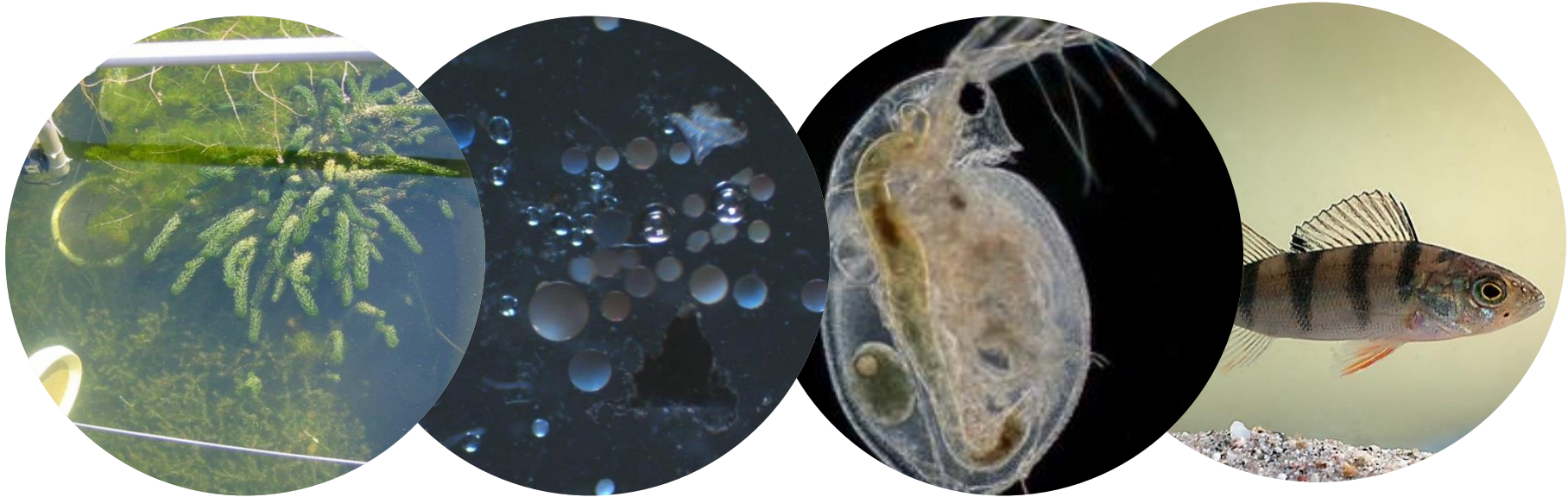


Microplastics en vis

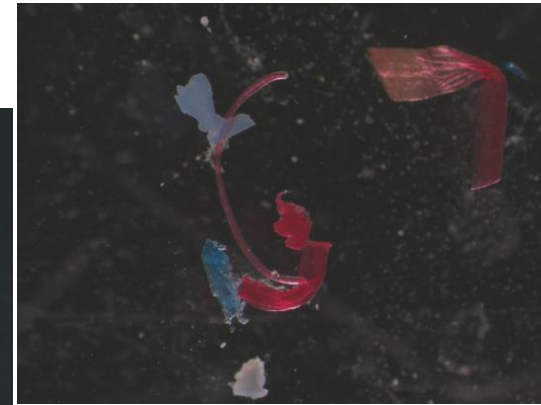
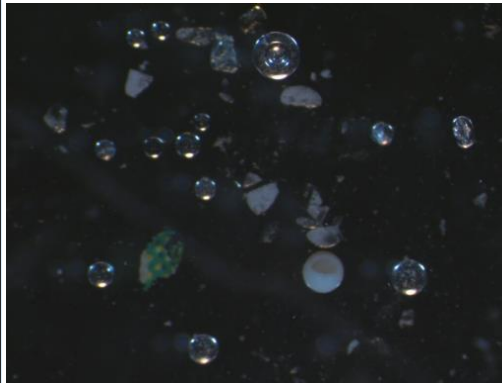
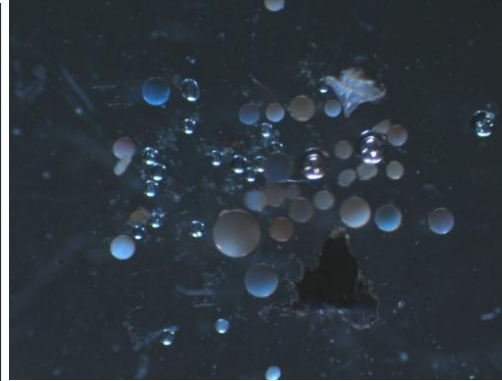
Edwin Foekema (edwin.foekema@wur.nl)



