Guidelines for River and Lake Microplastic Monitoring Methods

新旧対照表

頁	章・節など	（旧）（令和６年第３回検討会）	（新）
1頁	1 Introduction	Plastics smaller than 5 mm in diameter (hereinafter referred to as "microplastics") are found in the ocean around the world, and their impacts on marine environments are concerned.	Plastics smaller than 5 mm in diameter (hereinafter referred to as "microplastics") are found in the ocean around the world.~~, and~~ Their impacts on marine environments are concerned.
1頁	1 Introduction	（前略） The guidelines set survey methods for the distribution of microplastics in rivers and lakes, the main route of the outflow from land. Based on the results of the surveys, it is expected that the measures against the sources of microplastics are advanced by cooperations between local governments and relevant organizations and citizens. （後略）	（前略） The guidelines set survey methods for the distribution of microplastics in surface water of rivers and lakes, the main route of the outflow from land. Based on the results of the surveys, it is expected that the measures against the sources of microplastics are advanced by cooperations between local governments and relevant organizations and citizens. （後略）
1頁	1.1 Target readers	Target readers of the guidelines are the staff of local public agencies and other organizations who conduct the survey on the distribution of river and lake microplastics, and cooperative researchers, research institutions, and business operators.	Target readers of the guidelines are the staff of local public agencies and other organizations who conduct the survey on the distribution of microplastics in surface water of river and lake, and cooperative researchers, research institutions, and business operators.
1頁	1.2 Target microplastics	The guidelines are applied to the survey on plastic and fiber pieces smaller than 5 mm in rivers and lakes. It is assumed that nets with approximately 0.3 mm mesh openings are used to collect microplastics. However, plastics smaller than 1 mm are not completely collected with the 0.3 mm mesh nets, even if they are 0.3 mm or larger. Therefore, these smaller plastics are measured as supplemental references. Additionally, plastics ranging from 5 to 25 mm (known as mesoplastics) are also measured as supplemental references, as these measurements can help us understand the distribution of plastic in rivers and lakes.	The guidelines are applied to the survey on plastic and fiber pieces smaller than 5 mm in surface water of rivers and lakes. It is assumed that nets with approximately 0.3 mm mesh openings are used to collect microplastics. However, plastics smaller than 1 mm are not completely collected with the 0.3 mm mesh nets, even if they are 0.3 mm or larger. Therefore, these smaller plastics are measured as supplemental references. Additionally, plastics ranging from 5 to 25 mm (known as mesoplastics) are also measured as supplemental references, as these measurements can help us understand the distribution of plastic in surface water of rivers and lakes.
2頁	2.1 Purpose of survey	Purpose of the survey is to understand the distribution of microplastics in rivers and lakes which are one part of microplastics that flow out from land to sea.	Purpose of survey is to understand the distribution of microplastics in surface water of rivers and lakes which are one part of microplastics that flow out from land to sea.
3頁	2.3.1 Selection of sampling location	For on-site filtration sampling, it is important to choose locations where the water flow velocity equal to or greater than 0.3 m/s and the water depth is equal to or greater than 50 cm. （省略）	For on-site filtration sampling, it is important to choose locations where the water flow velocity is equal to or greater than 0.3 m/s and the water depth is equal to or greater than 50 cm.
5頁	3 Sampling in rivers 3.1 Outline	The samples containing microplastics are collected from rivers.	The samples containing microplastics are collected from surface water of rivers.
5頁	3.2.1 Net	Plankton nets are used for sampling. A flow meter and a bottom pipe (or cod end) made of rubber or metal are installed to the mouth and the end of a commercial short-cone-shaped plankton net with 30 cm in diameter and 0.3 mm mesh openings that is used for collecting underwater plankton in rivers (Photo 3-1). A float is attached near the bottom pipe (or cod end) for even spreads of the net (Photo 3-2).	Plankton nets are used for sampling. A flow meter and a bottom pipe (or cod end) made of rubber or metal are installed to the mouth and the end of a commercial short-cone-shaped plankton net (mouth size: diameter: 30 cm, mesh opening size: 0.3 mm, length: 75–100 cm) that is used for collecting underwater plankton in rivers (Photo 3-1). A float is attached near the bottom pipe (or cod end) for even spreads of the net (Photo 3-2).
5頁	脚注	MLIT Ministry of Land, Infrastructure, Transport and Tourism. "Chapter 1. Hydraulic and Water Quality Phenomena in Lakes". MLIT Ministry of Land, Infrastructure, Transport and Tourism. https://www.mlit.go.jp › kosyo › tec › pdf › 1.pdf, (accessed on 2023-03-08)	MLIT Ministry of Land, Infrastructure, Transport and Tourism. "Chapter 1. Hydraulic and Water Quality Phenomena in Lakes". MLIT Ministry of Land, Infrastructure, Transport and Tourism. https://www.mlit.go.jp › kosyo › tec › pdf › 1.pdf, (accessed on 2023-03-08) (in Japanese)

