Impact of microplastics on human health in the New Zealand diet

Jeane Nicolas[1], Olga Pantos[2], Sally Gaw[3]

[1] New Zealand Food Safety, Ministry for Primary Industries, Wellington, New Zealand
[2] Institute of Environmental Science and Research, Christchurch, New Zealand
[3] University of Canterbury, School of Physical and Chemical Sciences, Christchurch, New Zealand

Context

Microplastics are ubiquitous in the environment and are increasingly being reported in food.

The health hazard of microplastics, and any associated chemical contaminants or additives is largely unknown.

Research identified microplastic contamination in New Zealand seafood.[1,2] Key New Zealand government reports have highlighted the lack of New Zealand data on the characteristics and concentrations of chemical contaminants associated with microplastics.[3,4]

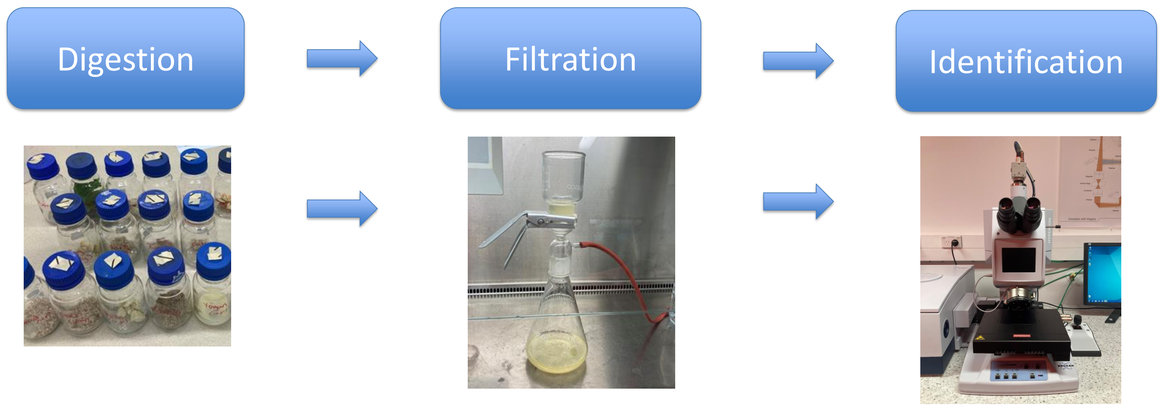
In 2020, New Zealand Food Safety began a 4-year research programme on microplastics to address these data gaps.

Research

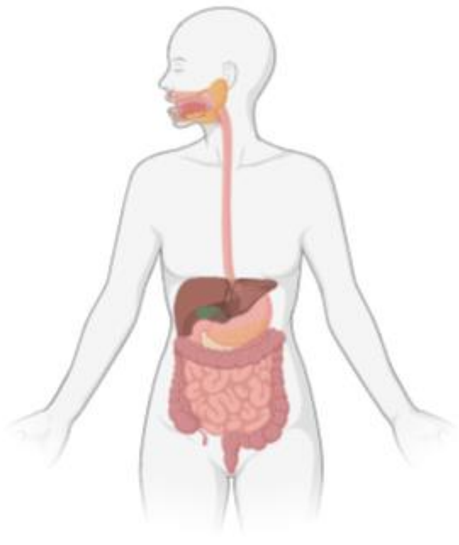
- Develop an analytical method to characterise microplastics in different food matrices;
- Food survey to characterise microplastics in a range of commercially available food;
- Food survey to characterise microplastics in wild gathered food;
- *In vitro*/*ex vivo* bioavailability study on oral exposure to microplastics and the associated chemical contaminants;
- Assessment of the economic impact of microplastics contamination on the primary industries.