- Microplastics in water
- Microplastics in vis
- Hoeveel last heeft de vis ervan?

Microplastics in zoetwater

Locatietype	$\geq 300 \mu\text{m}$ range (n/m ³)
RWZI influent	<10 - <25
RWZI effluent	2.2 - 9.6
Bovenstrooms RWZI	<0.2 - 6.0
Benedenstrooms RWZI	0.1 - 3.2
Landelijk gebied	0.3 - 0.4
2013 locaties	<0.3 - 0.4
Uitlaat	<0.1 - 0.3
Stedelijk gebied	0.1 - 0.1
Inlaat	<0.1 - 0.1



De glasheldere balletjes op de foto's zijn geen luchtballen maar kunststof pareltjes met een diameter van enkele tientallen micrometers

Microplastics in het beheersgebied van Waterschap Rivierenland, Foekema *et al.*, 2015

Microplastics in zoetwater

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Inlaat	<0.1 - 0.1

Microplastics in het beheersgebied van Waterschap Rivierenland, Foekema *et al.*, 2015

67 – 11532 deeltjes $\geq 20 \mu\text{m}$ / m³
Mediaan 862/m³
(1-34% microfibras)

Mintenig *et al* 2020. A systems approach to understand microplastic occurrence and variability in Dutch riverine surface waters. Water Research Vol. 176, 115723

HC₅ = 75600 deeltjes/m³

Koelmans *et al* 2022. Risk Assessment of Microplastic Particles
Nature Reviews Materials <https://doi.org/10.1038/s41578-021-00411-y>

HC₅ = geschatte concentratie waarbij 95%
van de soorten geen effect ondervindt

Hoeveel plastic zit er in vis? (1)

2013

1203 Noordzeevissen onderzocht

7 soorten

33 (2.6%) met plastic

Maximaal 4 mm groot

ENVIRONMENTAL
Science & Technology

Article

pubs.acs.org/est

Plastic in North Sea Fish

Edwin M. Foekema^{*,†} Corine De Gruijter^{†,§} Mekuria T. Mergia^{†,‡} Jan Andries van Franeker^{||}
AlberTinka J. Murk[‡] and Albert A. Koelmans^{†,§}

[†]IMARES Wageningen UR, Department Experimental Ecology, P.O. Box 57, 1780 AB Den Helder, The Netherlands

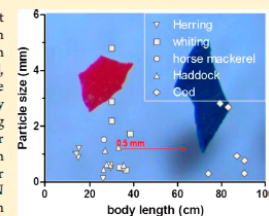
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Supporting Information

ABSTRACT: To quantify the occurrence of ingested plastic in fish species caught at different geographical positions in the North Sea, and to test whether the fish condition is affected by ingestion of plastics, 1203 individual fish of seven common North Sea species were investigated: herring, gray gurnard, whiting, horse mackerel, haddock, atlantic mackerel, and cod. Plastic particles were found in 2.6% of the examined fish and in five of the seven species. No plastics were found in gray gurnard and mackerel. In most cases, only one particle was found per fish, ranging in size from 0.04 to 4.8 mm. Only particles larger than 0.2 mm, being the diameter of the sieve used, were considered for the data analyses, resulting in a median particle size of 0.8 mm. The frequency of fish with plastic was significantly higher (5.4%) in the southern North Sea, than in the northern North Sea above 55°N (1.2%). The highest frequency (>33%) was found in cod from the English Channel. In addition, small fibers were initially detected in most of the samples, but their abundance sharply decreased when working under special clean air conditions. Therefore, these fibers were considered to be artifacts related to air born contamination and were excluded from the analyses. No relationship was found between the condition factor (size–weight relationship) of the fish and the presence of ingested plastic particles.



