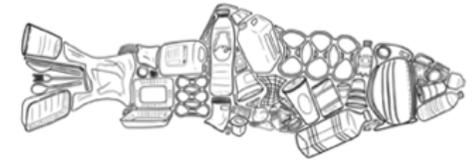# Plastic Fish

Scale, biological impacts and chemical behaviour of petrochemical and bioplastics within fish aquaculture

Numair Masud

Fish aquaculture

- Fastest growing food industry – worth £164 billion

- Key source of protein and omega-3 fatty acids

- Key issues facing aquaculture: pollutants and infectious diseases

Plastic pollution

- Plastics found in all surveyed aquaculture stocks

- Gut lesions, tissue necrosis, reduced weight – reduced aquaculture productivity

- What about >3000 additives associated with plastics?
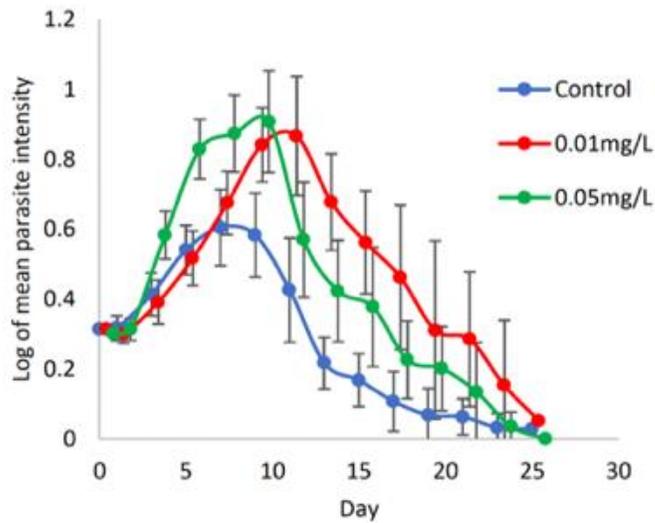
- Bioplastics= Potential greenwashing?

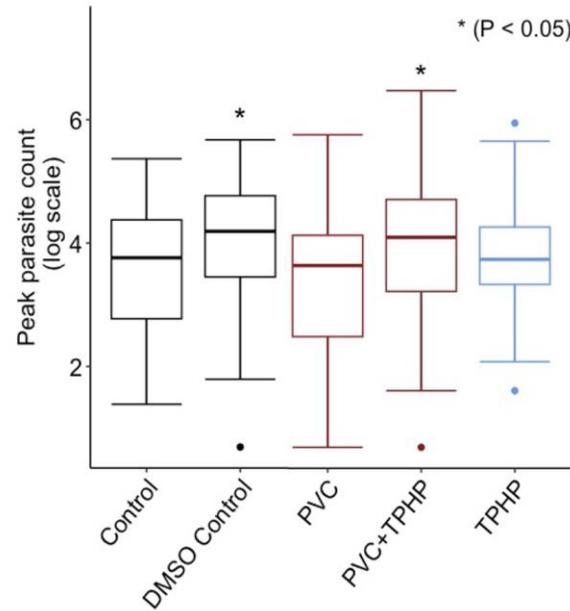# Plastic Fish: the story so far

Business as usual: petrochemical plastics and their additives
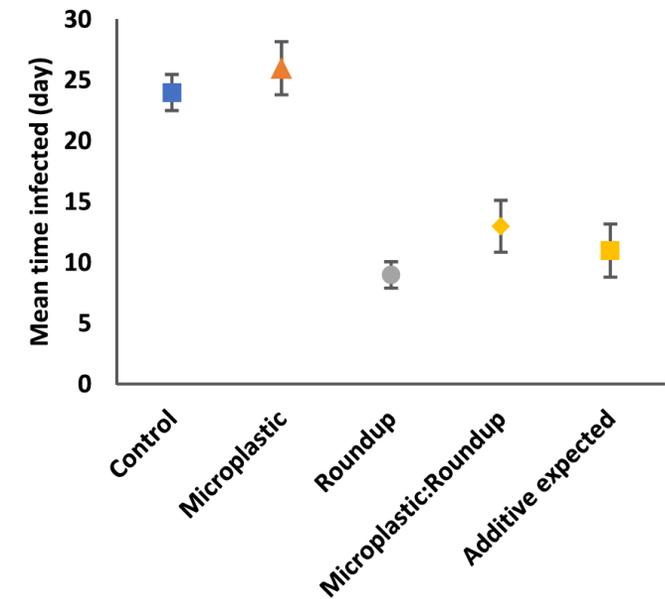
Plastics only

