



Marine Debris Monitoring Methods Handbook, Part II

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1 Foreword and updates

This project has grown and developed over the years, and we are now pleased to report that we have worked with partners to train citizen scientists, students and community members to collect high quality data in more than 15 countries around the world. From Australia and the Asia Pacific to Africa and the Americas, government staff, university personnel and students, community groups, volunteers and other types of organizations have participated in improving their understanding of litter losses to the environment in their local areas, in ways that meet their needs. We've documented litter along rivers, creeks, and streams, at inland areas, along our coastlines, and in coastal and marine environments. Across the countries where we've been privileged to work, we've seen big changes, and noted substantial differences in item types counted in countries – some of which relates to remoteness, population density, policies, practices, and local interventions, among other factors.

We now have version 2.0 of the handbook to share with you. In it, you will find that there are some substantial changes and updates.

What's new in this version of the handbook?

Due to Covid-19, we have needed to shift and adapt how we help to build capacity and train people from partner organisations. Some of the training resources we have developed are available on our website, and others are soon to follow (<https://research.csiro.au/marinedebris/resources/>).

In addition to remote training, we are excited to share with you the recently developed **ODK data entry portal/platform for capturing data** which works on Android devices. This is an easy-to-use app-like tool that you can use on your mobile phone or tablet. You simply go to your app store and search for ODK Collect. Once you have downloaded ODK to your device, open it and scan the QR code that CSIRO provides to you either prior to or during your training. Then you can simply start adding your data.

Don't worry, we provide training on this as well as part of the learning program!

To learn more about this tool and to download ODK, go to: <https://getodk.org/>.

In brief, we have now moved to app-based data collection. This exciting advancement supports the following improvements:

- Less time required for data entry;
- Videos available to provide immediate support/reminders in the field;
- Fewer errors (locations, forgetting to take photos, etc.);
- Streamlining data processes;
- No issues with low/no bandwidth;
- This platform works when you are offline or have no reception. When you return to an area where you do have reception, the data is automatically uploaded to the cloud.
- There is no cost to you as the user!

More information about ODK is provided throughout this handbook.

2 Overview and relevance

Plastic pollution in our environment has been identified as posing a substantial risk to biodiversity, people's livelihoods and economies. Given that most plastic that ends up in the environment comes from land-based sources, surveying litter in the environment, not only in coastal areas, but along waterways (rivers, creeks and streams) and at inland sites across a variety of land types, is an important and low-cost way to build a dataset that can enable long-term assessment and monitoring of anthropogenic debris in the environment. Because of our increased knowledge of the sources and pathways of litter in the environment, this global project focuses not only on the coast, but in upland and riverine areas. To understand the breadth of losses to the marine environment and in an aim to identify and quantify the 'urban plume' of floating plastics in the nearby coastal environment, we also quantify floating plastics in the nearshore environment.

Objective

We use a robust, statistically designed survey approach to measure waste losses in the environment. We couple this with mathematical modelling to estimate the distribution and movement of plastic waste near urban centres, along waterways, along the coastline and in the nearshore coastal/marine environment.

Approach

We work with collaborators to survey a/some major metropolitan areas and their surroundings in countries around the world. We conduct intensive training so that citizen scientist participants/organisation's staff members are equipped to survey within the selected area. This helps build capacity within the region, arming people with the tools to not only carry out an initial baseline survey, but to be able to use this information to build monitoring programs to address questions of interest. We generally target data collection at around 30 coastal sites, 30 riverine sites and 30-40 inland sites. We provide training and equipment to conduct surface trawls at 9 stations with 3 surveys each in the nearshore environment.

Outputs

We co-design robust sampling plans tailored for each country involved. These plans can be adapted for other participating countries. This data collectively comprises a comprehensive dataset and baselines of plastics on land, along rivers, at the coastal interface, and in the ocean for major coastal cities around the world. We are using this data with statistical models to produce maps that highlight the plumes of plastic emerging from urban centres and nearby areas. We can then estimate the amount of plastic from the plumes that is lost to the open ocean or redeposited back to land.

Outcomes

- Provide a clear linkage between land-based waste management and losses of waste into the coastal and marine environment, providing a comprehensive dataset that is harmonised with other global regions.
- Engaging and training local partner institutions.
- Building capacity to help people from participating countries be able to improve their analytical skills in terms of measuring, analysing, and mapping plastic pollution.
- Utilising learnings as a basis for advocacy to drive social pressure for investment in infrastructure and regulation for waste handling.

- Enabling knowledge such as predicting marine litter loads outside surveyed areas.
- Information to guide and engage with industry regarding best-practices.
- Identifying opportunities for waste management.
- Valuing plastic to reduce poverty and create alternative livelihoods.

3 Survey methods

This handbook provides detail on the various survey methodologies used by CSIRO’s team that focus on plastic pollution on land and at sea – in inland, riverine, coastal and marine (at-sea trawl) environments (Fig. 1). We invite you to follow our methodologies to develop consistent, robust datasets across various geographies that can be used in understanding waste or debris flows from land to the ocean.



Figure 1: An example of where surveys might take place in a coastal city across four site types.

Overview of survey methods

To get an overall view of the amounts and behaviours of litter in particular areas, we conduct surveys across multiple site types (Tab.1). We generally aim to survey across a 150-200 km coastline, within a single major watershed that is in and around a major metropolitan area (city or large town). Sites we survey include:

- **Inland:** Usually 30 to 40 inland sites are surveyed in a geographic region with 3-6 transects performed at each site. Inland transects are 25m² in area (either 12.5m X 2m or 25m x 1m) and are conducted in the primary land use types at the survey area. Transects are conducted at least 30m apart. See Inland specific method details in Section 9.
- **River:** Usually 30 to 40 river sites are surveyed in a geographic region with 3-6 transects performed at each site. River transects run from the water’s edge to 2m beyond the top of the riverbank and are 2m wide. Transects are conducted at least 50m apart. See River specific method details in Section 10.
- **Coastal:** Usually 30 to 40 coastal sites are surveyed in a geographic region with 3-6 transects performed at each site. Coastal transects are 2m wide and run from the water’s edge at the coastline to 2m into continuous vegetation or where the surveyor comes to a seawall or other barrier. Transects are conducted at least 50m apart. See Coastal specific details in Section 11.

- **At-sea Surface Trawl:** in the nearshore coastal environment: nine 10-15 minute tows over 3 transect lines (27 in total) conducted from a vessel or boat in nearshore areas, stemming from a major river near the city centre of the overall survey area.

The **difference between a site and a transect** can be confusing at first and there are separate ODK forms to fill out for both. See Figure 2.

- A **site** survey considers the area surrounding the transects and collects general information about what you can see in the area.
- **Transects** occur *within a site* and are where the actual item counts are surveyed and recorded. The image on the next page shows an example of a coastal site and three coastal transects within the site.

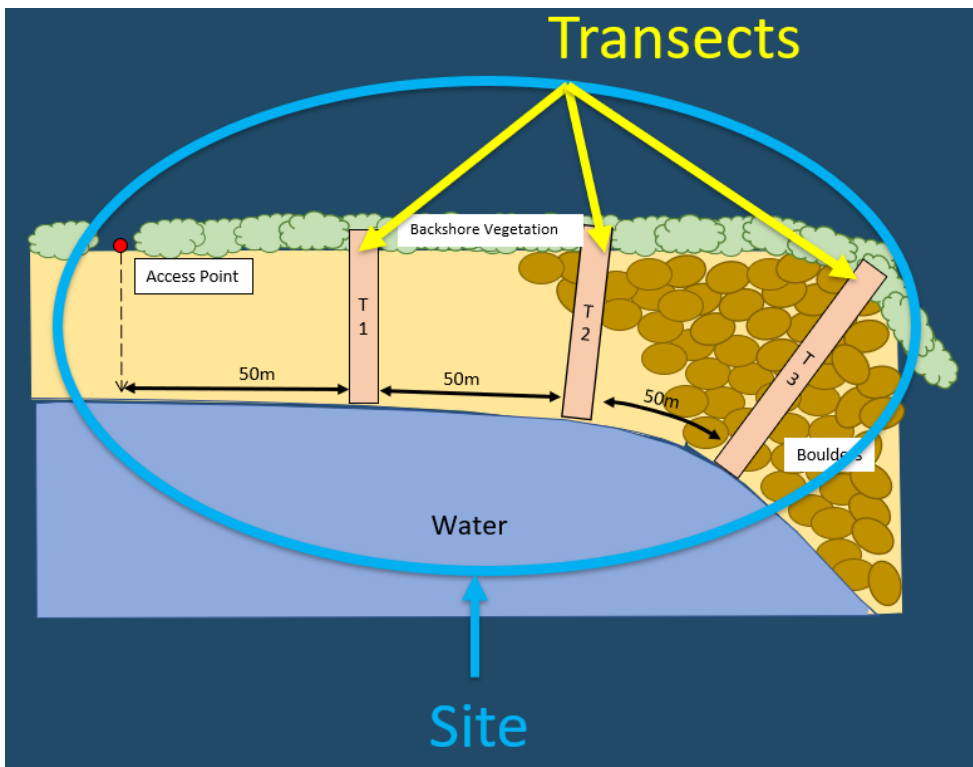


Figure 2: A site is the larger survey area, with multiple transects taking place within the site area.

Data entry

All survey data is recorded electronically using the **ODK Collect data entry portal/platform**. This is an easy-to-use app-like tool that you can use on your mobile phone or tablet. ODK Collect is free to all users and can be downloaded from the app store on any Android device by searching for 'ODK Collect'. We use ODK because it is open source, easy to use, and their ethos is about support environmental projects for the greater good – projects like this one!

Once the ODK Collect app is downloaded to a device, surveyors need to open it and scan the QR code that the CSIRO team provides. From then on, surveyors can use the app to add their data. Throughout this manual, we have outlined a step-by-step method for using the ODK Collect app and entering information/data collected for each site and transect conducted. The app also includes reminders and explanations for particular steps along the way.

ODK works on any Android device. For any surveyors who don't have an Android device during a training course, CSIRO can provide one for the duration of the training.

ODK Collect works even when there is no internet signal. All the information collected will be automatically uploaded to CSIRO's database when a signal is next available (conditions apply).

Multiple people can be working on different transects within the same site at the same time.

Communicating during fieldwork





Prior to going out in the field for surveys, we recommend setting up a WhatsApp group (or equivalent) which includes everyone doing surveys in your team, and the CSIRO trainers. You can use that platform to report locations, give updates of progress and ask questions.

Include the CSIRO trainers in the WhatsApp group also so they can help answer any questions.

It is important to have a 'check-in' base person who the survey team check in with at least **twice a day**, once when starting fieldwork and once when the fieldwork is finished.



Table 1: Examples of a transect occurring at each of the different site types.

Inland	River	Coastal	Trawl
			

4 Important tips and instructions

Please read this section carefully before you begin collecting data. Here you will find advice on topics that you will come across on all terrestrial surveys (Inland, River and Coastal).

4.1 Site selection

CSIRO staff will work closely with you and your team leader to identify exact survey sites. **Please do not undertake this activity without CSIRO's input.** YOU (and your team) identify the city and/or river of interest and we will use our software tools to select the specific survey sites for all the three land-based survey types (at-sea trawl transects are identified via discussion between CSIRO and the survey group).

When selecting sites, we generally limit a survey area to within a 100-200 km radius around an urban centre. We then consider a variety of information including population densities, proximity to roads and waterways, land use types and the socioeconomic status of the site areas. Including these socioeconomic and environmental layers and applying randomised site selection ensures that the data collected in surveys is representative of the study area – and can be used to predict where debris loads may be high in other similar areas. We also consider practicalities such as the distance of a site from an access road. For convenience, most river sites are selected within 2km from an inland site and we aim to have all survey sites within 2 km of a road.

Coastal sites are assigned evenly along the coastline of interest (still within the selected range for the chosen urban centre).

For at-sea trawl surveying, nine tows are conducted along three linear transect lines fanning out from the mouth of the largest river within the field sampling area. This can sometimes vary depending on marine zoning and weather restrictions.

If you would like to add a new area or change any of your sites, please let us know beforehand, as the sites that have been chosen for your project have been carefully selected based on random stratified sampling methodology. This ensures that the data cover a wide range of site types, and that all possible site types are accounted for (for instance varying population densities, proximity to roads and waterways, and land use types). If you intend on conducting surveys outside of the sites that have been selected by CSIRO, please ensure that they are selected at random, and not based on already existing debris accumulation points. We can work with you to include pre-existing sites, if required. If you find that your sites selected by CSIRO either have such high amounts of debris that they are too difficult to sample easily, or conversely have almost no debris, we will use adaptive sampling to make surveying these sites easier. We can help address any such issues.

What if I can't access the site?

If you can't reach the GPS point for any reason (e.g., it is inaccessible by road, the vegetation is too dense, or it is in a dangerous area), sample as close as you reasonably can to the GPS coordinates of the original site location. Keep in mind to select as randomly as possible (e.g., x number of steps and sample at that location). Don't bias the surveys – don't look for the area with the most amount of litter (or look for the cleanest area) to carry out the transect – this would bias the data and is not what we want. Remember to use the site ID of the original site.

What if the site is on a private property?

Always ask for permission to enter a private property to conduct a survey. If you are not granted permission, select an alternative site where you do have permission to survey and that is closest to the original location. Please make a note in the site form on ODK that this has occurred.

4.2 Transect location

Choosing transects locations within a site

Once the team has arrived at a CSIRO-designated site, the location of each transect needs to be decided. Regardless of the site type (Inland, River or Coastal), a site evaluation of land use types is made before deciding where to place the transects. Following this, transect location depends on the type of transect you are conducting.

For **river and coastal sites, transects should be located at least 50m from site access point** (ideally all should be located on the same side of access point unless they are in different habitat types).

More information on how to decide transect locations is provided in the specific method instructions (included in this handbook) for each site type.

How many transects do I complete?

Whether you are conducting river surveys, inland surveys, or coastal surveys, you will complete with a **minimum of three transects** at your site. If you finish all three transects and have not yet found a single item of debris on **any** of the transects, add another one. Keep adding transects either until you have found at least one litter item, or you have completed **six** transects, whichever comes first.

4.3 Counting litter items

How will I count all the litter?

Generally, all transects are 2m wide and are performed by two people with the measuring tape in the middle. That means each surveyor is responsible for recording all the items observed within 1m on one side of the tape measure (e.g. surveyor one counts items on the left side of the tape measurer while surveyor two counts the litter items within 1m on the right side of the tape measure). Try not to stand on the transect area while you are setting up the measuring tape.

When walking along the transect line, record all observable debris/litter items within the transect area that can be seen from **standing** height (Fig. 3 & 4).

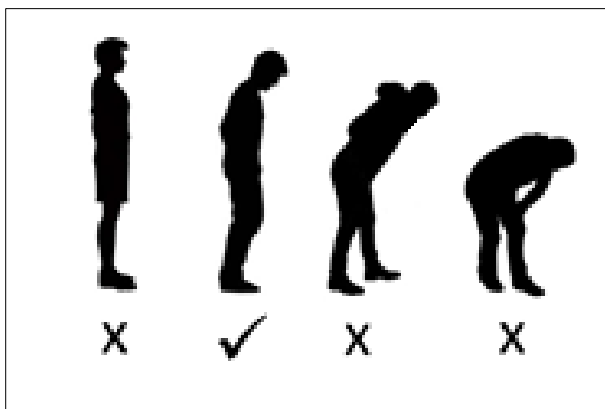


Figure 3: The correct way to perform a transect is to look down from standing height.

If you see something you are unsure about, bend down to pick it up (stand straight back up), and then decide if it is or is not an item to be reported. But when you are bending down, please do not look for other items to include – wait until you stand upright again!

If you find lots of one particular item type that is not listed specifically in the ODK app, please add it as ‘other’ category and describe the items seen.



Figure 4: Team members demonstrating the correct position for performing a transect.

What if I miss something?

Remember that the goal of this project is to gain an accurate representation of debris loads in the environment. While some (most likely tiny pieces of) debris, waste or litter may be missed, the goal is to record and report the best data possible. We realize that sometimes people may miss debris items. However, once you have completed a transect section, do not go back to look for more litter. If you missed it, you missed it, no going back!

Should I pick up the transect litter?

This is very dependent on your resources (for example, time, people, space for litter storage). In any case, conduct the survey first before considering any clean-up activities. We recommend you do what feels right for you and your team.

4.4 Recording the size of litter items

For each transect, we collect information about the size of the debris items we encounter. These **Size Classes** range from 1cm X 1cm to items that are larger than the size of an A4 sheet of paper. We collect size class information to understand the way debris moves around different environments. Because it would be too time consuming (and it is not necessary) to record the size of every item on the transect, we only record the size class or the first item in every interval (transects are evenly divided into 10 intervals- no matter the length of the transect). Therefore, we record the size class of a maximum of 10 items on each transect. The following technique will ensure that the data are collected as required, without adding too much additional time to record the size of every item observed.

For the first piece of debris/litter item you find in each interval, record the distance along the transect (to the nearest centimetre), the type of the item (e.g., hard plastic, soft plastic, glass etc), the item category and whether it is whole or fragmented and the size class. Don't worry if this sounds confusing, the ODK app will prompt you along the way.

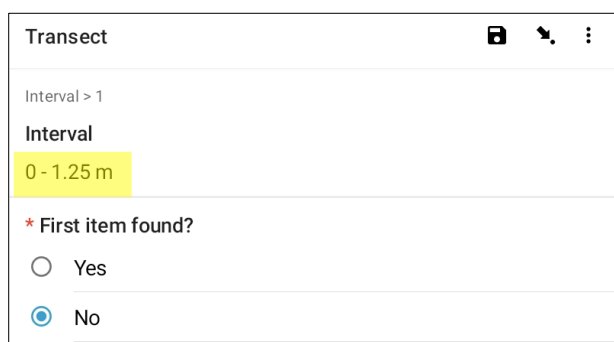
NOTE: Size Classes are determined by the longest dimension of the object that will fit within the size class box (see Appendix). Size Classes double – e.g., 1cm x 1cm; 2cm x 2cm, 4cm x 4cm, 16cm x 16cm, etc.

NOTE: Record the size class **ONLY** for the **FIRST** item you see in each interval. If there is no debris in an interval, select 'No' for first item found.

Size Class Intervals are automatically populated by the ODK app. You just need to follow the intervals the app provides. ODK does this by dividing the total length of the transect by 10. This gives you equal intervals to collect size class data. For example, if the total length of the transect is 12.5m, interval lengths will be 1.25m each.

Aside from inland transects which are generally 12.5 meters in length, **all transects** (coastal and river) **are to be recorded in whole meter lengths** (e.g. 12 meters, 17 meters, 61 meters, etc.).

ODK will determine the interval lengths for you and display the interval range as you work through the app prompts.