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7頁	3.2.4 Installation and fixation of flow meter	The fixation with a metal frame allows more accurate measurements than Case 1 by the stability and the low possibility of the contact with the rotor and net.	The fixation with a metal frame allows more accurate measurements than Case 1, because of the stability and the low possibility of contact with the rotor and net.
9頁	3.3.1 Setting of net in stream	The mouth of the net is immersed fully in the stream under the river surface (so that the upper part of the mouth of the net lies just below the surface) (Photo 3-8). The guidelines are intended to collect microplastics in river water; thus, to avoid contaminations by particles deposited on the riverbed, the upper part of the mouth of the net should not be set in deep under the surface of the river.	The mouth of the net is immersed fully in the stream under the river surface (so that the upper part of the mouth of the net lies just below the surface) (Photo 3-8). The guidelines are intended to collect microplastics in surface water of river water; thus, to avoid contaminations by particles deposited on the riverbed, the upper part of the mouth of the net should not be set ~~in~~ deep under the surface of the river.
11頁	3.4.3 Sampling	After checking that the bottom pipe (or cod end) is closed tightly, the net is set in streams until the filtered water volume reaches 10–20 m^3. The flow velocity measured in Section 3.4.2 is not constant due to the resistance and clogging of the net; thus, it is recommended to keep the net underwater for a specific period determined by calculation until the amount of filtered water volume reaches approximately 13–14 m^3. However, a sufficient number of plastic (approximately 30 particles) was collected in less than 5 m^3 of water. Sampling does not need to be continued. Confidence intervals for the number of collected microplastics are illustrated in Figure 3-2.	After checking that the bottom pipe (or cod end) is closed tightly, the net is set in streams until the filtered water volume reaches 10–20 m^3. The flow velocity measured in Section 3.4.2 is not constant due to the resistance and clogging of the net; thus, it is recommended to keep the net underwater for a specific period determined by calculation until the amount of filtered water volume reaches approximately 13–14 m^3. However, a sufficient number of plastic (approximately 30 particles) was collected in less than 10 m^3 of water. Sampling does not need to be continued. Confidence intervals for the number of collected microplastics are illustrated in Figure 3-2. Errors of approximately 50%, 33%, 25%, and 20% were recorded for 10, 30, 50, and 100 particles, respectively.
13頁	3.4.5 Transfer of samples from net to storage containers	In principle, to avoid contamination in the field, it is recommended to transfer samples from net to storage containers in the laboratory. In this case, samples in the net are collected to the bottom pipe (or cod end) by pouring tap water to the net from the outside and transfer to storage containers. Samples that adhere to the bottom pipe (or cod end) are transferred to storage containers with a small amount of tap water (photo 3-13, Photo 3-14). When the samples are transferred to the storage containers, it should be careful to prevent contaminants in the container and not to leave any samples in the net. When the nets are taken back to laboratories, their mouths are covered with cloths, and they are put in cloth bags and carried to the laboratories (photo 3-15, Photo 3-16). When multiple nets are not available, samples are transferred in the field. In this case, washing is used instead of tap water (photo 3-17).	In principle, to avoid contamination in the field, it is recommended to transfer samples from net to storage containers in the laboratory. In this case, samples in the net are collected to the bottom pipe (or cod end) by pouring tap water to the net from the outside, and then transferred to storage containers. Samples that adhere to the bottom pipe (or cod end) are transferred to storage containers with a small amount of tap water (photo 3-13, Photo 3-14). When the samples are transferred to the storage containers, ~~it should~~ be careful to prevent contaminants in the container and not to leave any samples in the net. When the nets are taken back to laboratories, their mouths are covered with cloths, and they are put in cloth bags and carried to the laboratories (photo 3-15, Photo 3-16). When multiple nets are not available, samples are transferred on site. In this case, washing is used instead of tap water (photo 3-17).
15頁	[Reference] Examples of formulae for filtered water volume and velocity	*t* is measurement time.	*t* is the measurement time.
15頁	3.5.1 Required items and recommended items 【Recommended items】 4. Condition of riverbed at sampling locations	Condition of riverbeds should be recorded to confirm safeties on stepping into rivers for sampling and estimate possibilities of contamination by riverbed sediment.	The condition of riverbed should be recorded to confirm safety during sampling in rivers for sampling and assess the potential for sample contamination by riverbed sediment.
16頁	3.5.1 Required items and recommended items 【Recommended items】 5. Local circumstances	Local circumstances around sampling locations that may affect distributions of underwater microplastics, such as upstream works, and drifting debris, should be checked and recorded.	Local circumstances around sampling locations that may affect distributions of surface underwater microplastics, such as upstream works, and drifting debris, should be checked and recorded.

