



Emerging Pollutants: Protecting Water Quality for the Health of People and the Environment

Microplastics in the Environment – Perspectives and Priorities

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Emerging Pollutants : Are microplastics Emerging pollutants?

Emerging pollutant (UNESCO definition)...

- “Synthetic chemicals not commonly monitored or regulated in the environment”
- “Potentially or suspected adverse ecological or human health effects”
- “Recently appeared in freshwater systems”
- “Pose risks that are not fully understood”
- “Released continuously”
- “May cause toxicity”
- “Assessment is required to build knowledge”



Attention on plastics...
... different than other pollutants

Emerging Pollutants : Are microplastics Emerging pollutants?

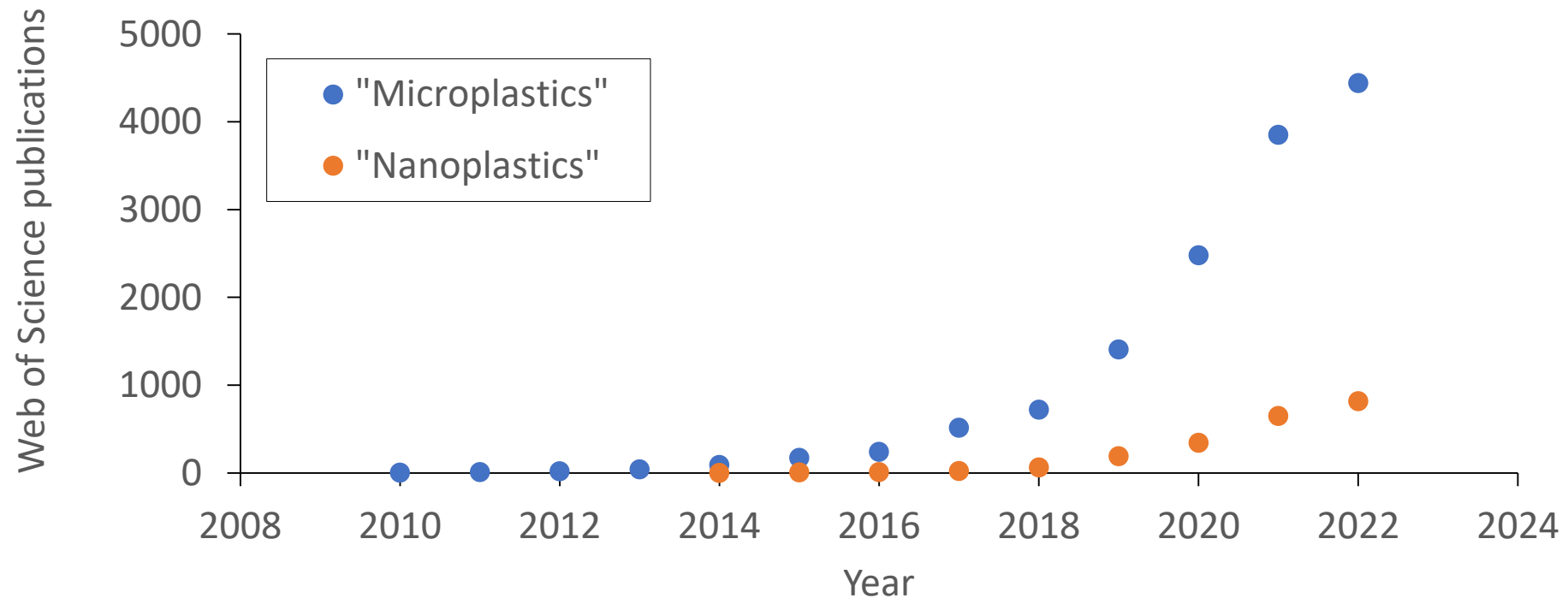
Attention on Plastics...

- Toothpaste and washes with plastic microbeads
- Plastics bottles 1 million produced per minute
- Billions of plastic bags used each week
- Plastic fibers from fabrics during washing
- Construction, agriculture, transportation
- >300 million tons of plastic now produced each year
- >7000 million tons of plastic produced since 1950



Waste management issue – local policies with global implications

Emerging Pollutants : Are microplastics Emerging pollutants?



Microplastics : Challenges for environmental toxicologists

Particles do not behave like traditional toxicants

- Particle characteristics – size, shape, polymer composition
- Detection in environmental media and tissues
- Development of new analytical techniques

Toxicology

- Absorption, distribution, metabolism, excretion?
- Toxicity relative to toxicants of concern?



