

PLASTIC BEACH PROJECT

HOW TO CARRY OUT A BEACH TRANSECT

The 5 Gyres Institute's (5 Gyres) mission is to conduct research on and promote awareness of the impact of plastic pollution in the world's oceans and ultimately help reduce the accumulation of plastic pollution in the five subtropical gyres (main oceans of the world). Plastic pollution is plastic litter that is found on beaches and throughout the oceans and other water bodies worldwide. It continues to be an important environmental concern locally, nationally and globally.

The Plastic Beach Project aims to better understand the distribution of plastic pollution on beaches all over the world. This information helps designate "Plastic Beach Hotspots" in order to better focus coastal management efforts, understand the sources of plastic pollution, and help others comprehend the vast scale of plastic pollution in the world's oceans.

The goal of the Plastic Beach Project is to gather information on plastic pollution on an international level. 5 Gyres Staff will focus on the West Coast of the United States in 2013 and 2014, with the intention of creating a West Coast Report Card for Plastic Pollution.

All data collected for the Plastic Beach Project will be displayed on an online mapping program that will allow comparison between beaches and highlight the most plastic beaches.

For more information and to get involved contact 5 Gyres Staff:
Carolynn Box, 5 Gyres Environmental Coordinator, carolynn@5gyres.org
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BEACH SELECTION

Ideally, two beaches should be selected in each community included in the Plastic Beach Project. If the community is a 'beach community,' one of the more frequented beaches (most popular tourist destinations) should be selected as one of the two beaches for that community. The other should be a beach that is less frequented, a more "natural" or "remote" beach. Many times there are beaches known in the community to gather an abundant amount of debris, such as logs, driftwood, seaweed and plastic pollution. If possible, one of these beaches should be included in the project. Beaches can be sandy or rocky.

Beaches should be clearly described on the "Plastic Beach Information Sheet" (Attachment 1). Maps and/or GPS locations for each beach should be included as part of the background information for each beach.

If just a single beach is selected, a sandy beach with the most beach-use should be selected. The results from a well-known beach will generate the most discussion and

attention. For example, in San Francisco, a section of Ocean Beach should be included in the research. Specifically, the southern section of Ocean Beach (at Sloat Blvd) should be included in the project because this section of Ocean Beach is highly used and known to have a significant amount of plastic pollution deposited from wave and tidal action.

BEACH TRANSECT: MACRO

To Evaluate Macro Plastic Pollution on Beach

Once the beach is selected, a beach transect should be conducted to evaluate beach litter and plastic pollution, based on methods developed by NOAA (NOAA Marine Debris Shoreline Survey Field Guide 2012, Attachment 3) and modified by Dr. Marcus Eriksen at 5 Gyres, Dr. Chris Pincetich at Sea Turtle Restoration Project, and Carolynn Box at 5 Gyres. This evaluation represents the beach litter and plastic pollution at the beach at the specific time that it is conducted. The results may vary depending on many factors, at different times of the year, and after storms. Research documenting plastic pollution at different times of the year is ideal. All beaches included in the Plastic Beach Project should be evaluated at least two times, including transects collected in the summer and winter months.

Prior to conducting the transect, some background information on the beach should be documented (Attachment 1): any storm drains and/or rivers or stream, wind and wave direction, last high tide, current weather, and beach type should be described for each beach. Also, note if there is significant beach or cliff erosion in the area and the current and general beach-use. If statistics on beach-use are available through the city, it would be helpful to know about how many people use the beach annually. Furthermore, some cities and counties and local environmental groups clean local beaches regularly; if this is the case, try to document as much information on cleanups as possible. Also include information on whether the beach was recently cleaned (if known).

In order to evaluate beach litter and plastic pollution at a beach over time, the beach transect should start from a point on the beach that is permanent, such as the edge of a seawall, sidewalk, parking lot, or large rock. The starting point should be described and the latitude and longitude documented, so that transects can be done in the same spot in the coming years.

EQUIPMENT

Needed to Carry out Beach Transect (Equipment can be borrowed by 5 Gyres Staff)

1. 100-meter tape measures (2)
2. 2.5-meter stick (2)
3. Data sheet
4. Sample bags or jars (please reuse sample bags if plastic and use alternatives, such as glass jars, if possible)

Step-By-Step Field Research Procedure for Macro Plastic Pollution Research:

1. Fill out the Beach Characteristics on the Plastic Beach Data Card (Attachment 1 & 2) for each beach. This includes Beach Name, contact information for the person/s

- conducting the transect, GPS coordinates, tidal range, time of high tide, sediment type, wave and wind direction, recreation details (public or private beach, how many people using the beach, etc), nearest town, nearest river, and location of any outfalls.
2. Photograph of the beach and the starting location of the transect.
 3. Draw a map of the beach that shows where transect is located and identifies any important features or any storm drains or rivers in the region.
 4. Select four random numbers between 0 and 100 (divisible by 5). If 5 is selected, the 5 – 10 meter section of the transect should be analyzed. Appendix C of the NOAA Marine Debris Shoreline Survey Field Guide (Attachment 3) also has a good method to use.
 5. The attached data sheet (Attachment 2) should be filled out for the four areas selected along each transect (you will have four data cards per transect). The length of beach analyzed should be identified for each transect.
 6. All plastic, including fragments, foam bits, fishing material and cigarette butts should be logged on the data cards. Plastic and foam fragments should be separated out by size (<1cm, 1cm – 2.5cm, and >2.5cm). Also indicate if the trash is “weathered” or “fresh.” “Weathered” materials are those that appear to have been sitting on the beach or floating in a river or the ocean for years (“Gyre” plastic pollution); they may have barnacles or other organisms attached to them, are likely very faded, and have gone through a lot of photo degradation. “Non Weathered” is “Fresh” materials are those that appear to have been just littered on the beach in the last few days or weeks. Extra spaces are included on the data card so that identifiable items can be written in (such as balloons, tires, etc).
 7. All plastic pollution and other trash picked up should be collected and put in a sample bag for further analysis. The material picked up during each of the four transects should be kept separate. The total weight and the weight of the plastic materials should be documented for each transect.