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16 頁	3.5.2 Precautions for sampling	2. To ensure safety, sampling should be conducted with multiple people. Researchers must put on life jackets and safety belts. Helmet must be also put at the places with risks of falling. 3. In the case of stepping in rivers for sampling, researchers must approach sampling locations from downstream and be careful not to kick up gravel on riverbeds. After conditions of streams become stable, sampling should be commenced. As mentioned above, they must check that the mouth of the net is immersed under the river's surface and the flow meter rotor rotates normally while paying attention not to disturb streams. 4. In the case that something that disturbs water flow through the net or damage the net and flow meter (e.g., driftwood and large floating objects) comes into the net while sampling, it is permitted to temporarily stop sampling and remove it. The temporary stop and circumstances must be recorded.	2. To ensure safety, sampling should be conducted with multiple people. Researchers must put on life jackets and safety belts. Helmets must be also put on at places with risks of falling. 3. In the case of stepping in rivers for sampling, researchers must approach sampling locations from downstream and be careful not to kick up gravel on riverbeds. After conditions of streams become stable, sampling should be started. As mentioned above, they must check that the mouth of the net is immersed under the river's surface and the flow meter rotor rotates normally while paying attention not to disturb streams. 4. In the case that something that disturbs water flow through the net or damages the net and flow meter (e.g., driftwood and large floating objects) comes into the net while sampling, it is permitted to temporarily stop sampling and remove it. The temporary stop and circumstances must be recorded.
17 頁	4 Sampling in lakes 4.1 Outline	Samples containing microplastics are collected from lake water. This guideline considers net tow sampling, conducted at the center of lakes from boats, as the primary method. Sampling from lakesides with motorized survey devices or pumps is considered as substitute methods. Considering the fact that the density and composition of microplastics vary depending on the surrounding environments, their representativeness of the whole lake may not be ensured.	Samples containing microplastics are collected from surface water of lake water. This guideline considers net tow sampling, conducted at the center of lakes from boats, as the primary method. Sampling from lakesides with motorized survey devices or pumps is considered as substitute methods. Considering the fact that the density and composition of microplastics vary depending on the surrounding environments, their representativeness of the whole lake may not be ensured.
19 頁	4.2.2.1 The setting of the net in water	The mouth of the net is fully immersed in the water under the lake surface (so that the upper part of the net mouth lies just below the surface). Floats and weights are installed at its mouth to control the net's depth. Because this guideline is set for microplastics in the water column, to avoid contamination with plastics and other particles accumulated at the bottom of lakes, the upper part of the net mouth must not be immersed deeper than the surface (Photo 4-4).	The mouth of the net is fully immersed in the water under the lake surface (so that the upper part of the net mouth lies just below the surface). Floats and weights are installed at its mouth to control the net's depth. Because this guideline is set for microplastics in the surface water column, to avoid contamination with plastics and other particles accumulated at the bottom of lakes, the upper part of the net mouth must not be immersed deeper than the surface (Photo 4-4).
19 頁	4.2.3.2 Sampling	- Immerse nets in water and tow at 1–2 knots until the filtered water volume reaches 10–20 m^3. When a net with 30 cm in diameter is towed 200 m, the filtered water volume is approximately 14.1 m^3. However, a sufficient number of microplastics (approximately 30 particles) can be collected in less than 5 m^3 of water, and sampling using clogged nets does not need to be continued. （後略） - Record the towing distance and boat wake using GNSS (GPS). The duration of towing should also record.	- Immerse nets in water and tow at 1–2 knots until the filtered water volume reaches 10–20 m^3. When a net with 30 cm in diameter is towed 200 m, the filtered water volume is approximately 14.1 m^3. However, a sufficient number of microplastics (approximately 30 particles) can be collected in less than 10 m^3 of water, and sampling using clogged nets does not need to be continued. （後略） - Record the towing distance and boat wake using GNSS (GPS). The duration of towing should also be recorded.
20 頁	4.2.3.3 Removal of impurities	Refer to Section 3.4.4 for the detail of removal of impurities.	Refer to Section 3.4.4 for the details of removal of impurities.

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21 頁	4.3.2 Sampling position	The devices are lowered parallel to lakesides and then sunk under the water surface of the lakes. The positions of the devices are controlled using a rope. Before sampling, the front parts of the devices are turned toward the center of the lakes at an angle of approximately 45 degree (Photo 4-7). To prevent plastic contamination from lake bottoms, sampling locations must have sufficient depth, and the openings of devices must not be sunk deeply.	The devices are lowered parallel to lakesides and then sunk under the water surface of the lakes. The positions of the devices are controlled using a rope. Before sampling, the front parts of the devices are turned toward the center of the lakes at an angle of approximately 45 degree (Photo 4-7). Sampling locations should be selected where sufficient water depth is available to prevent resuspension of bottom sediment, and the immersion depth should be adjusted by the length of the rope suspending the device. Because this guideline aims to collect microplastics from the surface water of lakes, excessive submergence of the device's opening should be avoided to prevent contamination by microplastic particles deposited on the lake bottom.
21 頁	4.3.3.2 Sampling	- Sink the device under the water surface in the lake and keep it until the filtered water volume reaches 10–20 m^3. However, a sufficient number of microplastics (approximately 30 particles) is collected in less than 5 m^3 water, further sampling does not need to be continued with clogged nets. （後略）	- Sink the device under the water surface in the lake and keep it until the filtered water volume reaches 10–20 m^3. However, a sufficient number of microplastics (approximately 30 particles) is collected in less than 10 m^3 water, further sampling does not need to be continued with clogged nets.
22 頁	4.4.1 Sampling with pumps (1) Pump	Pumps with sufficient power should be used even if connected to hoses and strainers. Before pumps are prepared, the total head is calculated from the static head which is the vertical distance between the inlet and outlet surfaces, the pressure head, the velocity head, and head loss in the pipes. The appropriate volume flow rate is 50–200 L/min. In cases where the pump has plastic components, the color and material must be checked before use.	Pumps with sufficient power to attain the required flow rate should be used even if connected to hoses and strainers. When selecting a pump, the vertical distance from the suction water surface to the discharge water surface, i.e., actual head, should be determined at the location where the pump is intended for use. Furthermore, the pipe loss, pressure, and velocity heads of the designated pump and hose should be confirmed using an instruction manual or similar documentation, and the total head should be calculated to confirm whether the pump can be used. If the pump has plastic components, the color and material must be checked and recorded prior to use. The pump should be cleaned before use to prevent contamination by solids accumulated inside the pump.
22 頁	4.4.1 Sampling with pumps (3) Hose	Hoses with sufficient pressure resistances should be used. Additionally, they must be sufficiently long to set a distance of more than 5 m between the inlet and outlet ports. When the hoses are made of plastic, the color and materials must be checked before use.	Hoses with sufficient pressure resistance should be used. Additionally, they must be sufficiently long to set a distance of more than 5 m between the inlet and outlet ports. When the hoses are made of plastic, the color and materials must be checked before use.
23 頁	4.4.2 Sampling position	All equipment is arranged at the lakeside. The strainer connected to the inlet port is submerged under the surface of the lake during sampling. To avoid plastic contamination from lake bottoms, sampling locations must have sufficient depth, and the strainer must not be sunk deep (Photo 4-10).	The pump and related equipments are installed at the lakeside. Sampling locations are selected where sufficient water depth is available to prevent suction of bottom sediments. The strainer connected to the inlet port is submerged under the surface water of the lake during sampling. Because this guideline aims to collect microplastics from the surface water of lakes and to avoid plastic contamination from lake bottoms, sampling locations must have sufficient depth, and the strainer must not be sunk deep (Photo 4-8).
25 頁	4.4.3.2 Sampling	（前略） - After the pumps operate stably, the tips of the hoses are connected to outlet ports inside the nets until 10–20 m^3 of water is filtered. However, a sufficient number of microplastics (approximately 30 particles) were collected in less than 5 m^3 water, sampling does not need to be continued with clogged nets. （後略）	（前略） - After the pumps operate stably, the tips of the hoses are connected to outlet ports inside the nets until 10–20 m^3 of water is filtered. However, a sufficient number of microplastics (approximately 30 particles) were collected in less than 10 m^3 water, sampling does not need to be continued with clogged nets. （後略）

