phenomenon, we identified a highly toxic quinone transformation product of N-(1,3-dimethylbutyl)-N'-phenyl-p-phenylenediamine) (6PPD), a globally ubiquitous tire rubber antioxidant. Retrospective analysis of representative roadway runoff and stormwater-impacted creeks of the U.S. West Coast indicated widespread occurrence of 6PPD-quinone (<0.3-19 μg/L) at toxic concentrations (LC_{50} of 0.8 ± 0.16 μg/L). These results reveal unanticipated risks of 6PPD antioxidants to an aquatic species and imply toxicological relevance for dissipated tire rubber residues.

Risiko = Effekt x eksponering

Forekomst av mikroplast i spiselig vev

- Europa, Kina, India, USA, Midtøsten
- Skjell, krepsdyr, hel fisk, fiskelever, fiskemuskel, kjøtt
- 0.02 (Martinelli et al. 2020)-10.5 (Li et al. 2015) MP per g

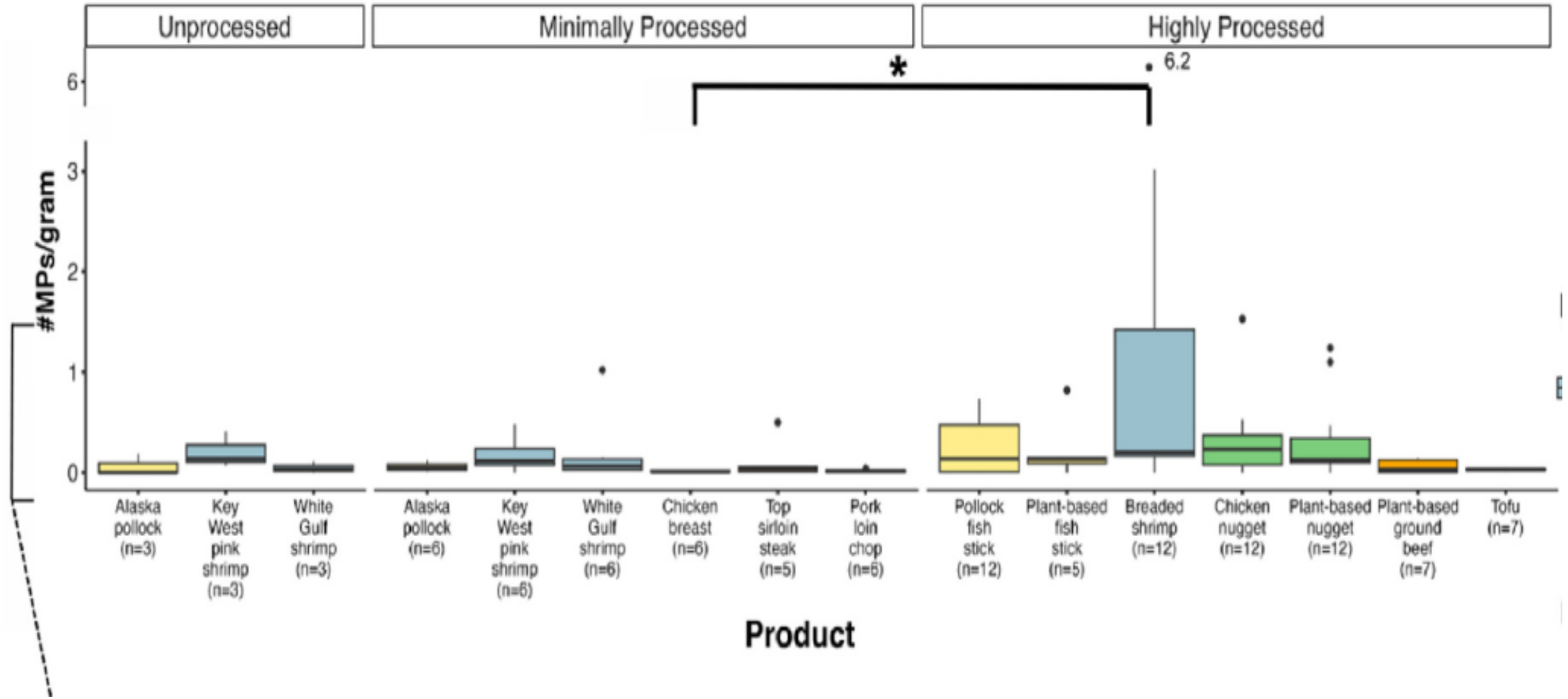
- Hva sier disse tallene?
- Flere oppsummeringer, men er datasettene moden til det?