Transect	
Interval > 1	
Interval	
0 - 1.25 m	
* First item found?	
<input type="radio"/>	Yes
<input checked="" type="radio"/>	No

4.5 Sub-sampling and estimating

Estimating

When you arrive at a site, look closely at the amount of debris/litter in the area. If there is too much litter of one type (e.g. glass fragments, polystyrene or similar over a small section of the transect, we conduct the transect as normal. However, if there is one area of the transect where there is LOTS of debris, it is appropriate to estimate the number of items within that area. We do this by counting the litter items in a small area of the larger area and calculating that number by how many areas fit into the transect. For example, if your transect interval is 1m wide by 2m long and you count all the glass pieces in a 20cm x 20cm square, then you need to multiply the number of glass items by 50.

Subsampling

If there is too much litter to count every item **over the entire transect**, you will need to **sub-sample** the transect (Fig. 5). With subsampling, you will conduct the transect over a small area or percentage of each interval along the transect. It is important to note that subsampling occurs over the entire **width** of the transect (not just one side of the measuring tape). See instructions on the following page about how ODK automatically adjust subsampling counts.



Figure 5: An example of a transect requiring sub-sampling.

Sub-sampling methods for transect surveys

As you are filling in the transect information, ODK will ask if the transect is subsampled.

If no sub-sampling is required, select 'No' then select 'NEXT' to move to the next screen.

If sub-sampling is required, select 'Yes' then 'NEXT' and you will be prompted to enter in the percentage (%) of the interval you are subsampling. This is the percentage of each interval you will survey and will be dependent on how much litter is along the transect.

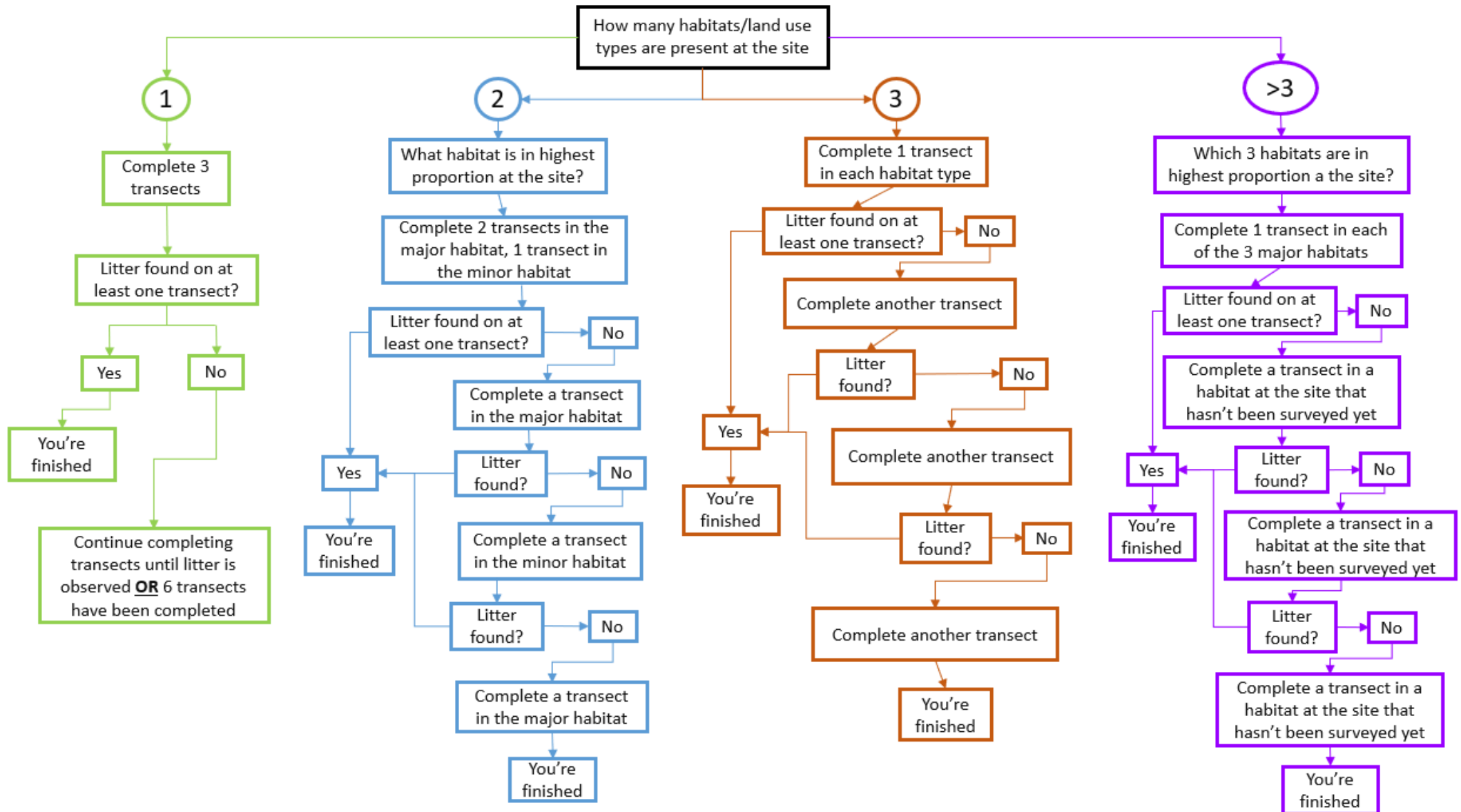
Transect	
* Subsampled?	
Only when there is too much litter to count over WHOLE transect	
<input checked="" type="radio"/>	Yes
<input type="radio"/>	No

At the start of each interval, mark out on the ground the areas you have chosen for subsampling. You will need to decide if you will subsample either 10, 20 or 50% of the interval area depending on how much debris is along the transect. Within each subsample area, count the number of each different item of debris found as you would on a standard transect and enter that into ODK.

Transect	
* Subsampled percentage	
<input type="radio"/>	10 percent
<input type="radio"/>	20 percent
<input type="radio"/>	50 percent

NOTE: ODK will do the math for you to expand up to the whole interval based on the percentage area you chose. For example, if you subsampled 10% of the interval and you found 5 bottles, ODK will record 50 bottles for the interval.

5 Flow chart for debris/litter surveys



6 Preparing for surveys

6.1 Equipment required

The following is a list of equipment you will need for land-based or terrestrial debris surveys. For at-sea surface trawl surveys, please refer to the equipment list in the Trawl Surveys method section.

1. 1 x **50m tape measure** (can use 25m tape measure for **Inland** transects if desired). We suggest 3 tape measures, one for each survey team at a site. This helps make surveys go more quickly.
2. 1 x **1m** long piece of **string or rope** for each surveyor that can be used to measure the width of transect.
3. **Gloves** (optional), noting you will probably pick up many pieces of litter to inspect them.
4. Printout of '**Size Class**' and '**Items list**' for easy referral – they are included in the appendix of this handbook.
5. **Protection from the weather**; a hat, sunscreen, sunglasses etc. if the weather is hot. A jacket and beanie etc. if the weather is cold.
6. **Food** and **water** to help keep your energy levels up!

6.2 Communication

1. Set up a WhatsApp group (or equivalent) with all survey team members and CSIRO trainers.



6.3 Technology required

1. Download an app for a **compass** to help you with determining wind direction, etc. For example, 'digital compass'.



2. Download the **ODK Collect app** onto an Android device (not available on iOS).



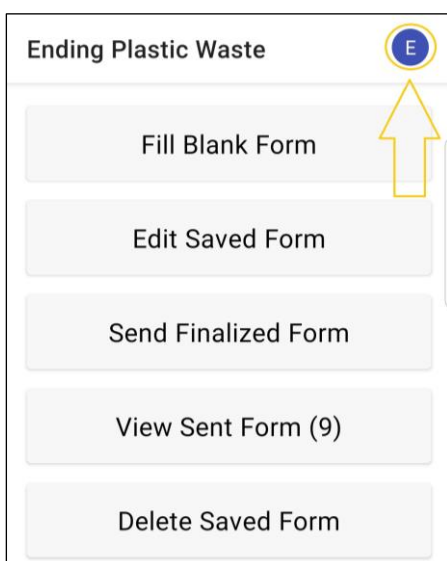
6.4 General ODK use

Further along in this manual we outline detailed instructions on how to use ODK to enter data for each site and transect type. However, there are some important general features within ODK that can be very useful.

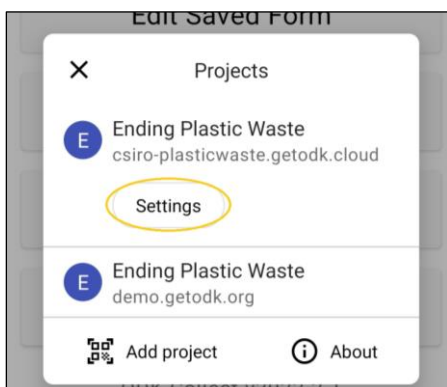
Changing the language in ODK

The default language in ODK is English however, this can be changed to hundreds of other languages. Follow these instructions if you would like to change the language.

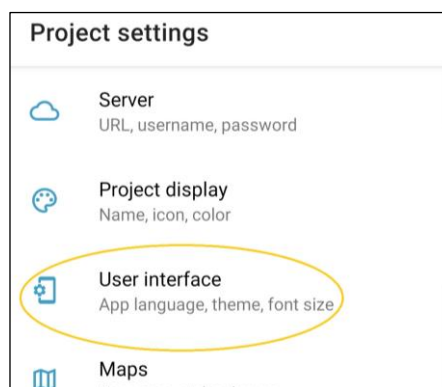
Step 1: Select the 'Profile icon' from your ODK home screen. This will usually be the first letter of your ODK profile name.



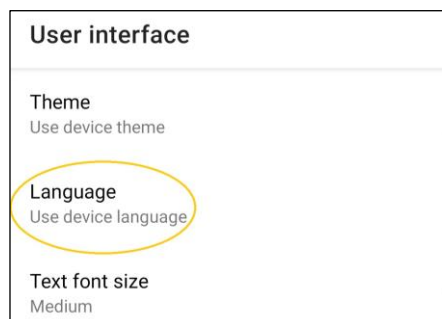
Step 2: Select 'Settings'.



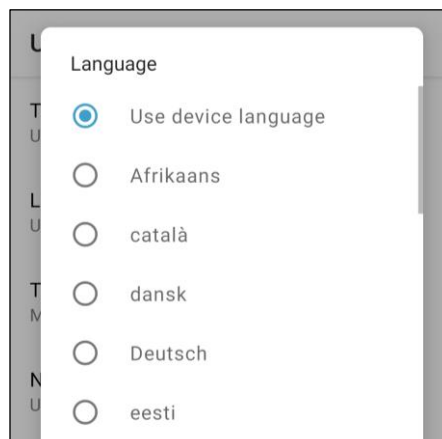
Step 3: Select 'User interface'.



Step 4: Select 'User interface'.



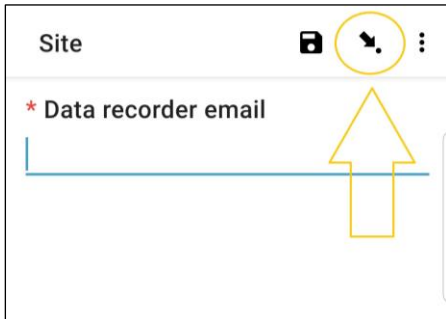
Step 5: Select your language of choice!



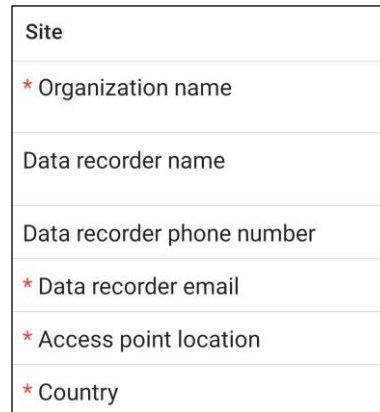
Shortcut to selecting/reviewing different data fields in ODK

There are multiple data entry fields/pages for site and transect forms. When entering data, we always move through them in order, however if you want to quickly review certain data entries there is a shortcut to seeing the list of fields.

Step 1: Select the 'Point to fields icon' as shown here.



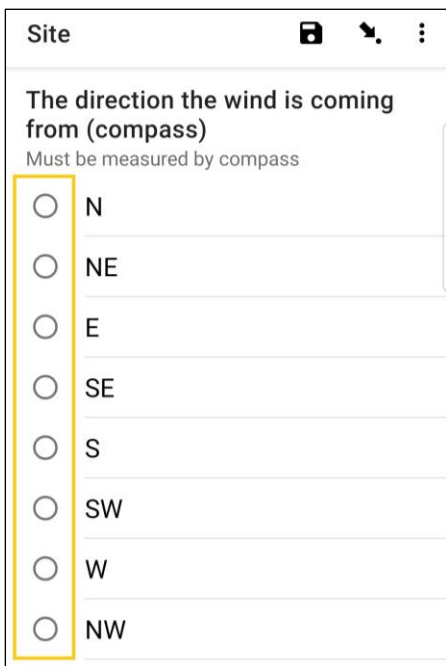
Step 2: The next page lists of data fields. Selecting one will take you back to that data entry field/page.



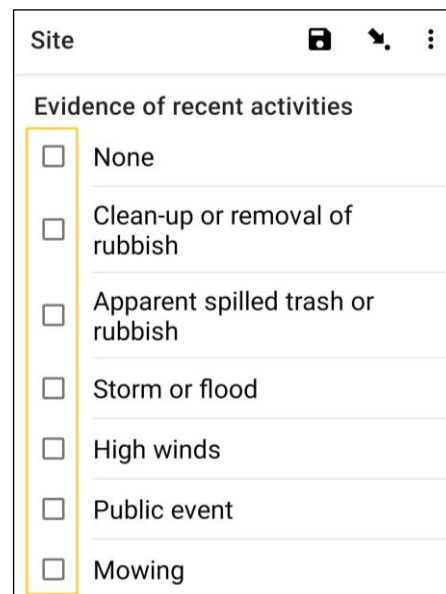
Data entry fields – selecting one option or multiple options in ODK

Some data entry fields allow only one selected option, while in others you can select multiple options. Here we show you to know the difference.

One option: When only one option can be selected, they will be listed with circles.



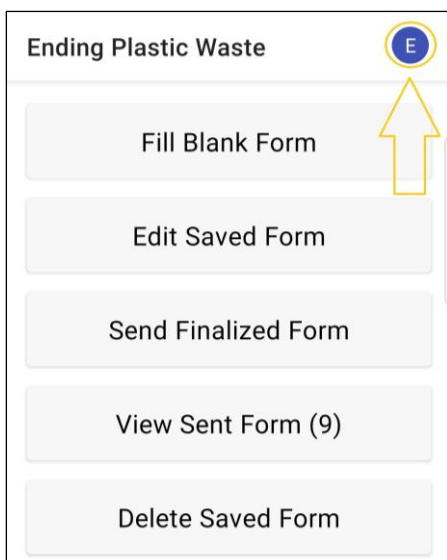
Multiple options: When multiple options can be selected, they will be listed with squares.



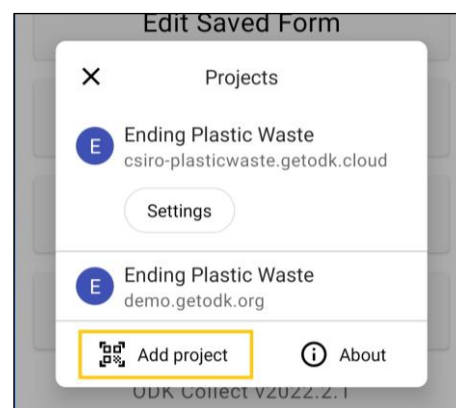
Adding a new survey area/QR code in ODK

When setting up the site and transect forms for a particular country or city, CSIRO will provide you with a QR code that ODK will prompt you to scan when you first download the ODK app. However, if you have already scanned one QR code and need to add another (for doing fieldwork in another location) you will need to follow these instructions.

Step 1: Select the 'Profile icon' from your ODK home screen. This will usually be the first letter of your ODK profile name.



Step 2: Select the 'Add project' icon. This will open up the QR scanner within ODK so you can scan in the new QR code/project.



7 Key points to remember

- Before you begin your first transect, have a close look at the area, and determine whether you will need to sub-sample. Sub-sampling methods are used when there is too much debris within the survey area to complete an accurate count (see Sub-Sampling, Section 4.5).
- Survey a **minimum of three** and a **maximum of six** transects per site
- Conduct transects in **each of the major habitat or land use types** (e.g., sand, rock slab, boulders, mangroves, park, roadway, vacant lot etc.).
- For coastal and river sites, **transects should be located at least 50m from site access point** (ideally all should be located on the same side of access point, unless they are in different habitat types).
- All **Inland** transects are either 12.5m x 2m or 25m x 1m (see Section 9).
- All **River** transects begin at the water's edge and end two meters past the top of the bank (see Section 10). Transect width = 2m. Transect length will vary. All transect lengths must be in whole meters.
- All **Coastal** transects begin at the water's edge and end two meters into the continual terrestrial vegetation. Transect width = 2m, transect length will vary (see Section 11). All transect lengths must be in whole meters.
- To ensure standardised data collection, **searching must be done from a standing position**. When looking for debris, DO NOT bend over. Walk upright and look down with your eyes. Pick up anything you are unsure of for closer inspection, as lots of shells look like plastic and vice versa.

8 Site information

For each Inland, River and Coastal survey you will need to collect information about the general site you are conducting the transects in. This includes details about the environment, weather conditions and the way the land is used. Use this section as a guide for how to work through entering Site Information into the ODK app.

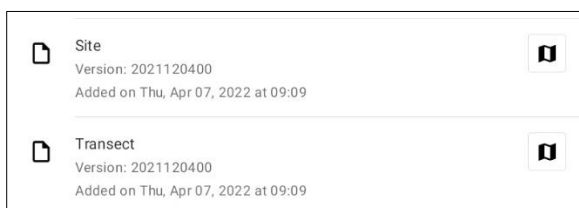
Walk to the GPS location (**Inland**) or to where you access the site (for **River** and **Coastal** sites). The site access point will be where you first enter the beach/shore/river. It is often useful to take the first photo here, especially if there is a sign with the site/beach name. Open the ODK app and follow the instructions below.

Entering Site Information into the ODK App

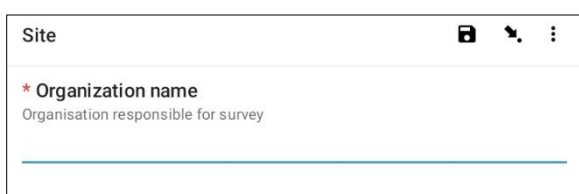
Step 1: From the Menu Options, select 'Fill Blank Form'.



Step 2: Select 'Site' from the form options displayed on the screen.