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26 頁	4.5.1 Required items and recommended items 【Recommended items】 ③周辺状況	Local circumstances around the sampling location that may affect the distribution of underwater microplastics, such as rivers, upstream work, and drifting debris, should be checked and recorded	Local conditions around the sampling location that may affect the distribution of surface underwater microplastics, such as river works, and drifting debris, should be checked and recorded.
27 頁	5.1.1 Outline	Solids from samples are separated with nets with 0.1 mm mesh openings.	Solids from samples are separated with nets with 0.1 mm mesh openings. If a high volume of solids is present and filtration becomes time-consuming, suction filtration may be employed exclusively at the beginning of the process (Figure 5-1). However, care must be taken when crushing plastic particles; if fragile particles are included, they should be separated before suction.  Figure 5-1 Suction filtration (Courtesy of Hisano Watanabe, National Institute for Environmental Studies)
28 頁	5.1.3 Procedure	Photo 5-5. Putting of container A on the net with samples	Photo 5-5. Putting container A on the net with samples side facing inward
29 頁	5.2.3 Procedure *Notes	- If water content in the dried samples is too high, oxidizing agent is diluted and reduced the effect of organic impurity decomposition.	- Be careful if water content in the dried samples is too high, because oxidizing agent is diluted and reduces the effect of organic impurity decomposition.
30 頁	5.2.3 Procedure	3. When white gel-like suspensions in the solutions do not disappear after leaving for three days, add another 100 mL of 30% hydrogen peroxide solutions and keep them warmed for one day.	3. When white gel-like suspensions in the solutions do not disappear after leaving for three days, add another 100 mL of 30% hydrogen peroxide solutions and keep them warm for one day.
32 頁	5.3 Density separation 5.3.1 Outline	A large number of inorganic impurities such as soil particles is sometimes included in samples. In such a case, to efficiently capture plastics, they are separated from the samples by utilizing differences in specific densities of inorganic impurities and plastics.	A large number of inorganic impurities such as soil particles are sometimes included in samples. In such a case, to efficiently capture plastics, they are separated from the samples by utilizing differences in specific densities of inorganic impurities and plastics. In this guideline, a funnel and a silicon tube are utilized; however, alternative instruments may be employed if the sediment and suspended matter can be reliably separated.
32 頁	5.3.2 Reagents and equipment	1) Funnel (made of glass) 2) Funnel stand 3) Silicon tube 4) Pinch cock (clip) 5) 5.3 M sodium iodide solution 6) Glass container 7) Net with 0.1 mm mesh openings	1) Funnel (made of glass) 2) Funnel stand 3) Silicon tube 4) Pinch cock (clip) 5) 5.3 M sodium iodide solution (ex. Approximately 800 g of sodium iodide diluted to 1L with water) 6) Glass container 7) Net with 0.1 mm mesh openings

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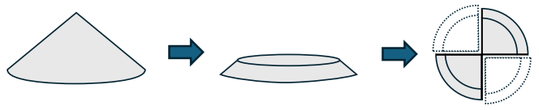
33 頁	5.3.3 Procedure	Photo 8-13. Securing of a tube tip （前略） 2. Add an appropriate amount of sodium iodide solutions to samples in a container. Stir it slowly with a glass rod (Photo 5-14). （後略）	Photo 8-13. Pinching the tube tip （前略） 2. Add an appropriate amount of 5.3M sodium iodide solutions to samples in a container. Stir it slowly with a glass rod (Photo 5-14). （後略）
33 頁	5.3.3 Procedure	Photo 8-15. Pouring of solutions into funnels	Photo 8.15. Pouring ~~of~~ solutions into funnels
34 頁	5.3.3 Procedure	6. Set a container under the tube. Remove the clip and drain the lower part solutions while the upper part one is remains (Photo 5-18).	6. Set a container under the tube. Remove the clip and drain the lower part solutions while retaining the upper part solutions (Photo 5-18).
36 頁	[Reference] Other method of density separation	（前略） The specific gravity of saturated aqueous sodium chloride solutions is 1.2 g/cm3, which is lower than the specific gravity of aqueous sodium iodide solutions (1.5 g/cm3). Thus, polyethylene terephthalate (PET) and other heavy microplastics are sometimes included in precipitates. It needs to check for microplastics in separated precipitates carefully. （後略）	（前略） The specific gravity of saturated aqueous sodium chloride solutions is 1.2 g/cm3, which is lower than the specific gravity of aqueous 5.3M sodium iodide solutions (1.5 g/cm3). Thus, polyethylene terephthalate (PET) and other heavy microplastics are sometimes included in precipitates. It needs to check for microplastics in separated precipitates carefully. （後略）
36 頁	[Reference] Contraction	（新規追加）	[Reference] Contraction In certain rivers, sampling 10–20 m^3 of water can yield more than 1,000 microplastic candidate particles. Because the principle involves a total analysis, the volume of water collected should be reduced and the analytical workload adjusted at sites where microplastic concentrations are known to be high based on previous surveys. However, if a large number of microplastic candidate particles is obtained, it can be splitting after transferring to a glass petri dish in 5.3.3 (10). Nevertheless, at least 100 candidate particles should be secured. Finally, the number of microplastics identified as plastics is multiplied by the splitting factor to determine the number of microplastics at that particular point. Example: Conic quadrant First, the candidate particles are stacked in a cone shape, and radially spread from the center with a spatula to form a flat disk. Next, a straight line is drawn passing through the center of the disk and dividing the circumference into quarters; subsequently a diagonal pair of opposite quadrants is collected and used as the analytical sample (Figure 5-24). If the number of candidate particles is large, the above process is repeated. It is desirable to confirm that splitting is conducted properly with weight control and marker particles.  Fig. 5-24 Conic quadrant

