



Guideline for the Survey of Marine Microplastics on Beaches (for citizen participation)



Northwest Pacific Region Environmental Cooperation Center

Introduction

In recent years, when people talked about marine litter, they paid more attention to microplastics, which are plastic litter with the size less than 5 millimeters long. As chemical substances are contained in or absorbed on the surface of these small plastic pieces, it is concerned that the chemicals might have negative influences on marine ecosystems.

So, world leaders discuss marine litter and marine microplastic pollution worldwide at meetings to solve the problem, and many institutions and laboratories around the world aggressively do researches on behaviors of microplastics in the marine environment and/or their threat on marine life and human well-beings.

In addition to them, citizen participatory surveys on marine litter and marine microplastics have many advantages. Expensive, high-tech devices are not necessary, and these surveys can be easily continued for a longer period than any on-site research by specialists. They also help citizens increase their awareness on environmental conservation.

With these reasons, Toyama Prefectural Government, Japan, and the Northwest Pacific Region Environmental Cooperation Center (NEPC) started the survey of marine litter on beaches in 1996 under international cooperation with municipalities along the coastal areas of the northwest Pacific region. As of 2019, 38 local governments and a total of about forty thousand people (school students and/or NGOs) in China, Japan, Korea and Russia have joined this activity, with an additional survey of marine microplastic litter since 2018.

The Guideline of Marine Microplastics on Beaches is developed based on the experiences and lessons learned from the over-two-decade surveys on marine litter and designed specifically for the use of a citizen participatory survey on marine microplastic litter on the beach with simple how-to steps.

Microplastic litter on the beach is not degraded naturally and difficult to be collected; therefore, people are strongly recommended to change their lifestyle to reduce generation of plastic litter.

We hope this guideline can help further understanding of marine microplastic litter on the beach and at the same time citizens can have a proactive attitude: Stop littering and Protect the marine environment.

I Purpose of the Survey

This survey is conducted by citizens to understand the state of microplastic litter on the beach (counting the number and checking the types) by using simple tools.

This simple procedure can be repeated at the same beach or reproduced in other beaches so as to observe the compare the results and to observe the situation of the beaches.

Note: When the basics of the survey is well-understood, this activity can be applied to further specified survey such as the one on seasonal changes and distribution of microplastic litter on the beach.

II Basic Steps of the Survey

There are three steps in this survey: designing/planning, conducting, and reporting the results.

Please work with specialists who knows about marine litter and/or the geography of the beach for conducting a safe and effective and efficient survey.

3 Steps to conduct the survey

A. Designing/Planning the Survey

- deciding the beach and the time
- preparing necessary tools
- confirming the safety (taking safety measures) of participants



B. Conducting the Survey

- selecting the survey spot(s) on the beach
- collecting microplastic litter
- sorting microplastic litter



C. Reporting the Survey Result

- reporting and observing the result

III Procedure of the Survey

A. Designing/Planning the Survey

1. Beach

It is recommended to select a sandy beach for safety reasons and easiness of litter collection. (Following examples are the case of a sandy beach)

Please select a safe and accessible sandy beach.

When concrete tetrapod structures are installed in shallow waters near the beach to protect coast lines eroding from the power of waves, they may influence the volume of plastic litter washed-up on the beach. So, please try to find the beach without tetrapod structures.

2. Timing

When an annual activity is planned, conduct the survey more than twice at the same season every year.

Please avoid typhoon and heavy rainy season. Also, avoid the time after vacation as beachgoers may litter on the beach than usual.

Note: On some beaches, the volume of washed-up litter increases by the increased river water, which causes by seasonal winds (for example, in Japan, south wind in summer on the Pacific side, and northwest wind in winter on the side of the Sea of Japan). The same increasing trend may happen to microplastics, so, take this tendency into consideration when deciding the timing of the survey.

3. Basic Necessary Tools

In the survey, participants collect a certain amount of sand from the beach, remove all microplastic litter from it, and count the number of microplastics by type. Tools basically used for the survey are shown in the table below.

< Basic Tools used for the survey (1 each, except for 4 short sticks) >

- tape measure (longer than 10 m)
- square frame (e.g. 20cm (H) x 20cm (W) x 5cm (D))
- bar with spatula or a hard flat sheet* (about 20 cm)
- small dustpan (if not available, nylon tape (1m))
- 4 short sticks (20 cm)
- shovel
- ruler (10cm)
- sieve (5 mm and 2 mm)
- tray
- pail
- dipper (1-metr-long) to take seawater
- tweezers
- magnifier
- gloves for protecting hands
- Survey record form
- pen and pencil
- first-aid kit
- bug repellent spray
- eye protection
- camera for recording

* A bar with a spatula or a hard flat sheet attached is used to collect sand in the frame.