Masud & Cable 2023

Plastics + additives

Masud, Cheung et al. in prep

Plastics + herbicides

Masud, Davies-Jones et al. 2022

**Key message: petrochemical plastics bad
BUT interactions between plastics + additives makes them worse**

Plastic Fish: the story so far

Bioplastic: hope or greenwashed distraction?

Metabolism

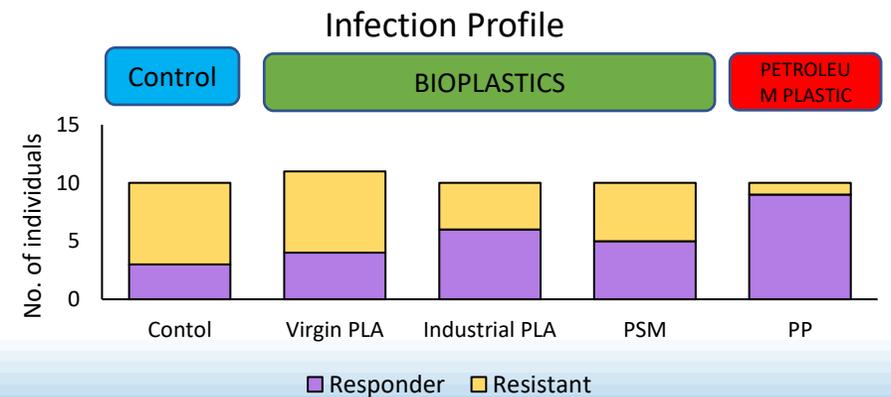- Lowest in control, highest in petroleum-based MP polypropylene (PP)
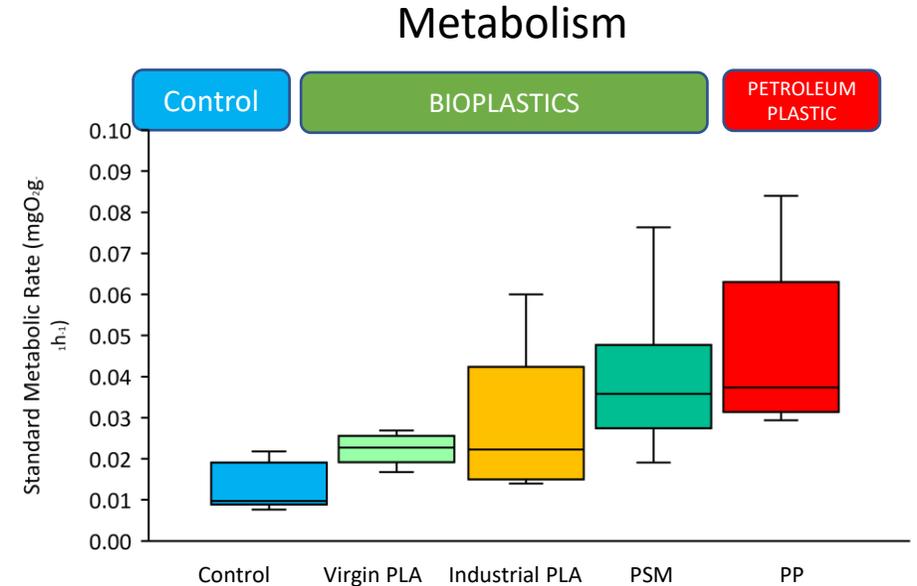
Growth

- PP inhibited growth the most (p < 0.05)

- Inhibited - PLA and PP
- Enhanced? PSM (p = 0.05)

- Degree of growth inhibition was sex-specific

Disease

- Most severe parasite burdens were observed in fish exposed to PP (p < 0.05)

Metabolism

Infection Profile

Key message: petrochemical plastics worse than bioplastics
BUT commercial bioplastics not far behind!

