"...guided inquiry into a real-world local issue"

AUSMAP

AUSTRALIAN MICROPLASTIC ASSESSMENT PROJECT

Survey WORKSHEET

Years 7-12

Context

The Australian Microplastic Assessment Project (AUSMAP) has partnered with NSW Department of Education Environmental & Zoo Education Centres to support the implementation of the AUSMAP citizen science investigation for secondary students.

AUSMAP enables you to conduct real world investigations, adding data to the AUSMAP database which is used by a range of research and management organisations.

The Survey Day

Following the correct method is the most important part of your survey day, as it means the data is valid and can be compared to other data sets. Your survey day will include:

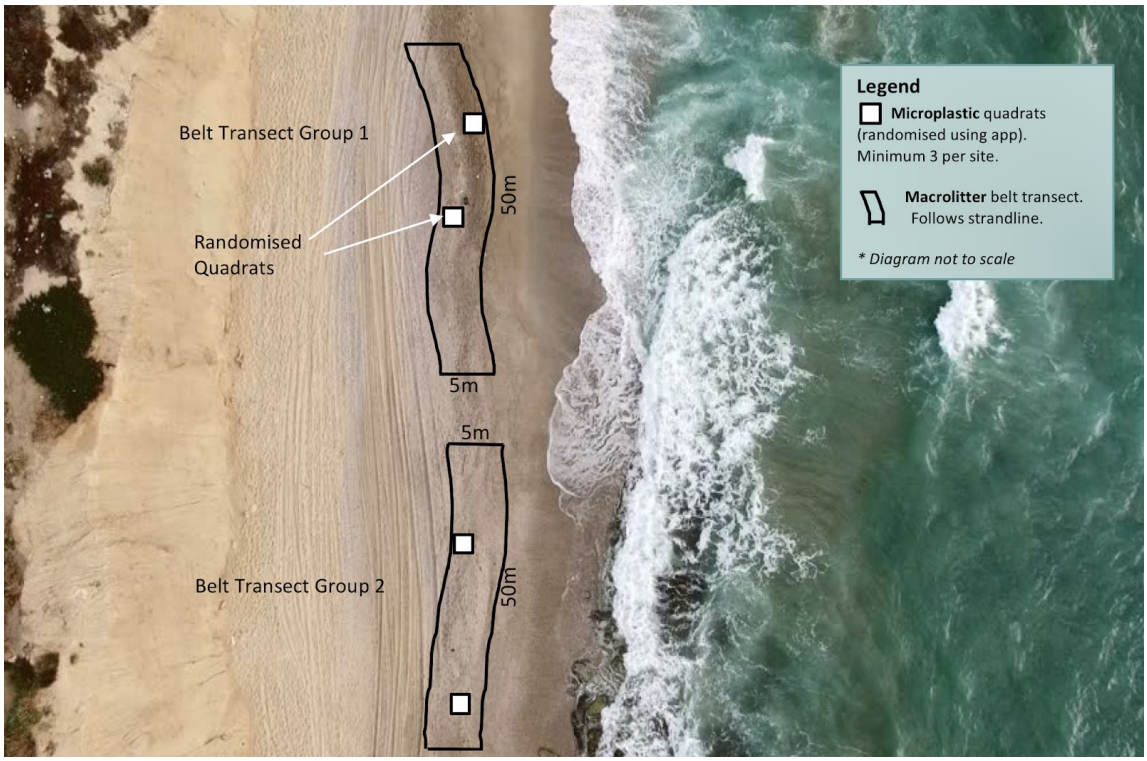
1	Site Assessment
2A	Microplastic Survey
2B	Microplastic Data Analysis
3	Macrolitter Survey
4	Data Reporting

Glossary of Key Terms

Macrolitter or Marine debris	Any human generated or modified litter or waste items greater than 5mm in size (e.g. plastics, metal, glass, timber, rubber, paper) that end up in a waterway. This term includes Mesoplastic (5-20mm) and Macroplastic (>20mm).
Microplastic (or MP)	Plastic waste or litter from 0.001 - 5mm in size
Nurdle (or resin pellet or industrial pellet)	Original form of plastic when first produced (pre-production)
Quadrat	Square plot used for sampling surface items over a small area
Strandline/HWM	The line/s on a shoreline where the last high tide or rain event has deposited debris. HWM = High Water Mark.
Transect	Set length used for sampling surface items over a large area. A belt transect is a type of transect used to sample a rectangular area.