See the explanation in the following section and photos.



Figure 1. Basic tools used for the survey

4. Safety Measures

Please well-prepared for the safety of participants for this outdoor survey.

- Prepare first-aid kit with basic medications
- Make a list of offices/stations (fire department, hospitals, etc.) and telephone numbers of participants in emergency
- Buy short-term insurances
- Wear comfortable clothes and (rubber) boots
- Do not enter dangerous areas
- Do not go close to dangerous animals/creatures and/or touch any dead creatures/animals
- Wear a hat/cap in summer, take a rest occasionally, and have some drinks not to be dehydrated
(Reference: “Safety Guidelines for Field Researchers” The Fieldwork Safety Committee, The Ecological Society of Japan, 2019)

B. Conducting the Survey

1. Selecting Survey Spots

- It is recommended to select a survey spot (or spots) on the high-water line as microplastics are often contained in washed-up litter and/or seaweeds, so they are easily collected there. Examine the high-water line carefully to select the spot(s) where microplastics are dense.
- On the other hand, microplastics are not scattered over a beach in the same density, so it is recommended to select more than three survey spots to increase the accuracy of the survey. Each spot should be about 10 meters away from others. It is planned to take about 45 minutes to conduct a survey on one place, so it is better to decide the survey spots not by the number but by the duration of time to be spent for a survey.

Note: It is said that while plastic litter break into smaller pieces while it moves back and forth on waves between the seawater and the beach. So, it is important to understand the situation of microplastics along the high-water line. Also, the survey spots at the inner area of the beach than the high-water line can provide information on the regular state without any seasonal and/or sudden accidental change of the beach.



Image of a beach with marine litter. Litter is accumulated along the high-water line.

2. Collecting Microplastics

a) Collecting Sand

(1) At the spot decided in the previous section, set a square frame and push it to be hidden underground. Then, take the sand in the frame with a bar with a spatula/hard flat sheet. (See the left and center photos below.) The depth of the sand to be taken should be decided in advance. After collecting sand, carefully remove only natural materials such as seaweeds. Leave microplastics in the sand at this stage.

For example, when using a 20 cm x 20 cm frame with 2.5 cm in depth, the volume of the sand to be taken is 1 liter. Taking the same amount of sand can make the survey results comparable to other data/surveys, so it is recommended to take the same amount of sand from the same-sized grid and depth of land at all spots in this survey.

(2) For collecting sand, using a square frame, a bar with a spatula or a hard flat sheet, and a small dust pan is helpful. When participants cannot find these things, they can use short sticks, a rope, a ruler and a shovel to collect sand. (See the right photo below.)

< Example of Collecting Sand >



(1) deciding a survey spot and setting a square frame there

(1) burying the frame underground, and collecting sand with a bar with a spatula or a hard flat sheet

(2) marking the survey spot with short sticks and a rope, and collecting sand with a shovel

b) Collecting and Sorting Microplastics

(1) Put the collected sand on a 5 mm sieve to sift. Put a tray under the sieve when sifting. Then, microplastics which are less than 5-mm-long are contained in the sand on the tray.

(2)-1 For Dry Sand

Again, sift the sand on the tray with 2 mm sieve. Then, micro-plastic pieces are left on the sieve.

Note: For more precise collection, put the left plastic pieces in seawater. Then, they are floated

on the surface and easily collected/sorted.

(2)-2 For Wet Sand

Wet sand cannot go through a 2 mm sieve. So, put seawater into a pail and put the sand in it. Most marine microplastics are lighter than seawater, so they float on the surface after a while. Then, pour all floating materials with the supernatant liquid into the 2 mm sieve. The left objects on the sieve contains microplastics.

Note: Very wet sand cannot go through even a 5 mm sieve. In such a case, sieve the sand with seawater with a 5 mm sieve, then a 2 mm sieve.

(3) Remaining on the 2 mm sieve is 2 mm – 5 mm microplastics, plants and/or sands. Put everything into a tray and collect only microplastics with a tweezer and a magnifier.

(4) Sort microplastics by color, shape and/or hardness. Please understand characteristics of microplastics: artificial colors, pointing shapes, and/or had to be broken when picking up with a tweezer.

< Collecting and Sorting Microplastics >



(1) sifting with a 5 mm sieve



(2)-1 sifting with a 2mm sieve



(2)-2 sifting with seawater



(2) collecting microplastics

3. Sorting Microplastics

Sort and count microplastics and record the results in a form. When multiple survey is conducted, also keep a record of average number of pieces in the form.