Plastic Fish: what's next?

Pipeline for testing plastic products and assessing aquaculture stocks

Samples

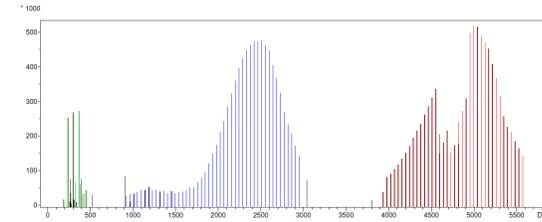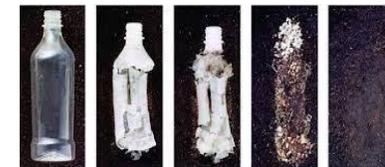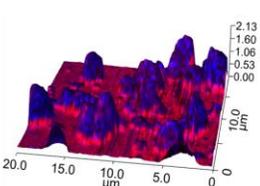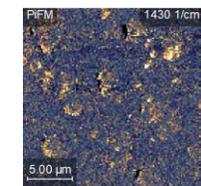Plastic samples

Aquaculture fish samples

Water samples

Testing

Data

Mass spectrometry (MALDI-ToF)

Detecting water soluble polymers

Baby bath wash

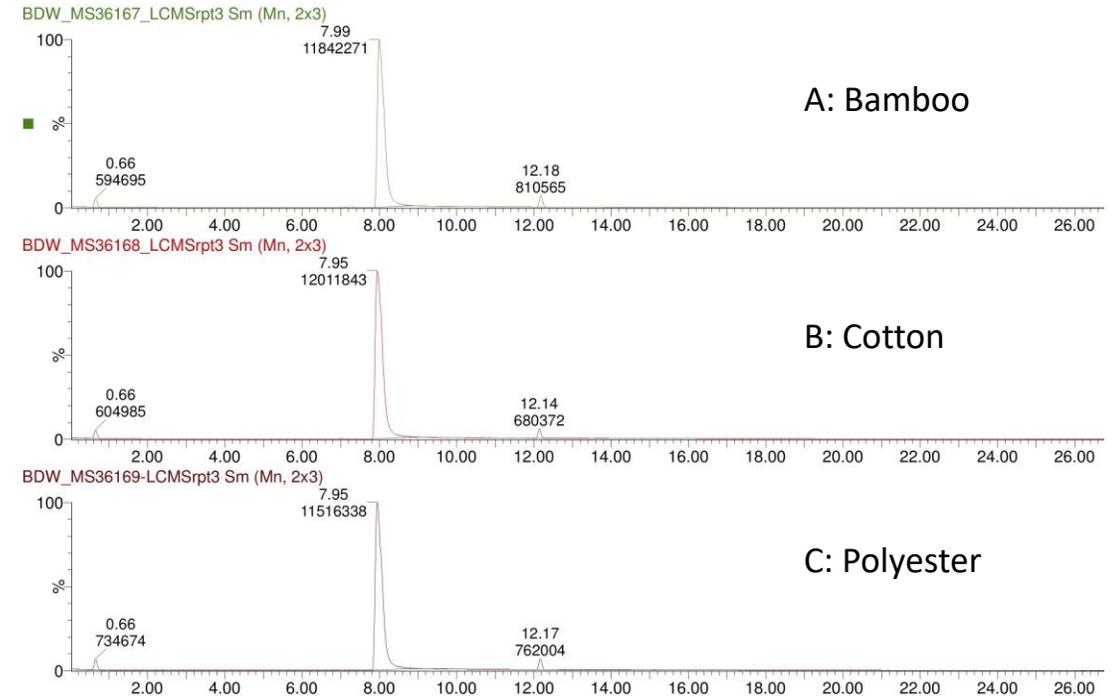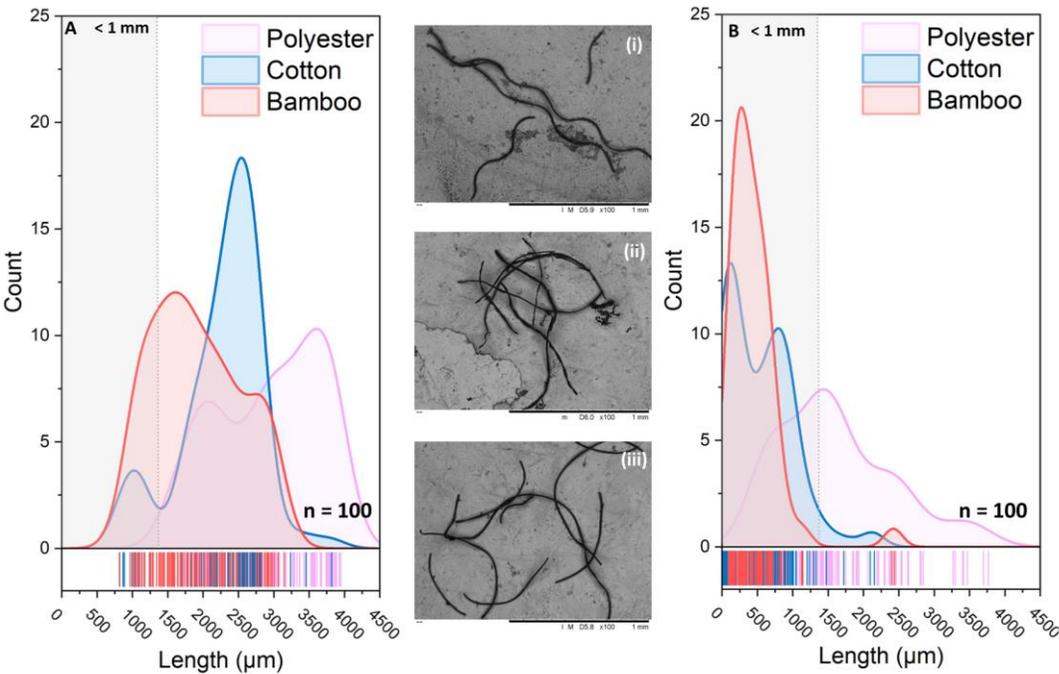| n	ser.	rep.unit	resid.	end1	end2	cation	Mn	Mw	pd	DP	% I.	cnt
1	1	44.0916	11.5299				4868.85	4902.83	1.00698	110.426	46.4	38