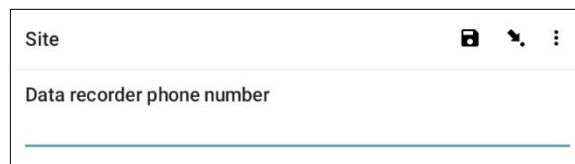
Step 3: Begin by entering/selecting the Name of the Organisation responsible for the survey. Please ensure that all punctuation is correct and that capital and lower-case letters are used appropriately. Then press 'NEXT' to move to the next screen.



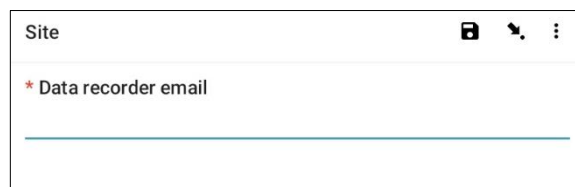
Step 4: Enter the First Name and Last Name of the person who is recording the data. (If this is you, enter your name). Then press 'NEXT' to move to the next screen.



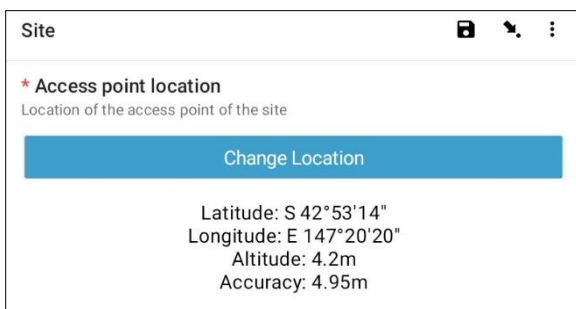
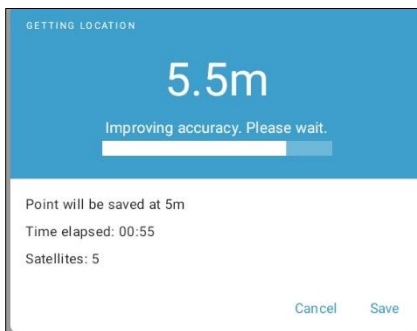
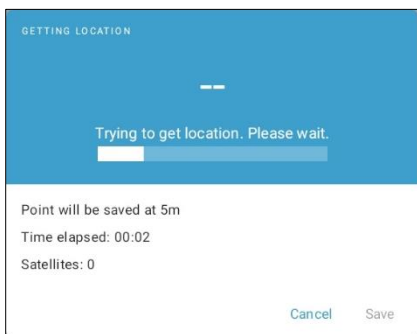
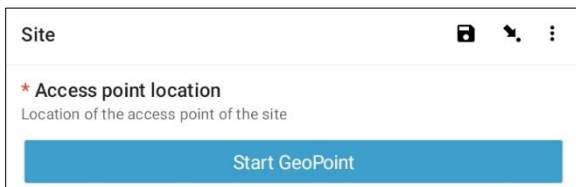
Step 5: Enter the Phone Number (including country code) of the person recording the data. Then press 'NEXT' to move to the next screen.



Step 6: Enter the Email Address of the person recording the data. Then press 'NEXT' to move to the next screen.



Step 7: To enter the Access Point of the site, select the blue 'Start GeoPoint' bar. This will get a satellite reading automatically, it may take a few minutes. Once the error is under 5m it will automatically stop. If it doesn't get to under 5m error in a reasonable time you can press the 'Save GeoPoint' button when it gets to under 10m. Then press 'NEXT' to move to the next screen.



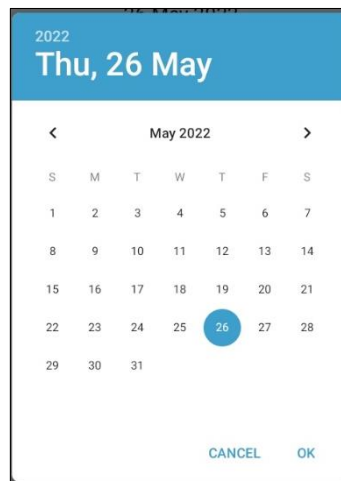
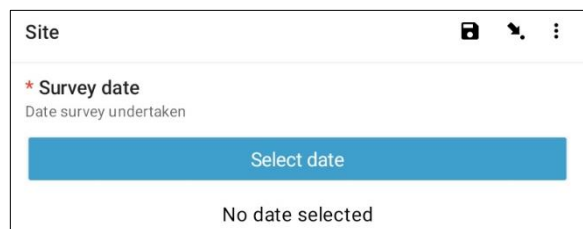
Step 8: Enter/Select the Country of the site. Then press 'NEXT' to move to the next screen.



Step 9: Enter the City/Town/Municipality of the site. Then press 'NEXT' to move to the next screen.



Step 10: Enter the Survey Date. To do this, select the blue 'Select date' bar and navigate through the month and day options until you have the correct date. Note that it automatically defaults to the current date. Then press 'NEXT' to move to the next screen.



Step 11: Select the Site Type out of the three options: Coastal, River and Inland. Then press 'NEXT' to move to the next screen.



Step 12: Select the correct Site ID (identification) code. This will be provided to you by CSIRO. Then press 'NEXT' to move to the next screen.

The screenshot shows a mobile form titled 'Site'. Below the title is a field labeled '* Site ID code' with the subtext 'Provided by CSIRO'. There is a blue underline below the text input area.

Step 13: Enter the Site Name. This is a name that you come up with that is both descriptive and unique to the site. For example, the Site Name can be a road name, a park name, a description of next to a known building, etc. If you can't think of a Site Name, use the Site ID (identification) Code from above using **CAPITAL LETTERS**. Then press 'NEXT' to move to the next screen.

The screenshot shows a mobile form titled 'Site'. Below the title is a field labeled 'Site name' with the subtext 'Unique name of site'. There is a blue underline below the text input area.

Step 14: Follow the ODK prompts and upload **four** photos. Note that you have the option to take a photo or choose an image from your photo gallery. One photo should be uploaded for each direction North, East, South and West. Use a compass to assist if necessary. Press ok for each photo if you are happy with them, then press 'NEXT' to move to the next screen.

The screenshot shows a mobile form titled 'Site'. Below the title is a field labeled '* Site photo 1 - North'. There are two blue buttons: 'Take Picture' and 'Choose Image'.

The following steps will vary slightly depending on site type.

Step 15: For **River** and **Inland** sites, select the Dominant Land Use from the options provided. Note that only one option can be selected. If your site has more than one land use, please choose the **DOMINANT** land type for your answer. Then press 'NEXT' to move to the next screen.

The screenshot shows a mobile form titled 'Site'. Below the title is a field labeled '* Dominant land use'. There are seven radio button options: Industrial, Residential, Commercial/Municipal, Natural/Parkland, Agricultural, and Roadway.

Step 16: Select the Time of Day that the site was accessed. To do this, select the blue 'Select time' bar and drag the numbers up or down to navigate to the correct time. Ensure that you select AM or PM correctly. Then press 'NEXT' to move to the next screen.

The screenshot shows a mobile form titled 'Site'. Below the title is a field labeled '* Time of day'. There is a blue bar with the text 'Select time' and the text 'No time selected' below it.

The screenshot shows a 'Select time' dialog. It features a digital clock interface with three columns for hours, minutes, and AM/PM. The current time shown is 11:58 AM. Below the clock are 'CANCEL' and 'OK' buttons.

Step 17: For **Coastal** and **River** sites, enter an estimate of the Visible Distance meaning how far you see into the distance. This is usually the approximate length of shore you can see (in meters) with a clear and unobstructed view. Then press 'NEXT' to move to the next screen.

The screenshot shows a mobile form titled 'Site'. Below the title is a field labeled 'Visible distance (m)' with the subtext 'Length of shore with clear and unobstructed view'. There is a blue underline below the text input area.

Step 18: Provide a quick count of the Number of People in the visible area of the site access point (the location where you are currently standing). Note this count does not include you or your team members. Then press 'NEXT' to move to the next screen.

Step 19: Select the Current Weather Conditions from the options provided. Select the option that is most accurate at the time of the survey. Then press 'NEXT' to move to the next screen.

Step 20: Select the Current Wind Speed from the options provided. Select the option that is most accurate at the time of the survey. There is no need to measure, just use your judgement. Then press 'NEXT' to move to the next screen.

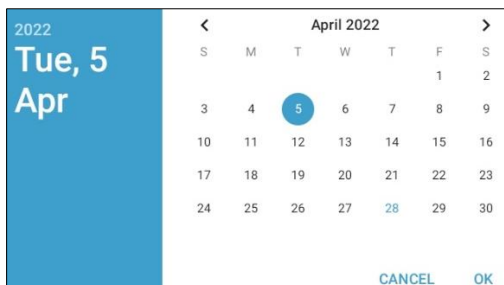
Step 21: Select the Wind Direction. You can work this out by pointing a compass at the direction the wind is coming from and noting what the compass shows. Select the option that is the closest to what the compass tells you. Then press 'NEXT' to move to the next screen.

Step 22: For **Coastal** and **River** sites, select the wind direction relative to the shore from the options provided. Then press 'NEXT' to move to the next screen.

Step 23: Do you know the date of the last clean-up at the site?

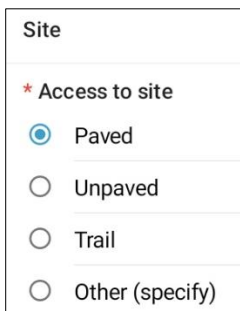
If Yes select 'Yes' and press 'NEXT' to move to the next screen. Enter the date of the last clean-up by pressing the blue 'Select date' bar.

A calendar will be displayed on the screen. Navigate to the correct month option by pressing the arrows next to the month and year subheadings, then select the correct date in the calendar. The date you have selected will show up on the blue heading bar above the calendar. Ensure you have the correct year, day, date and month displayed in this heading before you press 'OK' (at the bottom right of the calendar). Then press 'NEXT' to move to the next screen.

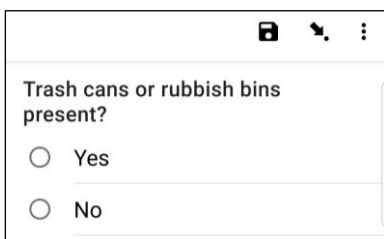


If you do not know the last clean-up date, select 'No' and press 'NEXT' to move to the next screen.

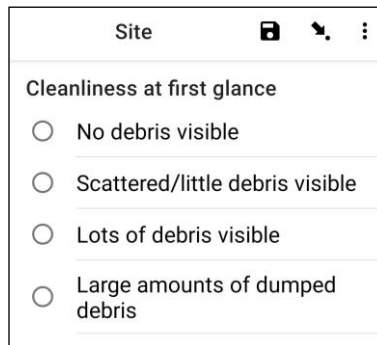
Step 24: Select the type of path access you used to get to the site from the options provided. If your access type does not appear, please choose 'Other' and press 'NEXT' and type in a description of the site access. Then press 'NEXT' to move to the next screen.



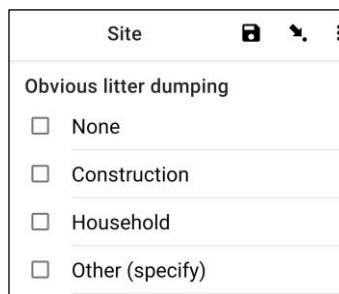
Step 25: Select whether there are trash cans or rubbish bins present in the site. Select either 'Yes' or 'No' and press 'NEXT' to move to the next screen.



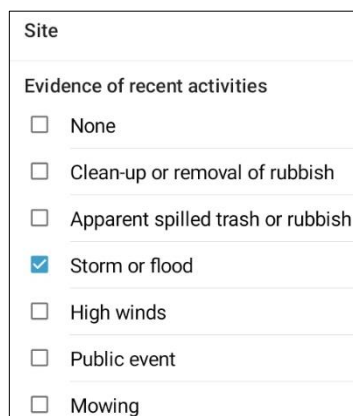
Step 26: Provide a general estimate of Cleanliness from a first glance around the site. Select the option that is most suitable from those provided. Then press 'NEXT' to move to the next screen.



Step 27: If there is any evidence of Obvious Litter Dumping that has occurred at your site, please specify the type from the options provided. You can select more than one option if necessary. You can select 'Other' and press 'NEXT' to type in a different answer to the ones provided. Press 'NEXT'. If there is no evidence of litter dumping, select 'No' and then press 'NEXT' to move to the next screen.



Step 28: Look for any evidence of recent activities at the site and select an answer from the options provided. Then press 'NEXT' to move to the next screen.



Step 29: If you have any additional Comments, please type them into the section provided then press 'NEXT' to move to the next screen.

A screenshot of a form titled "Site". It has a section labeled "Comments" with a text input field below it.

Step 30: You have now finished entering the Site Information. On the screen you should see the name of your site. Before saving, you have the option to select whether your form is finalized or not. The default option is the finalized option is unticked. If all data is entered correctly, tick the blue square and the form will be finalized.

A screenshot of a form titled "Site". It shows the text "You are at the end of Site." Below this, it says "River Site: SiteID". There is a checkbox labeled "Mark form as finalized" which is checked. At the bottom, there is a blue button labeled "Save Form and Exit".

Step 31: To save the form, press the blue 'Save Form and Exit' bar. You will now be directed back to the home page.

Note: It is useful to look through the information you have entered to ensure that it is correct. This can be done by navigating through the form with the 'BACK' or 'NEXT' options at the bottom of the screen before saving, or by checking the form overview in 'Edit Saved Form'. For instruction on how to do this, see Section 12.

A screenshot of a navigation bar with a grey background. On the left, there is a button labeled "< BACK". On the right, there is a button labeled "NEXT >".

Alternatively, select the 'Point to fields icon' as shown here.

A screenshot of a form titled "Site". It shows a field labeled "* Data recorder email". A yellow circle highlights a "Point to fields icon" (a square with a diagonal arrow) in the top right corner. A yellow arrow points from this icon down to the "Data recorder email" field.

The next page lists of data fields. Selecting one will take you back to that data entry field/page.

A screenshot of a list of data fields. The list is titled "Site" and contains the following items: "* Organization name", "Data recorder name", "Data recorder phone number", "* Data recorder email", "* Access point location", and "* Country".

9 Inland surveys

After collecting site information, you will need to determine where the Inland transects will be carried out. You will complete a minimum of 3 up to a maximum of 6 transects per site. If there is litter detected on the first three transects you are finished. If you did not find anything on your first 3 transects, add an additional transect. If you have 6 transects with no litter detected, you are finished. Do not carry out more than 6 transects at a site.

Size dimensions of inland transects

Inland transects will be either **12.5m x 2m** or **25m x 1m**. Note that this is different from river and coastal surveys which vary in length based on the size of the coastal area surveyed or the riverbank and are always 2m wide. Most often, inland transects are **12.5m x 2m**, and will be completed by 2 surveyors. Occasionally, we opt for a 1m x 25m inland transect for safety reasons – this is only where a transect is conducted along the edge of a road.

Selecting where to perform inland transects

Inland transects will be situated in different land use types found within 100 m of the site GPS point you have been supplied. The Inland transect form specifies a variety of Land Use Types. These include car parks/parking lots, roadways, schools, etc. It is ideal to have the minimum 3 transects in differing habitat types.

Figure 6 shows four habitat types at an inland site – Park, Carpark, Road and Walkway. Based on the guidelines, you would complete one transect in each of the dominant land use types: one in the park (2m x 12.5m), one in the carpark (2m x 12.5m) and one along the edge of the road (1m x 25m).

If you must add transects beyond the first three because you have found no debris, please add them first in any land-use types that you have not yet surveyed, and then add any remaining transects proportional to habitat types within the area. In the example below (Fig. 6), you would add a fourth transect along the walkway. If only one habitat type exists at a site, transects will be done in the same habitat type.

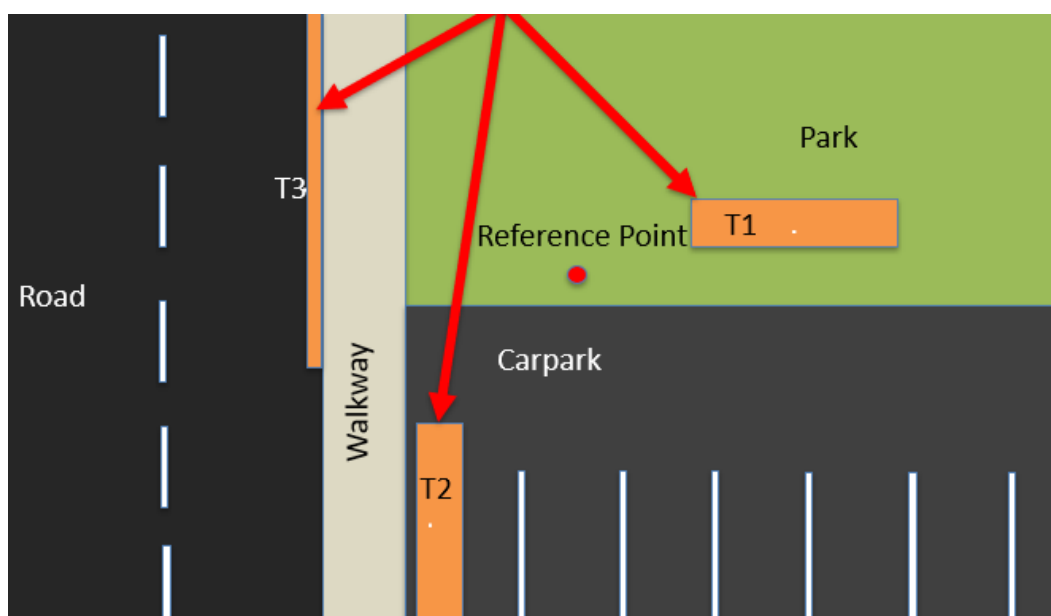


Figure 6: An example of a different habitat/land use types at an inland site.

How far apart do inland transects need to be?

When transects are performed in the same land use type, e.g., all in a park, they need to be performed at least **30m apart**. If transects are in different land use types, there is no required minimum distance between transects.

Entering Inland transect information into the ODK app

Step 1: From the menu options and select 'Fill Blank Form'.



Step 2: Select 'Transect' from the options displayed.



Step 3: Select **Inland** from the three options: Coastal, River and Inland. Then press 'NEXT' to move to the next screen.



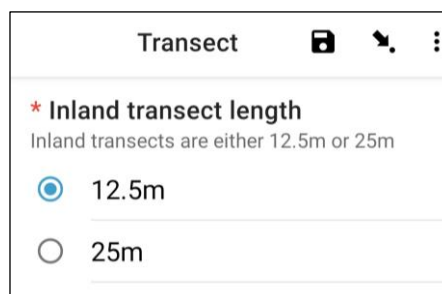
Step 4: Select from the Site ID (identification) codes listed which will match up to the associated site ID (identification) code provided by CSIRO. Then press 'NEXT' to move to the next screen.