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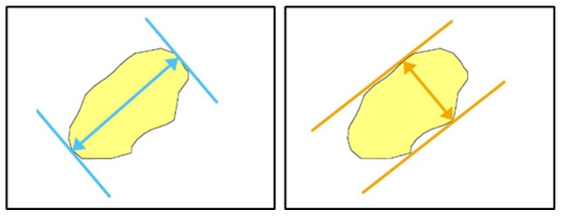
38 頁	6.3.1Visual measurement of maximum Feret’s diameter and other items	2. Transfer the candidate plastic particles to another Petri dishe.	2. Transfer the candidate plastic particles to another Petri dish.
39 頁、40 頁	6.3.2 Measurement of maximum Feret’s diameter and other items with image processing	5. For each of them, measure the maximum and minimum Feret’s diameters[VI] and area. Then, only fibrous plastics are measured with their lengths as the longest sides and the widths as the shortest sides (Photo 6-3). However, fiber clusters are measured in the same manner as that for the other plastic particles (i.e., maximum and minimum Feret’s diameters) without disassembly. 6. For each of them, make records about the maximum and minimum Feret’s diameters, area, shape, and color (for details of classification by shape and color, refer to Section 0 and 6-6). * The following treatments are not needed for candidate plastic particles whose maximum Feret's diameter is over 5 mm. * Depending on the shapes of plastic pieces, errors in the areas become big by calculating from maximum and minimum Feret’s diameters. Thus, image processing software is required to evaluate the accurate areas.	5. For each of them, measure the major axis, minor axis, and projected area. The maximum and minimum Feret’s diameters[VI] of each candidate particle are measured and used as the major and minor axes, respectively (Figure 6-3). However, because the fibrous plastic candidate particles may be overestimated or underestimated when measured using the Feret`s diameter, the length measured along the fiber and width are, if possible, recorded as the major and minor axes, respectively (Figure 6-4). Furthermore, for instances in which the fibers are entangled and become a lump (hereinafter referred to as "fiber mass"), the maximum and minimum Feret’s diameters and the projected surface area of the fiber mass should be measured as a single candidate particle without forcibly unwinding it. 6. For each of them, make records about the maximum and minimum Feret’s diameters, the projected surface area, shape, and color (for details of classification by shape and color, refer to Sections 6.5 and 6-6). * The following treatments are not needed for candidate plastic particles which maximum Feret's diameter is over 5 mm. * Depending on the shapes of plastic pieces, errors in the areas become big by calculating from maximum and minimum Feret’s diameters. Thus, image processing software is required to accurately evaluate the projected surface area. * Projected surface area was defined as the maximum visible area observed from above when each plastic particle was placed with its most stable plane facing downward under a stereoscopic microscope.  Figure 6-3 Left: maximum Feret’s diameter, right: minimum ferley’s diameter

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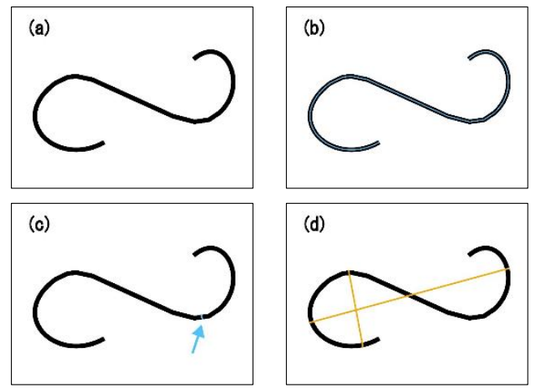
39 頁、 40 頁	6.3.2 Measurement of maximum Feret’s diameter and other items with image processing		 Figure. 6-4 Measurement part of fibrous plastic (schematic) ((a) original drawing, (b) major axis, (c) minor diameter, and (d) maximum and minimum Feret’s diameters)