2	2	44.0916	42.2336				2314.78	2390.61	1.03276	52.4994	43.7	47
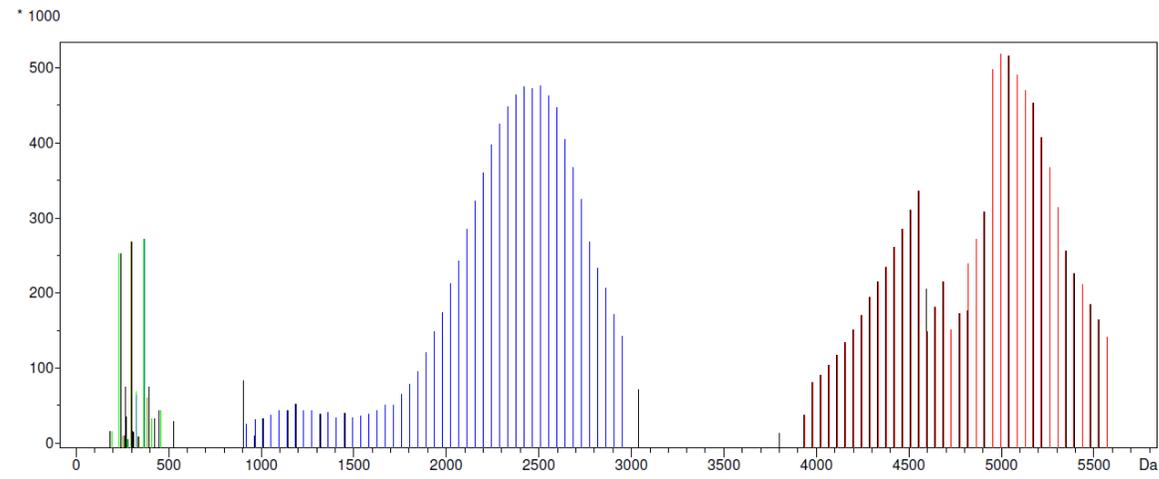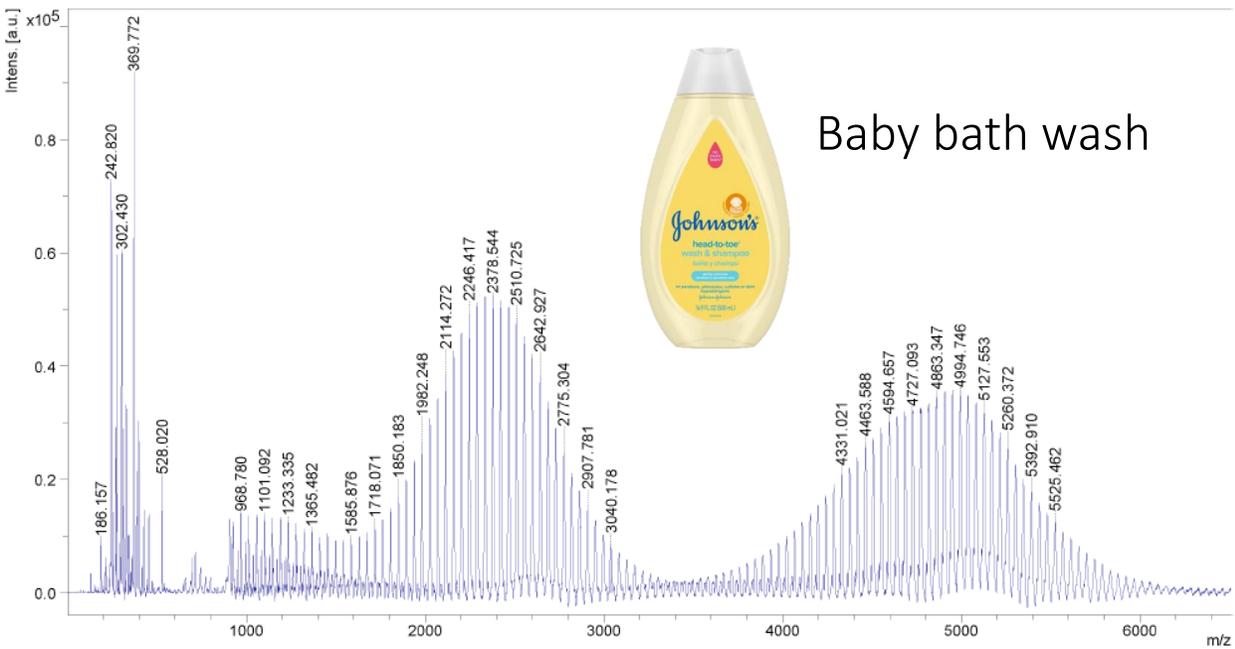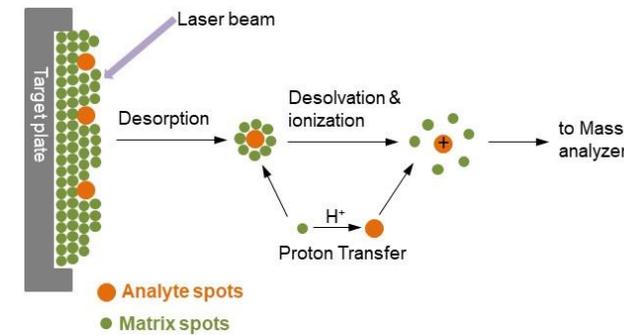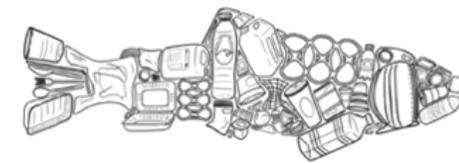
Key message: we have instrumentation to detect polymers & additives

