

# Uptake routes of microplastics in fishes: practical and theoretical approaches to test existing theories

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## Supplementary information

Variable	Habitat	fish size	Value	Reference
Drinking rate	freshwater	20-30 g	0.15 ± 0.03 ml kg <sup>-1</sup> h <sup>-1</sup>	Fuentes & Eddy 1997 <sup>1</sup>
		20-30 g	0.25 ml kg <sup>-1</sup> h <sup>-1</sup>	Fuentes <i>et al.</i> 1996 <sup>2</sup>
		50 g	1.43 ± 0.31 ml kg <sup>-1</sup> h <sup>-1</sup>	Lovegrove & Eddy 1982 <sup>3</sup>
		150 - 250 g	0 ml kg <sup>-1</sup> h <sup>-1</sup>	Shehadeh & Gordon 1969 <sup>4</sup>
		n.a.	0.03 ± 0.01 ml kg <sup>-1</sup> h <sup>-1</sup>	Perrot <i>et al.</i> 1992 <sup>5</sup>
		<b>mean</b>	<b>0.4 ml kg<sup>-1</sup> h<sup>-1</sup></b>	
	marine	20-30 g	3.89 ± 0.28 ml kg <sup>-1</sup> h <sup>-1</sup>	Fuentes & Eddy 1997 <sup>1</sup>
		20-30 g	2.4 ml kg <sup>-1</sup> h <sup>-1</sup>	Fuentes <i>et al.</i> 1996 <sup>2</sup>
		50 g	7.40 ± 1.63 ml kg <sup>-1</sup> h <sup>-1</sup>	Lovegrove & Eddy 1982 <sup>3</sup>
		150 - 250 g	5.4 ± 0.5 ml kg <sup>-1</sup> h <sup>-1</sup>	Shehadeh & Gordon 1969 <sup>4</sup>
		n.a.	1.42 ± 0.23 ml kg <sup>-1</sup> h <sup>-1</sup>	Perrot <i>et al.</i> 1992 <sup>5</sup>
		<b>mean</b>	<b>4.1 ml kg<sup>-1</sup> h<sup>-1</sup></b>	
Residence time	freshwater, marine	-	51 h	Roch <i>et al.</i> (in preparation)
		-	33 h	Grigorakis <i>et al.</i> 2017 <sup>6</sup>
		-	48 h	Lu <i>et al.</i> 2016 <sup>7</sup>
		<b>mean</b>	<b>44 h</b>	

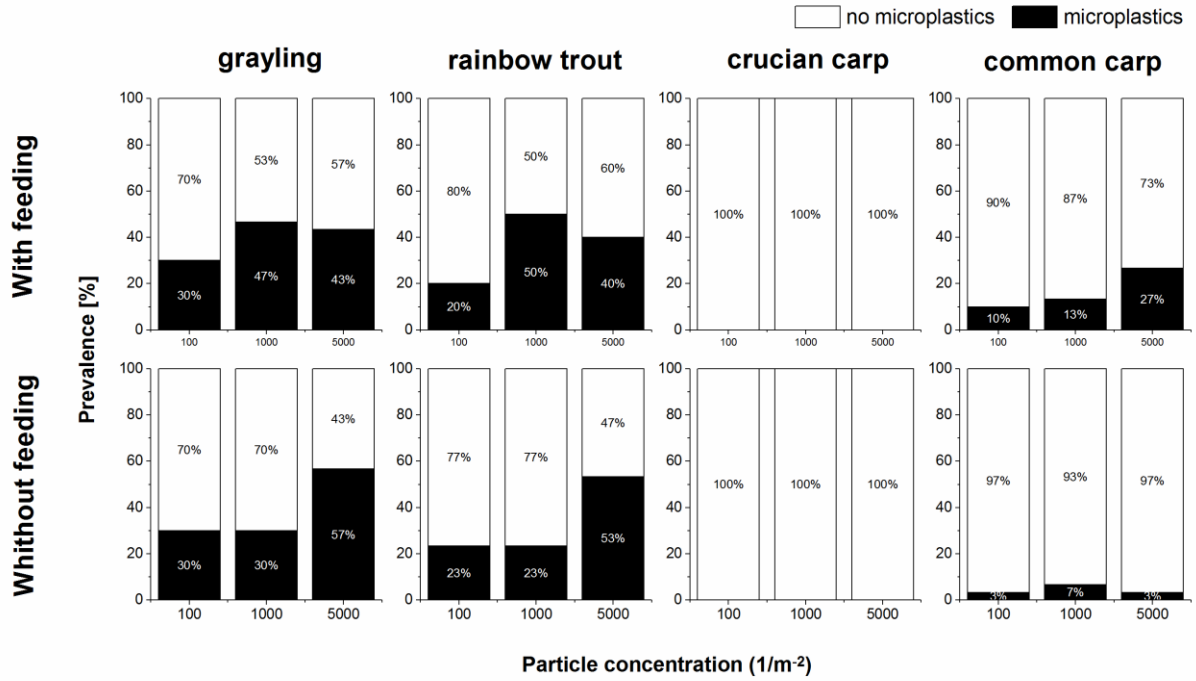
**Table S1.** Drinking rates of marine and freshwater fish and residence time of microplastics in the gastrointestinal tract for the model approaches to calculate the passive uptake of microplastics via drinking.