MP in Arctic fish

Species	FO [%]	MP [N] per individual	Lower detection limit	Methodology	Reference
Polar cod	2.8	0-1	>35 µm	Stomach content, visual inspection, suspected MP by FT-IR, fibers not included	(Kühn, Schaafsma et al. 2018)
Polar cod	18, 34	0-1	>700 µm	GI-tract and content alkaline digested, visual inspection, >700 µm by FT-IR	(Morgana, Ghigliotti et al. 2018)
Atlantic cod	0	n/a	>3.2 mm	Stomach content, visual inspection, suspected MP by FT-IR	(Brate, Eidsvoll et al. 2016)
Atlantic cod Saithe	20.5, 17.4	0.23, 0.28	>80 µm	GI-tract and content alkaline digested, visual inspection, FT-IR	(de Vries, Govoni et al. 2020)
Greenland cod	100	12 ±6	>20 µm	GI tract, visual and FT-IR on selected particles	(Granberg, von Friesen et al. 2020)
Greenland shark	3.33	0-1	>1 mm	Stomach content, visual examination	(Nielsen, Hedeholm et al. 2014)
Greenland shark	45	NN	>1 mm	Stomach content, visual examination	(Leclerc, Lydersen et al. 2012)

LITTER AND MICROPLASTICS MONITORING GUIDELINES ARCTIC MONITORING & ASSESSMENT PROGRAMME version 1.0 https://www.amap.no/documents/download/6761/inline

The abundance of microplastics was significantly greater in pre-cooked mussels with 1.4 particles/g compared to fresh mussels with 0.9 particles/g (Li et al. 2018)



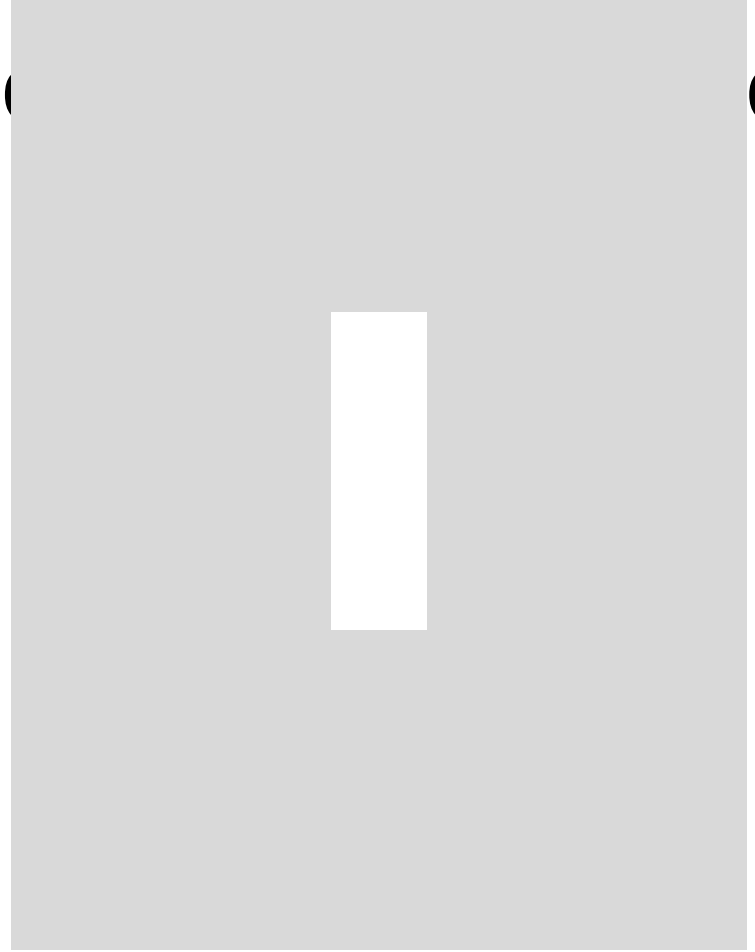
Published uptake estimates

Fish: 112 to 842 particles/year according to the EFSA and from 518 to 3078 particles/year/per capita according to the EUMOFA and NOAA (Barboza et al. 2020).

European countries, depending on bivalve consumption rates: 1800 to 11,000 particles/year/per capita (Van Cauwenberghe et al. 2014)

U.S. adults:11,000 ± 29,000 (median = 4300) MPs/year (combination of the 13 protein products tested with a range of 0–840,000 MP/year (Milne et al. 2024) (>50 µm).