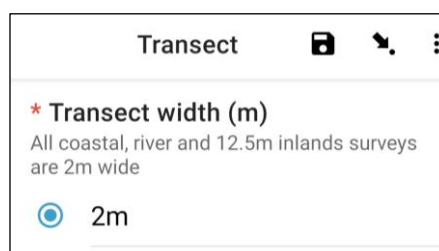
Step 5: Enter the Transect Number (i.e., 1, 2 or 3, etc.). Then press 'NEXT' to move to the next screen.



Step 6: Select the Transect Length. Unlike in River and Coastal surveys, you will only have two options to select from; 12.5m or 25m. If room permits, 12.5m surveys are preferred. Then press 'NEXT' to move to the next screen.



Step 7: Select the Transect Width. Unlike in River and Coastal surveys, you will only be given one option based on the transect length you entered in the previous step. Then press 'NEXT' to move to the next screen.



Step 8: Enter the Number of People surveying the transect. This will default to **2** (for the standard 2m x 12.5m transect) unless you are conducting a 1m x 25m inland transect, in which case it will default to **1**. Then press 'NEXT' to move to the next screen.

Transect

* Number of surveyors

2

Step 9: Select the Land Use Type from the options provided. You can only have one answer per site so if there is more than one, please choose the DOMINANT answer. Then press 'NEXT' to move to the next screen.

Transect

* Land use type

- Walkway
- Car park
- Roadway
- School
- Public transport
- Drain
- Natural vegetation
- Wetland
- Park
- Disused
- Agriculture - Pasture
- Agriculture - Cultivated
- Other (specify)

Step 10: Select the Gradient of the Land where the transect is being performed (i.e., the difference in elevation from the start to end of the transect). Then press 'NEXT' to move to the next screen.

Transect

Gradient
Difference in elevation from start to end of transect

- 0 - 5 cm (flat, no difference)
- 5 - 50 cm (ankle to knee)
- 50 - 100 cm (knee to hip)
- 100 - 150 cm (hip to chest)
- 150 - 180 cm (chest to head)
- > 180 cm (above head)

Step 11: Select the Substrate Colour from the options provided. Note that this is the colour of the ground or soil, not the vegetation. You can only have one answer per site so if there is more than one, please choose the DOMINANT answer. Then press 'NEXT' to move to the next screen.

Transect

* Substrate colour
Predominant colour of substrate (not vegetation)

- White/Cream
- Yellow
- Orange
- Brown
- Black
- Grey
- Red

Step 12: If there is vegetation, select the Vegetation Height from the options provided. If there is no vegetation, select 'No vegetation'. Then press 'NEXT' to move to the next screen.

Transect

Vegetation height

- No vegetation
- 0 - 5 cm
- 5 - 50 cm
- 50 - 100 cm
- 100 - 200 cm
- > 200 cm

Step 13: Estimate the percentage (%) of Bare Ground (i.e., ground that is free of vegetation) on the transect and select the closest percentage (%) from the options provided. Then press 'NEXT' to move to the next screen.

The screenshot shows a mobile application interface titled 'Transect'. Below the title is a section labeled 'Bare ground percentage' with a list of radio button options ranging from 0 percent to 100 percent in 10 percent increments. The '30 percent' option is selected, indicated by a blue dot in the center of the radio button.

Step 14: Select the approximate percentage (%) of the Transect Area Surveyed from the options provided. This means, how much of the transect area is surveyed. Then press 'NEXT' to move to the next screen.

The screenshot shows a mobile application interface titled 'Transect'. Below the title is a section labeled '* Area surveyed percentage' with a list of radio button options ranging from 0 percent to 100 percent in 10 percent increments. The '100 percent' option is selected. At the bottom of the screen, there are navigation buttons: '< BACK' on the left and 'NEXT >' on the right.

Step 15: If there is any evidence of any Obvious Litter Dumping that has occurred at the transect location, please specify the Type by selecting from the options provided. You can select more than one option if needed. Then press 'NEXT' to move to the next screen.

The screenshot shows a mobile application interface titled 'Transect'. Below the title is a section labeled '* Obvious litter dumping' with the subtext 'Can select more than one'. There are four checkbox options: 'None', 'Construction', 'Household', and 'Other (specify)'. The 'Construction' and 'Household' options are checked with blue checkmarks.

You can select 'Other' and press 'NEXT' to type in a different answer to the ones provided. Then press 'NEXT' to move to the next screen.

The screenshot shows a mobile application interface titled 'Transect'. Below the title is a section labeled '* Obvious litter dumping' with the subtext 'Can select more than one'. There are four checkbox options: 'None', 'Construction', 'Household', and 'Other (specify)'. The 'Other (specify)' option is checked with a blue checkmark.

The screenshot shows a mobile application interface titled 'Transect'. Below the title is a section labeled 'Please specify evidence of dumping' with a text input field below it.

If there is no obvious litter dumping, select 'None' and press 'NEXT' to move to the next screen.

The screenshot shows a mobile application interface titled 'Transect'. Below the title is a section labeled '* Obvious litter dumping' with the subtext 'Can select more than one'. There are four checkbox options: 'None', 'Construction', 'Household', and 'Other (specify)'. The 'None' option is checked with a blue checkmark.

Step 16: Look for Evidence of Recent Activities within the area of the transect and select from the options provided. You can select more than one option if needed. Then press 'NEXT' to move to the next screen.

Step 17: If you have any additional Comments, please type them into the section provided and press 'NEXT' to move to the next screen.

Step 18: Enter the First Name and Last Name of the person who is recording the data. (If this is you, enter your name). Then press 'NEXT' to move to the next screen.

Step 19: Enter the First Name and Last Name of the person/s who are surveying/observing the transect. Then press 'NEXT' to move to the next screen.

Step 20: To enter the Start of Transect Location, select the blue 'Start GeoPoint' bar. This will get a satellite reading automatically, it may take a few minutes. Once the error is under 5m it will automatically stop. If it doesn't get to under 5m error in a reasonable time you can press the 'Save GeoPoint' button when it gets to under 10m. Then press 'NEXT' to move to the next screen.

Step 21: Select the Time of Day that you started the transect. To do this, select the blue 'Select time' bar and drag the numbers up or down to navigate to the correct time. Ensure that you select AM or PM correctly. Then press 'NEXT' to move to the next screen.

Step 22: Take a photo that shows the start of the transect tape, looking towards the end of the tape. Press ok on the photo if you are happy with it, then press 'NEXT' to move to the next screen. (You will be given the option to take another photo if there is something of interest on the transect such as dumped litter or a noteworthy object.)

We now move record size class for individual items. Each transect is divided into 10 intervals for recording purposes. The ODK app will take you through recording litter information in intervals from 1 to 10.

Step 23: Is this transect being Subsampled? Subsampling occurs when there are too many litter items to be counted accurately. When Subsampling, you will count all items in a percentage of the transect area.

If you and your colleague will be Subsampling, click 'Yes'. Then press 'NEXT' and enter the percentage (%) of each interval along the transect that you will survey This is the Subsampled Percentage (%).

If you are not Subsampling, select 'No' then press 'NEXT' to move to the next screen.

Step 24: Interval 1: Is there any litter in this interval? The ODK app will provide the measurement for interval 1. In the example below, it is from 0 (the start of the transect) to 1.25m along the transect tape.

If no litter is present, select 'No'. Then press 'NEXT' to move onto the screen for Interval 2.

If litter is present, select 'Yes'. Another form will drop down and you will need to enter information about the litter item (including where it occurs along the transect, litter type and item, whether or not the item is whole or has been broken into a fragment and how big the litter item is). Use the dropdown menus to guide you. Refer to the Item Size Chart (in Appendix) if you need a reminder of Size Classes.

The ODK app will ask if you need to add an Additional Item. Use this feature if there is more than one litter item found in Interval 1.

If you find something else in the first interval press 'Add'. This will give you a drop-down page similar to the previous page. For Additional Items, you can group together litter of similar type and item. For example, if there are an addition 8 fragments of glass, you can add them in under one 'Additional Item'.

Keep adding items until all items in Interval 1 have been counted.

When all items have been counted (or if you didn't find any Additional Items) press 'Do Not Add'. This will take you to the next interval along the transect where the process is repeated.

Step 25: Repeat Step 24 for intervals 2 to 10.

Step 26: Please confirm if you did or didn't find litter on this transect (this seems obvious, but this answer helps with the statistical analysis of data after the surveys).

Step 27: To enter the End of Transect Location, select the blue 'Start GeoPoint' bar. This will get a satellite reading automatically, it may take a few minutes. Once the error is under 5m it will automatically stop. If it doesn't get to under 5m error in a reasonable time you can press the 'Save GeoPoint' button when it gets to under 10m. Then press 'NEXT' to move to the next screen.

GETTING LOCATION

5.1m

Improving accuracy. Please wait.

Point will be saved at 5m
Time elapsed: 00:07
Satellites: 19

Cancel Save

Transect

* Transect end location

Change Location

Latitude: S 42°53'14"
Longitude: E 147°20'20"
Altitude: 1.3m
Accuracy: 3.18m

Step 28: Select the Time of Day that the transect was completed. To do this, select the blue 'Select time' bar and drag the numbers up or down to navigate to the correct time. Ensure that you select AM or PM correctly. Then press 'NEXT' to move to the next screen.

Transect

* Transect end time

Select time

No time selected

Select time

1 38 AM

2 : 39 PM

3 40

CANCEL OK

Step 29: Take a photo that shows the end of the transect you just completed, looking back towards the start of the transect tape. Press ok on the photo if you are happy with it, then press 'NEXT' to move to the next screen. (You will be given the option to take another photo if there is something of interest on the transect such as dumped litter or a noteworthy object.)

Transect

* Transect end photo 1

Taken from transect end point looking to transect start point

Take Picture

Choose Image

Step 30: You have finished the transect! Check the blue box and press 'Save Form and Exit'.

You are at the end of Transect.

Inland Transect: TEST -1

Mark form as finalized

Save Form and Exit

Step 31: You will notice that the completed form is now in your 'Edit Saved Form' tab. Press on this tab and check that all the information you have entered on the form is correct. Then press 'Go to End'. Please make sure to check the blue box and press '**Save Form and Exit**'.

Step 32: The form will now go into your Send Finalized Form tab. The next time you are connected to the internet, the form will upload automatically and move into your View Sent Forms Tab. You cannot edit the form any further.

Note: at this point, if you need to make changes to the information you have entered you will need to email TJ at tj.lawson@csiro.au.

10 River surveys

After collecting site information, you will need to determine where you and your team will carry out river transects. You will complete a minimum of 3 to a maximum of 6 transects per site. If there is litter detected on the first three transects you will stop – no further transects required. If you did not find anything on your first 3 transects, add an additional transect. If you have 6 transects with no litter detected, you are finished. Do not carry out more than 6 transects at a site.

The first river transect will be conducted at least 50m from the location that you accessed the site (access point) (Fig. 7). Each subsequent transect should be located approximately 50m away from the first transect.

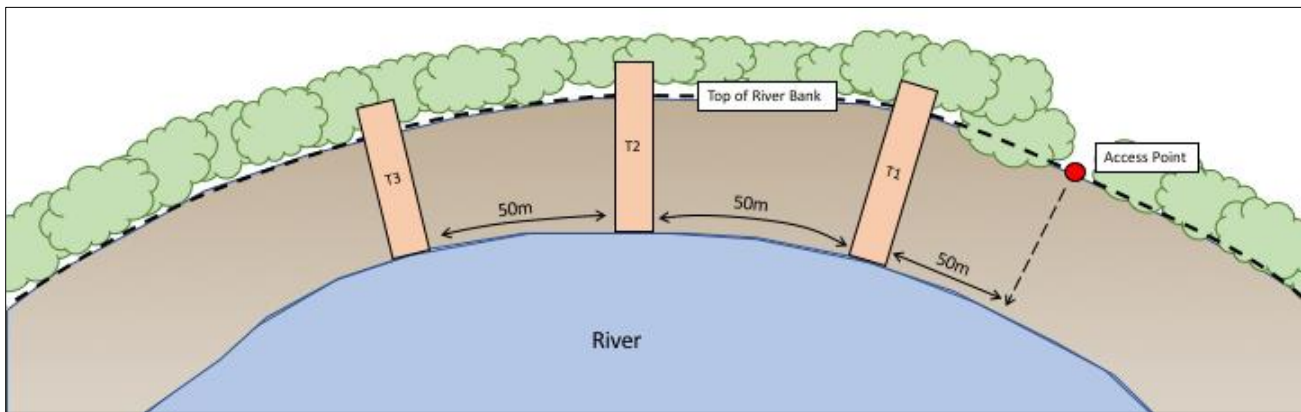


Figure 7: Each river transect is separated by at least 50m.

River transects start at the waterline/water's edge of the river and continue until 2m beyond the top of the riverbank (Fig. 8) (the length of river transects will vary depending on each location). Ensure that the transect length is measured in **whole** meters (e.g., 26m, not 26.4m). River transects are always 2m wide. In river transects you will be asked to measure the Obvious Debris Line and the Influence of the River. If you are not able to see this, tick the 'no' box in answer to the question.

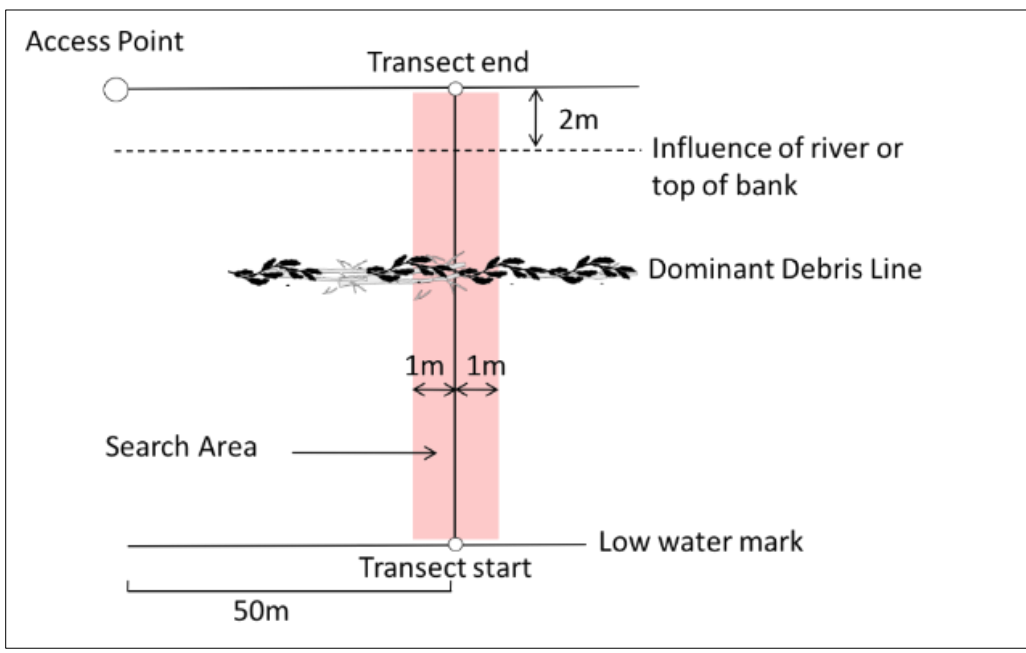


Figure 8: River transects start at the waterline and progress to 2m beyond the river bank.

If you encounter a 'braided river', run the transect from the edge of the main river to 2m beyond the top of the bank of the outermost side stream.

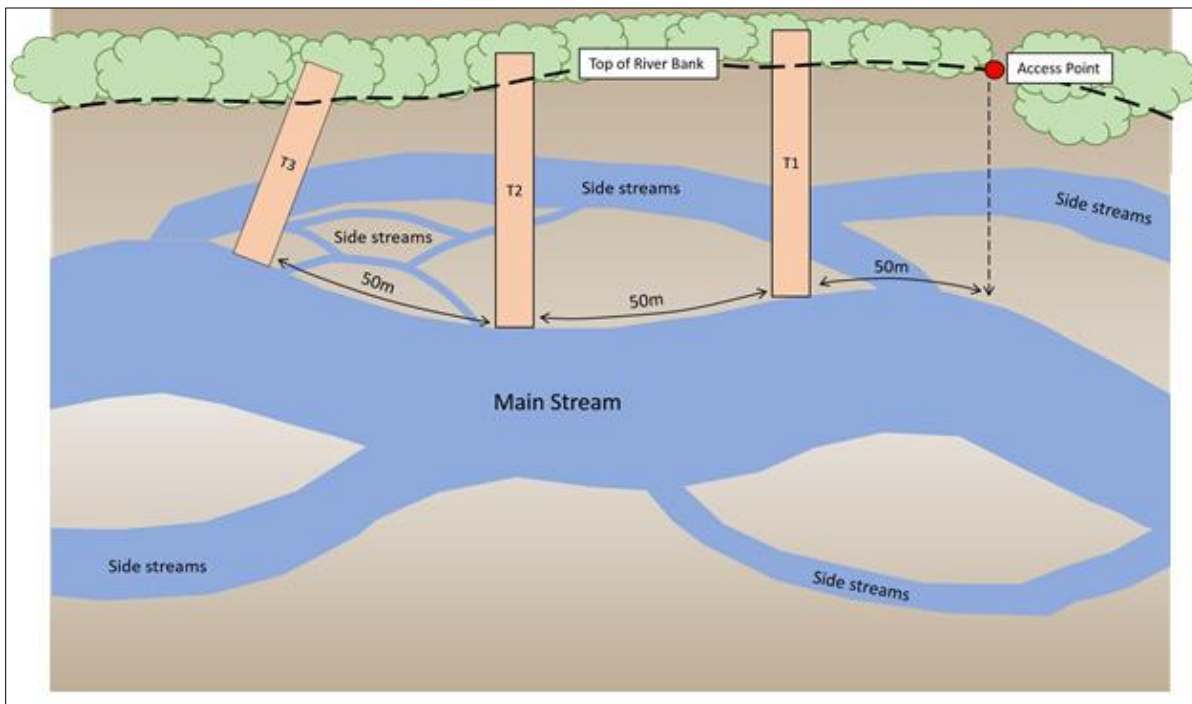


Figure 9: An example of where to place transects at a braided river site.

Lay out the transect measuring tape from the waterline to 2m beyond the top of the riverbank, open the ODK app and follow the instruction provided.

How far apart do river transects need to be?

River transects will be '50m plus' apart. The 'plus' is a random number of steps (between 1 and 15) that you chose before arriving at the site. This adds an element of randomness to selecting where transects occur without being influenced by the site itself.

What if the riverbed is dry?