Foekema et al 2013. Environmental Science & Technology 47, 8818-8824.

Hoeveel plastic zit er in vis? (2)

2018

4389 Noordzeevissen onderzocht

15 soorten

79 (1.8%) met plastic

Gemiddeld 3 mm groot

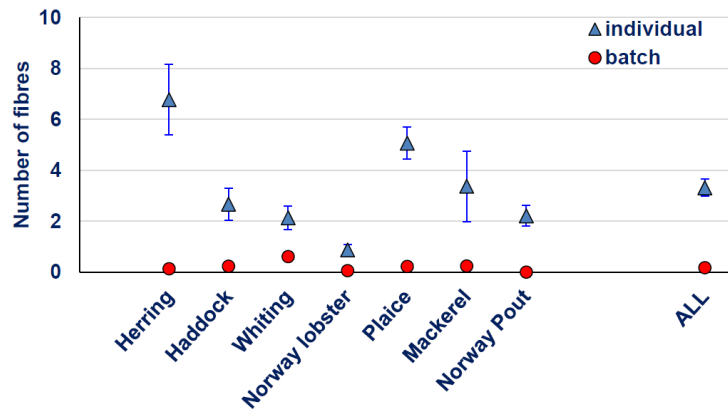
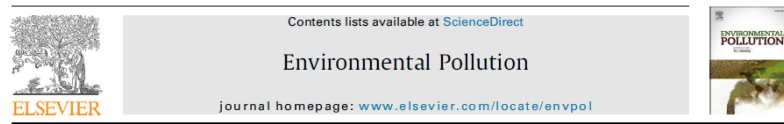


Fig. 1. Average number of fibres $\pm$ se per individual fish, detected in different fish species either assessed individually (blue triangles) or in batches (red circles). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)



Details of plastic ingestion and fibre contamination in North Sea fishes^{*}

Susanne Kühn^{a,*}, Jan A. van Franeker^a, Anastasia M. O'Donoghue^b, Ailynn Swiers^c, Marrit Starkenburg^c, Bernike van Werven^b, Edwin Foekema^a, Enya Hermesen^d, Marion Egelkraut-Holtus^e, Han Lindeboom^d

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(MSFD)

ABSTRACT

This study combines published datasets with unpublished data on plastic ingestion in several North Sea fish species. The combined dataset of 4389 individuals from 15 species allows the analysis of spatial distribution and temporal variability of plastic uptake in fish. Airborne fibre contamination was observed to be the main contributor to fibres encountered in the samples. The number of fibres in samples was strongly related to the time needed to process a sample, not to the number of individual fishes in the sample. Accurate correction for secondary fibre contamination was not possible, but corrections required would be similar to fibre numbers observed in the samples. Consequently, all fibres were omitted from further analysis. The frequency of occurrence and the average number of plastics in fish is generally low (1.8% and 0.022 pieces per organism respectively), with only cod having a higher prevalence (12.3%). While latitude of catch locations influences plastic uptake in fish, no correlation with the distance to the coast was found. Slightly less plastics were ingested in winter, and a decrease in plastics ingested was observed between 2009 and 2018. These factors should be considered when fish species, catch location and time are discussed as indicators for plastic pollution in the European Marine Strategy Framework Directive. We recommend considering demersal cod and pelagic sprat as two species suitable for monitoring plastic ingestion in biota, both on the seafloor and in the water column.

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Kuhn et al. 2020. Environmental Pollution 257
<https://doi.org/10.1016/j.envpol.2019.113569>

Een vis weet wat hij eet



Effecten op vis

In veld moeilijk aantoonbaar

- Blootstelling onzeker
- Microplastics accumuleren niet
- Effecten zijn subtiel
- Meerdere stressfactoren