Challenges of environmental + industry samples
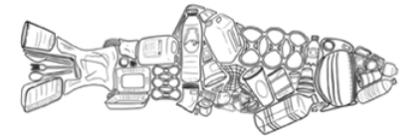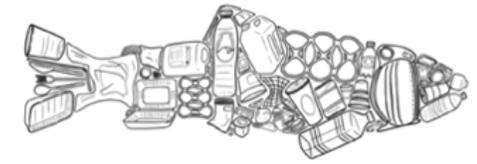
Issues of transparency and background noise

A: Bamboo

B: Cotton

C: Polyester

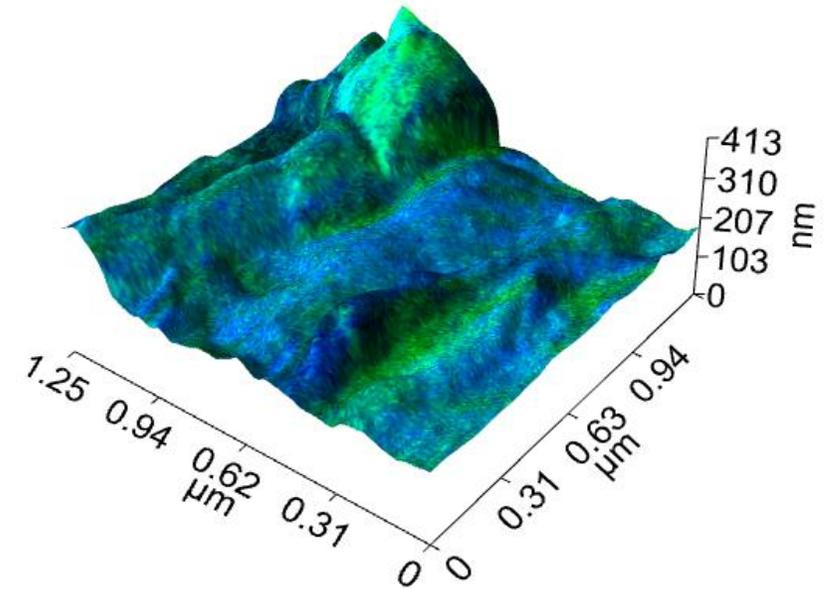MacAulay & Masud et al. in review

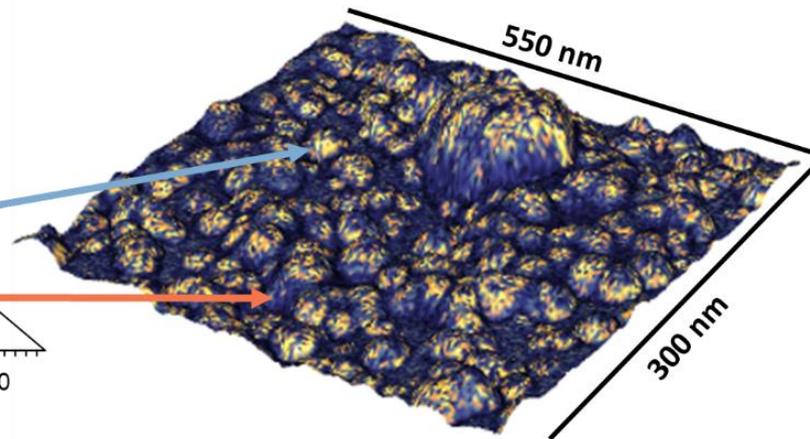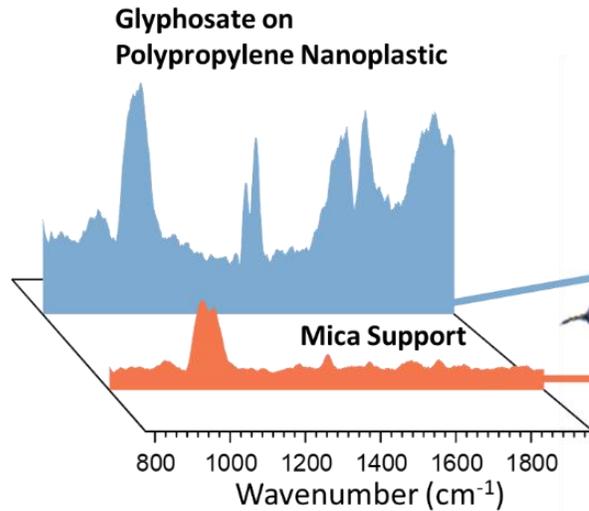**Key