The Survey Diagram

This diagram illustrates the macrolitter belt transects and microplastic quadrats. You will be working in groups. Each group will conduct **one** macrolitter belt transect and **at least one** microplastic quadrat. Your microplastic quadrats will be located at random locations within your macrolitter belt transects. Your site assessment should be done adjacent to the belt transect.



You will be working in groups of 4-6. You will be surveying a zone or area of shoreline and will be allocated a survey number (eg. North 1). This zone will be where all your surveys will be conducted. To find this zone:

1. Locate a start point on the beach. This should be a permanent landmark or feature (e.g. in line with steps, a prominent tree or surf club); take a **GPS reading** of this position.

2. Move down to the **recent strandline** (e.g. high-tide mark) in line with the identified landmark.

3. **Mark out a belt transect** (e.g. 50 m x 5 m for beaches or 30 m x 3m for rivers and mangroves) parallel to the shore either centred on major strandline for coastal beaches and mangroves or from shoreline up for river sites.

TRANSECT NEEDS TO FOLLOW THE STRANDLINE – IT CAN BE CURVED

4. **Use stakes or flags to mark position at start and finish** of the four points of each belt transect. Leave the tape measure out along one side of the transect.

1. Site Assessment

Site details are an important part of any environmental survey. Complete the following tables to upload to the system.

Site Name					
Location				GPS	
Date		Time		Recorder's Name	
Rainfall in last 72 hrs (mm)				Temperature (degrees C)	
Wind Speed (knots)				Wind Direction (compass bearing)	

Shoreline / Water Features			
Beach length (km)		Tide (ebb or flood)	
Aspect (position shoreline faces, e.g. compass bearing)		Shore slope (0-3%), (4-9%), (10-15%), (16-30%), (31-60%), (>60%)	
Natural features present (e.g. offshore reef, embayment, prominent headlands, mangroves, meandering river)		Average wave height or river flow (m)	
Mean channel width (rivers)		Water depth (in river if known)	

Dune or Riparian Zone (adjacent to sample location, within 10m)			
Number of trees >3m		Number of shrubs <3m	
Ground cover % (including pneumatophores)		Canopy cover %	
Width of dune/riparian zone (m)		Height of dune/shore (maximum)	
% Exotic species			

1. Site Assessment (continued)

Human Influences (within 500m of the sampling area)	
No. of people observed in area	
No. of access points	
No. and types of bins (e.g. recycling, landfill)	
Estimation of visual load of macrolitter (e.g. none, low, moderate, high)	
Distance to nearest stormwater outlet or other input (rivers/creeks)	
No. of stormwater outlets or other inputs	
Proximity and type of nearest gross pollutant trap (e.g. cage, net, rack)	
Proportion (%) of impermeable surfaces in surrounding area (e.g. carparks, pathways, roads)	
Predominant adjacent land use (e.g. industrial, commercial, residential, bushland)	
Other factors present (e.g. surf club, shops, housing, large logs/timber, boat ramp, boating, fishing, surfing, dog walking, picnicing)	
Photopoints Standing at the start of your belt transect, take a photograph facing North, South East and West.	

Include a planform (top view) sketch with a scale, or a photograph of the site Include all relevant features, e.g. stormwater drains, pollution traps, bins, entrance points, pathways, litter accumulation.

2A. Microplastic Survey

Even if a shoreline looks clear from macrolitter, it can be contaminated with microplastic. You will be conducting at least one microplastic survey quadrat at a random location within your macrolitter belt transect.

1. Each quadrat needs to be randomly located within the 50m (or 30m) transect. Using the **Random Number Generator app** (for Android or iPhone), set the minimum (1) and maximum (50) range and press 'generate' - this will give you a 'random number' which will be the start of the 1st quadrat.
2. **Place the 0.5 x 0.5 m quadrat on the strandline** or at shoreline edge (for non-tidal locations); make sure to avoid highly disturbed areas (e.g. heavily trampled or raked area).

3. **Press down on the quadrat edges** so that the complete frame is flush with the surface.
4. If there is a lot of **organic debris** (e.g. sticks, pumice, seaweed) in the quadrat, you will need to check for any microplastics on these before discarding. Do this by washing the debris in a large tray with sea water, then remove the organic debris from the tray and sieve the remaining tray contents.