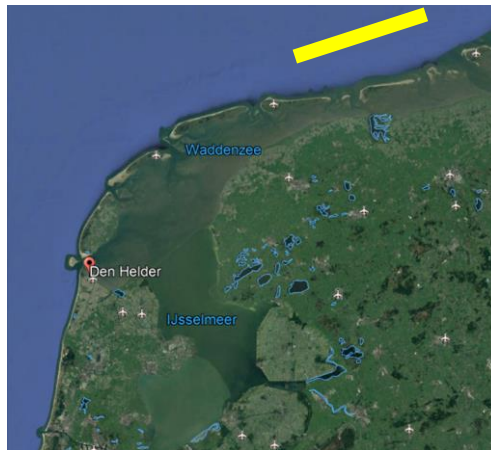


In lab mogelijk minder relevant

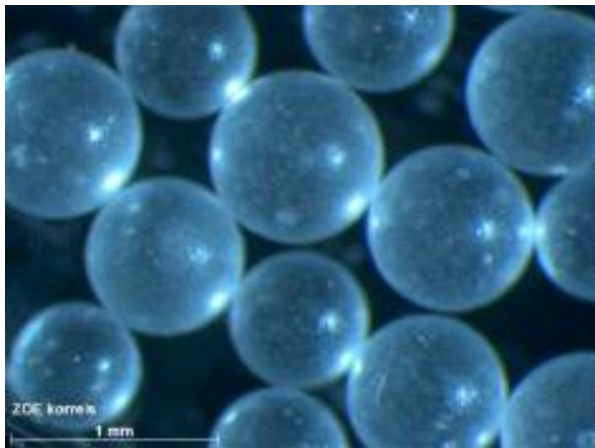
- Geen vrije voedselkeuze
- Feeding frenzy
- Vaak extreme hoge blootstellingsconcentraties

Hoeveel last heeft een vis van microplastic?

MSC Zoe

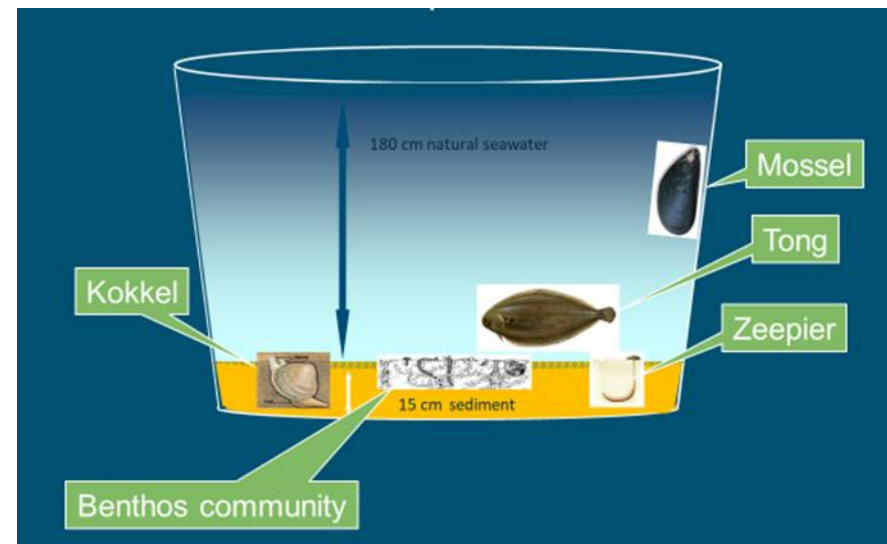


11250 kg polystyrene beads
0.7 mm diameter
 $\approx 5 \times 10^{10}$ individual beads