BEACH QUADRANT: MICRO

To Evaluate Micro Plastic Pollution

In order to better evaluate microplastic pollution in the area, at least 4 quadrants from within the 100-meter section should be evaluated. The quadrants should be randomly selected and located along the wrack line, the line on the beach that represents where the last high tide reached, within the selected 100m of beach. Often the wrack line is covered in seaweed and other material (i.e. plastic pollution and beach litter). If there are multiple wrack lines, all details describing which wrack line was evaluated should be included in the notes. If there were a storm wrack line on the beach, it would be good to conduct some of the quadrant research in this area. If possible, conduct half of the quadrant research at the storm wrack line and the other half at the high tide wrack line. It is important to describe all of the locations in the notes and include GPS coordinates if possible.

In order to get a random sample, the quadrant can be included in each of the transect lines that were randomly selected for the beach transect portion of the project. However, this should be done very carefully and in such a way that data is not duplicated or confused. At least four quadrants should be collected in the 100m section of beach.

The quadrant protocol was developed by Dr. Marcus Eriksen should be followed.

EQUIPMENT

Needed to Carry out Beach Quadrant Research

1. 1-meter by 1-meter square or rope (1-2)
2. 5 gallon bucket
3. 5 mm sieve and 1mm sieve
4. Shovel or scoop
5. Data sheet
6. Sample bags or jars (please reuse sample bags if plastic and use alternatives, such as glass jars, if possible)
7. Digital or hand scale

Step-By-Step Field Research Procedure for Micro Plastic Pollution Research:

1. Remove big pieces of natural debris, like seaweed, leaves and wood. Brush them off and throw them away.
2. Mark the 10-liter level on the 5-gallon bucket (half bucket).
3. Document (log on data sheet) any plastic pollution on surface of quadrant area.
4. Remove sediment from the surface evenly with a scoop or shovel and put in bucket. This will be approximately 3cm of the surface. The sediment should be scraped off the surface as evenly as possible.
5. The sediment should be sieved through the 5mm and 1mm sieves. If sieves are not available, mesh colanders can be used (note the size of the openings). Transfer the plastic into collection bag.
6. The number of fragments and type of plastic should be noted on the data sheet.
7. When a scale is available, the total and category weights should be noted on the data sheet. This is done best in an area with little to no wind.

DATA ENTRY AND SUBMISSION

Data Analysis and Inclusion in Plastic Beach Project Website

Data should be consolidated into an Excel Worksheet and submitted to 5 Gyres Staff for inclusion on the Plastic Beach Project webpage and map. Please send the data to carolynn@5gyres.org.



ATTACHMENT 1

THE PLASTIC BEACH PROJECT

5 GYRES BEACH INFORMATION

Beach Name	
City, County	
Number of volunteers/Origin	
Weather/wind direction and speed	
Date	
Start Time	
End Time	
Last High Tide (time)	
GPS - start of transect (0m)	
GPS - start of transect (100m)	
Length of Shoreline (meters)	
Average Width of beach (Avg T1:T4)(m)	
Direction of Transect when facing water	
Public or Prive Beach	
# of beach users at time of transect	
Site Usage: High/Medium/Low	
Parking lot adjacent?	
Describe any pipes, channels, outfalls etc?	
Describe beach type and details	
Notes:	

ATTACHMENT 2

THE PLASTIC BEACH PROJECT

5 GYRES MACRO DEBRIS DATA CARD

Beach Name:	Transect 1		Transect 2	
Transect Section Analyzed (ex. 20-25m)				
BEACH LENGTH (Back Beach to Water) (m)				
PLASTIC				
	WEATHERED	NOT WEATHERED	WEATHERED	NOT WEATHERED
TOTAL plastic frag (<2.5cm)				
TOTAL plastic frag (>2.5cm)				
TOTAL foam plastic (<2.5cm)				
TOTAL foam plastic (>2.5cm)				
TOTAL plastic filament (fishing line)				
TOTAL food wrappers				
TOTAL plastic bottles				
TOTAL plastic jugs				
TOTAL plastic caps				
TOTAL cigar tips				
TOTAL cigarettes				
TOTAL cigarette lighters				
TOTAL 6-pack rings				
TOTAL pieces of rope				
TOTAL buoys and floats				
TOTAL fishing lures/line				
TOTAL cups				
TOTAL balloons				
TOTAL personal care products				
TOTAL plastic bags (or frags)				
TOTAL Nurdles (<2.5cm)				
TOTAL PLASTIC ITEMS				
TOTAL PLASTIC WEIGHT (g)				
METAL				
Aluminum /tin cans				
aerosol cans				
metal bottle caps				
TOTAL METAL WEIGHT (g)				

Beach Name:	Transect 1		Transect 2	
GLASS				
Beverage Bottles (whole)				
Jars				
Glass Fragments (include beach glass)				
TOTAL GLASS WEIGHT (g)				
RUBBER				
Flip-Flops				
gloves				
tires				
TOTAL RUBBER WEIGHT (g)				
PAPER and PROCESSED LUMBER				
Cardboard cartons (milk and juice)				
paper and cardboard				
paper bags				
lumber/ building material				
TOTAL LUMBER AND PAPER WEIGHT (g)				
CLOTH/FABRIC				
Cloth (and clothing pieces)				
shoes				
towels/rags				
rope/net pieces (non-nylon)				
TOTAL CLOTH/FABRIC WEIGHT (g)				
OTHER/UNCLASSIFIABLE				
TOTAL OTHER WEIGHT (g)				
LARGE DEBRIS ITEMS (>1-foot or 0.3m)				
TOTAL LARGE DEBRIS WEIGHT (g)				
TOTAL WEIGHT of ALL Categories (g)				

