WAI WĀNAKA | A TEENY-TINY TRUTH

SAMPLING MICROPLASTICS IN WATER

A COMMUNITY APPROACH

PREPARED BASED ON METHODOLOGY TRIALLED AND TESTED BY MARINE SCIENTIST:

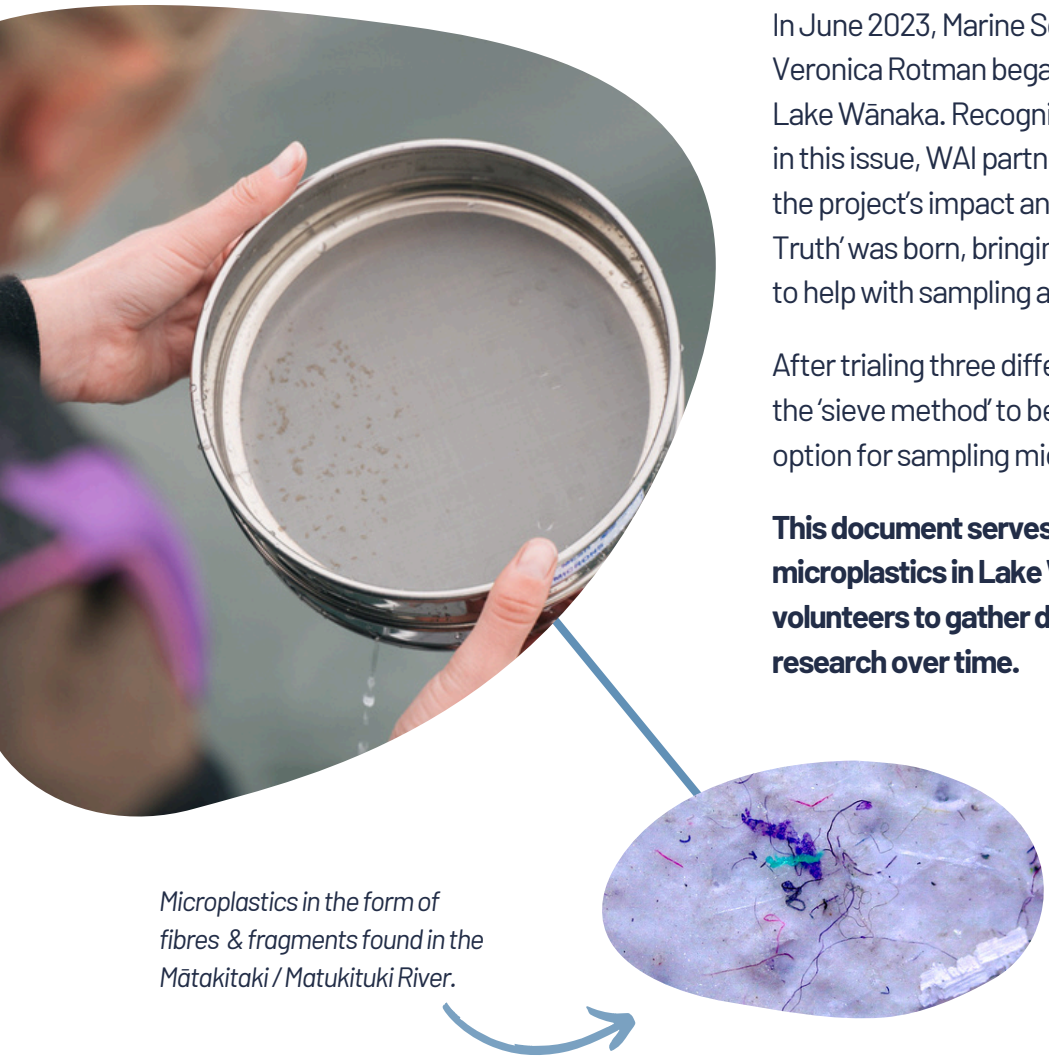
Veronica Rotman

What are microplastics and why are we monitoring their presence in fresh water?

Microplastics are any type of plastic less than 5mm long. Some have been made intentionally small, such as cosmetic microbeads, whereas others form through the break down of larger plastics over time.

In Aotearoa, microplastics could be degrading the health and mauri (lifeforce) of freshwater and marine ecosystems. Beyond their immense cultural and environmental value, the water from our lakes and river are a primary source of human drinking water, and rivers are a significant pathway for plastics to enter the ocean.

Therefore, it is important to understand the prevalence of microplastics in our aquatic environments, identify key sources and sinks of pollution, and mitigate these through innovation, education and policy change.



Microplastics in the form of fibres & fragments found in the Mātakitaki / Matukituki River.