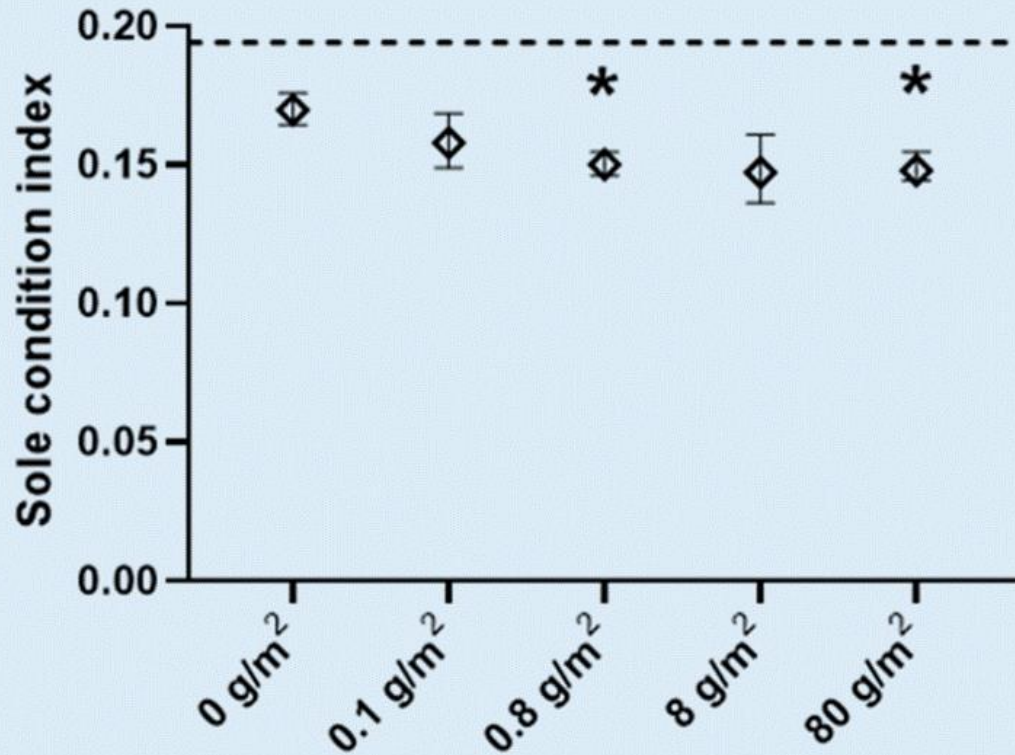
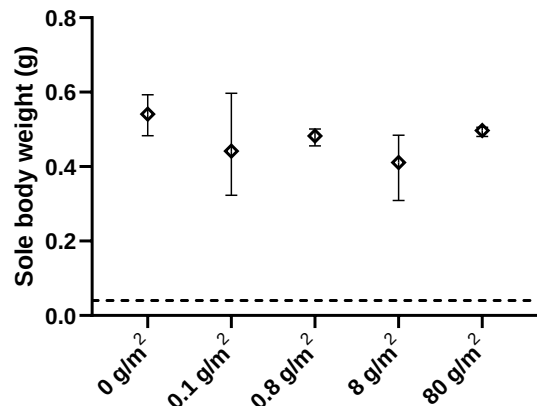
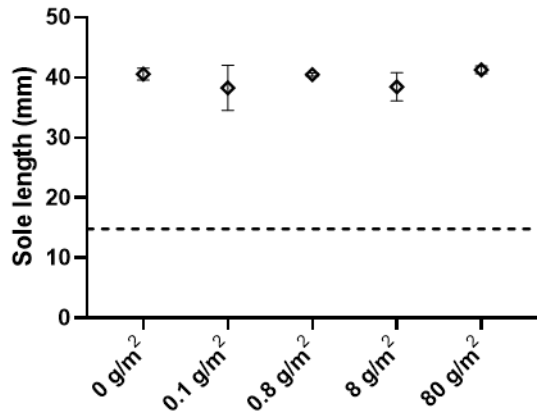
Mesocosm onderzoek

- ✓ Volume 6000 L
- ✓ 5 behandelingen in 3-voud
- ✓ Eenmalige dosering
- ✓ 8 weken monitoring van:
 - ✓ Plankton
 - ✓ Macro evertebraten
 - ✓ Vissen (tong)