5. **Insert the wooden ruler with 2cm line marked** into the sediment, this will act as a depth guide to determine how far to dig (2cm).
6. Make sure the **two sieves are aligned** on top of one another with the larger meshed one (5mm) on top.

7. **Excavate the top 2cm of sediment** (depth mark on ruler).
8. **Transfer the sediment from the quadrat to the sieves using the trowel**. This should be done in about a quarter of a quadrat at a time to avoid overloading the sieve. Thus, about four loads will be sieved for each micro plastic quadrat.

9. **Swivel the sieve back and forth** in semi-circular fashion, like you are panning for gold!
10. If sediment is dry the sieving can be done without water; if damp, then water will be required. Use the small bucket in the kit to pour water (collected from the beach) over the sediment and through the sieve or take to the water's edge and sieve in water.

However, do not submerge the sieve under water as potential samples may float away and do not push the sediment through with your hands.

11. **Continue to sieve until all sediment has passed through both sieves**. When the sieves are clear of sediment, place the next load of sediment from quadrat in the sieve.

    NB. Keep sieves together until all sieving is completed.

12. When all the sediment from the quadrat has been removed, separate the two sieves. The first sieve will collect only macro-litter (>5mm)

    NB. ***this will not be counted on the microplastics sheet but can be recorded on the marine debris data sheet.***

13. **Transfer contents of lower sieve (1mm) to a sorting tray**.

Tip *– to help with removing contents, turn sieve upside down and pour water over it, being careful not to overflow the tray.*

Tip *– when putting the sieves back together after tipping out contents, make sure there is no sand or debris on the base of the 5mm sieve and the top of the 1mm sieve. This will make getting them apart easier.*

14. After the whole quadrat has been sieved and the contents of the 2nd sieve (1mm) have been put on the sorting trays, **add some seawater or hypersaline brine to each tray**, just enough to float the buoyant items.

15. **Search the tray for floating objects that have obvious differences to the organic matter** (e.g. coloured items or different shaped items).

16. Use the **Microplastic Identification Guide** to help identify microplastics from other common items.

Tip *– Also check the walls of the tray as the plastics will commonly adhere to the tray surface. Be extra vigilant for clear and opaque plastics, if in doubt include anything that you think looks like plastic!*

Second Quadrat: If time allows, repeat the random number generator process and conduct another microplastic quadrat survey within your 50m belt transect. Ensure you keep samples of both quadrats separate for analysis and sharing.

2B. Microplastic Sorting

Microplastic is very small and hard to see, so make sure you use the charts below and look very carefully.

17. Using forceps or a pipette, place any plastics or potential plastics in the 'biopak tray'.

18. **Then sort by colour and type** (e.g. white hard plastic, white foam, clear resin pellet).

    See Microplastic Identification Guide for options.

> ***Tip*** *– if rushed for time, place all plastics in a labelled sample jar for classifying later.*
>
> *Alternatively, all the tray contents (organic and synthetic) can be bottled for sorting later.*

19. Also check the tray bottom as not all plastic will float. Carefully sort the bottom of the tray, a (mobile phone) light, torch or magnifying lens may help to find and pick up microplastics that are then added to the sorting tray.

> ***Tip*** *– a good iPhone app is* ***Mag Light*** *or* ***Cosy Magnifier*** *for android phones*

20. The **sieve or tray can be further searched in the field** using plug in microscopes, magnifying glasses or smartphone apps by placing a portion of the sample on a petri dish or second tray.

21. Once plastic has been separated any remaining organic matter can be thrown away.

22. **Record any microplastics found on the Microplastic Data Sheet noting**:

    - Colour,
    - Approximate size class (1mm ranges),
    - Type (foam plastic fragment, hard plastic or sheet plastic fragments, pellet, foam, fibre),
    - Shape, and
    - Quantity.

23. Once all data has been recorded for tray, **place <u>all</u> microplastics (< 5mm) in a jar and label** with site, date, group or number (e.g. **Manly Cove, 27/09/18, Grp1 or Q1E** (quadrat 1 east)).

24. **<u>One sample jar is required for each quadrat.</u>** As soon as possible, please **<u>send all samples</u>** to Macquarie University at the following address for sample verification and further analysis:

Dr Scott Wilson

Dept. Environmental Science, Macquarie University, 12 Wally's Walk,

North Ryde NSW 2109.

YOU NEED A MINIMUM OF 3 QUADRATS PER SAMPLING LOCATION

(E.G. IF YOU ARE ONLY DOING 1 TRANSECT, THEN AT LEAST 3 QUADRATS;
IF 5 TRANSECTS, NEED AT LEAST 5 QUADRATS).