You can still conduct a survey if the riverbed is dry. Find the centre of the riverbed then conduct the transect along the riverbed to the riverbank, plus 2 meters beyond the bank (as per normal). Please make a note in the site and transect forms that this has occurred.

What if the river is flooded?

If a river is flooded, do not conduct a survey if it is unsafe to do so! Your safety is the most important consideration during field work, and we never want you to put yourself into a dangerous situation. We recommend you leave a flooded river site and return to it once flooding has receded. However, if this is not possible, perform an inland site as close to the original river site as you safely can. Be sure to name the inland site and transects with the same ID as the river site. Please make a note in the site and transect forms that this has occurred and let CSIRO know of this change.

Entering River transect information into the ODK app


Step 1: From the menu options and select 'Fill Blank Form'.



Ending Plastic Waste

- Fill Blank Form
- Edit Saved Form (1)
- Send Finalized Form (1)
- View Sent Form (8)
- Delete Saved Form

Step 2: Select 'Transect' from the options displayed.



- Site
Version: 2021120400
Added on Thu, Apr 07, 2022 at 09:09
- Transect
Version: 2021120400
Added on Thu, Apr 07, 2022 at 09:09

Step 3: Select **River** from the three options: Coastal, River and Inland. Then press 'NEXT' to move to the next screen.



Transect

* Site type

- Coastal
- River
- Inland

Step 4: Select from the Site ID (identification) codes listed which will match up to the associated site ID (identification) code provided by CSIRO. Then press 'NEXT' to move to the next screen.



Transect

* Site ID code

TEST

Step 5: Enter the Transect Number (i.e., 1, 2 or 3, etc.). Then press 'NEXT' to move to the next screen.



Transect

* Transect number

1

Step 6: Enter the Transect Length. For **River** transects, this is the length from the water's edge to 2m past the top of the riverbank (enter length as a whole number). Then press 'NEXT' to move to the next screen.



Transect

* Transect length (m)

25

Step 7: Enter the Transect Width, this will default to 2. Then press 'NEXT' to move to the next screen.

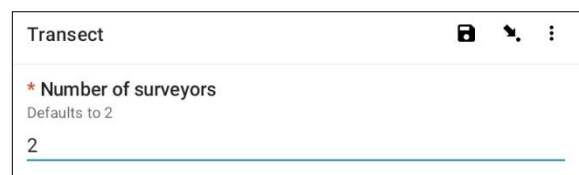


Transect

* Transect width (m)
Defaults to 2 m

2

Step 8: Enter the Number of People surveying the transect. This should always be 2 (note: 2 is the default setting in the ODK app). Then press 'NEXT' to move to the next screen.

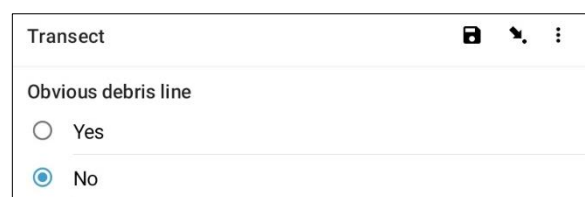


Transect

* Number of surveyors
Defaults to 2

2

Step 9: Is there an obvious or dominant Debris Line? If there is no obvious Debris Line, select 'No' and press 'NEXT' to move to the next screen.



Transect

Obvious debris line

- Yes
- No

If there is an obvious Debris Line, select 'Yes', then press 'NEXT' to move onto the next screen. The ODK app will then prompt you to enter the distance along the tape to the Debris Line (to the closest .10 of a meter: e.g., 2.3m or 3.0 m). Take the measurement at the middle of the debris line

Transect

Distance to dominant debris line (m)
Distance from water edge to major debris line (in meters) at time of survey

5

Step 10: Enter the distance to the Top of the Riverbank recording the number to one decimal place, e.g. 2.3. Press 'NEXT' to move onto the next screen.

Transect

* Distance to top of bank (m)
Distance from water edge to top of bank

8

Step 11: Can you see the River Influence/Erosion Line? This is the highest point that the river water has risen to up the bank.

If No, do not enter anything and press 'NEXT' to move onto the next screen.

If Yes, enter the distance along the tape measure and press 'NEXT' to move onto the next screen.

Transect

Distance to river influence/erosion line (m)
Height that water comes up to the bank

2

Step 12: Select the Gradient of the Land where the transect is being performed (i.e., the difference in elevation from the start to end of the transect). Then press 'NEXT' to move to the next screen.

Transect

Gradient
Difference in elevation from start to end of transect

- 0 - 5 cm (flat, no difference)
- 5 - 50 cm (ankle to knee)
- 50 - 100 cm (knee to hip)
- 100 - 150 cm (hip to chest)
- 150 - 180 cm (chest to head)
- > 180 cm (above head)

Step 13: Select the Substrate Type from the options provided. You can only have one answer per site so if there is more than one, please choose the DOMINANT answer. Then press 'NEXT' to move to the next screen.

Transect

River substrate type
Predominant type

- Mud
- Sand
- Pebble/Gravel
- Cobble
- Boulders
- Rock slab
- Mangrove
- Dirt bank
- Vegetated
- Cement

Step 14: Select the Substrate Colour from the options provided. Note that this is the colour of the ground or soil, not the vegetation. You can only have one answer per site so if there is more than one, please choose the DOMINANT answer. Then press 'NEXT' to move to the next screen.

Transect

* Substrate colour
Predominant colour of substrate (not vegetation)

- White/Cream
- Yellow
- Orange
- Brown
- Black
- Grey
- Red

Step 15: Select the Riverbank Vegetation Type from the options provided (if there is no vegetation, please select 'None'). You can only have one answer per site so if there is more than one, please choose the DOMINANT answer. Then press 'NEXT' to move to the next screen.

Transect

Bank vegetation

- Grass/Reeds
- Broadleaf/Herb
- Shrub (< 3 m)
- Tree (> 3 m)
- Forest
- None

Step 16: If there is vegetation, select the Vegetation Height from the options provided. If there is no vegetation, select 'No vegetation'. Then press 'NEXT' to move to the next screen.

Transect

Vegetation height

- No vegetation
- 0 - 5 cm
- 5 - 50 cm
- 50 - 100 cm
- 100 - 200 cm
- > 200 cm

Step 17: Estimate the percentage (%) of Bare Ground (i.e., ground that is free of vegetation) on the transect and select the closest percentage (%) from the options provided. Then press 'NEXT' to move to the next screen.

Transect

Bare ground percentage

- 0 percent
- 10 percent
- 20 percent
- 30 percent
- 40 percent
- 50 percent
- 60 percent
- 70 percent
- 80 percent
- 90 percent
- 100 percent

Step 18: Select the approximate percentage (%) of Transect Area Surveyed from the options provided. This means, how much of the transect area is surveyed. Then press 'NEXT' to move to the next screen.

Transect

* Area surveyed percentage

- 100 percent
- 90 percent
- 80 percent
- 70 percent
- 60 percent
- 50 percent
- 40 percent
- 30 percent
- 20 percent
- 10 percent
- 0 percent

< BACK NEXT >

Step 19: Select the Shore Exposure or Shape of the Location within 25 meters either side of where you are carrying out the transect. A 'Cove/Bay' is rounded with the edges like an upturned smile 😊. 'Straight' means the coastline where you are and other either side of you for 25 meters in each direction is reasonably straight and regular. A 'Headland' means you're at an area that is shaped like a frown – the opposite of a cove or smile 😞. When completed, press 'NEXT' to move to the next screen.

Transect

* Shape of shoreline

Shape of shoreline within 25 m each side of transect

- Cove/Bay
- Straight
- Headland

Step 20: Select the most appropriate Aspect of the river site – that is the direction you are looking when you are facing the water. Press ‘NEXT’ to move onto the next screen.

Step 21: Is the riverbank Channelised? This means, has there been any human intervention of the river channel? Select ‘Yes’ or ‘No’ and press ‘NEXT’ to move onto the next screen.

Step 22: Are there Storm Water Drains present? Select ‘Yes’ or ‘No’ and press ‘NEXT’ to move onto the next screen.

Step 23: If there is any evidence of Obvious Litter Dumping that has occurred at the transect location, please specify the Type by selecting from the options provided. You can select more than one option if needed. Then press ‘NEXT’ to move to the next screen.

You can select ‘Other’ and press ‘NEXT’ to type in a different answer to the ones provided. Then press ‘NEXT’ to move to the next screen.

If there is no obvious litter dumping, select ‘None’ and press ‘NEXT’ to move to the next screen.

Step 24: Look for Evidence of Recent Activities within the area of the transect and select from the options provided. You can select more than one option if needed. Then press 'NEXT' to move to the next screen.

Step 25: If you have any additional Comments, please type them into the section provided and press 'NEXT' to move to the next screen.

Step 26: Enter the First Name and Last Name of the person who is recording the data. (If this is you, enter your name). Then press 'NEXT' to move to the next screen.

Step 27: Enter the First Name and Last Name of the persons who are surveying/observing the transect. Then press 'NEXT' to move to the next screen.

Step 28: To enter the Start of Transect Location, select the blue 'Start GeoPoint' bar. This will get a satellite

reading automatically, it may take a few minutes. Once the error is under 5m it will automatically stop. If it doesn't get to under 5m error in a reasonable time you can press the 'Save GeoPoint' button when it gets to under 10m. Then press 'NEXT' to move to the next screen.

Step 29: Select the Time of Day that you started the transect. To do this, select the blue 'Select time' bar and drag the numbers up or down to navigate to the correct time. Ensure that you select AM or PM correctly. Then press 'NEXT' to move to the next screen.

Step 30: Take a photo that shows the start of the transect tape, looking towards the end of the tape. Press ok on the photo if you are happy with it, then press 'NEXT' to move to the next screen. (You will be given the option to take another photo if there is something of interest on the transect such as dumped litter or a noteworthy object.)

We now move into the section for recording actual items of litter. Each transect is divided into 10 intervals for recording purposes. The ODK app will take you through recording litter information in intervals from 1 to 10.

Step 31: Is this transect being Subsampled? Subsampling occurs when there are too many litter items to be counted along the entire length of the transect accurately. When Subsampling, you will count a percentage of the litter items along the transect.

If you and your colleague will be Subsampling, click 'Yes'. Then press 'NEXT' and enter the percentage (%) of each interval along the transect that you will survey. This is the Subsampled Percentage (%).

If you are not Subsampling, select 'No' then press 'NEXT' to move to the next screen.

Step 32: Interval 1: Is there any litter in this interval? The ODK app will tell you the measurement for interval 1. In the example below, it is from 0 (the start of the transect) to 2.5m along the transect tape.

If no litter is present, select 'No'. Then press 'NEXT' to move onto the screen for Interval 2.

If litter is present, select 'Yes'. Another form will drop down and you will need to enter information about the litter item (including where it occurs along the transect, litter type and item, whether or not the item is whole or has been broken into a fragment and how big the litter item is). Use the dropdown menus to

guide you. Refer to the Item Size Chart (in Appendix) if you need a reminder of Size Classes.

The ODK app will ask if you need to add an Additional Item. Use this feature if there is more than one litter item found in Interval 1.

If you find something else in the first interval press 'Add'. This will give you a drop-down page similar to the previous page. For Additional Items, you can group together litter of similar type and item. For example, if there are an addition 8 fragments of glass, you can add them in under one 'Additional Item'.

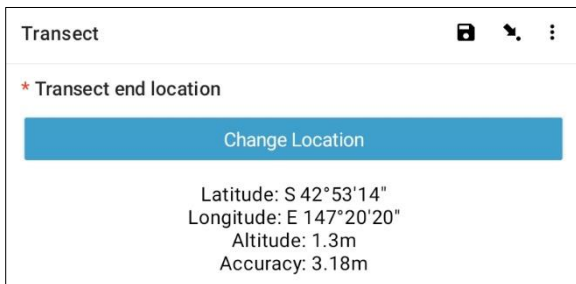
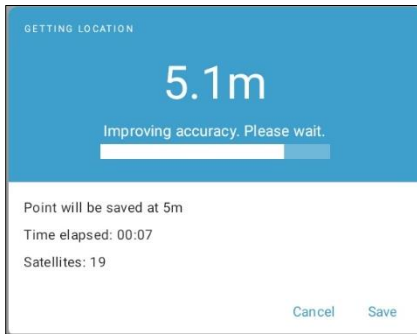
Keep adding items until all items in Interval 1 have been counted.

When all items have been counted (or if you didn't find any Additional Items) press 'Do Not Add'. This will take you to the next interval along the transect where the process is repeated.

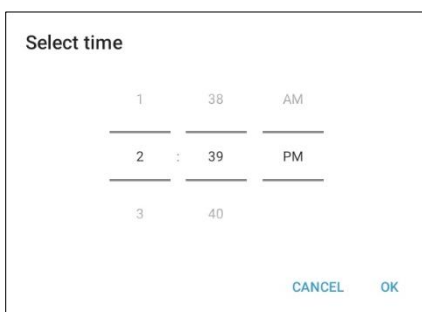
Step 33: Repeat Step 32 for intervals 2 to 10.

Step 34: Please confirm if you did or didn't find litter on this transect (this seems obvious, but this answer helps with the statistical analysis of data after the surveys).

Step 35: To enter the End of Transect Location, select the blue 'Start GeoPoint' bar. This will get a satellite reading automatically, it may take a few minutes. Once the error is under 5m it will automatically stop. If it doesn't get to under 5m error in a reasonable time you can press the 'Save GeoPoint' button when it gets to under 10m. Then press 'NEXT' to move to the next screen.

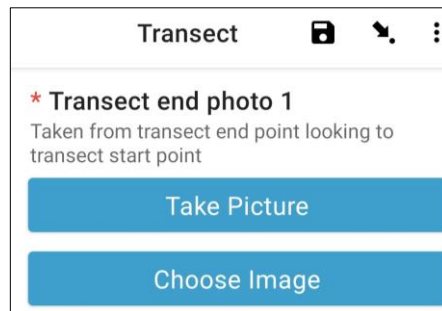


Step 36: Select the Time of Day that the transect was completed. To do this, select the blue 'Select time' bar and drag the numbers up or down to navigate to the correct time. Ensure that you select AM or PM correctly. Then press 'NEXT' to move to the next screen.

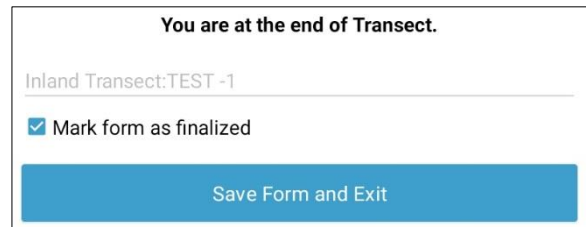


Step 37: Take a photo that shows the end of the transect you just completed, looking back towards the

start of the transect tape. Press ok on the photo if you are happy with it, then press 'NEXT' to move to the next screen. (You will be given the option to take another photo if there is something of interest on the transect such as dumped litter or a noteworthy object.)



Step 38: You have finished the transect! Check the blue box and press 'Save Form and Exit'.



Step 39: You will notice that the completed form is now in your 'Edit Saved Form' tab. Press on this tab and check that all the information you have entered on the form is correct. Then press 'Go to End'. Please make sure to check the blue box and press '**Save Form and Exit**'.

Step 40: The form will now go into your send finalized form tab. The next time you are connected to the internet, the form will upload automatically and move into your View Sent Forms Tab. You cannot edit the form any further.

Note: at this point, if you need to make changes to the information you have entered you will need to email TJ at tj.lawson@csiro.au.

11 Coastal surveys

After collecting site information, you will need to determine where to carry out Coastal transects. You will complete a minimum of 3 and a maximum of 6 transects per site. If there is litter detected on the first three transects you will not need to do anymore. If no litter is detected on the first 3 transects, add an additional transect. If you did not find anything on your first 3 transects, add an additional transect. If you have 6 transects with no litter detected, you are finished. Do not carry out more than 6 transects at a site.

The first coastal transect should be conducted at least 50m from the location that you accessed the site (access point). Each subsequent transect should be at least 50m away from the first transect.

First, have a look at the environment around you. If the landscape is all very similar, all of the transects can be placed in the same habitat type (such as sand), taking into account minimum distances from the access point (50m) and between transects (50m).

If there are several different habitat types at the site, choose the 3 initial transects proportionally between the habitat types. For example, a Coastal site may contain sandy beach areas and rocky slab areas as shown in Figure 10.

Since more of the beach is sandy, carry out 2 transects in the sandy area and 1 transect along the rocky area.

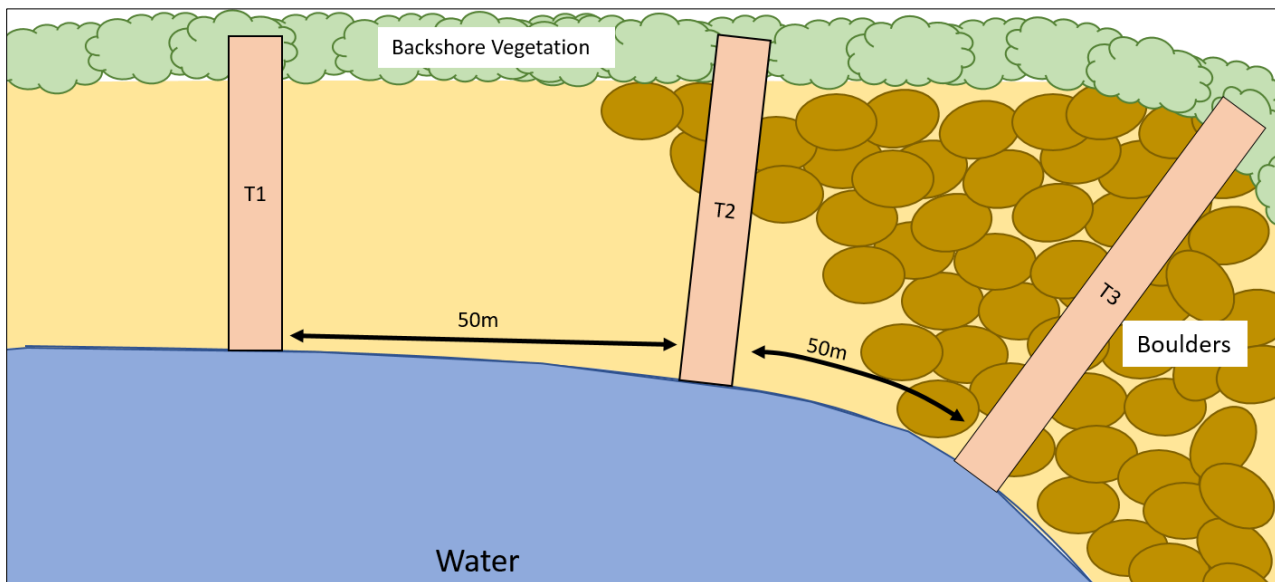


Figure 10: An example of where to place transects at a coastal site with multiple habitat types.