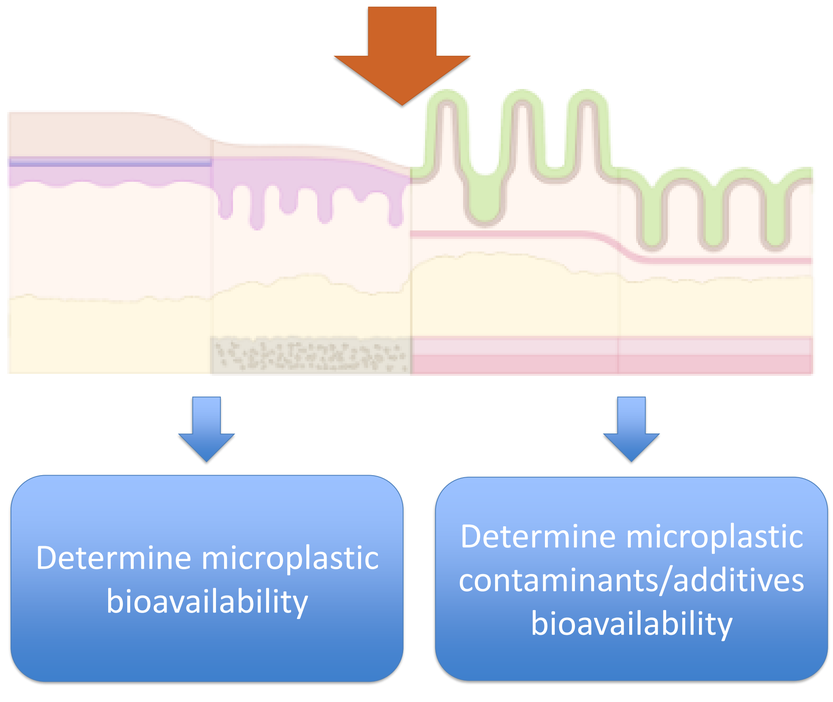
Food surveys

- NZ food survey categories: fruits, vegetables, grains, animal products, beverages, miscellaneous (e.g. yoghurt, oil), wild food (land, marine and freshwater harvested food);
- Development of an analytical method for the detection and identification of microplastics in different food matrices;
- Extraction of microplastics from different food matrices without impacting the plastic integrity.



In vitro / ex vivo bioavailability study





Lessons learned from analytical method development

- ✓ No standardised method is available to extract microplastics from the different food matrices.
- ✓ Methods available to extract microplastics from environmental samples (e.g. soil, water) do not work for food matrices.
- ✓ Chemicals at low concentrations, or a combination of enzymes and chemicals, are needed to digest food matrices for filtration.
- ✓ Temperatures up to 55°C, and digestion time up to 7 days is needed for some food matrices.
- ✓ Differences in digestion efficiency between uncooked and cooked food.
- ✓ Filter type has an impact on filtration of protein or starch rich food.
- ✓ Multiple methods are needed to extract microplastics from food matrices across the diet.

Acknowledgements
This work is funded by the Ministry for Primary Industries Operational Research Programme.

References
[1] Webb, S., Ruffell, H., Marsden, I., Pantos, O. and Gaw, S., 2019. Microplastics in the New Zealand green lipped mussel *Perna canaliculus*. Marine Pollution Bulletin, 149, p.110641.
[2] Markic, A., Niemand, C., Bridson, J. H., Mazouni-Gaertner, N., Gaertner, J.-C., Eriksen, M., & Bowen, M. (2018). Double trouble in the South Pacific subtropical gyre: Increased plastic ingestion by fish in the oceanic accumulation zone. Marine Pollution Bulletin, 136, 547-564.
[3] Rethinking Plastics in Aotearoa New Zealand, A report from the panel convened by the Office of the Prime Minister's Chief Science Advisor, December 2019
[4] Pantos O., Cressey P., Nicolas J. Risk Profile: Microplastics in the diet New Zealand Food Safety. Technical Paper No: 2019/09 Prepared for New Zealand Food Safety, Institute of Environmental Science and Research, Christchurch, New Zealand, November 2019

Further Information
Jeane.Nicolas@mpi.govt.nz

New Zealand Food Safety
Ministry for Primary Industries
Manatū Ahu Matua