THE PLASTIC BEACH PROJECT

5 GYRES MACRO DEBRIS DATA CARD

Beach Name:	Transect 3		Transect 4	
Transect Section Analyzed (ex. 20-25m)				
BEACH LENGTH (Back Beach to Water) (m)				
PLASTIC				
	WEATHERED	NOT WEATHERED	WEATHERED	NOT WEATHERED
TOTAL plastic frag (<2.5cm)				
TOTAL plastic frag (>2.5cm)				
TOTAL foam plastic (<2.5cm)				
TOTAL foam plastic (>2.5cm)				
TOTAL plastic filament (fishing line)				
TOTAL food wrappers				
TOTAL plastic bottles				
TOTAL plastic jugs				
TOTAL plastic caps				
TOTAL cigar tips				
TOTAL cigarettes				
TOTAL cigarette lighters				
TOTAL 6-pack rings				
TOTAL pieces of rope				
TOTAL buoys and floats				
TOTAL fishing lures/line				
TOTAL cups				
TOTAL balloons				
TOTAL personal care products				
TOTAL plastic bags (or frags)				
TOTAL Nurdles (<2.5cm)				
TOTAL PLASTIC ITEMS				
TOTAL PLASTIC WEIGHT (g)				
METAL				
Aluminum /tin cans				
aerosol cans				
metal bottle caps				
TOTAL METAL WEIGHT (g)				

Beach Name:	Transect 3		Transect 4	
GLASS				
Beverage Bottles (whole)				
Jars				
Glass Fragments (include beach glass)				
TOTAL GLASS WEIGHT (g)				
RUBBER				
Flip-Flops				
gloves				
tires				
TOTAL RUBBER WEIGHT (g)				
PAPER and PROCESSED LUMBER				
Cardboard cartons (milk and juice)				
paper and cardboard				
paper bags				
lumber/ building material				
TOTAL LUMBER AND PAPER WEIGHT (g)				
CLOTH/FABRIC				
Cloth (and clothing pieces)				
shoes				
towels/rags				
rope/net pieces (non-nylon)				
TOTAL CLOTH/FABRIC WEIGHT (g)				
OTHER/UNCLASSIFIABLE				
TOTAL OTHER WEIGHT (g)				
LARGE DEBRIS ITEMS (>1-foot or 0.3m)				
TOTAL LARGE DEBRIS WEIGHT (g)				
TOTAL WEIGHT of ALL Categories (g)				

THE PLASTIC BEACH PROJECT

5 GYRES MICRO DEBRIS DATA CARD

Beach Name:	Quad 1		Quad 2	
Transect Section Analyzed (ex. 20-25m)				
PLASTIC				
NOTE: Analyze what is on surface prior to carrying out the full analysis	SURFACE	BELOW SURFACE	SURFACE	BELOW SURFACE
Plastic Fragments >4.75mm				
Plastic Fragments 1mm to 4.75mm				
Foam Fragments >4.75mm				
Foam Fragments 1mm to 4.75mm				
Plastic Film >4.5mm				
Plastic Film 1mm to 4.5mm				
Plastic Food Wrappers >4.75mm				
Plastic Food Wrappers 1mm to 4.75mm				
Plastic Bottle Cap >4.75mm				
Plastic Bottle Cap 1mm to 4.75mm				
Plastic Pellets/nurdles >4.75mm				
Plastic Pellets/nurdles 1mm to 4.75mm				
Plastic Fillament (fishing line, rope) >4.75mm				
Plastic Fillament (fishing line, rope) 1-4.75mm				
Plastic jugs or containers >4.75mm				
Plastic jugs or containers 1mm to 4.75mm				
Cigar tips >4.75mm				
Cigar tips 1mm to 4.75mm				
Cigarettes >4.75mm				
Cigarettes 1mm to 4.75mm				
Personal Care Products >4.75mm				
Personal Care Products 1mm to 4.75mm				
TOTAL PLASTIC WEIGHT (g)				
PAPER and METAL				
Paper and Cardboard				
Metal (aluminum foil)				
TOTAL PAPER AND METAL (g)				
OTHER				
Balloons				
Glass				
TOTAL OTHER DEBRIS (g)				
TOTAL WEIGHT of all CATEGORIES (g)				

THE PLASTIC BEACH PROJECT

5 GYRES MICRO DEBRIS DATA CARD

Beach Name:	Quad 3		Quad 4	
Transect Section Analyzed (ex. 20-25m)				
PLASTIC				
NOTE: Analyze what is on surface prior to carrying out the full analysis	SURFACE	BELOW SURFACE	SURFACE	BELOW SURFACE
Plastic Fragments >4.75mm				
Plastic Fragments 1mm to 4.75mm				
Foam Fragments >4.75mm				
Foam Fragments 1mm to 4.75mm				
Plastic Film >4.5mm				
Plastic Film 1mm to 4.5mm				
Plastic Food Wrappers >4.75mm				
Plastic Food Wrappers 1mm to 4.75mm				
Plastic Bottle Cap >4.75mm				
Plastic Bottle Cap 1mm to 4.75mm				
Plastic Pellets/nurdles >4.75mm				
Plastic Pellets/nurdles 1mm to 4.75mm				
Plastic Fillament (fishing line, rope) >4.75mm				
Plastic Fillament (fishing line, rope) 1-4.75mm				
Plastic jugs or containers >4.75mm				
Plastic jugs or containers 1mm to 4.75mm				
Cigar tips >4.75mm				
Cigar tips 1mm to 4.75mm				
Cigarettes >4.75mm				
Cigarettes 1mm to 4.75mm				
Personal Care Products >4.75mm				
Personal Care Products 1mm to 4.75mm				
TOTAL PLASTIC WEIGHT (g)				
PAPER and METAL				
Paper and Cardboard				
Metal (aluminum foil)				
TOTAL PAPER AND METAL (g)				
OTHER				
Balloons				
Glass				
TOTAL OTHER DEBRIS (g)				
TOTAL WEIGHT of all CATEGORIES (g)				