All coastal transects start at the water's edge and move up the beach until 2m beyond the continuous vegetation line or you come up to a seawall/cliff (Fig. 11) (the length of coastal transects vary depending on the site). Ensure that transect length is in **whole** meters (e.g., 26m, not 26.4m). Coastal transects are always 2m wide.

How far apart do coastal transects need to be?

Coastal transects will be '50m plus' apart. The 'plus' is a random number of steps (between 1 and 15) that you chose before arriving at the site. This adds an element of randomness to selecting where transects occur without being influenced by the site itself.

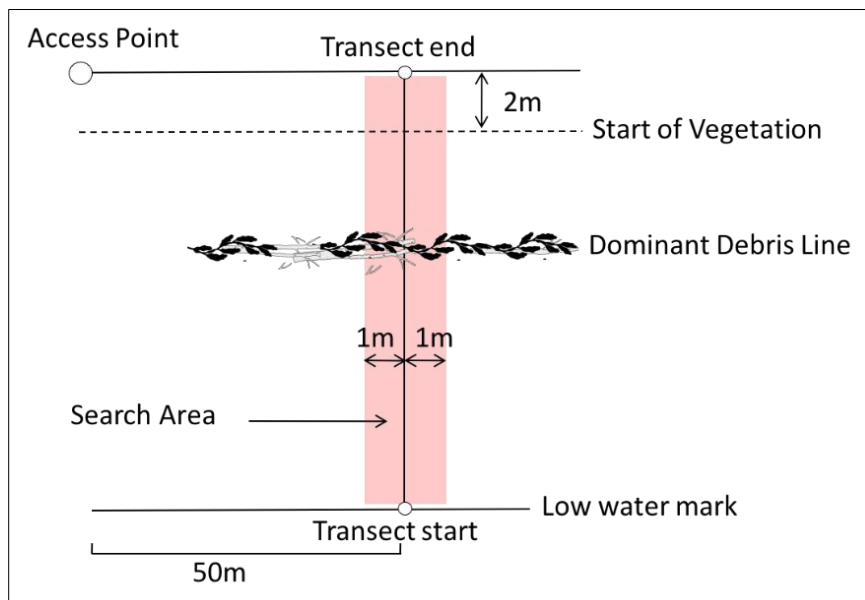


Figure 11: Coastal transects start at the water's edge and progress to 2m beyond the continuous vegetation line.

What if there is a seawall at the back of the site?

If there is suitable area between the water's edge and the seawall, carry out the transects at this site. However, surveys cannot be conducted if there is no beach (or rocks, cobble, or slab) between the tideline and a seawall.

If it is not possible to complete the transects at the chosen site, select the nearest coastal site to the original GPS location to conduct the survey. Please make a note of this change in the ODK site form.

What if the beach is not long enough?

We recommend conducting surveys on beaches/coastlines that are at least 150m long to allow for the correct distance between the site access point and between transects. The distance between transects can be reduced to as little as 30m in rare cases where the beach/coastline is not long enough and there is not another suitable coastline nearby. However, if you can't have a minimum of 30m between transects, you will need to select another coastal site as close to the original GPS location as possible. Please make a note of this in the ODK site form.

Entering Coastal transect information into the ODK app

Step 1: From the menu options and select 'Fill Blank Form'.



Step 2: Select 'Transect' from the options displayed.



Step 3: Select **Coastal** from the three options: Coastal, River and Inland. Then press 'NEXT' to move to the next screen.



Step 4: Select from the Site ID (identification) codes listed which will match up to the associated site ID (identification) code provided by CSIRO. Then press 'NEXT' to move to the next screen.



Step 5: Enter the Transect Number (i.e., 1, 2 or 3, etc.). Then press 'NEXT' to move to the next screen.



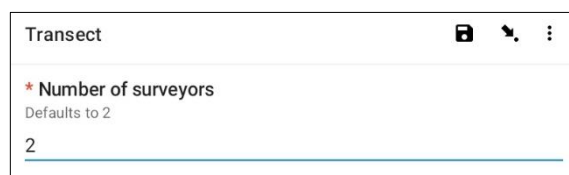
Step 6: Enter the Transect Length. For **Coastal** transects, this is the length from the water's edge until 2m beyond the continuous vegetation line or you come up to a seawall/cliff (enter length as a whole number). If possible, you would continue to 2 meters from the top of the seawall into the area beyond. Then press 'NEXT' to move to the next screen.



Step 7: Enter the Transect Width, this will default to 2. Then press 'NEXT' to move to the next screen.



Step 8: Enter the Number of People surveying the transect. This should always be 2 (note: 2 is the default setting in the ODK app). Then press 'NEXT' to move to the next screen.



Step 9: Is there an obvious or dominant Debris Line?
 If there is no obvious Debris Line, select 'No' and press 'NEXT' to move to the next screen.

Transect

Obvious debris line

Yes

No

If there is an obvious Debris Line, select 'Yes', then press 'NEXT' to move onto the next screen. The ODK app will then prompt you to enter the distance along the tape to the Debris Line (to the closest .10 of a meter: e.g., 2.5m or 3.0 m).

Transect

Distance to dominant debris line (m)
 Distance from water edge to major debris line (in meters) at time of survey

5

Step 10: Select the Gradient of the Land where the transect is being performed (i.e., the difference in elevation from the start to end of the transect). Then press 'NEXT' to move to the next screen.

Transect

Gradient
 Difference in elevation from start to end of transect

0 - 5 cm (flat, no difference)

5 - 50 cm (ankle to knee)

50 - 100 cm (knee to hip)

100 - 150 cm (hip to chest)

150 - 180 cm (chest to head)

> 180 cm (above head)

Step 11: Select the Substrate Type from the options provided. You can only have one answer per site so if there is more than one, please choose the DOMINANT answer. Then press 'NEXT' to move to the next screen.

Transect

* Coastal substrate type
 Predominant type

Mud

Sand

Pebble/Gravel

Cobble

Boulders

Rock slab

Cement

Coral

Step 12: Select the Substrate Colour from the options provided. Note that this is the colour of the ground or soil, not the vegetation. You can only have one answer per site so if there is more than one, please choose the DOMINANT answer. Then press 'NEXT' to move to the next screen.

Transect

* Substrate colour
 Predominant colour of substrate (not vegetation)

White/Cream

Yellow

Orange

Brown

Black

Grey

Red

Step 13: Select the most appropriate Backshore Type. Then press 'NEXT' to move to the next screen.

The screenshot shows the 'Transect' app interface. At the top, it says 'Transect' with a save icon, a share icon, and a menu icon. Below that is the section 'Backshore type' with the subtitle 'Where beach meets terrestrial vegetation'. There are ten radio button options listed: Cliff, Seawall, Urban building, Forest/Tree (> 3 m), Shrub (< 3 m), Dune, Grass - tussock, Grass - pasture, and Mangrove.

Step 14: Select the Shape of the Shoreline within 25 meters either side of where you are carrying out the transect. A 'Cove/Bay' is rounded with the edges like an upturned smile 😊. 'Straight' means the coastline where you are and other either side of you for 25 meters in each direction is reasonably straight and regular. A 'Headland' means you're at an area that is shaped like a frown – the opposite of a cove or smile 😞. When completed, press 'NEXT' to move to the next screen.

The screenshot shows the 'Transect' app interface. At the top, it says 'Transect' with a save icon, a share icon, and a menu icon. Below that is the section '* Shape of shoreline' with the subtitle 'Shape of shoreline within 25 m each side of transect'. There are three radio button options listed: Cove/Bay, Straight, and Headland.

Step 15: Select the most appropriate Aspect of the river site – that is the direction you are looking when you are facing the water. Press 'NEXT' to move onto the next screen.

The screenshot shows the 'Transect' app interface. At the top, it says 'Transect' with a save icon, a share icon, and a menu icon. Below that is the section 'Aspect' with the subtitle 'Direction when you are facing the water'. There are nine radio button options listed: N, NE, E, SE, S, SW, W, and NW. A scroll indicator is visible on the right side.

Step 16: If there is any evidence of Obvious Litter Dumping that has occurred at the transect location, please specify the Type by selecting from the options provided. You can select more than one option if needed. Then press 'NEXT' to move to the next screen.

The screenshot shows the 'Transect' app interface. At the top, it says 'Transect' with a save icon, a share icon, and a menu icon. Below that is the section '* Obvious litter dumping' with the subtitle 'Can select more than one'. There are four checkbox options listed: None, Construction (checked), Household (checked), and Other (specify).

You can select 'Other' and press 'NEXT' to type in a different answer to the ones provided. Then press 'NEXT' to move to the next screen.

The screenshot shows the 'Transect' app interface. At the top, it says 'Transect' with a save icon, a share icon, and a menu icon. Below that is the section '* Obvious litter dumping' with the subtitle 'Can select more than one'. There are four checkbox options listed: None, Construction, Household, and Other (specify) (checked).

The screenshot shows the 'Transect' app interface. At the top, it says 'Transect' with a save icon, a share icon, and a menu icon. Below that is the section 'Please specify evidence of dumping' with a text input field.

If there is no obvious litter dumping, select 'None' and press 'NEXT' to move to the next screen.

Step 17: Look for Evidence of Recent Activities within the area of the transect and select from the options provided. You can select more than one option if needed. Then press 'NEXT' to move to the next screen.

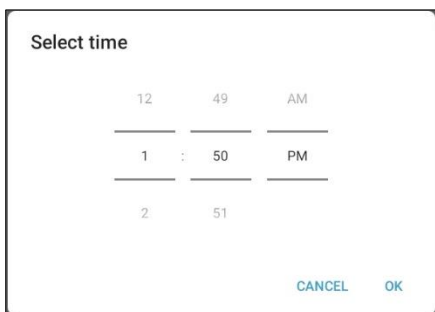
Step 18: If you have any additional Comments, please type them into the section provided and press 'NEXT' to move to the next screen.

Step 19: Enter the First Name and Last Name of the person who is recording the data. (If this is you, enter your name). Then press 'NEXT' to move to the next screen.

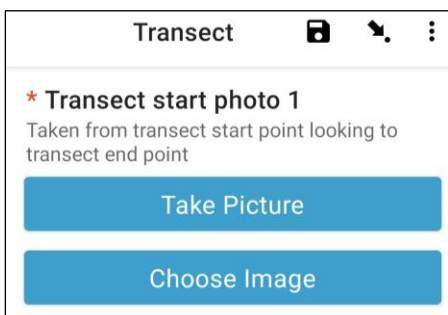
Step 20: Enter the First Name and Last Name of the persons who are surveying/observing the transect. Then press 'NEXT' to move to the next screen.

Step 21: To enter the Start of Transect Location, select the blue 'Start GeoPoint' bar. This will get a satellite reading automatically, it may take a few minutes. Once the error is under 5m it will automatically stop. If it doesn't get to under 5m error in a reasonable time you can press the 'Save GeoPoint' button when it gets to under 10m. Then press 'NEXT' to move to the next screen.

Step 22: Select the Time of Day that you started the transect. To do this, select the blue 'Select time' bar and drag the numbers up or down to navigate to the correct time. Ensure that you select AM or PM correctly. Then press 'NEXT' to move to the next screen.



Step 23: Take a photo that shows the start of the transect tape, looking towards the end of the tape. Press ok on the photo if you are happy with it, then press 'NEXT' to move to the next screen. (You will be given the option to take another photo if there is something of interest on the transect such as dumped litter or a noteworthy object.)

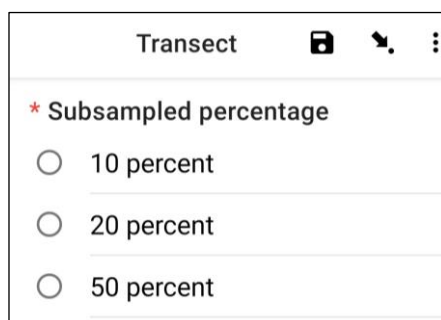


We now move into the section for recording actual items of litter. Each transect is divided into 10 intervals for recording purposes. The ODK app will take you through recording litter information in intervals from 1 to 10.

Step 24: Is this transect being Subsampled? Subsampling occurs when there are too many litter items to be counted accurately. When Subsampling,

you will count a percentage of the litter items along the transect.

If you and your colleague will be Subsampling, click 'Yes'. Then press 'NEXT' and enter the percentage (%) of each interval along the transect that you will survey. This is the Subsampled Percentage (%).

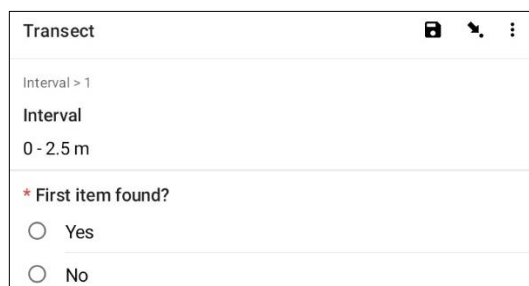


If you are not Subsampling, select 'No' then press 'NEXT' to move to the next screen.



Step 25: Interval 1: Is there any litter in this interval? The ODK app will tell you the measurement for interval 1. In the example below, it is from 0 (the start of the transect) to 2.5m along the transect tape.

If no litter is present, select 'No'. Then press 'NEXT' to move onto the screen for Interval 2.



If litter is present, select 'Yes'. Another form will drop down and you will need to enter information about

the litter item (including where it occurs along the transect, litter type and item, whether or not the item is whole or has been broken into a fragment and how big the litter item is). Use the dropdown menus to guide you. Refer to the Item Size Chart (in Appendix) if you need a reminder of Size Classes.

The ODK app will ask if you need to add an Additional Item. Use this feature if there is more than one litter item found in Interval 1.

If you find something else in the first interval press 'Add'. This will give you a drop-down page similar to the previous page. For Additional Items, you can group together litter of similar type and item. For example, if there are an addition 8 fragments of glass, you can add them in under one 'Additional Item'.

Keep adding items until all items in Interval 1 have been counted.

When all items have been counted (or if you didn't find any Additional Items) press 'Do Not Add'. This will take you to the next interval along the transect where the process is repeated.

Step 26: Repeat Step 25 for intervals 2 to 10.

Step 27: Please confirm if you did or didn't find litter on this transect (this seems obvious, but this answer helps with the statistical analysis of data after the surveys).

Step 28: To enter the End of Transect Location, select the blue 'Start GeoPoint' bar. This will get a satellite reading automatically, it may take a few minutes. Once the error is under 5m it will automatically stop. If it doesn't get to under 5m error in a reasonable time you can press the 'Save GeoPoint' button when it gets to under 10m. Then press 'NEXT' to move to the next screen.

Transect

* Transect end location

Start GeoPoint

GETTING LOCATION

Trying to get location. Please wait.

Point will be saved at 5m
Time elapsed: 00:01
Satellites: 0

Cancel Save

GETTING LOCATION

5.1m

Improving accuracy. Please wait.

Point will be saved at 5m
Time elapsed: 00:07
Satellites: 19

Cancel Save

Transect

* Transect end location

Change Location

Latitude: S 42°53'14"
Longitude: E 147°20'20"
Altitude: 1.3m
Accuracy: 3.18m

Step 29: Select the Time of Day that the transect was completed. To do this, select the blue 'Select time' bar and drag the numbers up or down to navigate to the correct time. Ensure that you select AM or PM correctly. Then press 'NEXT' to move to the next screen.

Transect

* Transect end time

Select time

No time selected

Select time

1 38 AM

2 : 39 PM

3 40

CANCEL OK

Step 30: Take a photo that shows the end of the transect you just completed, looking back towards the start of the transect tape. Press ok on the photo if you are happy with it, then press 'NEXT' to move to the next screen. (You will be given the option to take another photo if there is something of interest on the transect such as dumped litter or a noteworthy object.)

Transect

* Transect end photo 1

Taken from transect end point looking to transect start point

Take Picture

Choose Image

Step 31: You have finished the transect! Check the blue box and press 'Save Form and Exit'.

You are at the end of Transect.

Inland Transect:TEST -1

Mark form as finalized

Save Form and Exit

Step 32: You will notice that the completed form is now in your 'Edit Saved Form' tab. Press on this tab and check that all the information you have entered on the form is correct. Then press 'Go to End'. Please make sure to check the blue box and press 'Save Form and Exit'.

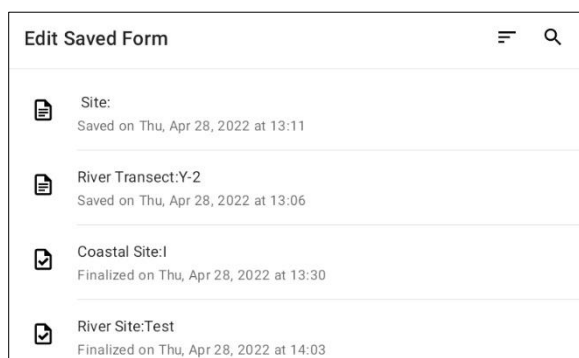
Step 33: The form will now go into your send finalized form tab. The next time you are connected to the internet, the form will upload automatically and move into your View Sent Forms Tab. You cannot edit the form any further.

Note: at this point, if you need to make changes to the information you have entered you will need to email TJ at tj.lawson@csiro.au.

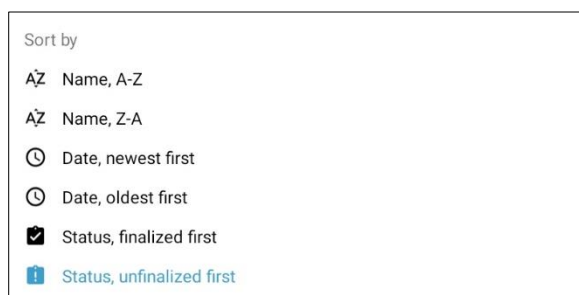
12 Further information about using ODK

Editing a saved ODK form

Read the menu options and select 'Edit Saved Form'.

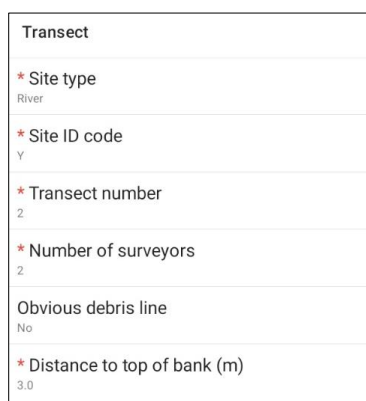


Your saved forms should display on the screen in list view. You can sort forms by tapping the icon with three dashes displayed at the top right of the screen. Select the desired 'Sort' option from the list that is displayed.



Alternatively, you can search for a form by tapping the 'Search icon' at the top right of the screen. In the search bar, type in the site type or name, or transect type or name and select the desired form from the list that is displayed.