Quality Control Procedure

It is critical that the Group leader (or designated person) checks over <u>all sample trays</u> to ensure all microplastics have been retrieved.

Microplastic Identification Guide

Resin Pellets

Also known as nurdles
Spherical or slightly cylindrical shape
3-4mm diameter
Various colours, including clear/opaque

Fibres

Consistent width and colour along length
Length varies
Width can be microscopic to 1mm
Various colours

Foam Beads & Fragments

Light and float, like small or fragmented beanbag beans
Spherical beads or irregular fragments
Usually white
Various sizes

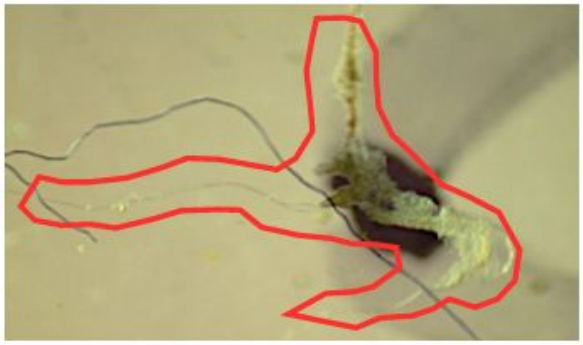
Sheet Plastic Fragments

Fragments of flat pieces of plastic
Size and shape varies
Various colours

Hard Plastic Fragments

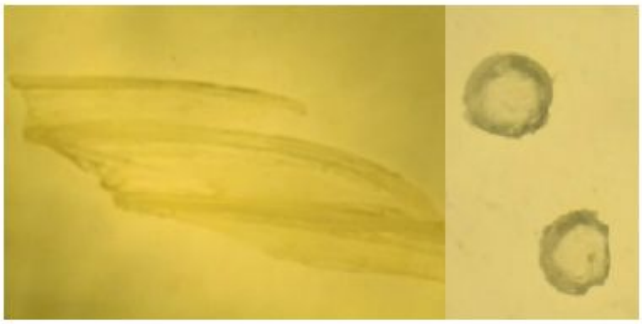
Usually with distinct edges
Angular, irregular shapes
Various sizes

Items Commonly Mistaken for Microplastics



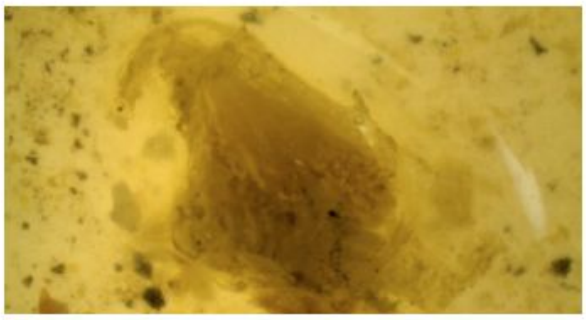
Organic Fibres

Variable width with cellular structure
Irregular shapes
Various sizes
* Blue synthetic fibre also present in photo.