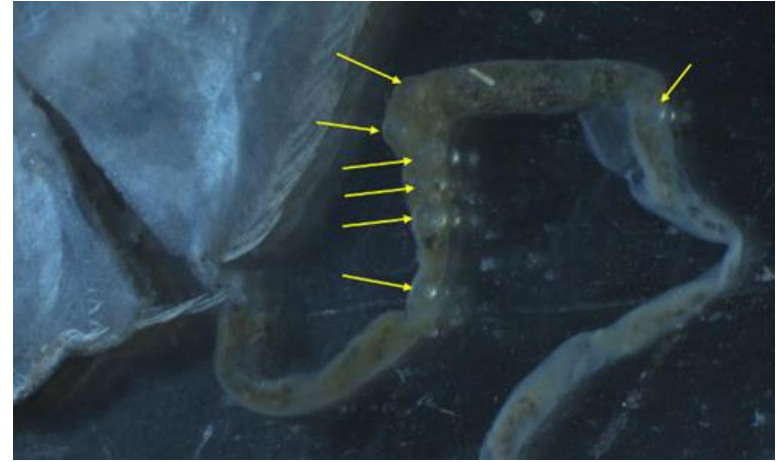
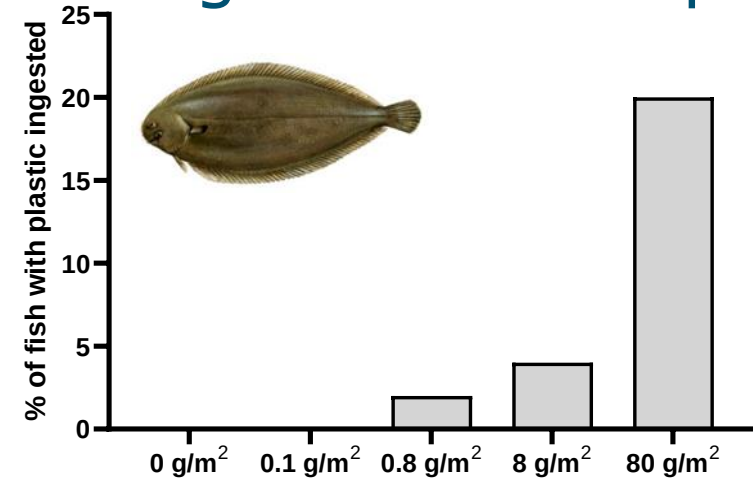


Scenario: % of Dutch Waddensea affected	gram/m2	beads/m2
Blanco (no beads)	0	0
Concentrated in 10% of WS (=all east of Schiermonnikoog)	0.08	326
Concentrated in 1% of WS	0.8	3 259
Concentrated in 0.1% of WS	8	32 590
Concentrated in 0.01% of WS	80	325 900

Effecten op tong



Ingeslikte microplastics



Voer en plastic formaat maakt verschil

Makkelijk verteerbaar voedsel
in combinatie met relatief groot plastic
veroorzaakt sterkste effect op voedselopname



Less impact than suspected: Dietary exposure of three-spined sticklebacks to microplastic fibers does not affect their body condition and immune parameters

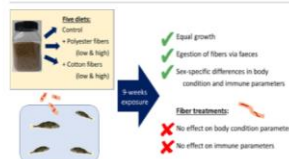
Anja Bunge^a, Vincent Lugert, Melissa McClure, Ulrike Kammann, Reinhold Hanel, Jörn P. Scharsack

^aThünen Institute of Fisheries Ecology, Heligoland, 31, 2572 Bremerhaven, Germany

HIGHLIGHTS

- Dietary exposure to polyester fibers does not affect the body condition of fish.
- Polyester fiber amounts higher than encountered in nature do not affect fish growth.
- Immune parameters are sensitive enough to measure gender differences.
- Ingestion of fibers does not induce alterations in immune parameters.
- Absence of impacts on fish similar for ingested polyester and natural fibers.

GRAPHICAL ABSTRACT



ARTICLE INFO

Article history:

ABSTRACT

Microplastic fibers are frequent anthropogenic contaminants in most aquatic environments and have consequences

Marine Pollution Bulletin 145 (2019) 254–259



Contents lists available at ScienceDirect

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



Decreased growth and survival in small juvenile fish, after chronic exposure to environmentally relevant concentrations of microplastic*



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ARTICLE INFO

Keywords:
Glassfish
Ambassis damulieri
Glassfish
Plastic ingestion
Natural plastic concentrations
Chronic plastic exposure

ABSTRACT

Glassfish, *Ambassis damulieri* (Cuvier, 1828), was used as a sentinel species to investigate the effects of the ingestion of environmentally relevant microplastic concentrations on juvenile fish growth and survival. Both virgin plastic and plastic collected from an urban harbour were fed to small juvenile fish daily for 95 days. Fish standard length, body depth and mass were recorded at intervals of 20 days, while survival was continuously recorded. All fish were fed tropical flakes, measured at 1.7% of the body mass per tank. Overall, fish in in plastic treatments grew less in body length and body depth compared to those control treatments. Fish mass was also lower in the virgin plastic treatment than control fish; however, the growth in mass was not significantly lower than fish in the harbour plastic treatment. The survival probability of fish in both plastic fed treatments was also lower than fish in controls.