- Size: Large (1 – 5 mm), small (1 μ m – 1 mm)
- Primary (produced); secondary (fragments)
- Many different shapes
- Different polymer types

Microplastics – Detected globally, hot spots recognized...

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Baseline

Microplastic contamination in surface waters in Guanabara Bay, Rio de Janeiro, Brazil

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Ingestion of Microplastics

Questions:

Do organisms ingest MPs?

Are MPs absorbed?

How long until MPs pass through gut?

Approach:

- Feed pellets: fish paste + MPs
 - All MPs counted in each pellet
- Procedure
 - Crabs fed feed pellet with MPs
 - Crabs faeces collected every 24 hours



Shore crab *Carcinus maenas*

UG Student: Joseph Hatfield

Ingestion of Microplastics

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Shore crab *Carcinus maenas*

Results:

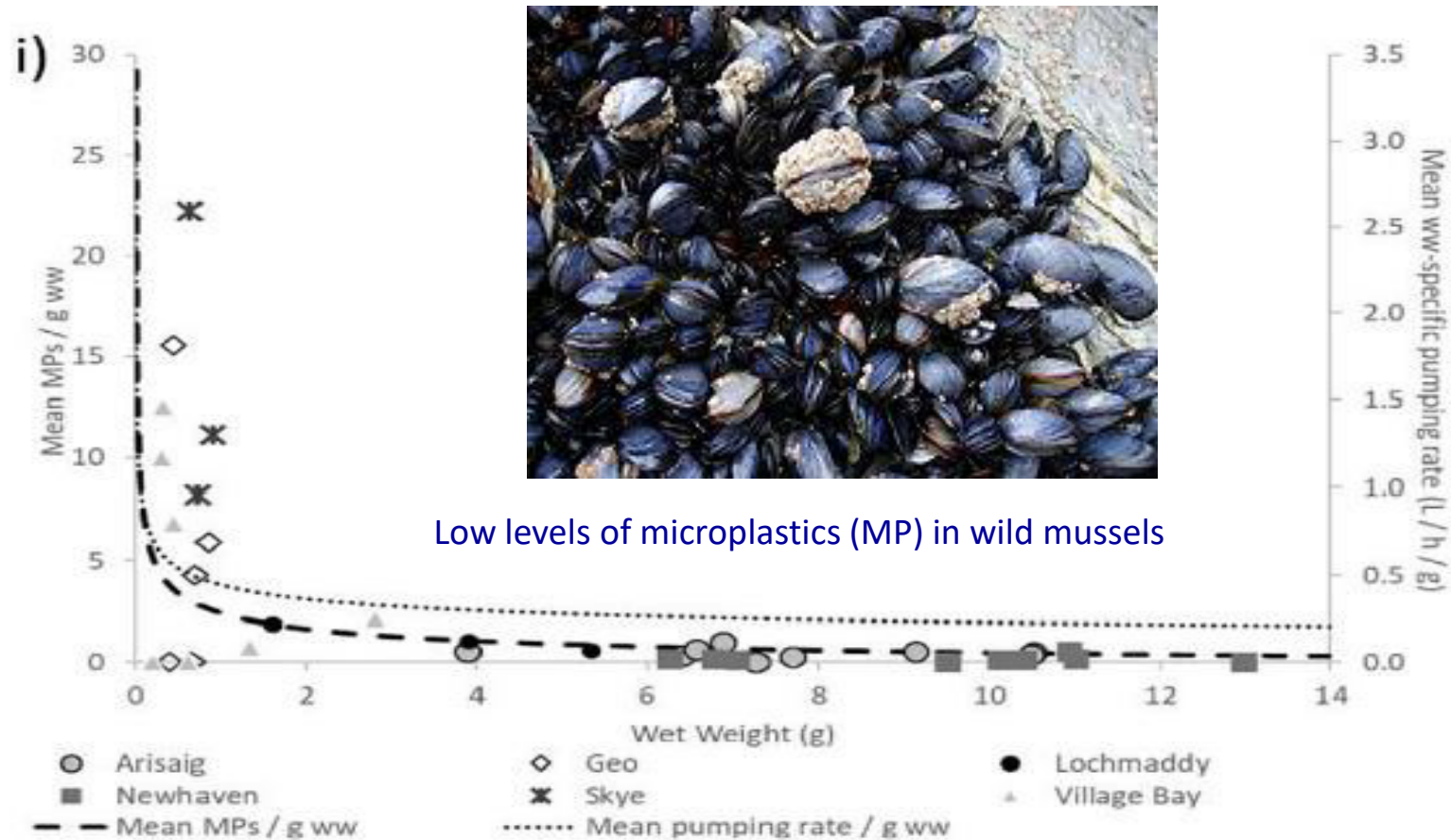
- All MPs found in faeces within three days
- MPs stayed in gut a few hours longer than sand particles