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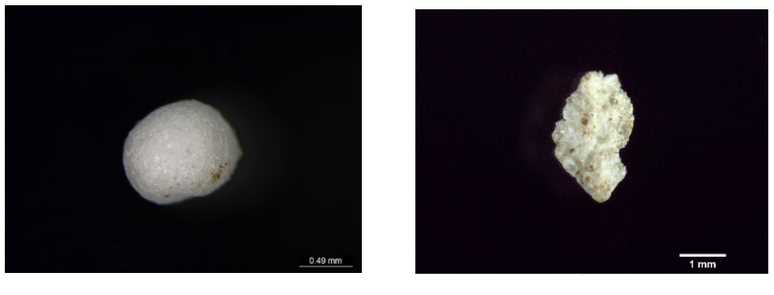
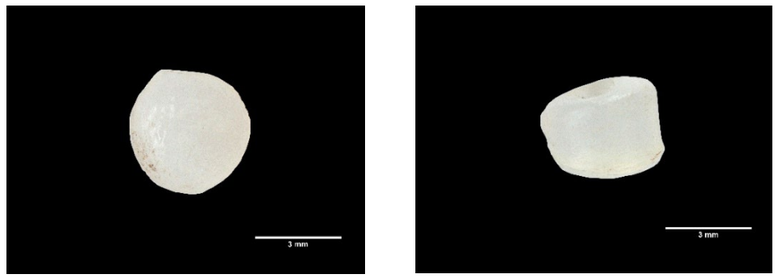
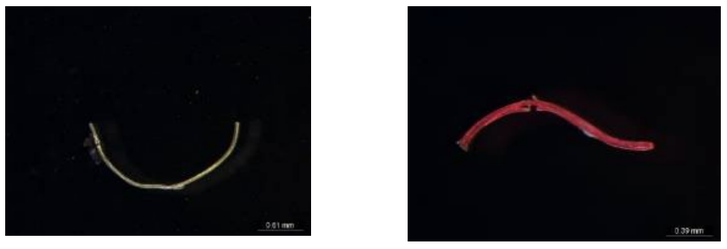
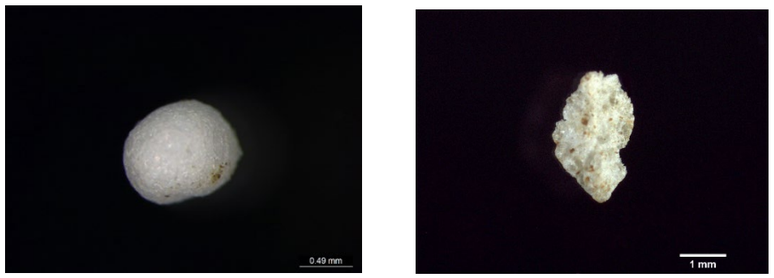
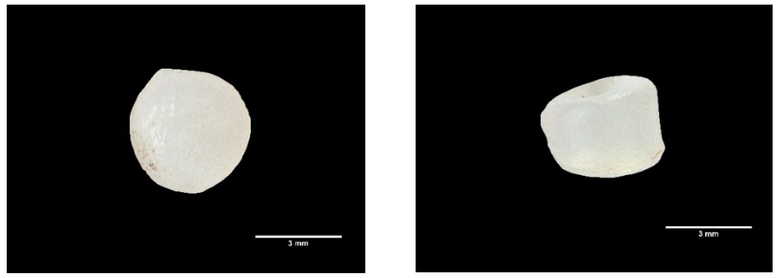
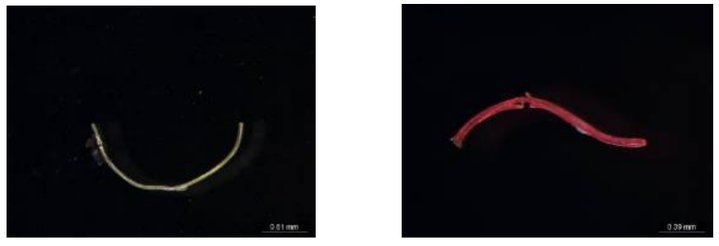
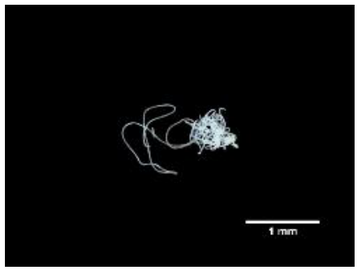
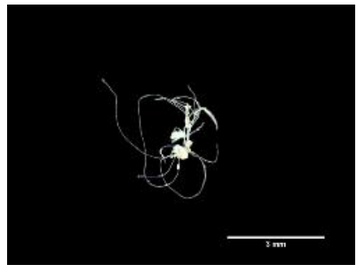
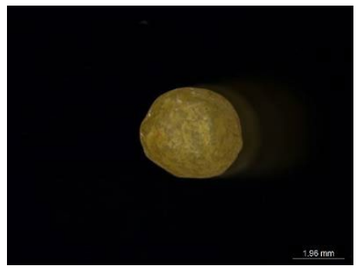
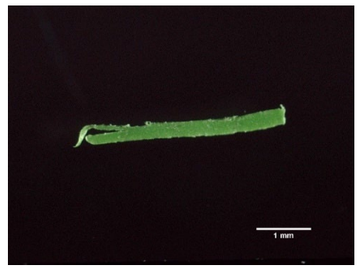
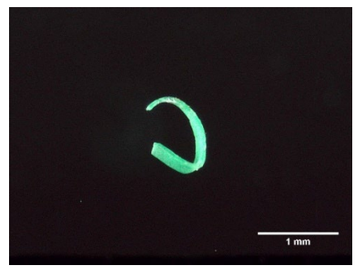
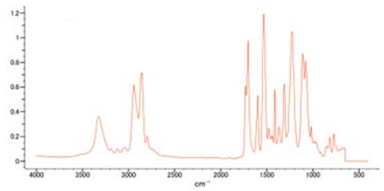
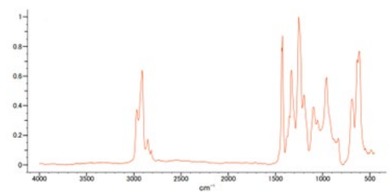
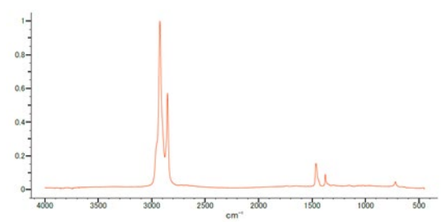
41 頁～ 44 頁	6.5 Classification by shape	Candidate plastic particles are classified into the following shape categories: 1. Fragment 2. Film and sheet 3. Bead 4. Foam (expanded) 5. Cylinder and sphere (pellet) 6. Fiber 7. Fiber cluster 8. The others （中略）  4. Foam (expanded): spherical and expanded pieces  5. Cylinder and sphere (pellet)  	Candidate plastic particles are classified into the following shape categories: 1. Fragment 2. Film and sheet 3. Bead 4. Foam (expanded) 5. Cylinder and sphere (pellet) 6. Fiber 7. Fiber cluster 8. Plastic-coated fertilizer 9. Artificial turf, artificial grass 10. Others （中略）  4. Foam (expanded): expanded pieces  5. Cylinder and sphere (pellet)  6. Fiber: elongated string-like and rod-like pieces