Model	Dependent variable	Fish species	Sampling points	Model effects
Nominal-logistic regression model	prevalence	rainbow trout, grayling, common carp, crucian carp	0 h	origin, foraging style, feeding status, particle concentration, total length, foraging style x feeding
Generalized linear model <sup>a</sup>	abundance	rainbow trout, grayling, common carp, crucian carp	0 h	origin, foraging style, feeding status, particle concentration, total length
	abundance	rainbow trout, grayling, common carp, crucian carp	0 h, 6 h, 24 h	sampling time, fish species, feeding status, particle concentration
	intensity	rainbow trout, grayling, common carp, crucian carp	0 h, 6 h, 24 h	feeding status, particle concentration, particle appearance, particle density
Generalized regression model <sup>b</sup>	intensity	rainbow trout, grayling	0 h, 6 h, 24 h	particle concentration, origin, feeding status, particle appearance, particle appearance x particle concentration, origin x particle concentration

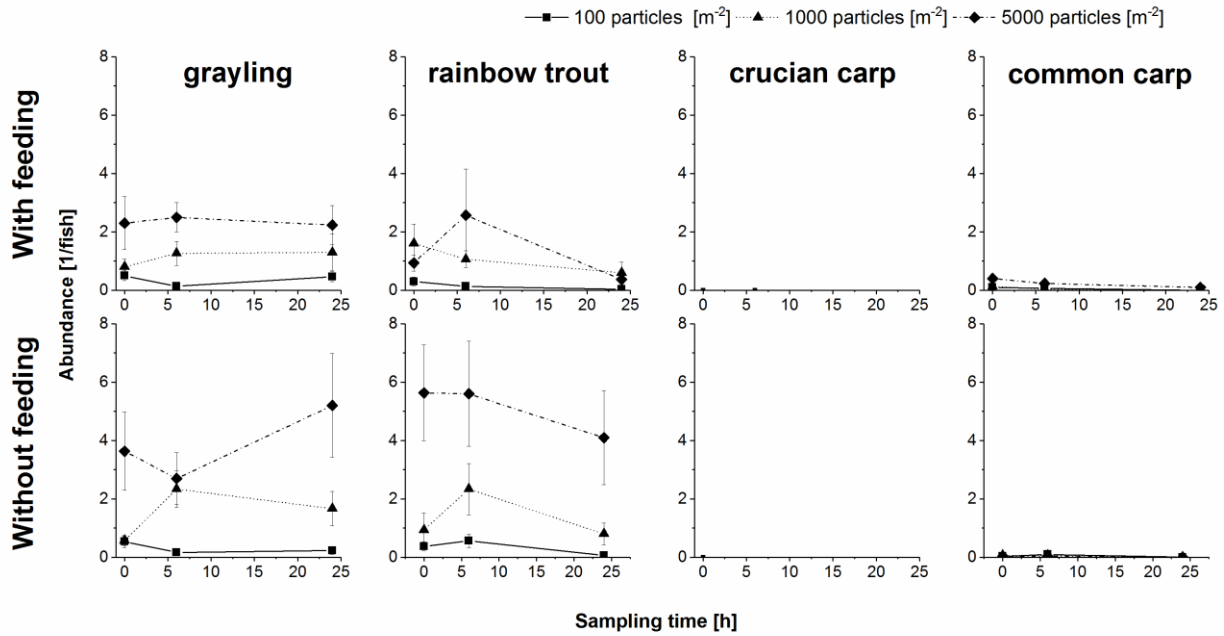
**Table S2.** Model specifications for each performed model to examine the microplastic uptake of fish in the exposure experiments. <sup>a</sup>A Poisson distribution with a logarithmic link function was assumed for each GLM. Furthermore, an overdispersion parameter was included in each model to adjust variance independent of the mean<sup>8</sup>. <sup>b</sup>A negative binomial distribution was assumed and the model was fitted with help of an elastic net and AIC as the model evaluation method<sup>9</sup>.