message: really important for industries to be more transparent with researchers**

Photo-induced Force Microscopy (PiFM)

Surface interactions between nanoplastics –environmental contaminants

Blue – Polyester
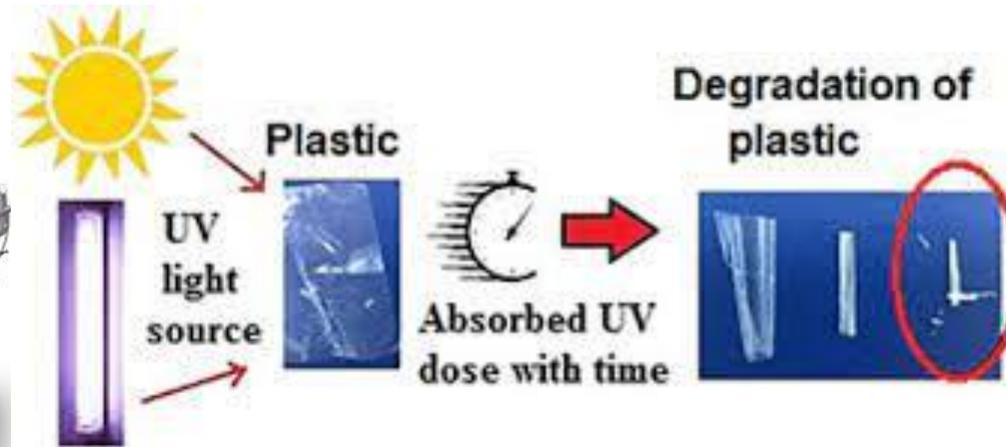Green – Glyphosate

Key message: we can understand surface behaviour of plastic + chemical additive interactions