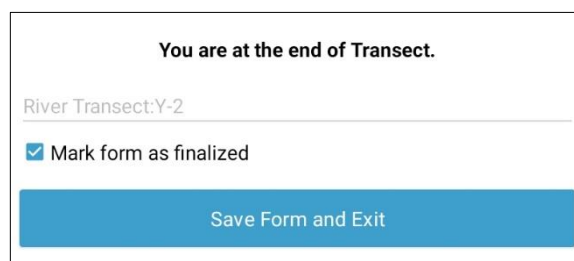
Once you have selected the form you would like to edit, you will be provided a list view of all information that has been entered.



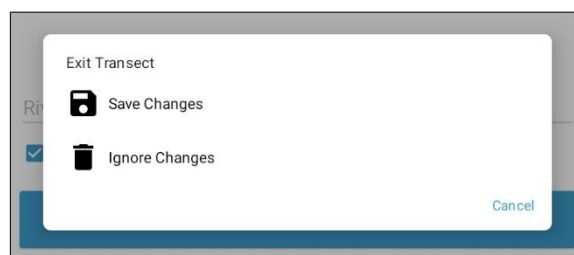
Two options are displayed at the bottom of the screen. 'Go to Start' takes you to the beginning of the form, and 'Go to End' takes you to the end of the form. Alternatively, you can scroll down or up the page and tap on the specific information you would like to edit.

Once you start to edit information in the form, use the 'NEXT' or 'BACK' options to navigate through the information. Tapping the 'Arrow icon' will take you back to the list view of all information that has been entered.

You can save your edited form by selecting the 'Save icon' at the top right of the screen (when in form view), or by tapping 'Go to End' and selecting the blue 'Save Form and Exit' bar at the end of the form. Note here you have the option to mark form as finalized by ticking or unticking the box next to 'Mark form as finalized'.



Once your form is saved you will be taken back to the home page. Note if you exit the form without saving, a box will appear to allow you to save or ignore changes. If this occurs select the option you require and you will be taken back to the home page.

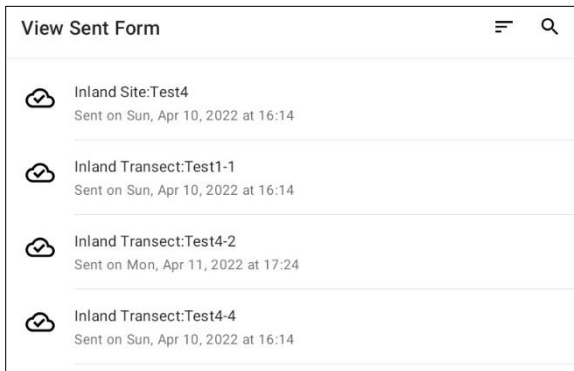


Viewing a sent ODK form

Note: once a form has been finalised and sent, you are NOT able to edit the form.

Read the menu options and select 'View Sent Form'.

Your sent forms should display on the screen in list view. You can sort forms by tapping the icon with three dashes displayed at the top right of the screen and selecting the desired 'Sort' option from the list that is displayed.

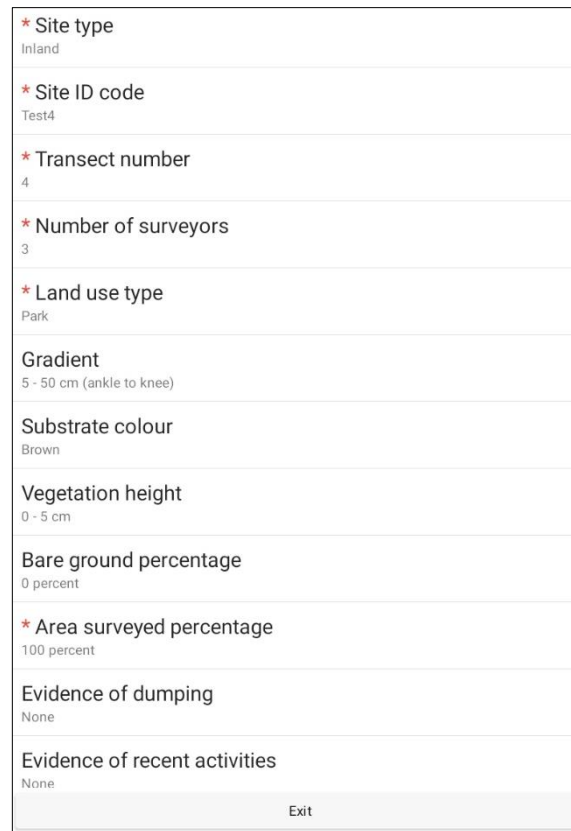


Alternatively, you can search for a form by tapping the 'Search icon' at the top right of the screen. In the search bar, type in the site type or name, or transect type or name and a list of forms matching your search entry will be displayed

Select the desired form/s by tapping their title.

To view the information contained in a sent form, select the desired form from the list that is displayed. You can scroll up and down by dragging the screen up or down to view all the information. Note that you will

not be able to edit the information in a form once it has been sent.



The screenshot shows a mobile application interface displaying the details of a sent ODK form. The form is titled "View Sent Form" and has a search icon at the top right. The form data is as follows:

* Site type	Inland
* Site ID code	Test4
* Transect number	4
* Number of surveyors	3
* Land use type	Park
Gradient	5 - 50 cm (ankle to knee)
Substrate colour	Brown
Vegetation height	0 - 5 cm
Bare ground percentage	0 percent
* Area surveyed percentage	100 percent
Evidence of dumping	None
Evidence of recent activities	None

At the bottom of the screen, there is a grey bar with the text "Exit".

Tapping the 'Exit' bar at the bottom of the screen will take you back to the home page.

13 At-sea trawl surveys

Unlike inland, river and coastal surveys, at-sea trawl surveys happen in two parts. The first part is the actual trawling of the sea surface from a boat (Fig. 12), while the second is back on land sorting, counting and recording the marine debris/litter caught in the trawl net.

Trawl surveys are typically conducted along three trawl lines fanning out from the mouth of the largest river within the field sampling area. Each trawl line takes approximately 3 hours and along with preparation and travel between sites, at-sea trawl sampling typically takes 1.5 to 2 days.



Figure 12: Team members emptying a trawl sample to sort back on land.

Trawl sampling needs to be carried out during calm to low wind/wave days, where whether conditions are suitable for the trawl net to operate. If it is too windy or there is too much swell, the net will jump out of the water which leads to inaccuracy in data collection – as well as seasickness!

The boat used to do the trawl sampling must be capable of **motoring slowly at 2-3 knots** of speed. It should be big enough to hold a minimum of three surveyors plus the driver. Ideally there should be the capability to fit a boom to hold the sampling net off the lee side of the boat.

The boom must be strong enough to withstand the significant pressure of the net dragging through the water. We do not provide a boom; this must be supplied either by you or by the boat owner. Generally, it is best to discuss boat requirements with CSIRO staff directly.

Keep in mind that seasickness can be an issue and plan your staff and schedule accordingly.

After the trawls are completed, the collected **trawl samples will need to be sorted**. This is detailed work and can take quite some time after the trawls have been completed, typically an additional 2 to 3 days. Be sure to allocate time to sort the trawl samples.

13.1 Equipment required

CSIRO will supply the actual trawl net and associated equipment required for at-sea trawl sampling, but it is the host organisation's responsibility to **organise the boat** and provide all other equipment. Please contact CSIRO if you have any questions or concerns regarding the equipment. We provide a full list of useful equipment to have to make the process as simple and straightforward as possible.

Equipment provided by CSIRO

Trawl nets, Tow rope, Cod ends (X3) to attach to the end of the trawl net, Flow meter (spinning tail on right), Flow meter connection apparatus (rod and 3 X nuts).



Trawl net



Tow Rope



Cod end x3



Flow meter



Connector

Equipment provided by partnering organisation

Equipment to take on the boat (in brief): Buckets (2-3 x 10-15 litre buckets (larger is fine)), Watertight storage jars (x27) or zip lock bags (x54 – double bagged), Permanent markers (Sharpie) and/or labels, Squeeze bottle(s), Ladle or cup, GPS, Camera, Compass, Data sheets, Clipboard, Pencil/Pen.

Equipment to use back on land in lab or sorting station (in brief): Plastic tubs (clear or white, X3 per sorting station), Tweezers, Petri dishes, Permanent marker (Sharpie), Ruler, Aluminium foil, Torch/light source, Timer, White paper.

Further details about equipment provided by partnering organisation

Equipment to take on the boat



Squeeze bottle



Large Jar



Zip lock bag

- Squeeze bottle (at least 200mL volume) – to be filled with sea water for rinsing debris items from cod ends.
- Watertight storage containers such as large jars or large zip lock bags (at least 1L in volume) to contain debris/litter (and sea water) from the tows. One container per tow x3 tows for each of the 3 stations, on

each of the 3 trawl lines. With a total of nine stations across the three trawl lines, there will be a total of 27 separate samples. If using zip lock bags, the plastic thickness should be at least 0.12 mm and have enough to double bag each sample (54 in total).

- Buckets for seawater (2-3), approximately 10L in volume
1. Marking pen that can mark sample numbers on the containers/bags, plus labels if necessary.
 2. Data sheets
 3. GPS - preferably hand-held or on boat console, as reception at sea may not permit accurate GPS locations from a mobile phone.
 4. Camera - can be on mobile phone.
 5. Compass - boat console or on hand-held GPS.
 6. Windspeed app

Equipment to use back on land in lab or sorting station

7. Sorting tubs - 3 x clear, white or light-coloured plastic tubs, trays, or buckets.



8. Tweezers/forceps – one pair for each person processing samples, plus one spare. Very fine needle tweezers are ideal, and often two pairs of tweezers makes the transfer of sample from tub to petri dish or foil easier.



9. Petri dishes, at least 70 mm in size (with 1cm x 1cm grid – can draw using a fine permanent marker)



10. Marking pen that can mark sample numbers on the petri dishes, etc.
11. Aluminium foil for storing samples
12. Light source – a battery-powered torch or flashlight or phone can assist with detection of plastics in samples
13. A timer – you can use the timer in your mobile phone
14. Ruler
15. White paper

Data entry for trawl surveys

Unlike Inland, River and Coastal surveys, we still use paper-based forms for recording trawl data. We have trailed using ODK for recording trawl data but found the paper-based form much easier. This is because when starting a tow, a lot of data is recorded at the same time, usually from multiple different people. Having to move through an electronic form sequentially at this time is challenging, hence the paper-based forms which you will find at the end of this section.

13.2 Methodology

The trawl sampling methodology includes steps to take before leaving land, how to deploy a surface trawl net and store the collected marine debris/litter (if any). Then the method on how to sort and count the items collected. This method is divided into the following sections:

- Requirements for survey vessel
- Choosing locations for trawl sampling
- Before leaving land
- On the vessel
 - Setting up the trawl equipment
 - Conducting each trawl
 - Sea scale – Beaufort number chart
- Sorting samples back on land

Requirements for the survey vessel/boat

The boat used for the trawl sampling must be capable of motoring at 2-3 knots and travelling at least 12-15 nautical miles offshore. It should be big enough to hold a minimum of three surveyors plus a driver. Ideally there should be the capability to fit a boom to hold the net off to the side of the boat. The boom must be strong enough to withstand significant pressure of the net dragging through the water. You will also need a method of attaching the boom to the boat, usually a thick rope or duct tape is sufficient. The net is generally placed on the leeward side of the boat.

We recommend sending photos of the vessel you plan to use to the CSIRO team for discussion on boom requirements, placement and attachment methods.

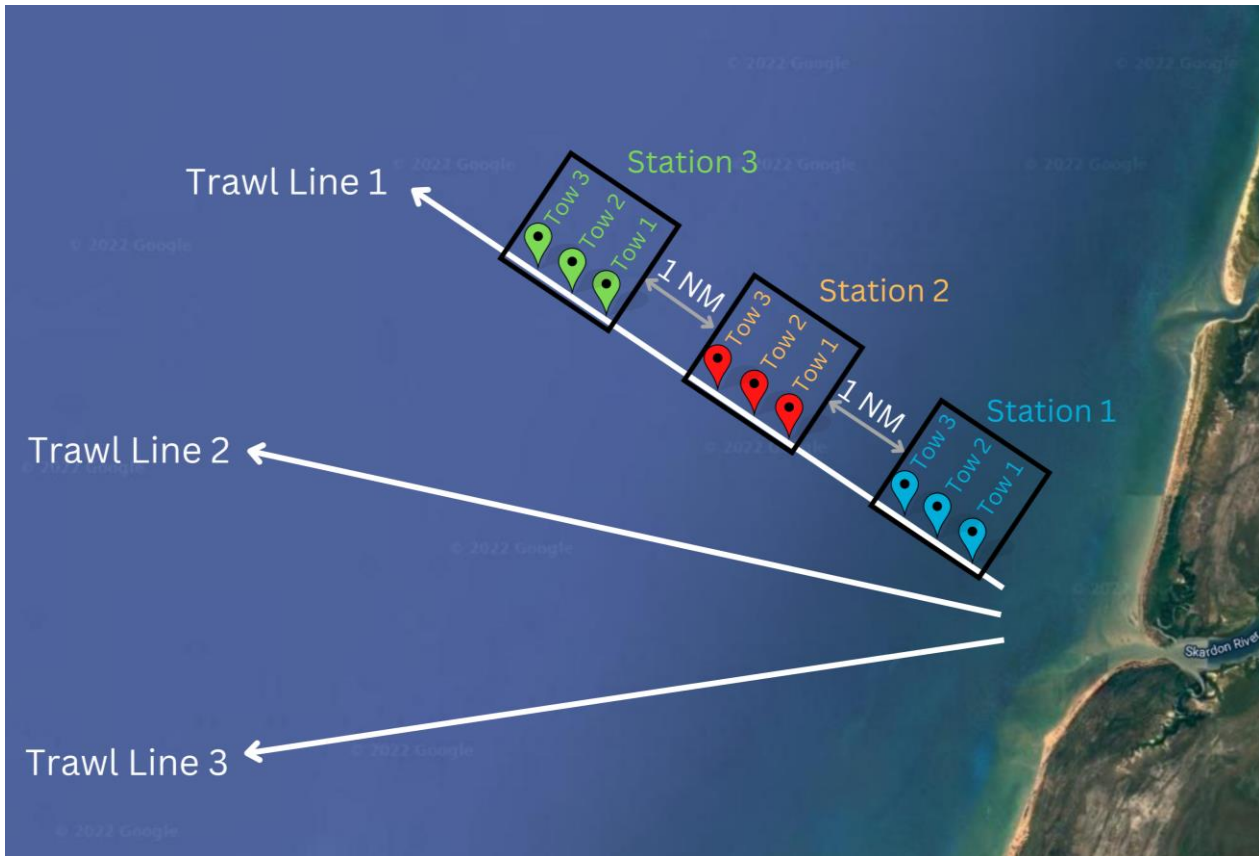


Figure 13: For at-sea trawl sampling, we sample along three trawl lines with a total of nine tows along each trawl line.

Choosing locations for trawl sampling

Trawls are conducted along **three lines** (trawl lines) fanning out from the mouth of a major river running through an urban area in the study site. There are **three stations** on each line, with **three tows** at each station. You will empty the net after each tow meaning there will be nine samples along each of the three trawl lines and therefore 27 tows/sample collections in total (Fig. 13).

The lines should start 50-100m from the shore, leaving one nautical mile between the start points of each line. They should be centred around the mouth of the river and fan out from there. The position of the lines may need to be adjusted to avoid nearby islands or other land masses. Currents and wind will cause the actual trawl locations to vary from the ideal line. Therefore, **CSIRO will not provide exact GPS locations for each tow**, as we understand the need to adapt in the field. However, we recommend that you identify the compass heading for the direction of travel and keep the boat moving that direction during each tow.

Each tow will be approximately 1 nautical mile or almost 2 km in length, the equivalent of travelling for 10-15 minutes at 2-3 knots. Leave at least 1 nautical mile (or ~2 km) between the end of one **station** and the beginning of the next. This means that the total length of each trawl line will be approximately 12 nautical miles or around 22 km, but will vary depending on the factors such as the current, length of time setting up for next tow, etc. The first tow begins as soon as the first one had finished, and the team has changed the cod end. Generally, there is a little space between each **tow** – just long enough to remove and replace the cod end.

We understand that it is not always possible to run straight lines due to islands, currents, boat drift etc. This is the optimal method, but often you will have to adapt to local circumstances. Please do the best you can.

Before leaving land

Remove the contents of the blue trawl bag and check that you have the following equipment: one trawl net and four bolts and wingnuts plus a rope, flow meter and connection apparatus. Attach the black wing-like panels to the metal using the bolts and wingnuts (see below). Be familiar with how the net goes together – it is much simpler to put the net together on land than when at sea.

Assemble the trawl net, including adding the flow meter, by following these images.



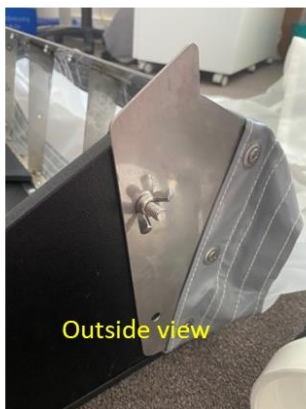
Trawl net unfolded from bag



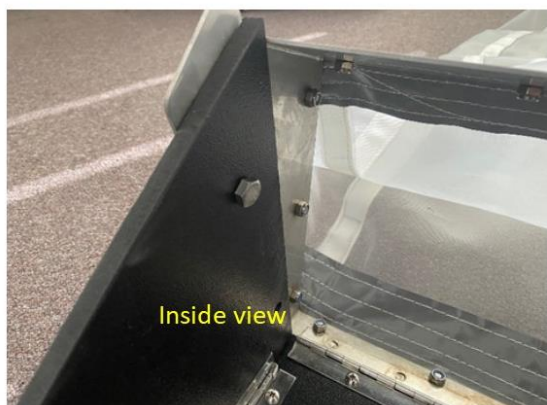
Screws and wingnuts to hold the sides of the frame



Screws go here



Outside view



Inside view



Top view

Fold the sides up and secure

Check the net for holes and repair if necessary. The standard net used by CSIRO has a mouth size of 60 cm x 22 cm, and a mesh size of 330 microns. If you are using a net other than the type provided by CSIRO, please ensure that the mesh size is 330 microns, and that you record the mouth dimensions on the [At-Sea Surface Trawl Site and Tow Data Sheet](#). Also ensure that it can be towed at the surface and does not sit below the water.

On the vessel

Assigning trawl tasks

Prior to placing the trawl net in the water, we recommend the team becomes **familiar with the data sheet** and **assigns tasks** as a lot of parameters need to be obtained and recorded simultaneously. Ideally, assign 2 people to deploy and retrieve the net – one of who will read the flow meter before and after each net deployment, while the other changes over the cod end. You will also need someone to record the information (compass direction, vessel speed etc and act as a timekeeper). We recommend teams of 3 to 5 people for conducting trawl surveys.