Salm en ➡



T Kögel, BE Grøsvik et al., unpublished - do not share

Unpublished – do not share
T Kögel et al.

FHF project: NORCE (M. Haave, A. Gomiero, K. B. Øysæd), IMR (T. Kögel, Ø. Bjorøy) and NILU (D. Herzke, V. Nikiforov). Industry partners and reference group: Lerøy, Blue Planet AS, NCE Seafood Innovation Cluster, Veterinary institute.
https://www.hi.no/resources/Salmodetect-report-final.pdf

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Contents lists available at ScienceDirect

Marine Pollution Bulletin

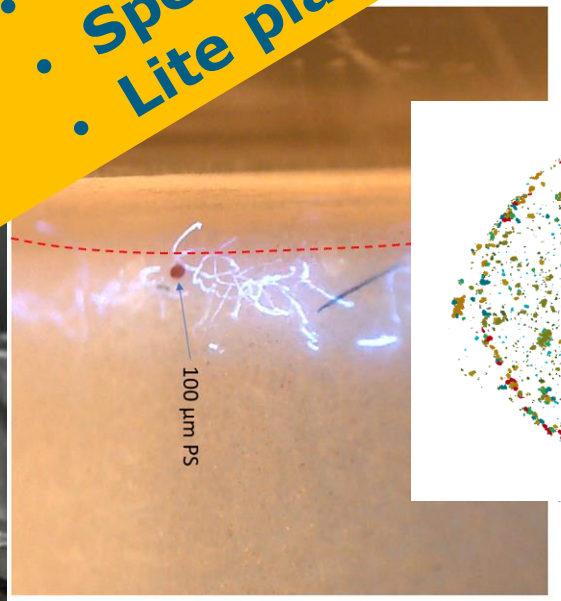
journal homepage: www.elsevier.com/locate/marpolbul

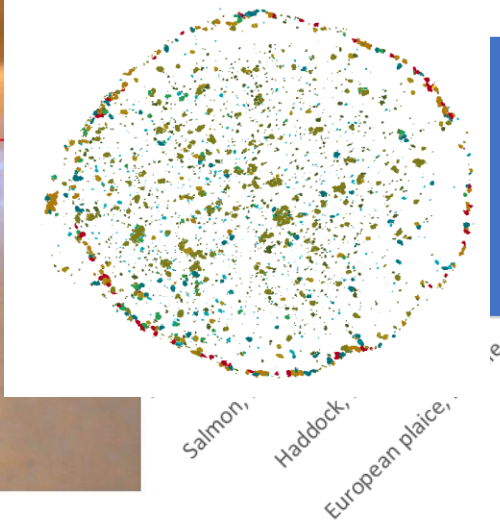
Quick and efficient microplastic isolation from fatty fish tissues by surfactant-enhanced alkaline digestion

Helge Torbjørn Bull Hove [a,1], Thomas Næsheim [a,b], Tanja Kögel [a,*]

[a] Institute of Marine Research, P.O. Box 1870 Nordnes, 5817 Bergen, Norway
[b] EUROFINS, Sandviksveien 110, 5035 Bergen, Norway

pH	Salmon, muscle	Haddock, muscle	European plaice, muscle	Cod, muscle
2.5				
3.5				
4.5				
5.5				
6.5				

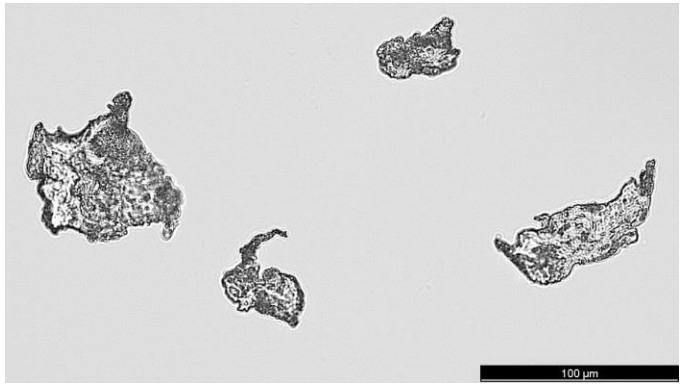




Renlaboratorium
- **Overtrykk med sluse**
- **HEPA Luftfiltrering**
- **Spesialklær, hår i hestehale**
- **Lite plast**

https://laboratorier.hi.no/plastlab/

Recovery %	Test 1	Test 2	Test 3	mean	STDEV
PE	85	75	99	86	12.1
PP	94	82	114	97	16.2
PS	101	97	111	103	7.2
PVC	93	81	112	95	15.6
PET	55	92	79	75	18.8
PC	26	72	62	53	24.2
PA	58	64	58	60	3.5
PMMA	36	93	67	65	28.5



Alice Refosco, Andre Bienfait, Jennifer Gjerde, Tanja Kögel, unpublished – do not share without consent

Risiko = Effekt x eksponering

Hva trenger man for en risiko analyse?