UG Student: Joseph Hatfield

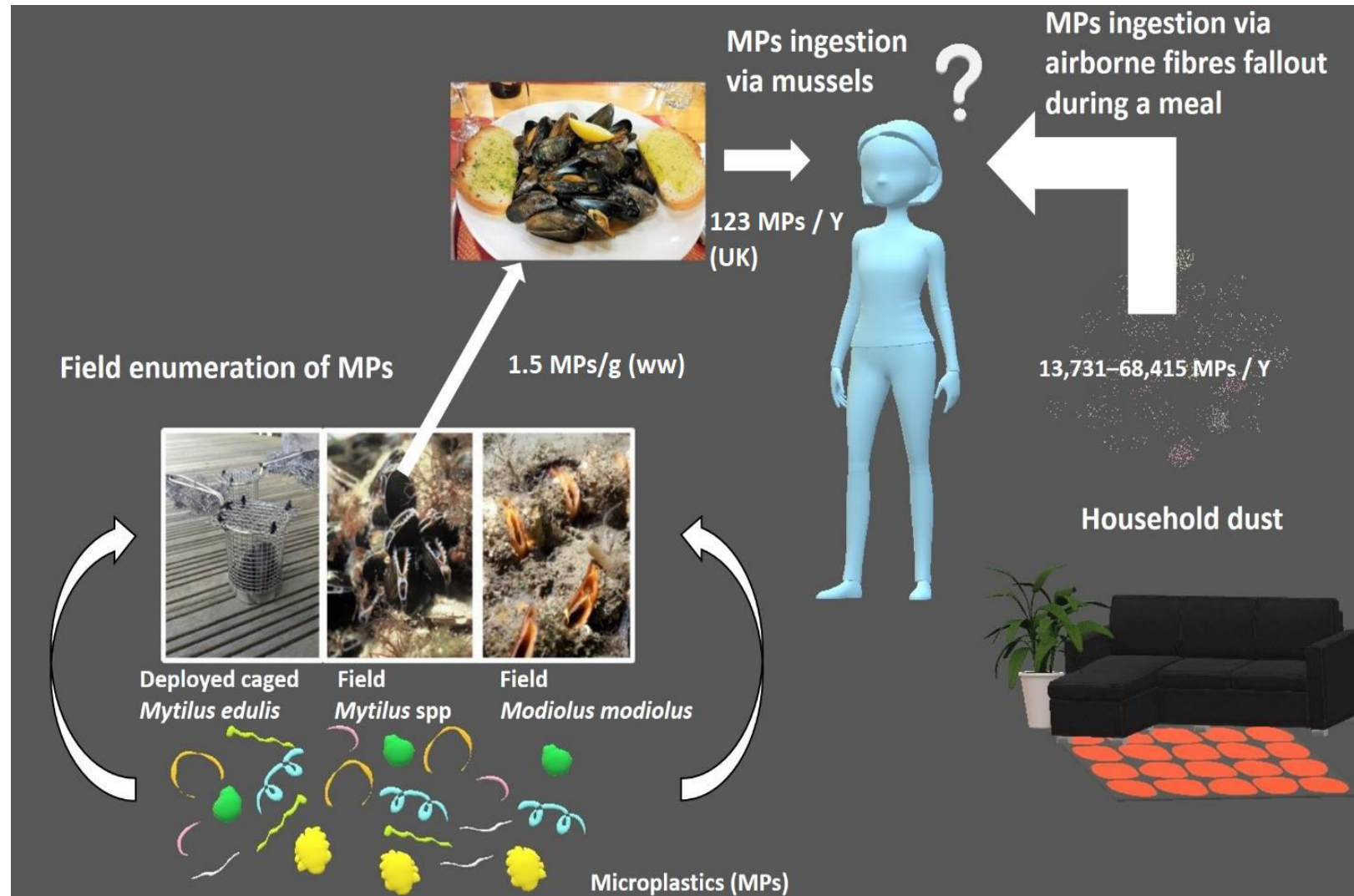
Microplastics in
Seafood: are
humans at risk?