1. Introduction

The ingestion of microplastics, ≤ 5 mm in length, by fish has been recorded from the early 1970s (Carpenter et al., 1972), when scientists speculated on its negative influence on fish health (Hoss and Settle,

1978). Such alterations could result in organism changes that include decreased feeding and decreased body mass (Walden and Cowie, 2016). Higher level effects include impaired development and decreased reproductive potential, even by virgin plastic, as shown for the sea urchin

Gifstoffen en microplastics

Geabsorbeerde gifstoffen:

PCBs, DDT, PBDEs, ect

Stofeigenschappen:

Persistent

Giftig

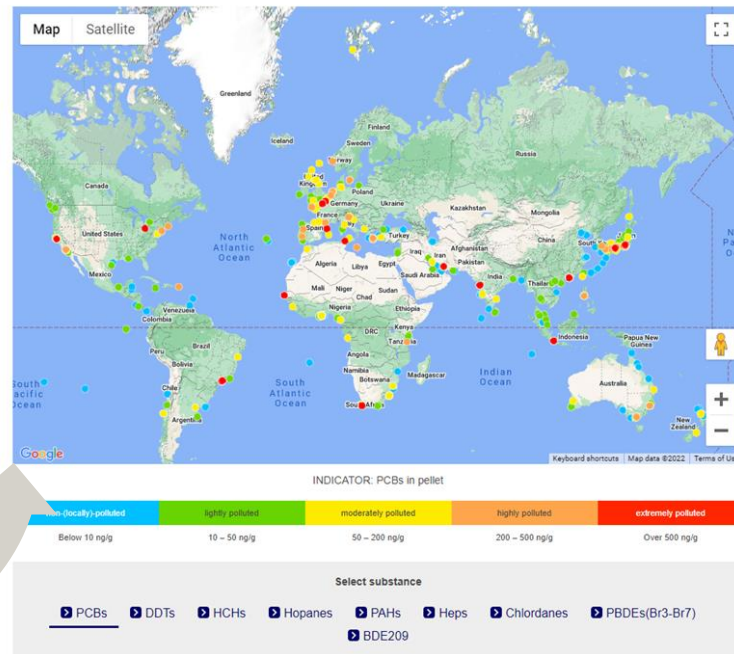
Slecht wateroplosbaar (log Kow = 5-8)

In evenwichtssituatie is concentratie in octanol 10^5 tot 10^8 hoger dan in water