ATTACHMENT 3



NOAA Marine Debris Shoreline Survey Field Guide

Sarah Opfer, Courtney Arthur, and
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U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Ocean Service
Office of Response and Restoration
Marine Debris Program

January 2012

This shoreline protocol was developed and tested by the NOAA Marine Debris Program. This document is a revised version of the August 2011 field guide, and should be treated as a draft protocol that may be altered in the future. Further testing is currently underway to develop a statistically robust survey design that will recommend the frequency of sampling, number of transects, and sampling unit size at site, location, and regional spatial scales.

Mention of trade names or commercial products does not constitute endorsement or recommendation for their use by the National Oceanic and Atmospheric Administration.

NOAA Marine Debris Shoreline Survey Field Guide

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January 2012

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Introduction

Marine debris has become one of the most widespread pollution problems in the world’s oceans and waterways today. The NOAA Marine Debris Program (MDP) serves as a centralized marine debris resource within NOAA, coordinating and supporting activities within NOAA and with other federal agencies. The MDP uses partnerships to support projects carried out by state and local agencies, tribes, non-governmental organizations, academia, and industry.

Marine debris monitoring programs are necessary to compare debris sources, amounts, locations, movement, and impacts across the US and internationally. Monitoring data can be used to evaluate the effectiveness of policies to mitigate debris and provide insight into priority targets for prevention. Thus, the NOAA MDP has developed standardized marine debris shoreline survey protocols to facilitate regional and site-specific comparisons. This document provides a standard data sheet and two different methods for shoreline monitoring and assessment.

Types of Shoreline Surveys

The objectives of your study will determine how you monitor for marine debris. There are two main types of shoreline surveys: accumulation and standing-stock surveys.

- Accumulation studies provide information on the rate of deposition (flux) of debris onto the shoreline. These studies are more suited to areas that have beach cleanups, as debris is removed from the entire length of shoreline during each site visit. This type of survey is more labor-intensive and is used to determine the rate of debris deposition (# of items per unit area, per unit time). Accumulation studies can also provide information about debris type and weight. These surveys cannot be used to measure the density of debris on the shoreline because removal of debris biases the amount of debris present during subsequent surveys.
- Standing-stock studies provide information on the amount and types of debris on the shoreline. Debris within discrete transects at the shoreline site is tallied during standing-stock surveys. This is a quick assessment of the total load of debris and is used to determine the density (# of items per unit area) of debris present. Debris density reflects the long-term balance between debris inputs and removal and is important to understanding the overall impact of debris.

Table 1. Salient characteristics of standing-stock and accumulation surveys.

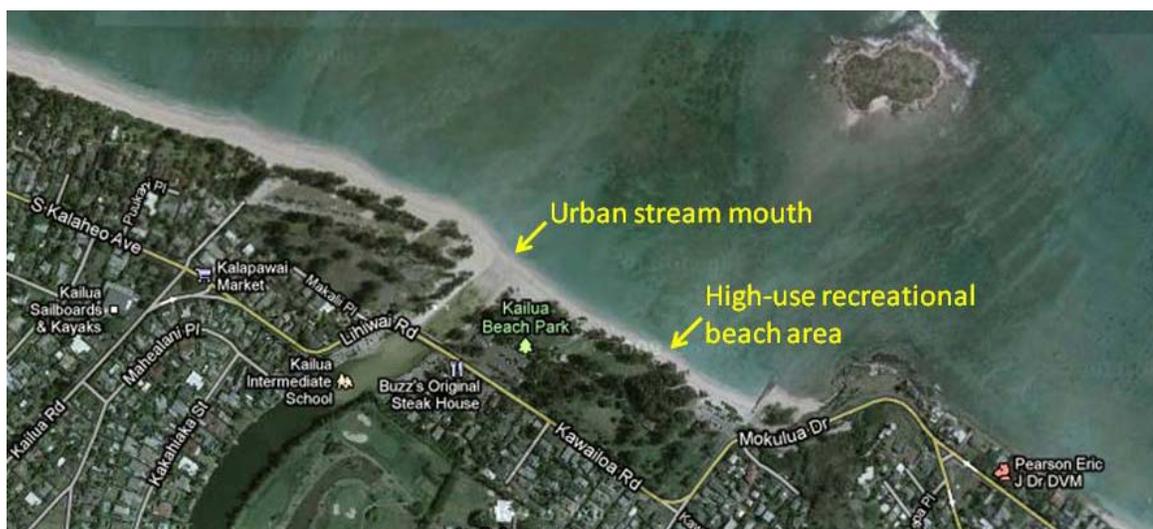
CHARACTERISTIC	STANDING-STOCK	ACCUMULATION
Debris removed during surveys?	No	Yes
Time required per survey	Less	More
Length of shoreline site	100 m	100 m or longer
Is a set survey interval required (e.g., once per week or per month)?	Yes	Yes
Types of data that can be collected	<ul style="list-style-type: none"> • Debris density (# of items / unit area) • Debris material types 	<ul style="list-style-type: none"> • Debris deposition rate (# of items / unit area / unit time) • Debris material types • Debris weight

We suggest that users give careful consideration to which type of survey best suits their goals and objectives. [Table 1](#) provides important information to take into account when deciding how to monitor. Once a survey type is chosen, meaningful data can be collected through regular monitoring. The following sections describe how to choose survey sites and conduct surveys.