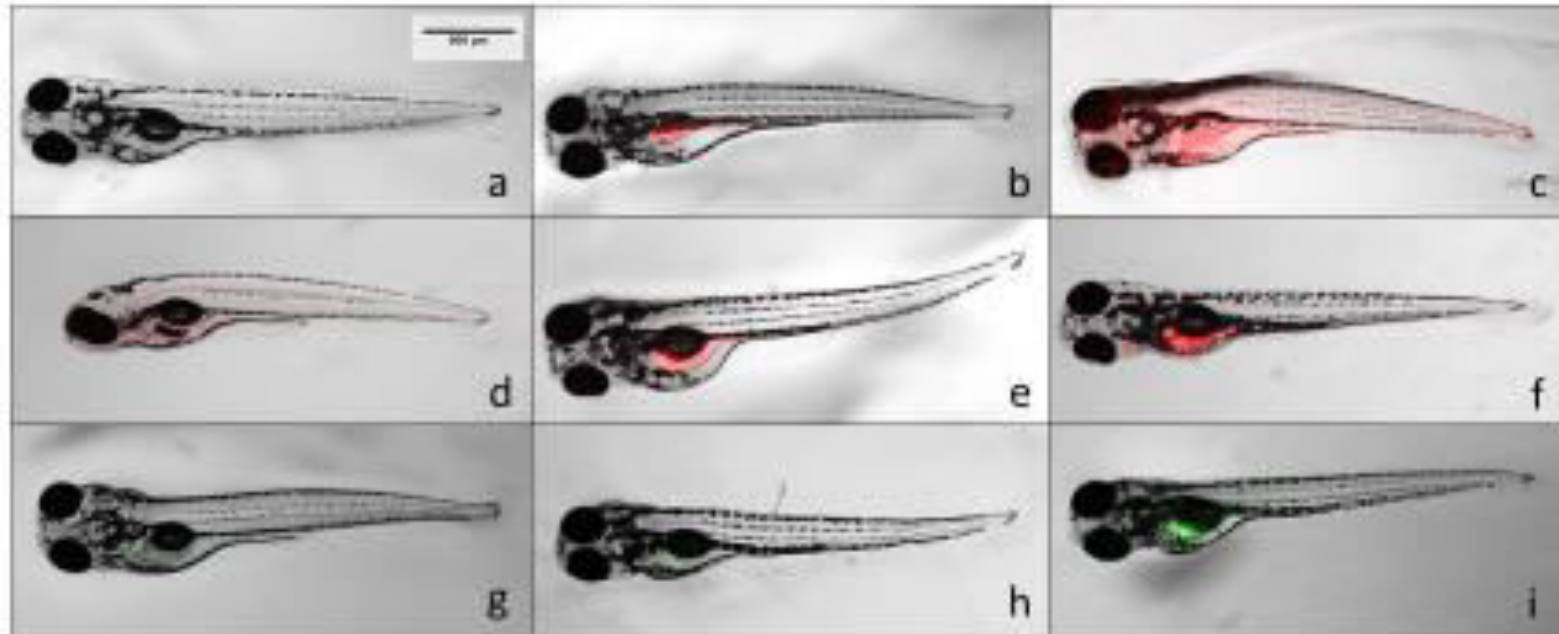
Microplastics in Wild Mussels (Scotland)



“Low Levels of Microplastics (MP) in Wild Mussels Indicate that MP Ingestion by Humans is Minimal Compared to Exposure via Household Fibres Fallout During a Meal”