Vergelijkbare
ophoping in
plastics

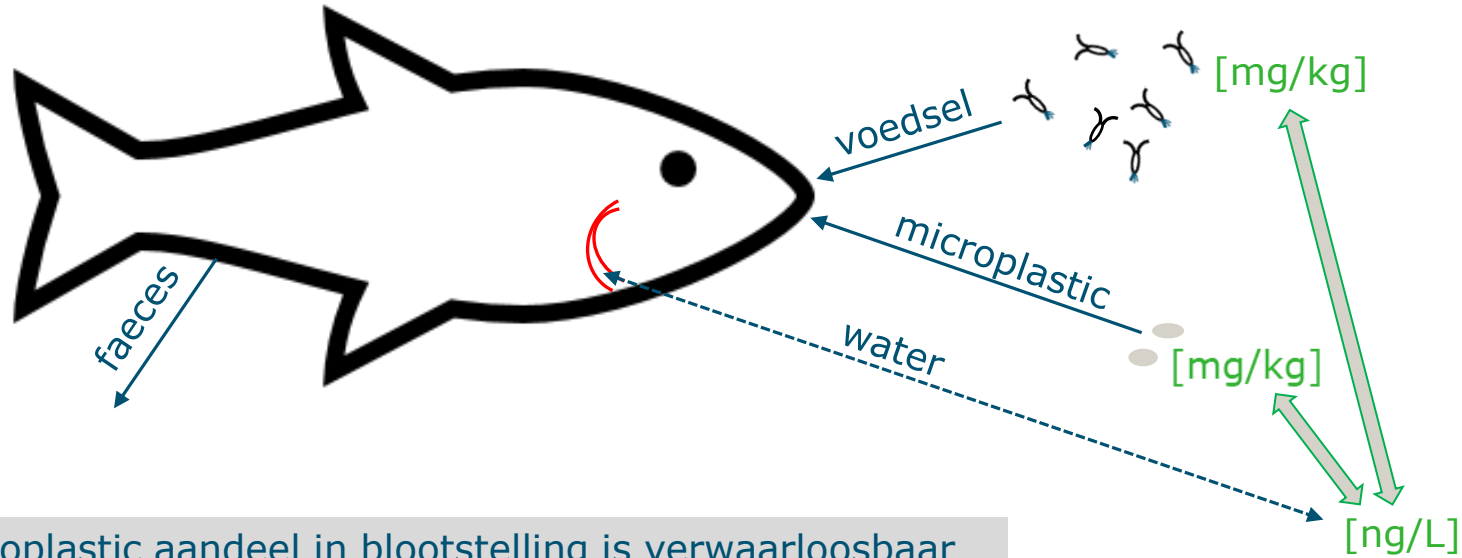


Plastic pellets op het vloedmerk van het strand van Schiermonnikoog in januari 2019. Foto: Jan Willem Zwart (Natuurmonumenten)



www.pelletwatch.org

Blootstelling van een vis

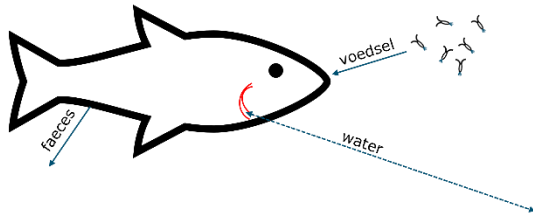


Microplastic aandeel in blootstelling is verwaarloosbaar
(als dat niet zo is sterft de vis eerder aan ondervoeding)

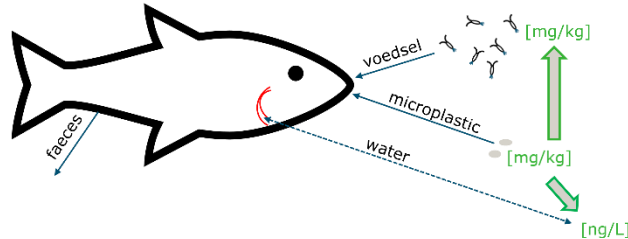
*Dit kan anders zijn voor landdieren waar
evenwicht via water niet geldt*

Waar komt het verhaal vandaan?

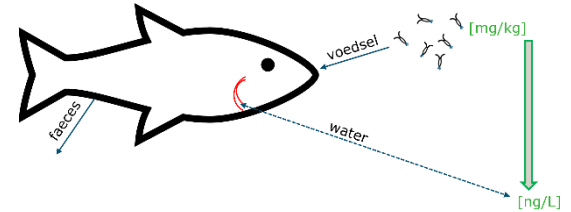
Blanco:
Schoon voer,
geen microplastics



Behandeling:
Schoon voer,
verontreinigde
microplastics



Vergeten?:
Verontreinigd over,
geen microplastics



Conclusies

- Gehalten microplastics in water zijn (nog) lager dan effect concentraties
- Effecten op vis zijn in veldonderzoek niet aantoonbaar
- En zijn in laboratoriumonderzoek sterk afhankelijk van de proefopzet

Take home messages

Onderzoek effecten/impact onder realistische omstandigheden

**OOK ALS MICROPLASTIC WEINIG EFFECT HEEFT ZIJN WIJ VERPLICHT
ONZE TROEP OP TE RUIMEN EN VERDERE VERSPREIDING TE
VOORKOMEN!**