How to Pick Your Site

To select your sampling site(s), follow these steps:

1. The first step is to choose an appropriate shoreline location based on the objectives of your study. For example, if you wish to examine the impact of land use, you should select locations in watersheds with various land use types. Next, categorize the various areas within your location (it may help to use an aerial photo or map, as shown below). For example, your location may cover a span of shoreline 1 km long. Within that 1 km, there may be an area with heavy recreational use and another area where an urban stream mouth is located. Identify any barriers to shoreline access or offshore structures that may affect nearshore circulation (e.g. jetties).



2. Select shoreline sites (where you will sample) according to the characteristics below. If your location includes different use areas (for example, an area with heavy recreational use and a more remote area), it is preferable to select a site within each use category.

Shoreline sites should have the following characteristics:

- Sandy beach or pebble shoreline
- Clear, direct, year-round access
- No breakwaters or jetties
- At least 100 m in length parallel to the water (note that standing-stock surveys require a 100-m shoreline site)
- No regular cleanup activities

These characteristics should be met where possible, but can be modified.

Before You Begin Your Surveys

Before any data collection begins, the [Shoreline Characterization Sheet](#) should be completed for each shoreline site. On this data sheet you will note:

- GPS coordinates in decimal degrees at the beginning and end of your shoreline site, or at the site's four corners if the width of the beach is > 6 m;
- Shoreline characteristics (e.g. tidal range and substrate); and
- Surrounding land-use characteristics that may influence the delivery of land-based debris to the site (e.g., farmland 5 km from a small town or urban parkland 50 m from a river mouth).

The [Shoreline Characterization Sheet](#) needs to be completed only once per site per year unless major changes occur to the shoreline.

Shore IDs (on the [Shoreline Characterization Sheet](#)) should be created based on the initials of the shoreline name (e.g., Fort Smallwood = FS). This will make it easier to keep track of multiple sampling sites.

The [Shoreline Characterization Sheet](#) and [Debris Density Data Sheet](#) were adapted from Cheshire et al. (2009)¹.

You will need the following supplies in order to complete your surveys:

- Digital camera
- Hand-held GPS unit
- Extra batteries for GPS and camera (we recommend rechargeable batteries)
- Surveyor's measuring wheel - *for standing-stock surveys only*
- Flag markers or stakes
- ~100' fiberglass measuring tape
- First aid kit (including sunscreen, bug spray, drinking water)
- Work gloves
- Sturdy 12" ruler
- Clipboards for data sheets
- Data sheets (on waterproof paper)
- Pencils
- Trash bag or bucket - *for accumulation surveys only*

Safety is a priority. Do not touch or lift potentially hazardous or large, heavy items. Notify your local officials if such items are encountered.

All of the data collection forms you will need are included in [Appendix A](#) at the end of this document. The same data collection forms are used for accumulation and standing-stock surveys.

- [Shoreline Characterization Sheet](#) (pp. 8–9)
- [Debris Density Data Sheet](#) (pp. 10–12)

¹ Cheshire, A. C., E. Adler, et al. (2009). UNEP/IOC Guidelines on Survey and Monitoring of Marine Litter, UNEP Regional Seas Intergovernmental Oceanographic Commission: 132 pp.

Accumulation Surveys

If you decide to conduct accumulation surveys, follow this protocol:

1. BEFORE arriving at the site, check local tide tables and plan to arrive at your site during low tide.
2. ONCE ARRIVED, begin filling out the [Debris Density Data Sheet's](#) Additional Information section. Mark the beginning and end of your shoreline site, perhaps with flags or stakes. (Remember to pick up these markers at the end of your survey to make sure they do not become marine debris!) The back of the shoreline is where the primary substrate (e.g., sand) changes (e.g., sand becomes gravel) or at the first barrier (e.g., vegetation line).
3. In order to cover the entire site from water's edge to the back of the shoreline, decide whether you will traverse the survey area parallel or perpendicular to the water. See [Appendix B](#) for walking pattern schematics. If more than one surveyor is available, the survey area should be divided evenly with clearly specified areas assigned to each individual. Surveyors should traverse the survey area in a pre-determined walking pattern until the entire site is cleared of marine debris.
4. Record on your [Debris Density Data Sheet](#) counts of debris items that measure over 2.5 cm, or 1 inch (~bottle cap size), in the **longest** dimension (see Figure 1). If any part of the item is within the survey area, count the item. Record large debris items, anything bigger than 1 foot (~ 0.3 m, typical forearm length from palm to elbow) in the large debris section of the [Debris Density Data Sheet](#).
5. Take photos of your shoreline site and some of the debris items!

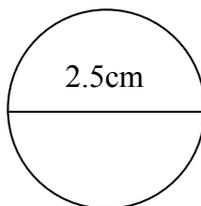


Figure 1. Minimum debris size to be counted. **This size is required to keep surveyors counting the same size items and to help keep the survey results uniform.*

Standing-stock Surveys

If you decide to conduct standing-stock surveys, follow this protocol:

1. Sketch your 100-m shoreline site and divide the 100 m into 5-m segments. There should be 20 of them. Number each section (left to right) from 1 to 20. Each 5-m segment should run from the water's edge to the back of the shoreline (Figure 2). The back of the shoreline is where the primary substrate (e.g., sand) changes (e.g., sand becomes gravel) or at the first barrier (e.g., vegetation line).
2. BEFORE arriving at the site, select four numbers from the [Random Number Table](#) ([Appendix C](#)) by first choosing a number between 1 and 5, and then a number between 1

and 4. The corresponding number in the table (1–20) is one of the four transects you will survey. Complete this exercise four times to choose four random transects (each transect can be used only once per survey). These numbers correspond to the 5-m segments you drew on your sketch and are called transect ID numbers (see [Debris Density Data Sheet](#)). You should fill out one [Debris Density Data Sheet](#) per transect. On any sampling day, 20 m of your 100-m shoreline site is analyzed (i.e., 20% coverage of the area). In addition, check local tide tables and plan to arrive at your site during low tide.