- Konsentrasjon av kontaminanten i vev av sjømat
  - Kjemisk idenditet

  og størrelsesfraksjon og form

  Måleusikkerhet: x mg/kg ± x mg/kg

sammenligning

  - Toksisitet ved langtidseksponering

  i forhold til størrelse og form

Tilsettingsstoffer og produksjonsrester

→ Lekker ut
Ofte ikke merket på produktet
Gjennomsnittlig 4% av vekten

Tilsettingsstoff, NIAS (non intentionally added substances), overflatebehandling

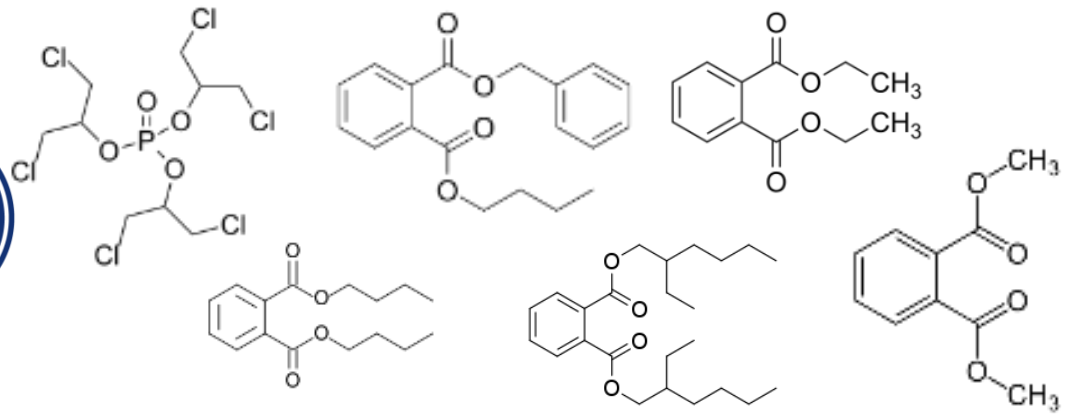
(Campanale et al., 2020; Espinosa Ruiz et al., 2016; Fred-Ahmadu et al., 2020; Kwon et al., 2017).

For eksempel: Rest-monomerer, reaksjonsbiprodukter, katalysatorer, mykgjørere (phtalater, BPx), nonylfenol (thermoresistens), UV-stabilisatorer, antioksidanter, PFAS, flammehemmere, biocider, fargestoffer.

Plast Chem Project NTNU: publisert 2024 (https://zenodo.org/records/10701706): Prioritert liste av 18 000 kjemikalier etter

persistens, bioakkumulering, mobilitet og toksisitet

- 66% ukjent toksisitet



Navn	Bruk	Forkortelse	Formel
Benzyl butyl phthalate	Plast (Gulv, plastskum, tepper)	BBP	$C_{19}H_{20}O_4$
Bis(2-ethylhexyl) phthalate	PVC (leker, møbel, dusjforheng, lim, overflater)	DEHP	$C_{24}H_{38}O_4$
Dibutyl phthalate	Plast, elastomer, lakk, sprengstoff, blekk, lim, overflater	DBP	$C_{16}H_{22}O_4$
Diethyl phthalate	Plast (matforpakning), kosmetikk, aspirin	DEP	$C_{12}H_{14}O_4$
Dimethyl phthalate	Plast, kosmetikk, insekt frastøtende, lakk	DMP	$C_{10}H_{10}O_4$
tris(chloropropyl)phosphate	PU flammehemmer	TCPP	$C_9H_{18}Cl_3O_4P$

Vanavermaete *et al.*
Microplastics and Nanoplastics (2024) 4:6
https://doi.org/10.1186/s43591-024-00083-9