		6. Fiber: elongated string-like and rod-like pieces	
頁	章・節など	（旧）（令和６年第３回検討会）	（新）
41 頁～ 44 頁	6.5 Classification by shape		  7. Fiber clump: tangled fibers   8. Plastic-coated fertilizer   9. Artificial turf, artificial grass

頁	章・節など	（旧）（令和６年第３回検討会）	（新）
47 頁	[Reference] Spike-and-Recovery test with standard plastic particles (example)	[Reference] Addition-Recovery test with standard plastic particles The accuracy of sorting of candidate plastic particles with microscopes are sometimes varied depending on researchers. When multiple researchers are involved in sorting, it is recommended to test the sort-out accuracy with standard plastic samples. Procedure 1. Add standard plastic particles to collected samples before sorting them out. 2. Sort out the standard plastic particles from the collected samples. 3. Check how accurately the standard plastic particles are sorted and collected. * Multiple sizes of standard plastic particles should be selected. The sizes are selected from 0.3, 0.5, 1, and 2 mm in consideration of sizes of candidate plastic particles. * The number of standard plastic particles should be approximately 50, and recovery rates should be calculated. * Colors of standard plastic particles should be unusual colors in nature to distinguish them from collected samples.	[Reference] Spike-and-Recovery test with standard plastic particles (example) The accuracy of sorting of candidate plastic particles with microscopes is sometimes varied depending on the operator. When multiple operators are involved in sorting, it is recommended to conduct spike-and-recovery tests to manage separation accuracy. Procedure 1. Add standard plastic particles to collected samples before sorting them out. 2. Sort out the standard plastic particles from the collected samples. 3. Check how accurately the standard plastic particles are sorted and collected. * Multiple sizes of standard plastic particles should be selected. The sizes are selected from 0.3, 0.5, 1, and 2 mm in consideration of sizes of candidate plastic particles. * The number of standard plastic particles should be approximately 50, and recovery rates should be calculated. * Colors of standard plastic particles should be unusual colors in nature to distinguish them from collected
48 頁	7.1.3 Procedure 2	2. Configure measurement conditions. * Measurements of microplastics are performed with the number of sample scans set to five or more and the conserved wave area set to 4000 to 400 cm^{-1} or much-extended range.	2. Configure measurement conditions. * Measurements of microplastics are performed with the number of sample scans set to five or more and the conserved wave area set to 4000 to 650 cm^{-1} or much-extended range.
48 頁	7.1.4 Notes 1. Hit quality	In academic survey, the lower limit of hit quality is set, and some samples less than this limit are excluded from collected data. However, this survey aims to understand actual distributions of microplastics carried out by local governments and other organizations. Therefore, even if hit qualities are low, plastic types are visually identified from shapes of similar spectra based on characteristic peaks of infrared spectra.	In academic study, the lower limit of hit quality is set, and some samples less than this limit are excluded from collected data. However, this survey aims to understand actual distributions of microplastics carried out by local governments and other organizations. Therefore, even if hit qualities are low, plastic types are visually identified from shapes of similar spectra based on characteristic peaks of infrared spectra.
49 頁	7.1.4 Notes 2. Characteristic peak shapes by plastic shapes	2. Characteristic peak shapes by plastic types - Photo 10-1 show examples of infrared spectra based on plastic types. For reference, the spectra in cases that impurities are included are also shown to show differences in appearance of peaks. When peaks unique to the components shown below are observed, samples should be identified even they contain impurities. In some figures, the spectra of non-plastics are shown.	2. Characteristic peak shapes by plastic types - Photo 10-1 show examples of infrared spectra based on plastic types. For reference, the spectra in cases that impurities are included are also shown to show differences in appearance of peaks. When peaks unique to the components shown below are observed, samples should be identified even if they contain impurities. In some figures, the spectra of non-plastics are shown.