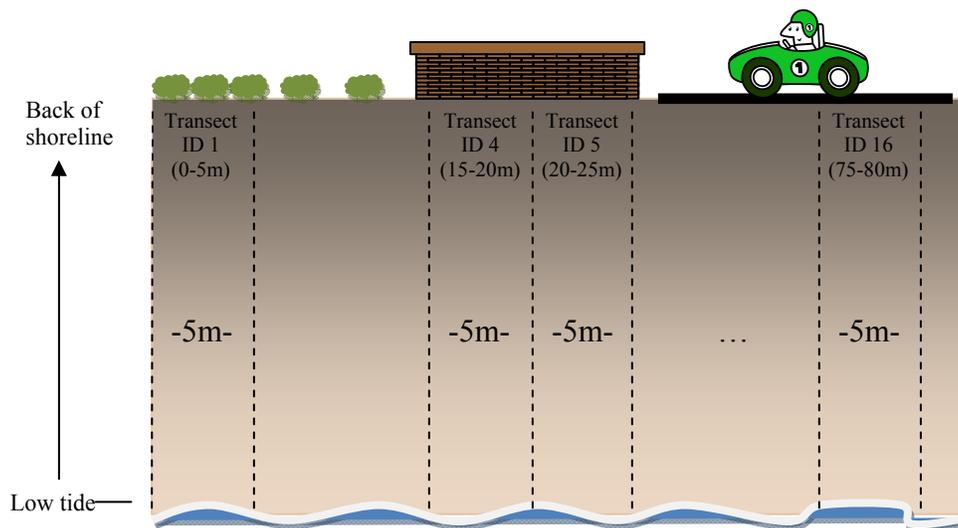


Figure 2. Shoreline section (100 m) displaying perpendicular transects from water’s edge at low tide to the first barrier at the back of the shoreline section.

3. ONCE ARRIVED, begin filling out the [Debris Density Data Sheet](#) Additional Information section. Using your measuring wheel, begin at the start of your shoreline section and mark the four selected transect boundaries with flags according to the distances provided in the Transect ID table (for example, transect 12 covers 55 to 60 m from the start of your shoreline section).
4. Measure the width of each transect from water’s edge to the back of the shoreline. Record GPS coordinates for each transect in decimal degree format. For shoreline segments that are less than 6 m wide from the water’s edge to the back of the shoreline, GPS coordinates should be taken at the center (Figure 3). For shoreline segments that are over 6 m wide, take GPS coordinates at two spots—one nearer the back of the shoreline and one nearer the water.
5. Walking each transect from water’s edge to the back of the shoreline, record on your [Debris Density Data Sheet](#) counts of debris items that measure over 2.5 cm, or 1 inch (~bottle cap size), in the **longest** dimension (see Figure 1). If any part of the item is within the sample transect, count the item. *Remember that for standing-stock surveys, debris is not removed from the shoreline.* Record large debris items, anything bigger than 1 foot (~ 0.3 m, typical forearm length from palm to elbow) in the large debris section of the [Debris Density Data Sheet](#).

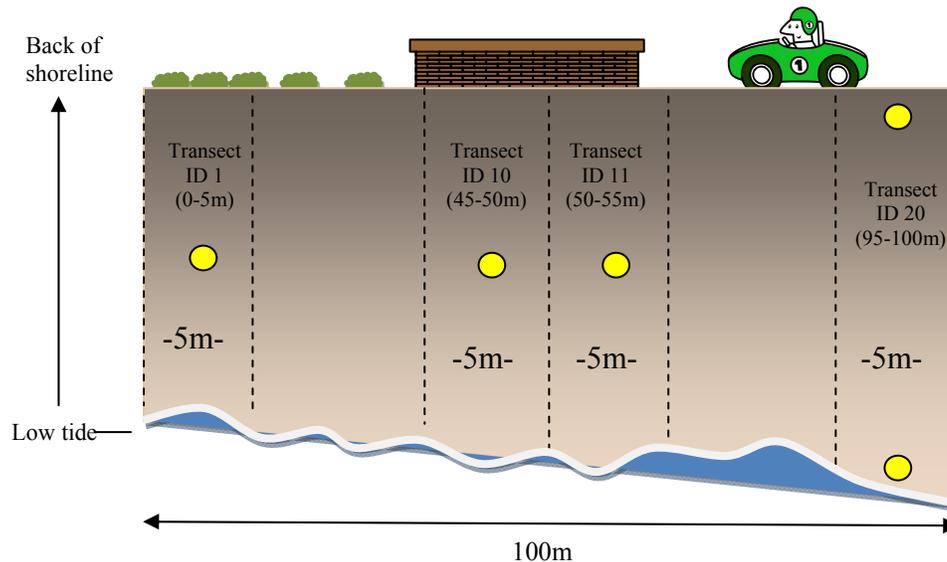


Figure 3. Example of a shoreline section (100m) with yellow circles indicating marked GPS coordinates. Width determines location of GPS coordinates.

6. Take photos of each transect and some of the debris items!

Submitting Your Shoreline Debris Data to NOAA

Marine debris monitoring groups should plan to compile and analyze their own survey results. The NOAA MDP will have periodic calls for data from monitoring groups. If you would like more information on data analysis or to be included in data calls, please send an email to MDmonitoring@noaa.gov.