Microplastics and Nanoplastics

REVIEW **Open Access**

Plastics in biota: technological readiness level of current methodologies

David Vanavermaete[1], Amy Lusher[2], Jakob Strand[3], Esteban Abad[4], Marinella Farré[4], Emilie Kallenbach[5], Michael Dekimpe[1], Katrien Verlé[1], Sebastian Primpke[6], Stefano Aliani[7] and Bavo De Witte[1*]

systematic review, reproducible analytical pipelines were examined and the technological readiness levels were assessed (for monitoring)

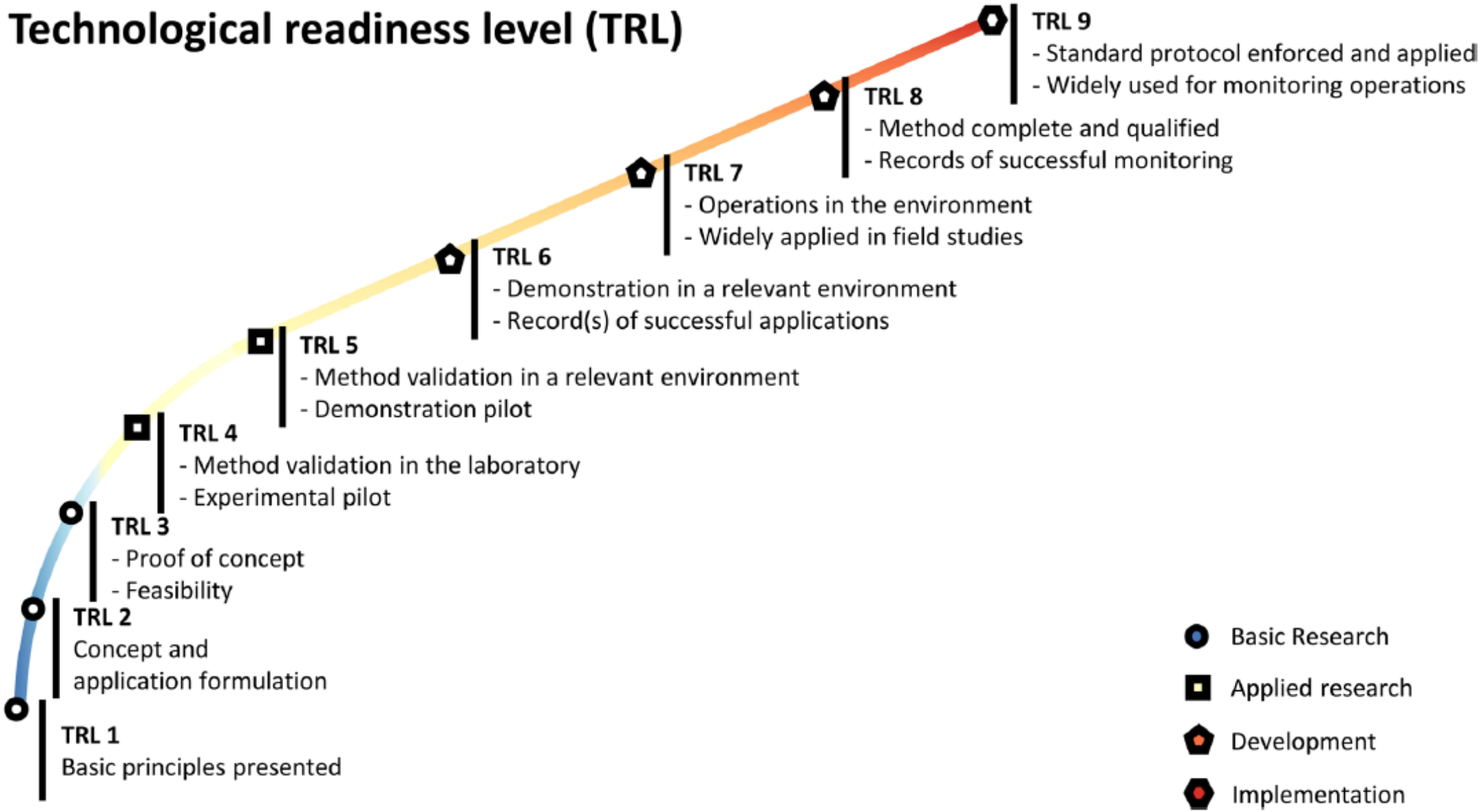


Fig. 2 Overview the the different technological readiness levels as defined by [2]

BASEMAN

MICROPLASTICS ANALYSES
IN EUROPEAN WATERS

DET KONGELIGE
NÆRINGS- OG FISKERIDEPARTEMENT

FACTS

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