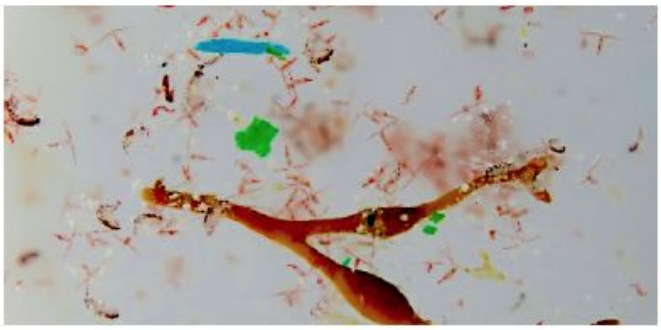
Fish Lens & Bone Structures

Clear/opaque colour
Look and feel like plastic
Will bubble in hydrogen peroxide



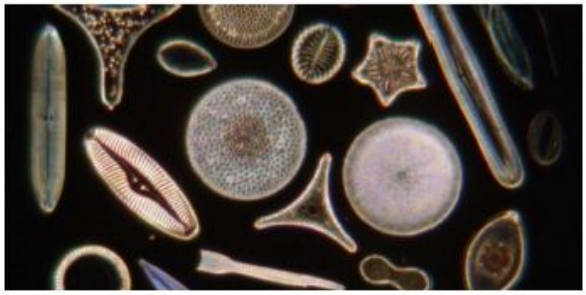
Organic Debris

Variable shapes
Breaks up easily



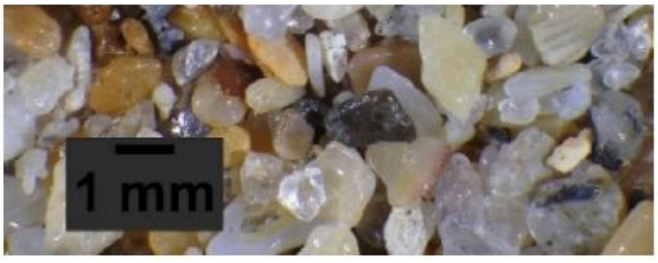
Seaweed & Micro-Crustaceans

Organic colours
Irregular shapes
Cells visible under microscope
* 3 colourful microplastic fragments also present in photo



Phytoplankton

Structure visible under microscope



Shell & Rock Fragments

Will sink in water

Microplastic Data Sheet

Date:	Group Number:	Team members in group:
Site:		
Site type and description: (beach or river shoreline)		
GPS coordinates: (retrieve from page 6)		Shoreline section: (e.g. northern end)
Quadrat Number:		

Colour: (including clear & opaque)	Plastic type: (hard fragments, pellets, films, foams, fibres, beads)	Size: (<1mm, 1-2mm, 2-3mm, 3-4mm, 4-5mm, >5mm)	Shape: (cylindrical, rounded, angular, irregular)	Amount	Comments: (fresh, weathered, grooved, fracturing)

3. Macrolitter Survey

We need to know the type and abundance of macrolitter. This enables us to assess the relationship between macrolitter and microplastic at each site.

1. **Label sample bag** with site name and code, date and transect number with permanent marker.

2. Record the GPS coordinates at either end of the belt transect:

GPS Coordinates of Belt Transect			
GPS at 0m:		GPS at 50m:	

3. **Only macrolitter from the transect goes in the bags**. Use multiple bags if necessary but add number of bags used (e.g. Terrigal Lagoon, 16/04/2018, North 1, Bag 1 of 2).

4. **Walk up and back along the transect slowly in emu file and collect all human generated debris** (e.g. plastics, metal, glass, timber, rubber, cloth) on the beach surface within the transect and place in collection bag.

5. **Collect all surface visible items** (approximately down to pinky nail size).

6. Do not dig in the sand or turn over seaweed unless retrieving a debris item partly visible. **Be careful of dangerous objects (e.g. glass, syringes).** Any large items too big to fit in the sample bag should be noted on the bag or data sheet (e.g. timber, tyres etc.).

7. Use the following Tangaroa Blue Data Collection sheets to sort and tally your macrolitter.

Data Collection Sheet

Tangaroa Blue Foundation
PO Box 1176 Margaret River WA 6285 www.tangaroablue.org

AUSTRALIAN MARINE DEBRIS INITIATIVE

Name of Cleanup Location (Beach)			
Cleanup Locality			**Locality Postcode**
Nearest Town	**Nearest Road or Landmark**		
Date	**Start time**	**Finish time**	**Number of People**
Contact Name		**Phone or email**	
Organisation/School (if applicable)			
Total Filled Bags	**Total Weight Kg**	**Length of Beach Cleaned (m)**	
Average Width of Beach (m)	**Type of Adjoining land**		

Please enter items not listed below in the additional items section or on an attached sheet.
Country of origin and barcode information from intact labels can be entered in the tally and note section against the particular item or on a separate sheet. A secondary data sheet is also available to record this and other information.