Appendix A: Data Forms

SHORELINE DEBRIS Shoreline Characterization Sheet	Organization		Name of organization responsible for collecting the data
	Surveyor name		Name of person responsible for filling in this sheet
	Phone number		Phone contact for surveyor
Complete this form ONCE for each site location	Date		Date of this survey

SAMPLING AREA

Shore ID			Unique code for the shoreline
Shoreline name			Name by which the section of shoreline is known (e.g., beach name, park)
State/County			State and county where your site is located
Coordinates at start of shoreline section	Latitude	Longitude	Recorded as XXX.XXXX (decimal degrees) at start of shoreline section (in both corners if width > 6 meters)
	-----	-----	
Coordinates at end of shoreline section	Latitude	Longitude	Recorded as XXX.XXXX (decimal degrees) at end of shoreline section (in both corners if width > 6 meters)
	-----	-----	
Photo number/ID			The digital identification number(s) of photos taken of shoreline section

SHORELINE CHARACTERISTICS – from beginning of shoreline site

Length of sample area (should be 100 m if standing-stock survey)		Length measured along the midpoint of the shoreline (in meters)
Substratum type		For example, a sandy or gravel beach
Substrate uniformity		Percent coverage of the main substrate type (%)
Tidal range		Maximum & minimum vertical tidal range. Use tide chart (usually in feet).
Tidal distance		Horizontal distance (in meters) from low- to high-tide line. Measure on beach at low and high tides or estimate based on wrack lines.
Back of shoreline		Describe landward limit (e.g., vegetation, rock wall, cliff, dunes, parking lot)
Aspect		Direction you are facing when you look out at the water (e.g., northeast)

LAND-USE CHARACTERISTICS – within shoreline location

Location & major usage	Urban		Select one and indicate major usage (e.g., recreation, boat access, remote)
	Suburban		
	Rural		
Access			Vehicular (you can drive to your site), pedestrian (must walk), isolated (need a boat or plane)
Nearest town			Name of nearest town
Nearest town distance			Distance to nearest town (miles)
Nearest town direction			Direction to nearest town (cardinal direction)
Nearest river name			If applicable, name of nearest river or stream. If blank, assumed to mean no inputs nearby
Nearest river distance			Distance to nearest river/stream (km)
Nearest river direction			Direction to nearest river/stream (cardinal direction from site)
River/creek input to beach	YES	NO	Whether nearest river/stream has an outlet within this shoreline section
Pipe or drain input	YES	NO	If there is a storm drain or channelized outlet within shoreline section
Notes (including description, landmarks, fishing activity, etc.):			

SHORELINE DEBRIS Debris Density Data Sheet	Organization		Name of organization responsible for data collection
	Surveyor name		Name of person responsible for filling in this sheet
	Phone number		Phone contact for surveyor
Complete this form during EACH survey or transect (if standing-stock) per site visit	Email address		Email contact for surveyor
	Date		Date of this survey

ADDITIONAL INFORMATION

Shoreline name			Name for section of shoreline (e.g., beach name, park)
Survey Type	Accumulation <input type="checkbox"/>	Standing-stock <input type="checkbox"/>	Type of shoreline survey conducted (check box)
Transect ID # (N/A if accumulation survey)			Transect ID (include shoreline ID, date, and transect #)
Coordinates of start of shoreline site	Latitude	Longitude	Recorded as XXX.XXXX (decimal degrees). Record in both corners if width > 6 m. If transect, record at water's edge.
Coordinates of end of shoreline site	Latitude	Longitude	Recorded as XXX.XXXX (decimal degrees). Record in both corners if width > 6 m. If transect, record at back of shoreline.
Width of beach			Width of beach at time of survey from water's edge to back of shoreline (meters)
Time start/end	Start	End	Time at the beginning and end of the survey
Season			Spring, summer, fall, winter, tropical wet, etc.
Date of last survey			Date on which the last survey was conducted
Storm activity			Describe significant storm activity within the previous week (date(s), high winds, etc.)
Current weather			Describe weather on sampling day, including wind speed and % cloud coverage
Number of persons			Number of persons conducting the survey
Large items	YES	NO	Did you note large items in the large debris section?
Photo ID #s			The digital identification number(s) of debris photos taken during this survey.

Notes: Evidence of cleanup, sampling issues, etc.

DEBRIS DATA: (continued on back)

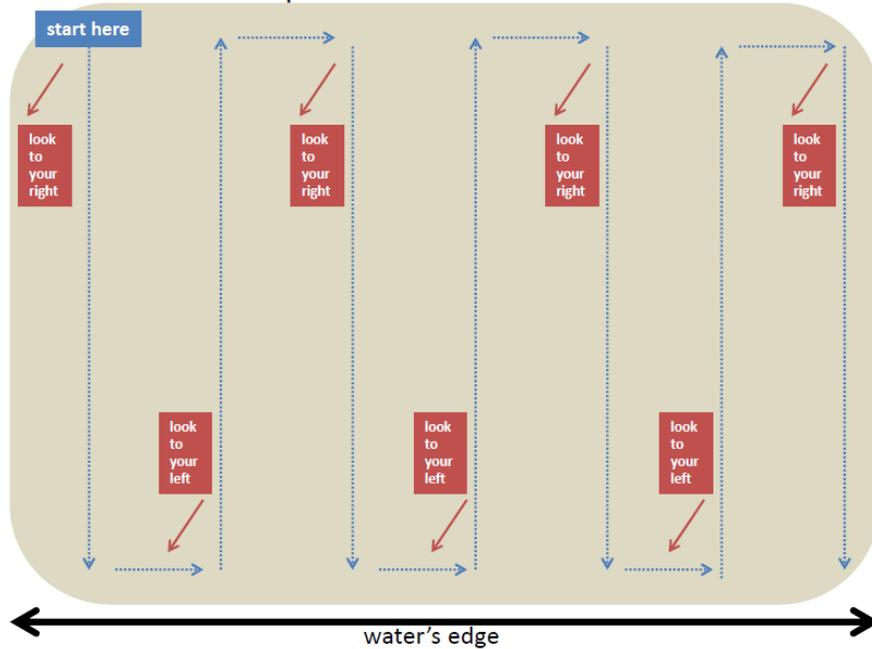
ITEM	TALLY (e.g., III)			TOTAL
	<i>PLASTIC</i>			
Plastic fragments	Hard	Foamed	Film	
Food wrappers				
Beverage bottles				
Other jugs or containers				
Bottle or container caps				
Cigar tips				
Cigarettes				
Disposable cigarette lighters				
6-pack rings				
Bags				
Plastic rope/small net pieces				
Buoys & floats				
Fishing lures & line				
Cups (including polystyrene/foamed plastic)				
Plastic utensils				
Straws				
Balloons				
Personal care products				
Other:				
<i>METAL</i>				
Aluminum/tin cans				
Aerosol cans				
Metal fragments				
Other:				
<i>GLASS</i>				
Beverage bottles				
Jars				
Glass fragments				
Other:				