In June 2023, Marine Scientist and PhD Student Veronica Rotman began her study on microplastics in Lake Wānaka. Recognising the community's interest in this issue, WAI partnered with Veronica to amplify the project's impact and reach. Thus, 'A Teeny Tiny Truth' was born, bringing together over 30 volunteers to help with sampling at 10 different locations.

After trialing three different methods, Veronica found the 'sieve method' to be the best citizen science option for sampling microplastics in fresh water.

This document serves as a guide for sampling microplastics in Lake Wānaka and beyond, enabling volunteers to gather data and build on Veronica's research over time.

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Equipment:

PREPARATION AND FIELD WORK

125 µm STAINLESS STEEL STACKED SIEVE

SQUEEZE BOTTLE

CARDBOARD BOX TO STORE SIEVES

STAINLESS STEEL FUNNEL TO FIT SIEVES

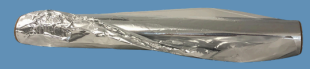
12L STAINLESS STEEL BUCKET WITH MARKED 10L LINE

500 - 1000ML GLASS JARS WITH LIDS

 # DEPENDANT ON SAMPLE SIZE, INCLUDING BLANKS

ULTRA-PURE DEIONISED (DI) WATER

PYRONEG SOLUTION



ALUMINIUM FOIL

CLOTHING MADE FROM NATURAL FIBERS

Equipment:

LAB WORK

ULTRA-PURE DEIONISED (DI) WATER

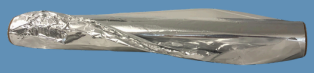
SQUEEZE BOTTLE

1000-2000ML GLASS BEAKERS

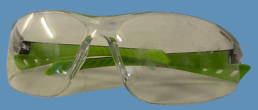
ONE PER SAMPLE

1.6 µm PORE SIZE GLASS FIBRE FILTER PAPERS

60% H^2O^2



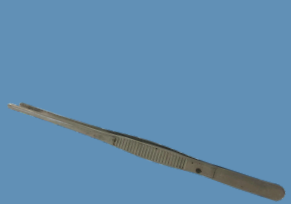
ALUMINIUM FOIL



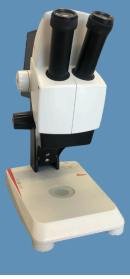
SAFETY GLASSES

LAB COAT

NITRILE POWDER FREE GLOVES



FINE TIP STAINLESS STEEL FORCEPS



DISSECTION MICROSCOPE

OVEN

A WATER BATH OR OTHER DEVICE THAT CAN REACH 40°C WORKS TOO

Equipment:

LAB WORK CONTINUED

VACUUM FILTER SET UP INCLUDING:
VACUUM PUMP, CLAMP, BÜCHNER FLASK, BÜCHNER FUNNEL WITH RUBBER ADAPTER, AND RUBBER VACUUM TUBING

CLICK HERE for how-to

Method:

PREPARATION

1. THOROUGHLY WASH GLASS JARS IN DETERGENT OR PYRONEG SOLUTION. RINSE FOUR TIMES WITH ULTRAPURE WATER AND LEAVE UPSIDE DOWN TO DRY ON A CLEAN WORKSPACE. COVER DRYING JARS WITH ALUMINIUM FOIL TO PREVENT AIRBORNE FIBRES FROM SETTLING ON THEM.

2. ONCE DRY, CUT OUT SMALL SQUARES OF ALUMINIUM FOIL AND COVER JARS BEFORE SCREWING THE LID ON TOP.

3. LABEL JARS BY SAMPLE SITE AND REPLICATE NUMBER. AIM FOR 5 REPLICATES PER SITE.

4. PREPARE ENVIRONMENTAL BLANKS TO PLACE OUT AT THE TIME OF SAMPLING BY FILLING TWO GLASS JARS HALF FULL OF ULTRAPURE DI WATER PER SAMPLE SITE.

Method:

FIELD WORK

1. OPEN TWO GLASS JARS HALF FULL OF ULTRAPURE DI WATER AND LEAVE OUT FOR THE ENTIRETY OF THE SAMPLING AT EACH SITE.

2. RINSE STAINLESS STEEL BUCKET AND BACKWASH SIEVE THOROUGHLY IN SAMPLING SITE WATER.

3 USING A STAINLESS STEEL BUCKET, POUR 60L OF WATER (OR 20L-40L IF HEAVILY POLLUTED) OVER 125 µM SIEVE IN 10L INCREMENTS. SAMPLES SHOULD BE TAKEN FROM THE SIDE OF A BOAT OUTSIDE OF WAKE ZONE, OR UPSTREAM OF YOUR POSITION TO AVOID CONTAMINATION OR AGITATION.