Following each sample collection, the cod end will need to be emptied into labelled bags/jars. This involves a lot of looking down and is a task best suited to people who do not get seasick.

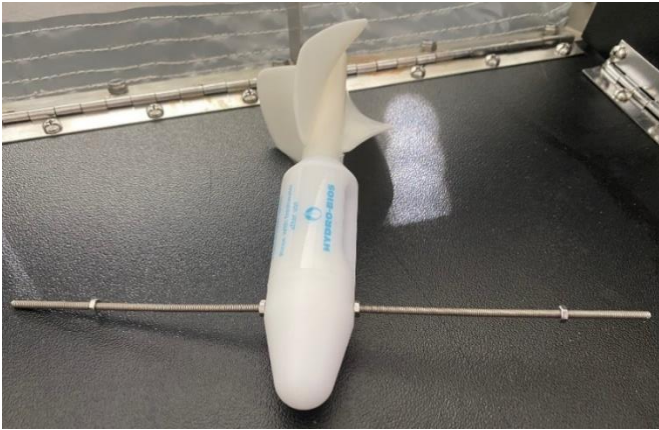
Setting up the trawl equipment

Step 1: Attach a cod end to the trawl net, making sure that it is clean of all debris/litter. The cod end screws on to the trawl net. While it is important to attach the cod end firmly, ensure you only **hand tighten** it so you can still change the cod end between tows.

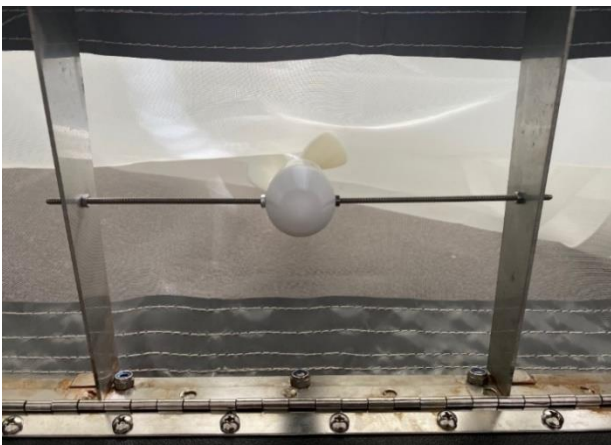


Screw the cod end onto the net

Step 2: Attach the flow meter to the middle of the mouth of the net using the nuts and threaded rod provided. Each flow meter has 8 nuts. One should be placed on either side of the flow meter to keep it in the middle of the rod. Place one nut flush against the inside frame of the net, and two outside of the frame, on each side, as shown in the following images.



Thread the rod through the head of the flow meter and secure a nut on either side



The flow meter in its correct position in the net



Position of nuts on net frame

Step 3: Check that the flow meter is turning freely by ensuring the 'tail' spins without restriction. The flow meter shows how much water has passed through the mouth of the net. You will record the number shown on the flow meter at the beginning and end of each tow. This number can be recorded 'continuously,' meaning that it does not need to be reset to 0 at the beginning of each tow. During the tow, the flow meter may pass through 99999 and begin counting over again. This is not a problem and can be later taken into account when calculating the total flow.

Step 4: Attach the tow rope to the net using the D shackles that are already fixed to the net frame.



D Shackle on side of net



Attach the two ends of the rope to the two D shackles

Step 5: Attach the other end of the tow rope to a boom (Fig. 14) or point on the vessel so it is being towed alongside the boat not in the wake of the boat. Note: the net should run parallel with the boat and the ropes should not be twisted. The black wood structure of the net is the top and should skim along the surface of the water.



Figure 14: Examples of booms on the side of boats for attaching the trawl net via the tow rope.

Conducting each trawl

Before you deploy the net, fill in the first section of the [At-Sea Surface Trawl Site and Tow Data Sheet](#) (included at the end of this methodology section). This includes the country, location, station number, surveyors' names and organisation, the date, mesh size, net mouth dimensions and salinity and water temperature (if boat has available sensors).

Follow these steps for each tow:

Step 1: Make sure the boat is going at a speed of 2-3 knots (3.7 – 5.5 km/h) and double check that all the trawl/cod net rigging has been assembled correctly.

Step 2: Prior to starting the trawl, record the following:

- 5-digit number from the flow meter
- Sea state (Beaufort number chart)
- Wind direction

Step 3: Gently deploy the net over the side of the vessel and record the following:

- Start latitude and longitude in decimal degrees (dd.dddd)
- Start time.

NOTE: when deploying the trawl net, the large black square panel on the net entrance must be on the topside of the net (Fig. 15). If this is on the bottom (seaside) it will get dragged under.



Figure 15: The large black square panel is on the top side of the net when sampling.

Step 4: Tow the net for approximately 10-15 minutes, while maintaining the vessel speed of 2-3 knots. This will give you a travel distance of approximately one nautical mile or just under 2 kms.

Step 5: Pull the net out of the water after 10-15 minutes and record the following

- End latitude and longitude
- End time
- Duration of tow
- Flow meter end count

NOTE: a wet trawl net is very heavy. Please be mindful of this when lifting it from the water and take care to avoid injury.

Step 6: Keep the boat heading in the same direction at the same speed along the same trawl line (while you prepare for the trawl/cod net rigging for the next tow). Take the cod end off and place in a bucket, replace with another clean cod end

Step 7: Put the net back into the water for the second tow, recording all information

Step 8: While the second tow is being conducted wash the contents of the first tow into a bucket using sea water (this is where a squeeze bottle and/or jug can be useful). Make sure to wash the cod end thoroughly to get all debris/litter out, as any remaining litter will contaminate the next sample. Carefully empty the contents of the bucket into a storage jar or zip lock bag (if using zip lock bags, ensure to enclose the first bag in a second bag to insure against leakage). Using a sieve can help to catch the litter items without collecting all of the sea water. **Label the jar/zip lock bag with the station number and tow number** (e.g., S1T1, S1T2, S1T3 etc.,).



Cod end washed out in bucket, bucket labelled with S1T1 meaning Station 1, Tow 1.

Step 9: Repeat steps 1 to 8 for tows 2 and 3.

Step 10: Repeat steps 1 to 9 for station 2 and 3 along the same trawl line. Ensure you have travelled at least 1 nautical mile between the end of one station and the beginning of the next (no stopping time is required between tows).

Step 11: Repeat steps 1 to 10 for each of the three trawl lines.

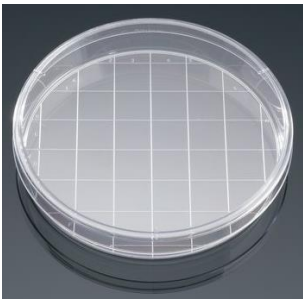
NOTE: Sorting of the trawl samples occurs back on land, not in the boat.

Sorting samples back on land

IMPORTANT: Once you are back on land, wash all the trawl gear thoroughly in fresh water and leave to dry before packing back up in bag.

We ask that team members have three separate 'looks' at each tow sample, each separated by a short break because our eyes get tired when looking at the same thing for too long. Data from each of these is recorded separately on the data sheet.

Step 1: Using a permanent marker and a ruler, draw a 1 cm x 1 cm grid on the bottom of a clear plastic petri dish. Debris/litter items will be placed in this dish, and the grid will allow us to estimate the size of each item from the photograph.



Petri dish with 1 cm x 1 cm grid

Step 2: Tip the contents of Station 1 Tow 1 into a clear plastic tub, making sure that the rinse water also goes into the tub.



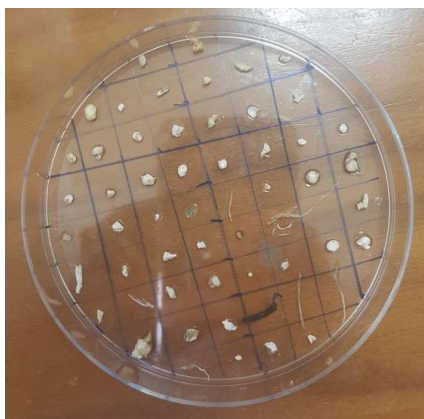
Emptying the collected trawl sample contents into a sorting container

Step 3: Set a timer and look for litter in the sorting container for 15 minutes. Remove any natural or organic material such as seaweed etc. from the bucket, making sure there are no pieces of debris/litter stuck to the organic material. If there are high levels of litter, you may need to subsample.

Step 4: Using metal tweezers, remove all pieces of debris/litter you see (using natural light) and put them in the gridded petri dish.



Removing debris/litter items using tweezers



Debris/litter placed in gridded petri dish

Step 5: Tally the debris/litter on the [At-Sea Surface Trawl Collection/Sort Data Sheet](#) (included at the end of this method section). Record the observer's name for each sort and take turns observing and recording.

***** After allowing at least 15 minutes for the first sort, take a break *****

Step 6: Do a second 15-minute sort on the **same** trawl contents by repeating steps 3 to 5. Add any new pieces of debris/litter found into the same petri dish.

***** Take a short break *****

Step 7: Do a third ten-minute sort on the **same** trawl contents, but this time use a good light source (if available) to search for any remaining debris/litter items.

Step 8: If you find anything that you are unsure of, have a look under a dissecting microscope (if available). If in doubt, include it as a debris/litter item.

Step 9: Once you have completed your 3 sorts for the same tow contents/sample or the petri dish is full, set the dish on a piece of white paper with the station number, tow number and the date written on it. Take a photo of the dish and station information, then place the contents of the petri dish into a piece of aluminium foil that is folded to make an envelope.

Step 10: Using a permanent marker, label the foil with the following information:

- a. Country
- b. Station number
- c. Tow number
- d. Date



Best practice for labelling samples

Step 11: Repeat steps 1 to 10 for all 27 collected tow samples.

At-Sea Surface Trawl Site and Tow Data Sheet

STATION DETAILS			
Country			
Location		<i>(e.g. river name, nearest city, etc)</i>	
Station Number			
Surveyor name and organisation			
Date <i>(local; dd/mm/yyyy)</i>			
Net type			
Net mesh size			
Net mouth dimensions			
Salinity <i>(if known, ppt)</i>		Sea surface temperature (°C)	

TOW DETAILS			
Tow Number	1	2	3
Wind speed <i>(true, kn)</i>			
Wind direction (degrees)			
Start latitude (decimal deg)			
Start longitude (decimal deg)			
Start time <i>(local / UTC)</i>			
Start flow meter count			
End latitude <i>(-S)</i>			
End longitude <i>(E)</i>			
End time <i>(local / UTC)</i>			
End flow meter count			
Average vessel speed <i>(ground, kn)</i>			
Average vessel direction (degrees)			
Average depth <i>(local, m)</i>			
Notes			

At-sea Surface Trawl Collection/Sort Data Sheet

Country									
Location (e.g. river name, nearest city, etc)									
Station Number									
Collection Data	Separate the three sorts for each sample in the boxes provided								
Tow Number	1			2			3		
Sorted By (name)									
Sort number	1	2	3	1	2	3	1	2	3
Sort start time									
Sort end time									
Total sort time									
Hard plastic									
Soft plastic									
Plastic line / fibres									
Foam / Styrofoam									
TOTAL PLASTIC									
Photo details									
Notes									

14 Appendix

Marine Debris Size Chart

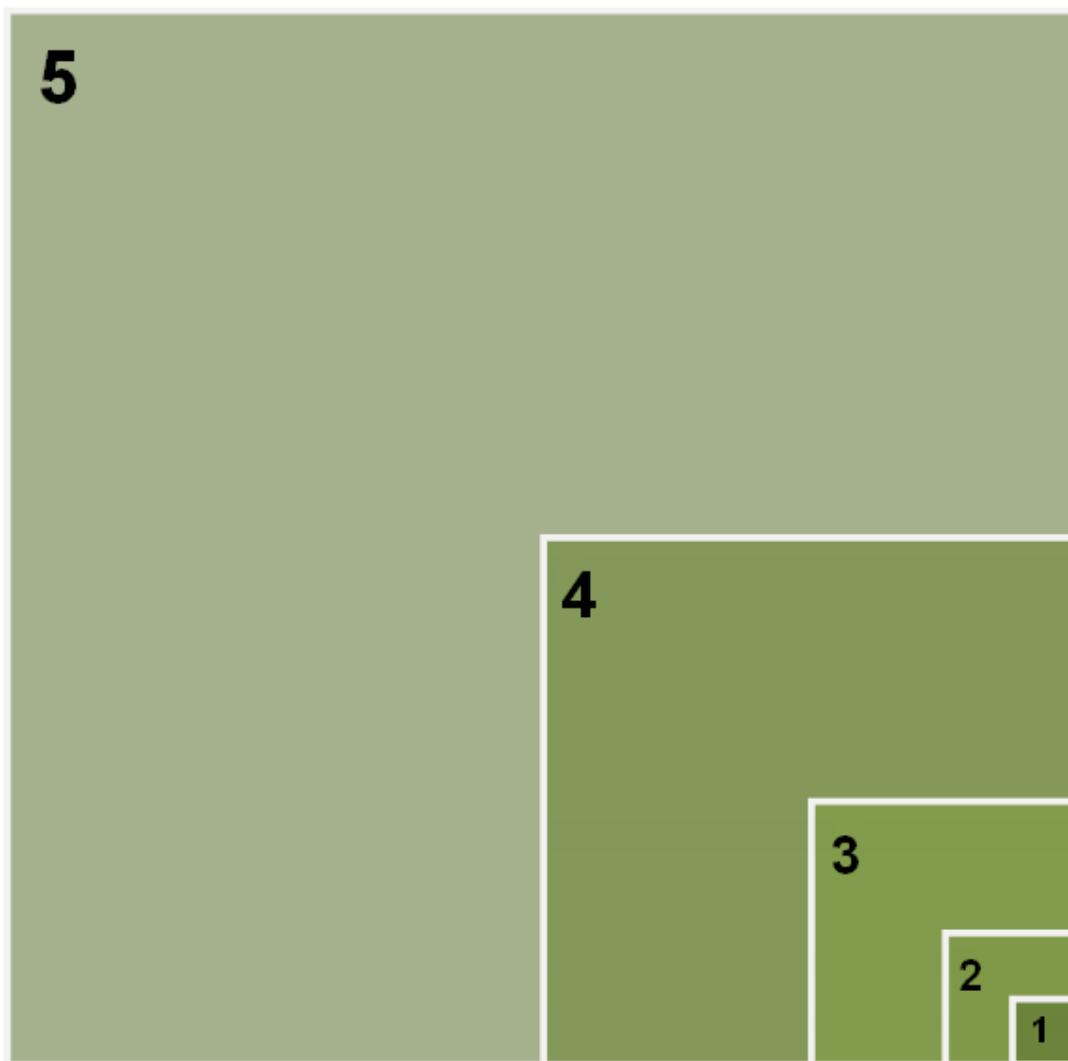
This chart should be used as a guide to help estimate the size of marine debris during surveys.

The squares below represent different size classes. To estimate size class, determine which square the object's longest dimension will fit into. Objects should be measured on the diagonal.

- 1 = 0–1 cm²
- 2 = 1–2 cm²
- 3 = 2–4 cm²
- 4 = 4–8 cm²
- 5 = 8–16 cm²
- 6 = 16–21 cm²
- 7 = >22 cm²

↑
← **7** *(larger than page)*

6 *(whole of page)*



Marine Debris Items List

Category	Code	Item	Category	Code	Item
Hard Plastic	H1	Pipe/PVC	Timber	T1	Wood/timber
Hard Plastic	H2	Beverage bottle <1 L	Timber	T2	Utensil/food stick
Hard Plastic	H3	Other bottle	Timber	T3	Bottle cork
Hard Plastic	H4	Bottle cap/lid	Timber	T4	Pallet
Hard Plastic	H5	Food container	Timber	T5	Unknown/other
Hard Plastic	H6	Utensil/plate/bowl	Foam	D1	Food container
Hard Plastic	H7	Bucket/Crate	Foam	D2	Cup/plates/bowls
Hard Plastic	H8	Lighter	Foam	D4	Polystyrene
Hard Plastic	H9	Lollipop stick/earbud	Foam	D5	Unknown/other
Hard Plastic	H10	Unknown/other hard	Paper	P1	Cigarette/butt
Soft Plastic	S1	Thin film carry bag	Paper	P2	Paper/cardboard
Soft Plastic	S2	Food wrapper/label	Paper	P3	Magazine/newspaper
Soft Plastic	S3	Sheeting	Paper	P4	Bag
Soft Plastic	S4	Cup/lid	Paper	P5	Box
Soft Plastic	S5	Straw	Paper	P6	Food container/box
Soft Plastic	S6	Unknown/other soft	Paper	P7	Food wrapper/bag
Soft Plastic	S7	Other plastic bag	Paper	P8	Beverage container
Plastic Straps	BP1	String/rope/ribbon	Paper	P9	Cups
Plastic Straps	BP2	Packing strap	Paper	P10	Plates/bowls
Plastic Straps	BP3	Cable ties	Paper	P11	Unknown/other
Plastic Straps	BP4	Unknown/other strap	Fishing	F1	Net
Metal	M1	Pipe	Fishing	F2	Fishing line
Metal	M2	Wire	Fishing	F3	Fishing Lures
Metal	M3	Aerosol	Fishing	F4	Buoys/floats
Metal	M4	Beverage can	Fishing	F5	Glow stick
Metal	M5	Food can/tin	Fishing	F6	Fishhook/sinker
Metal	M6	Lid/cap	Fishing	F7	Unknown/other
Metal	M7	Food wrapper	Miscellaneous	Z1	Battery
Metal	M8	Aluminium foil	Miscellaneous	Z2	Brick/cement
Metal	M9	Bucket/drum	Miscellaneous	Z3	Carpet
Metal	M10	Unknown/other hard	Miscellaneous	Z4	Ceramic
Metal	M11	Unknown/other soft	Miscellaneous	Z5	E Waste
Glass	G1	Beverage bottle	Miscellaneous	Z6	Furniture
Glass	G2	Jar	Miscellaneous	Z7	Appliances
Glass	G3	Light globe/tube	Miscellaneous	Z9	Large car parts
Glass	G4	Unknown/other glass	Miscellaneous	Z10	Large boat parts
Rubber	R1	Thong/shoe	Miscellaneous	Z11	Bag/box dom. waste
Rubber	R2	Tyre	Other	O1	Other (specify)
Rubber	R3	Balloon	Other	O2	Other (specify)
Rubber	R4	Rubber band	Other	O3	Other (specify)
Rubber	R5	Unknown/other	Other	O4	Other (specify)
Cloth	C1	String/rope/strap	Other	O5	Other (specify)
Cloth	C2	Clothing/towel			
Cloth	C3	Wipes/cloths			
Cloth	C4	Insulation/stuffing			
Cloth	C5	Unknown/other			