ITEM	TALLY (e.g., IIII)			TOTAL
RUBBER				
Flip-flops				
Gloves				
Tires				
Rubber fragments				
Other:				
PROCESSED LUMBER				
Cardboard cartons				
Paper and cardboard				
Paper bags				
Lumber/building material				
Other:				
CLOTH/FABRIC				
Clothing & shoes				
Gloves (non-rubber)				
Towels/rags				
Rope/net pieces (non-nylon)				
Fabric pieces				
Other:				
OTHER/UNCLASSIFIABLE				
LARGE DEBRIS ITEMS (> 1 foot or ~ 0.3 m)				
Item type (vessel, net, etc.)	Status (sunken, stranded, buried)	Approximate width (m)	Approximate length (m)	Description / photo ID #
Notes on debris items, description of "Other/unclassifiable" items, etc:				

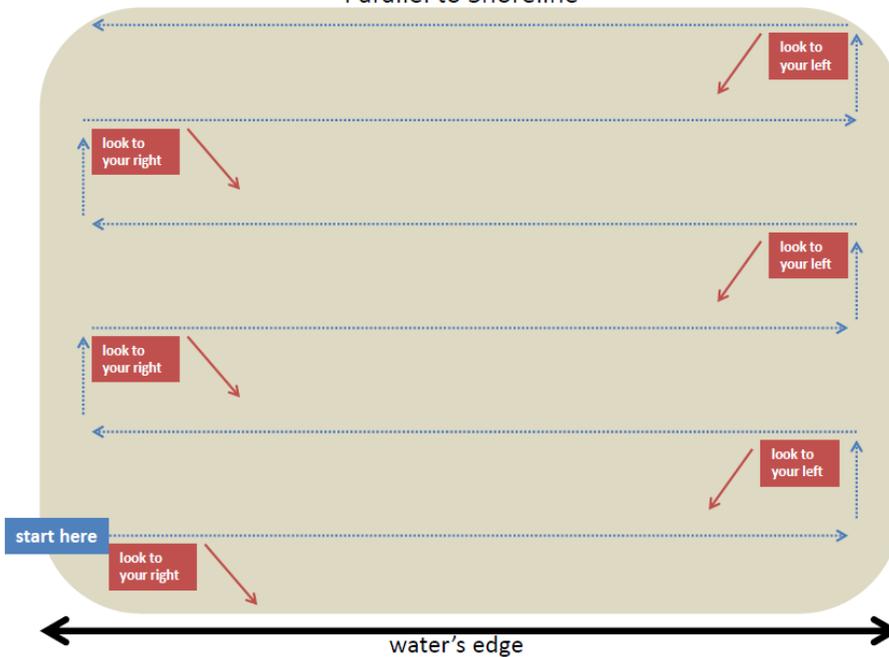
Appendix B: Shoreline Walking Patterns

The schematics below are potential survey walking patterns to ensure that the entire shoreline site or transect is covered. Suggested distance between walking lines is approximately one meter.

Walking Pattern #1:
Perpendicular to Shoreline



Walking Pattern #2:
Parallel to Shoreline



APPENDIX C: RANDOM TRANSECT SELECTION

If you are conducting a standing-stock survey, use these tables to select transects. BEFORE arriving at the site, select four numbers from the Random Number Table, by first choosing a number between 1 and 5, and then a number between 1 and 4. The corresponding number in the table (1–20) is one of the four transects you will survey. Complete this exercise four times to choose four random transects (each transect can be used only once per survey).

Random Number Table					
	1	2	3	4	5
1	4	8	17	9	1
2	7	19	2	12	20
3	18	14	6	16	11
4	3	5	15	10	13

**Transect ID and distance along shore from start of 100-m shoreline section
(see Figure 2 above)**

Transect ID	Meters	Feet and inches
1	0–5 m	0–16' 4"
2	5–10 m	16' 4"–32' 9"
3	10–15 m	32' 9"–49' 2"
4	15–20 m	49' 2"–65' 7"
5	20–25 m	65' 7"–82'
6	25–30 m	82'–98' 5"
7	30–35 m	98' 5"–114' 9"
8	35–40 m	114' 9"–131' 2"
9	40–45 m	131' 2"–147' 7"
10	45–50 m	147' 7"–164'
11	50–55 m	164'–180' 5"
12	55–60 m	180' 5"–196' 10"
13	60–65 m	196' 10"–213' 3"
14	65–70 m	213' 3"–229' 7"
15	70–75 m	229' 7"–246'
16	75–80 m	246'–262' 5"
17	80–85 m	262' 5"–278' 10"
18	85–90 m	278' 5"–295' 3"
19	90–95 m	295' 3"–311' 8"
20	95–100 m	311' 8" - 328' 1"

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Coastal Zone Management**