4 USING THE SQUEEZE BOTTLE FILLED WITH SITE WATER, FLIP SIEVE ONTO STAINLESS STEEL FUNNEL AND BACKWASH CONTENTS INTO LABELLED GLASS JAR. FILL APPROXIMATELY QUARTER OF THE JAR PER SIEVE, AND REPLACE LID WHEN HALF FULL.

5 MOVE RANDOMLY 10M IN ANY DIRECTION AND REPEAT FOR EACH OF THE FIVE REPLICATES AT THE SITE.

6 STORE JARS IN A DARK FRIDGE OR DARK ROOM TO REDUCE ANY GROWTH OF PHOTOSYNTHETIC ORGANISMS UNTIL LABORATORY PROCESSING OCCURS.

Method:

LAB WORK

1 PREFILTER 60% H^2O^2 THROUGH 1.6 µM GLASS FIBRE FILTER PAPER TO REMOVE ANY CONTAMINANTS.

2 PLACE TWO LABORATORY BLANK GLASS FIBRE FILTER PAPERS OUT IN THE WORKING AREA TO PICK UP AIRBORNE CONTAMINATION WHEN SAMPLES ARE EXPOSED (SEE VIDEO ON NEXT PAGE).

CLICK HERE for setting up control samples/blanks how-to

3 CREATE A 30% SOLUTION OF H^2O^2 BY FILLING THE JARS WITH THE SAME VOLUME OF EACH SAMPLE WITH PREFILTERED 60% H^2O^2 .

4 COVER SAMPLES IMMEDIATELY WITH ALUMINIUM FOIL AND PLACE INTO A 40 °C OVEN (OR ALTERNATE HEAT SOURCE SUCH AS WATER BATH OR PIE OVEN) FOR 48-72 HOURS, OR UNTIL THE MAJORITY OF ORGANIC MATTER IS ABSENT.

5 VACUUM FILTER EACH SAMPLE THROUGH A 1.6 µM GLASS FILTER PAPER. RINSE THE BUCHNER FUNNEL FOUR TIMES USING A SQUEEZE BOTTLE FILLED WITH ULTRA-PURE DI WATER, AND LEAVE VACUUM ON TO RINSE BOTTOM OF BUCHNER FUNNEL ONTO FILTER PAPER (SEE VIDEO ON NEXT PAGE)

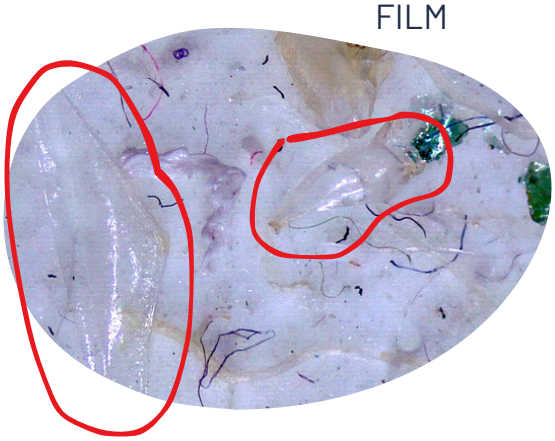
CLICK HERE for vacuum filter and rinsing Buchner funnel how-to

6 USING A DISSECTION MICROSCOPE AT 20× TO 60× MAGNIFICATION, PERFORM A VISUAL IDENTIFICATION OF MICROPLASTICS. MICROPLASTIC **FRAGMENTS** ARE IDENTIFIED AS PARTICLES OF OFTEN IRREGULAR SHAPE WITH NO EVIDENCE OF CELLULAR STRUCTURE (UNLIKE ORGANIC); **FIBRES** WITH AN EQUAL THICKNESS ALONG THE LENGTH; **NURDLES** CAN BE IDENTIFIED AS SMALL ROUND BEADS; **FILMS** AS THIN AND FLAT PIECES; AND **FOAMS** AS LIGHT, POROUS PARTICLES. MICROPLASTICS ARE CATEGORISED AS PARTICLES UNDER 5MM IN SIZE. ONCE IDENTIFIED, THE COLOUR, SHAPE AND NUMBER OF MICROPLASTICS ARE TO BE RECORDED. (SEE VISUAL OF DIFFERENT TYPES ON NEXT PAGE).