Fish species	Total length [cm]		Fresh weight [g]	
	mean	SD	mean	SD
rainbow trout	11.3	0.8	17.0	3.8
grayling	11.8	1.0	9.1	2.3
common carp	8.0	0.7	7.3	2.9
crucian carp	7.0	0.5	5.3	1.4

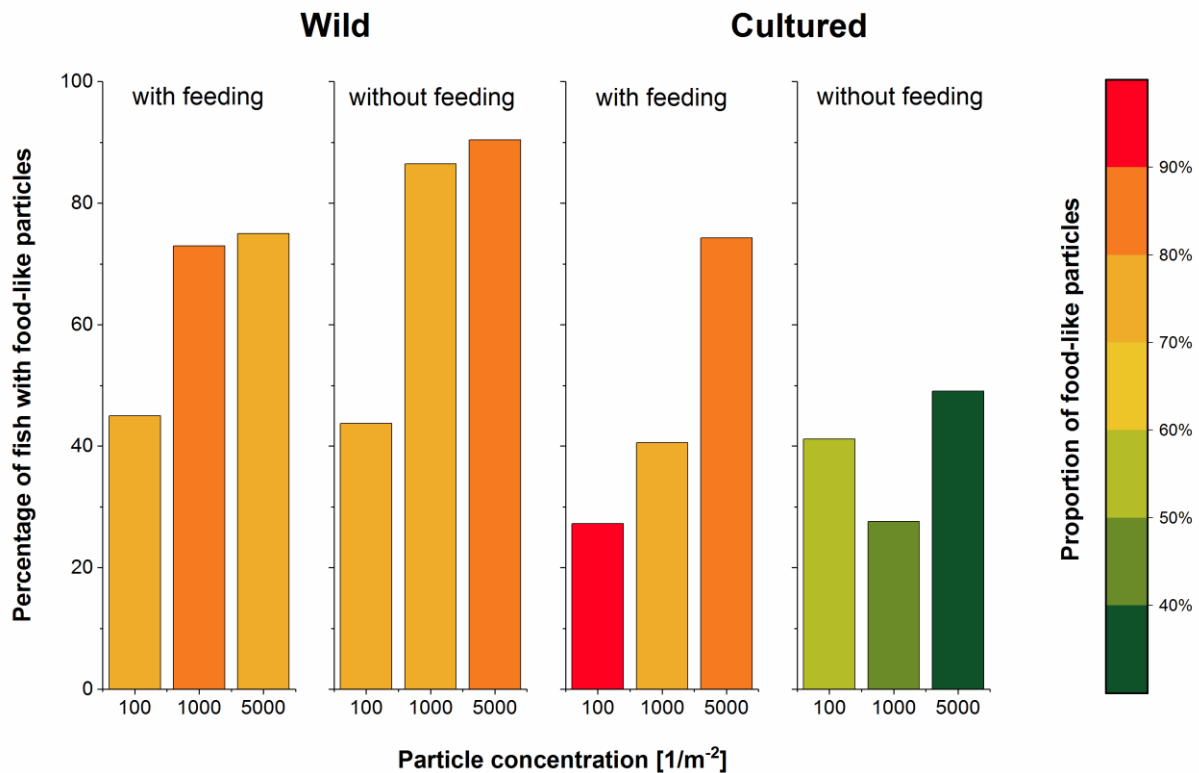
**Table S3.** Summary of the total length and fresh weight of experimental fish used in the exposure experiments. SD = Standard deviation.



**Figure S1.** Mean microplastic prevalence for each fish species, particle concentration and feeding status, directly after exposure.



**Figure S2.** Mean microplastic abundance [ $\pm$  standard error] for each fish species, particle concentration, sampling point and feeding status.



**Figure S3.** Percentage of fishes with microplastics that ingested at least one food-like particle (all time points). Colours indicate the proportion of food-like particles, compared to all particles ingested.

## References

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