Testing claims of degradation

Environmental chambers

Plastic and food quality

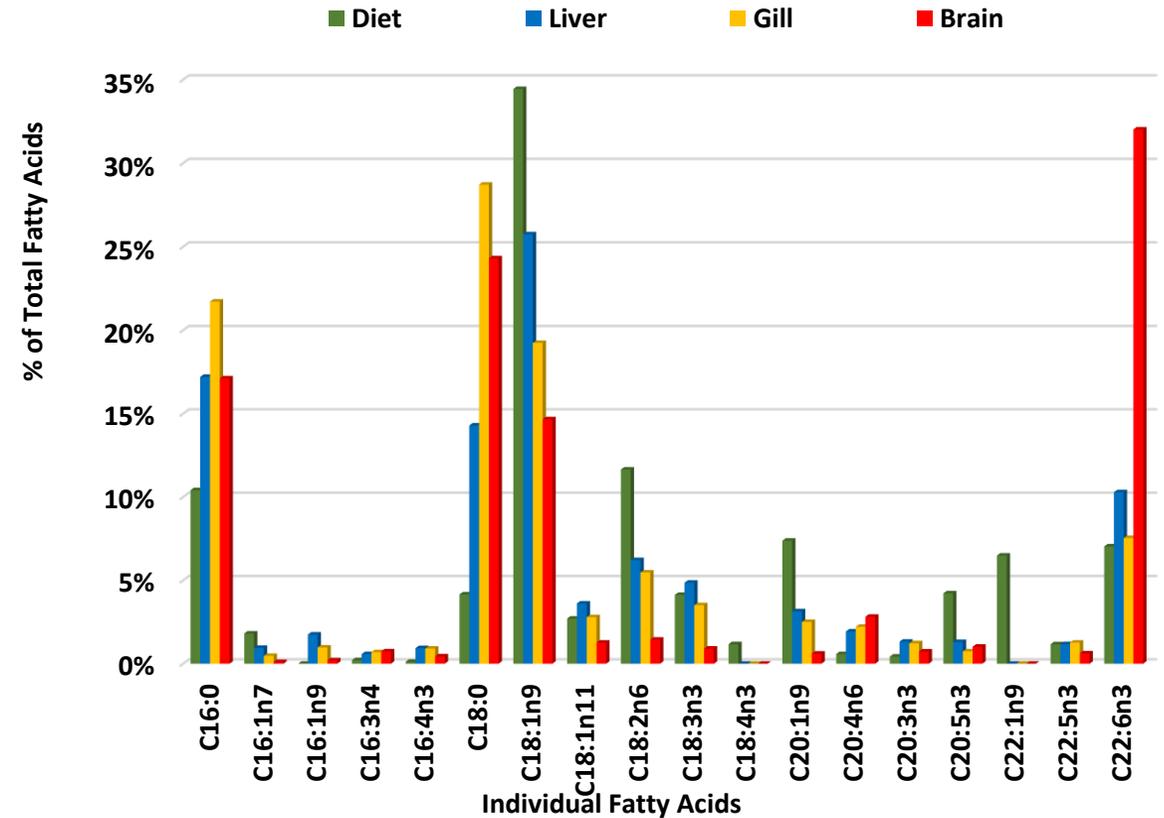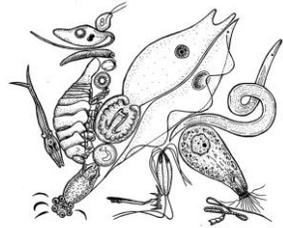*Fish fillet or fish fill-less!*

Fish farm samples

Gas chromatography

Fatty acid profiling

Key message: plastics can have detectable impact on nutrient quality of fish samples

The Plastic Fish Pipeline

Sample	Degradation chamber	MALDI-ToF	PiFM	Biological testing
Polyproylene			████████████████████	
Polyvinyl chloride	████████████████████████████████			██
Polyethylene fish nets	████████████████████████			
PLA coffee cups	████████████████████████			
Bamboo fibres for clothing	████████████████████████████████			
PSM plates	████████████████████████████████			
Sea Weed fish nets	████████████████████████			
Trixylyl phosphate-flame retardant			████████	
Triphenyl phosphate- flame retardant			██████████████████████	
Dibutyl pthalate-plasticiser			████████	
Dihexyl phthalate-plasticiser			████████	

Plastic Fish

Water samples?

Fish farmers?

Novel plastic polymers?

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