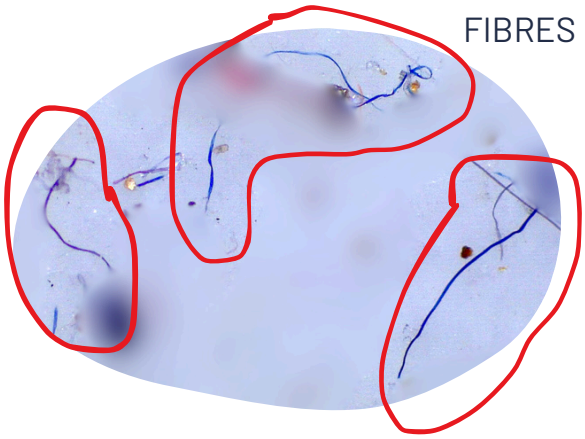
7 CARRY OUT THE SAME VISUAL IDENTIFICATION FOR ENVIRONMENTAL AND LABORATORY BLANKS.

Types of Microplastics

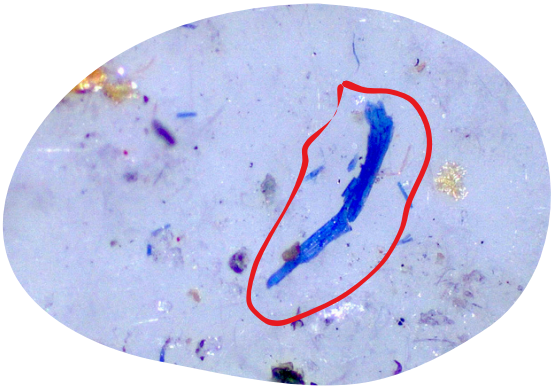
FILM



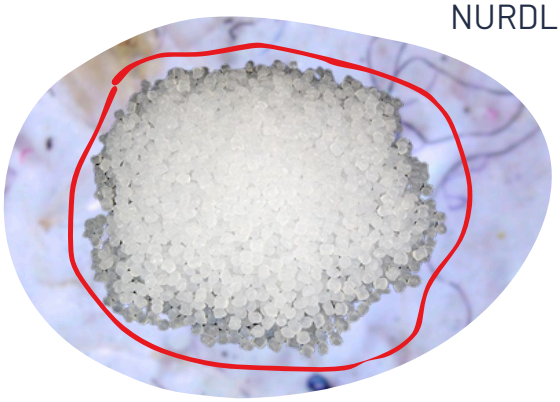
FIBRES



FRAGMENTS



NURDLES



'Spotters Guide to Plastic Pollution'

8 IF RESOURCES ALLOW, A SUBSAMPLE CAN BE SENT TO A LABORATORY FOR FTIR (FOURIER TRANSFORM INFRARED SPECTROSCOPY) OR RAMAN SPECTROSCOPY, WHICH CAN IDENTIFY THE CHEMICAL COMPOSITION OF MICROPLASTICS, OFFERING A MORE DEFINITIVE IDENTIFICATION THAN VISUAL METHODS ALONE.

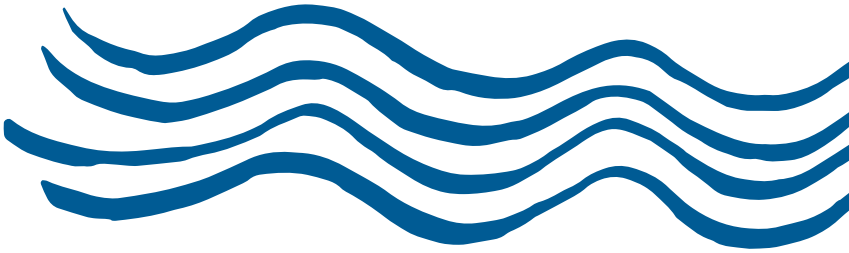
Data Anaysis

1 CORRECT COUNT DATA BY SUBTRACTING NUMBER OF PARTICLES IN ENVIRONMENTAL AND LABORATORY BLANKS FROM RELEVANT SITE COUNT DATA.

2 THE MICROPLASTICS ABUNDANCE IN WATER SHOULD BE EXPRESSED AS MICROPLASTICS (MP) PER L^{-1}.

3 IF FURTHER STATISTICAL ANALYSIS IS AVAILABLE, THE COUNTS OF MICROPLASTICS PRESENT IN SAMPLES CAN BE COMPARED ACROSS LOCATIONS USING A NEGATIVE BINOMIAL GENERAL LINEAR MODEL.

4 IN ORDER TO ADJUST P-VALUES FOR PAIRWISE COMPARISONS BETWEEN LOCATIONS, A TUKEY POST HOC TEST CAN BE USED. SIGNIFICANT DIFFERENCES ARE ACCEPTED AT THE LEVEL OF $P<0.05$.



KĀ MIHI NUI

THANK YOU VERY MUCH

A huge thank-you goes out to:

Marine Scientist Veronica Rotman, the University of Auckland and the University of Otago

As well as the Otago Participatory Science Platform for supporting this initiative.