頁	章・節など	（旧）（令和６年第３回検討会）	（新）
49 頁～ 51 頁	7.1.4 Notes 2. Characteristic peak shapes by plastic shapes	（新規追加）	(f) Polyurethane (PU) It exhibits characteristic peaks for the N-H stretching vibration near 3291 cm^{-1}, CH_2 stretching vibration near 2858 and 2938 cm^{-1}, C=O stretching vibration near 1734 cm^{-1}, C-N-H bending vibration near 1538 cm^{-1}, and C-O stretching vibration near 1109 cm^{-1}. (g) Polyvinyl chloride (PVC) It exhibits characteristic peaks for the CH_2 stretching vibrations near 2862 and 2911 cm^{-1}, CH_2 bending vibration near 1426 cm^{-1}, CH_2-Cl bending vibration near 1254 cm^{-1}, and C-Cl bending vibration near 637 and 694 cm^{-1}. (h) Mixed PE and PP (PE/PP) Similar to PE, it exhibits peaks for the C-H stretching vibration at approximately 2845 and 2915 cm^{-1}, CH_2 bending vibration at approximately 1462 cm^{-1}, and CH_2 rocking vibration at 717 cm^{-1}. In addition, similar to PP, it has a relatively strong CH_2 bending vibration peak at approximately 1455 and 1377 cm^{-1}.  (f) Polyurethane (PU)  (g) Polyvinyl chloride (PVC)  (h) Mixed PE and PP (PE/PP)

頁	章・節など	（旧）（令和６年第３回検討会）	（新）
54 頁	[Reference] Geometric relationship between the projected surface area and mass of a plastic particle	（新規追加）	[Reference] Geometric relationship between the projected surface area and mass of a plastic particle The quantification of the mass of the meso/microplastic particles (MMP) is crucial for assessing the global inventory of ocean plastics and assessing environmental and human health risks; however, weighing individual samples is extremely laborious. A linear regression model between mass and projected surface area on a log scale was established by directly measuring the masses of 4,390 MMP particles collected at 35 sites in 17 Japanese rivers with an ultramicrobalance (Kataoka et al., 2024). This model is applicable from 10^{-4} mm^2 to 10^2 mm^2 projected surface area. Furthermore, it can be applied to different shapes and material types. $Log10M = bLog10S + a$ M: particulate mass, S: projected surface area a:-1.12±0.01　b:1.14±0.01 - a and b are regression coefficients that were determined by the least squares method - Projected surface area was defined as the maximum visible area observed from above when each plastic particle was placed with its most stable plane facing downward under a stereoscopic microscope. - there are two limitations of applying the geometric relationship: (1) large uncertainty in the mass estimation of particles with a major-axis length > 10 mm and (2) the quantification of microplastic particles <10 μm. （Source: Geometric relationship between the projected surface area and mass of a plastic particle. Kataoka et al., 2024）
55 頁	9.1 Sorting of measurement results of microplastics	Recommended items 1. Minimum Feret’s diameter (for samples analyzed with image processing) 2. Area (for samples analyzed with image processing) 3. Thickness 4. Mass 5. Wave range	Recommended items 1. Minimum Feret’s diameter (for samples analyzed with image processing) 2. The projected surface area (for samples analyzed with image processing) 3. Thickness 4. Mass 5. Wave range

頁	章・節など	（旧）（令和６年第３回検討会）	（新）
58 頁	Members of the Study Group on the Actual Situation of Plastic Waste Outflow into the Ocean in Rivers and Lakes in 2023	（新規追加）	**Members of the investigation committee for the Microplastic Monitoring in Rivers and Lakes in 2023** KAMEDA Yutaka, Professor of Chiba Institute of Technology, Faculty of Creative Engineering, Department of Civil Environmental Engineering. KATAOKA Tomoya, Associate Professor of Ehime University, Graduate School of Science and Engineering. NAKATA Haruhiko, Associate Professor of Kumamoto University Graduate School of Advanced Science and Technology. NIHEI Yasuo, Professor of Tokyo University of Science, Faculty of Science and Technology, Department of Civil Engineering. SUZUKI Go, Principal Researcher of National Institute for Environmental Studies, Division of Resource Recycling. TANAKA Shuhei, Associate Professor of Kyoto University, Graduate School of Global Environmental Studies. *The names are arranged in alphabetical order. Their posts are those in March 2023.

頁	章・節など	（旧）（令和６年第３回検討会）	（新）
58 頁	委員名簿	（新規追加）	**Members of the investigation committee for the Microplastic Monitoring in Rivers and Lakes in 2024** KAMEDA Yutaka, Professor of Chiba Institute of Technology, Faculty of Creative Engineering, Department of Civil Environmental Engineering. KATAOKA Tomoya, Associate Professor of Ehime University, Graduate School of Science and Engineering. NAKATA Haruhiko, Associate Professor of Kumamoto University Graduate School of Advanced Science and Technology. NIHEI Yasuo, Professor of Tokyo University of Science, Faculty of Science and Technology, Department of Civil Engineering. SUZUKI Go, Director of the Office of National Institute for Environmental Studies, Division of Resource Recycling. TANAKA Shuhei, Associate Professor of Kyoto University, Graduate School of Global Environmental Studies. *The names are arranged in alphabetical order. Their posts are those in March 2024.

頁	章・節など	（旧）（令和６年第３回検討会）	（新）
—	Appendix. 1	Appendix **Standard Specification** **of Automatic Sample Preparations** **in Guidelines for River and Lake** **Microplastic Monitoring Methods**	Appendix. 1 **Standard Specification** **of Automatic Sample Preparations** **in Guidelines for River and Lake** **Microplastic Monitoring Methods**
—	Appendix. 2	（新規追加）	Appendix. 2 Survey procedure manual for Microplastics in River by net towing *DRAFT ver. 1.0* XXXXXX XX, 2025 This procedure manual is developed based on insights gained through the Ministry of the Environment (MOEJ)'s technical cooperation projects for microplastics monitoring in developing countries. It outlines the procedures for conducting surveys using a net towing method with a boat in rivers where water flow is absent or insufficient for using . It consists of excerpts from relevant sections of the Guidelines for Microplastic Surveys in Rivers and Lakes by MOEJ, including Section 4.2 “Methodology: Trawling Method,” and supplementary information in the Guidelines. 本文は省略（参考資料 5 を参照してください）