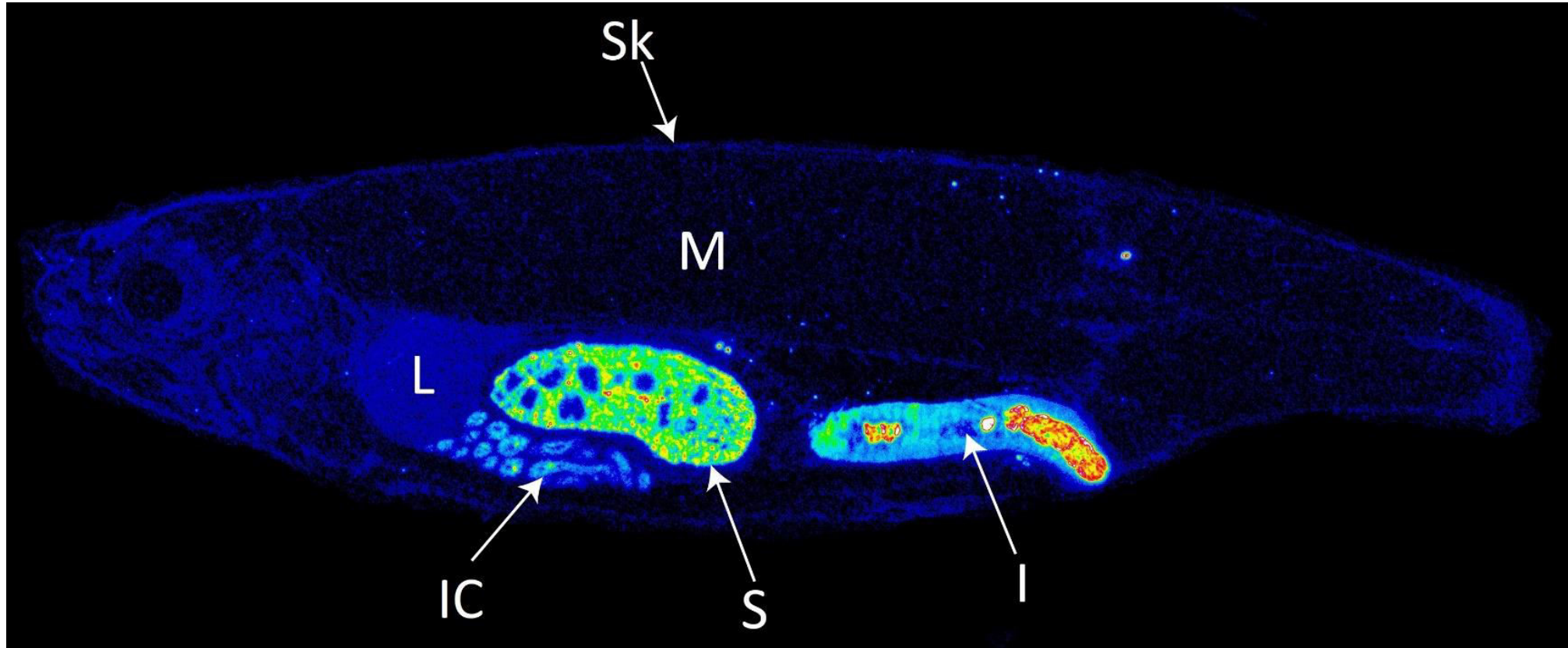
Are ingested plastics absorbed?



Absorbed = cross epithelial membrane (accumulate within internal organs?)

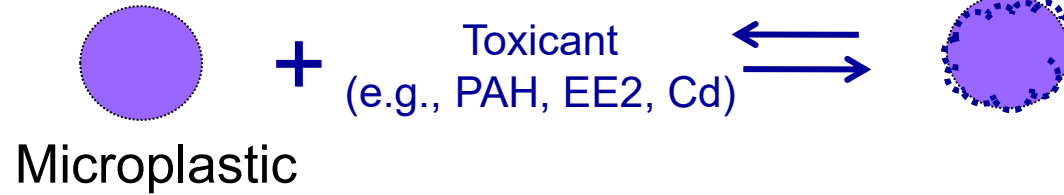
- Fluorescent signal is not sufficient evidence

Fish ingest plastics, but absorption is minimal



^{14}C labelled Polystyrene

Toxicant Sorption:



Toxicants are sorbed to microplastics

- Toxicant presence **not** = bioavailability

Our results indicate:

- Sorption to MPs in aqueous phase (EE2, PAHs, Cd²⁺)
- Sorption less than predicted by physicochemistry
- Delivery of toxicants to organisms minimal
- Presence of MPs reduces toxicant bioavailability

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Microplastics in the Environment – Perspectives and Priorities

- Are microplastics ingested?
- Absorbed and accumulate internally?
- Transfer in food web – human exposure?
- Are substances attached to microplastics?
- Are substances bioavailable to organisms?
- Are microplastics toxic?

Yes
No(?)
No(?)
Yes
No(?)
No(?)