The followings are some examples of microplastics which can be recognized with naked eyes. If it is difficult to judge the type, keep the microplastics in a plastic bag and consult a specialist.

< Microplastics which can be recognized with naked eyes >



hard plastic



sheet flake



fiber



foamed plastic



resin pellet

intermediate material of plastic products in transparent, white or other colors



flattened piece

presumably artificial turf in green or gray



microcapsule

presumably a hull of fertilizer-containing plastic microcapsule. It is often found in busted shape.

C. Recording the Survey Result

In Step 2, microplastics contained in beach sand are collected, sorted and counted.

Then, based on the survey result, please think of the origin and the route of marine microplastics and actions to prevent/reduce microplastics.

The state of microplastics on the beach are easily changed by sea climate and weather. Also, please note that microplastics are not scattered evenly on the beach, so this partial survey of the beach cannot tell the exact conditions of the entire beach. But, by comparing the survey results with the past survey or surveys at other beaches, it is possible to understand the characteristics of the surveyed beach.

Visit NPEC website and find survey results, which are conducted in the northwest Pacific region (URL:[http:// www. npec.or.jp/umigomiportal/index.html](http://www.npec.or.jp/umigomiportal/index.html)).

< Report Forms >

Report of Marine Microplastic Litter on the Beach Form 1

| | | | | | |
|---|---|---------------------------------|------|----------|--|
| Name of Beach | | Address | | Reporter | |
| Latitude/longitude | Latitude: degree min. sec. | Longitude: degree min. sec. | | | |
| Date, Day, Time | (year/month/day) / / () | () | | | |
| Weather | [survey day] () | [previous day] () | | | |
| Wind speed | [survey day] Max/day min () | [previous day] Max/day min () | | | |
| Watch/Warning | [past 1 month] Min/monthly / / Max. () | [survey day] () | | | |
| Typhoon/heavy rain | [just before survey] () | () | | | |
| Geographical characteristics of the survey area | (Observation Station) | () | | | |
| Details of the area | [purpose of use] () | [neighboring area] () | | | |
| Details of the beach | [distance between the innermost edge of the beach and the water edge] () | m | | | |
| Participants | [frequency of beach cleaning] () | [number of annual visitors] () | | | |
| Microplastic survey spots | [name of participants/participating organizations] () | [# of participants] () | | | |
| (Additional information) Survey of Marine Litter on Beaches | [# of participants] () | people (adult:) | | | |
| | Spots No. | No.1 | No.2 | No.3 | |
| | From water edge | m | m | m | |
| | [total surveyed area] () | m ² (details) | | | |
| | [# of row] () | rows/total | | | |
| | [# of square] () | squares/total | | | |
| | [# of square under 100m ²] () | | | | |
| | [distance from water edge to marine litter mass] () | | | | |
| | Survey area code | H- | H- | | |
| | Distance from water edge | m | m | | |
| Note (state of marine litter on the survey day) | | | | | |

*Toyoza Prefectural Government, Japan, and the Northwest Pacific Region Environmental Cooperation Center (NPEC) started the survey in 1995 under international cooperation with municipalities along the coastal areas of the northwest Pacific. As of 2019, 38 local governments and a total of about forty thousand people (students and NGOs) in China, Japan, Korea and Russia have joined it.

No. _____

Report of Marine Microplastic Litter on the Beach Form 2

| | |
|---------------|------------------|
| Name of Beach | Survey date/time |
| Survey spot # | Reporter |

| | | | |
|----------------------------------|--------------------------------------|----------------------------|--------------------------------|
| Area of collecting sand | Height [cm] (1) | Width [cm] (2) | Depth [cm] (3) |
| Volume of collected sand (L) (4) | (1) × (2) × (3) × 1,000 | | |
| Size range of microplastic [mm] | *It's okay to mention the sieve size | | |
| # of microplastics (5) | | | |
| Density of microplastics | # / liter | (5) / (4) | |
| | # / m ² | (5) / ((1) × (2) × 10,000) | |
| Type of microplastics (6) | 1. hard plastic | 2. sheet flake | 3. fiber |
| | 4. foamed plastic | 5. resin pellet | 6. flattened (plastic bottles) |
| | 7. microcapsule | 8. other () | 9. other () |
| | 10. other () | 11. other () | 12. other () |

* For "Other" in No. 9-12, if any types of microplastics are found other than No. 1 - 7, put the type name(s) in ().

[results of survey, observations from the results]

* Use one form for one survey spot.



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