	Plastic Items	Total	Tally and Note
Consumer Items	Cigarette butts & filters		
	Cigarette lighters		
	Pens, markers & other plastic stationary		
	Straws, confection sticks, cups, plates & cutlery		
	Toothbrushes, brushes & combs, hair ties etc		
	Toys, party poppers, ribbons, clips & similar		
Packaging Items	Bleach & cleaner bottles		
	Lids & tops, pump spray, flow restrictor & similar		
	Personal care & pharmaceutical packaging		
	Plastic bags supermarket, garbage, dog poo, ice		
	Plastic containers non food (oil, sealant, chemical)		
	Plastic drink bottles (water, juice, milk, soft drink)		
	Plastic packaging food (wrap, packets, containers)		
	Plastic wrap non food (bubble wrap etc)		
	Strapping band scraps		
	Strapping band whole (record as single item)		
Fishing Items	Bait & tackle bags & packaging		
	Bait containers & lids, bait savers		
	Commercial fishing remnants (float, pot, crate bits)		
	Cylume glow sticks		
	Fishing line in metres (recreational)		
	Recreational fishing items (lures, floats, rods, reels)		
	Rope & net scraps less than 1 metre		
	Rope (estimated length in metres)		
Remnants	Plastic bits & pieces hard & solid		
	Plastic film remnants (bits of plastic bag, wrap etc)		
	Remnants burnt plastic		
	Foamed Plastic (Polystyrene) Items	**Total**	**Tally and Note**
	Foam buoys		
	Foam cups, food packs & trays		
	Foam insulation & packaging (whole and remnants)		
	Other Materials	**Total**	**Tally and Note**
	Oil globules & tar-balls		
	Sanitary (tissues, nappies, Condoms, cotton buds)		
	Shoes leather & fabric		

Data Collection Sheet

Tangaroa Blue Foundation
PO Box 1176 Margaret River WA 6285 www.tangaroablue.org

AUSTRALIAN MARINE DEBRIS INITIATIVE

Glass & Ceramic Items	Total	Tally and Note
Fluorescent light tubes and bulbs		
Glass beer stubbies & pre-mixed alcohol bottles		
Glass jars & sauce bottles		
Glass or ceramic broken		
Glass wine, spirit and similar bottles		
Cloth Items	**Total**	**Tally and Note**
Binding, thread, string & cord natural		
Cloth, clothing, hats & towels		
Metal Items	**Total**	**Tally and Note**
Aerosol cans		
Aluminium cans		
Foil wrappers, packets, bladders & alfoil		
Metal bottle caps, lids & pull tabs		
Metal fishing items (sinkers, lures, hooks, traps, pots)		
Tins under 4 litres (food, drink tins and similar)		
Paper & Cardboard Items	**Total**	**Tally and Note**
Newspaper, magazines & brochures		
Paper & cardboard packaging		
Tetra packs & drink cartons		
Rubber Items	**Total**	**Tally and Note**
Rubber balloons, balls & toys, elastic straps & bands		
Rubber footwear & thongs		
Rubber remnants		
Wood Items	**Total**	**Tally and Note**
Brooms, brushes & paint brushes		
Processed timber, pallets & other wood		
Wooden confection sticks, pencils, matches etc		
Additional Items	**Total**	**Notes**
Additional Information	(Circle)	**Comments**
Did you observe any **plastic resin pellets**?	**Y N**	
Did you observe any dead/injured **animals or birds**?	**Y N**	
Did you observe any highly unusual **beach conditions**?	**Y N**	
Other comments and feedback		

4. Reporting

AUSMAP needs a copy of your data set. Data from each group needs to be collated and pooled, so this might need to be done back at school. Your data is invaluable, so make sure you follow the steps below to share it.

1. Data for macrolitter and microplastics should be recorded on the appropriate data sheets noted in this Manual.

2. Macrolitter data for each sample will **need to be pooled** before being uploaded (e.g. one data sheet for each location).

3. Once compiled, send both the **microplastic data sheets and macro debris data sheets** **AUSMAP** (info@ausmap.org) and also enter the macro debris data into the Tangaroa Blue (TB) website (https://www.tangaroablue.org/database.html).

4. To access the TB database, you must first 'I ACCEPT THE OPEN ACCESS POLICY FOR THE AMDI DATABASE' which allows data sharing.

5. Follow the prompts to submit data; in order to do this, you will have to register and then sign in.

6. Once logged in, identify the location of your data collection point/s and the detail of the data collection, e.g. date, time, number of people, etc.

7. The items collected will then be listed under the appropriate category. All items collected in the macro (or marine debris) clean-up with be recorded under their specific item category.

8. Submit the form.

9. After the data has been accepted (which may take a couple of days), you will then be able to access a summary of your data so best to keep a copy of the data sheets should in depth analysis is required.

Summary

Forms to complete and return to AUSMAP:

1. **AUSMAP Site Assessment Form**
2. **AUSMAP Microplastic Data**
3. **Macrolitter Data Sheets (collate and send copy of data to AUSMAP & upload data to Tangaroa Blue/AMDI)**

AUSMAP.ORG

This student worksheet is updated as of 24 January 2019