

TREASURE Project

Methodological Factsheets: Litter Observations in River-Sea Interfaces

Factsheets elaborated by Flanders Marine Institute (VLIZ), CEDRE, Stichting De Noordzee, University of Oldenburg, KIMO Denmark, Lemvig Vand, Noria, University of Littoral Côte d'Opale (ULCO)

Oktober 2026.VI.0



For more information about the Interreg North
Sea TREASURE Project:
<https://www.interregnorthsea.eu/treasure>

Authors: Therese Nitschke, Gita Maas, Charlotte Dhondt, Yannik Heisel-Sure, Jasper Laschinger, Layla Bartos, Nele Albrecht, Nicoletta Lahanas, Matthieu Bompil, Guillaume Veillet, Périne Doyen, Rachid Amara, Mette Svenningsen, Isa Schipperheijn, Per Kristiansen, Parshva Mehta, Jur van Wijk, Rinze de Vries, Ryan d'Arcy Metcalfe, Camille Lacroix, and Ana Isabel Catarino

Methodological Factsheets: Litter Observations in River-Sea Interfaces

Citation: Nitschke, T., Maas, G., Dhondt, C. a. L., Heisel-Sure, Y., Laschinger, J., Bartos, L., Albrecht, N., et al. (2026) 'Methodological factsheets: Litter observations in river-sea interfaces'. Available at: <https://doi.org/10.48470/140>.

Doi: <https://dx.doi.org/10.48470/140>

Acknowledgements: We gratefully acknowledge the valuable contributions of all staff and volunteers who participated in the litter collection efforts undertaken within the framework of the Interreg North Sea TREASURE project.

Contact: treasure-project@vliz.be

Table of Contents

List of Abbreviations	4
1. Foreword	5
2. Macrolitter in the water column	7
2.1 Aquatic drone	7
2.2 Water column measurements (nets on levels)	8
2.3 Bridge-mounted camera	9
2.4 Bridge counting	10
2.5 Manual collection by kayak, canoe, or boat	11
2.6 Collection using a litter removal technique	12
2.7 Manual collection from quays	13
2.8 Wooden drifters	14
2.9 GPS/GNSS trackers	15
3. Stranded macrolitter	16
3.1 Transect sampling	16
3.2 Plastic Pirates	17
3.3 Quadrat Sampling macrolitter	18
4. Macrolitter at wastewater discharge points	19
4.1 Camera images at sewage overflow	19
4.2 Camera images at wastewater treatment plant outlet	20
5. Large micro- and mesolitter	21
5.1 Ferry Box	21
5.2 Manta Net	22
5.3 Quadrat Sampling micro- and mesolitter	23
5.4 Aquatic Drone for micro- and mesolitter sampling	24
5.5 Plastic Pirates (micro- and mesolitter)	25
5.6 Van Veen grab for sediment sampling	26
6. References	27

List of Abbreviations

GNSS	Global Navigation Satellite System
GPS	Global Positioning System
J-List	Joint List of Litter Categories for Marine Macrolitter Monitoring
NERC	Natural Environment Research Council (UK)
QC/QA	Quality Control/Quality Assurance
SOP	Standard Operating Procedure
TREASURE	Targeting the REduction of pIASitic oUtfLOW into the noRth sEa

1. Foreword

This document is a factsheets collection based on technical field observations carried out by the TREASURE Consortium in riverine and coastal areas of the North Sea region. The observations were conducted between 2023 and 2026 by partners from Belgium, Denmark, France, Germany, and the Netherlands as part of the Interreg North Sea programme. The methodological factsheets for litter observations encompass methods for detecting, collecting, or removing litter, including litter-capture systems, as well as approaches for investigating litter transport pathways, such as drifter experiments. The factsheets are modular and separated into the following thematical categories: Observations of **macrolitter in the water column**, **stranded macrolitter** (riverbanks, beach, etc.), **macrolitter at wastewater discharge points**, and **large micro- and mesolitter**. The methodologies presented in these factsheets are a non-exhaustive list of litter observation methods based on current established best-practices and guidelines, and work as a baseline for future developments and to support monitoring programs.

Macrolitter can be defined as any anthropogenic (persistent, manufactured or processed) solid waste item larger than 2.5 cm in its longest dimension that has been discarded, lost, or otherwise introduced into the natural environment (Galgani et al. 2023). Within TREASURE, we also sampled micro- (0.05 – 0.5 cm) and mesolitter (0.5 - 2.5 cm).

Macrolitter in the Water Column

The observations of macrolitter in the water column included litter detected in or removed from the water, whether floating or submerged. The following observation methods were used: Aquatic drone, Water column measurements (nets on levels), Wooden drifters, GPS/GNSS trackers, Bridge-mounted camera, Bridge counting, Manual collection by kayak, canoe, or boat, Collection using a litter removal technique and Manual collection from quays.

Stranded Macrolitter

The observations of stranded macrolitter included the manual collection of macrolitter found on land at local beaches, riverbanks or in harbours and marinas, partially using a transect or quadrat method, also supported by the EU citizen science project Plastic Pirates (Kiessling et al. 2019). The following observation methods were used: Transect sampling, Plastic Pirates, and Quadrat Sampling. Where applicable, standardized protocols, like the OSPAR Beach Litter Survey protocol, were used for the observations of stranded macrolitter.

Macrolitter at Wastewater Discharge Points

Recent studies show that sewer systems can transport macrolitter into aquatic environments through combined sewer overflows and untreated wastewater discharges (Ó Briain et al., 2020; Bach et al., 2025). Further, wastewater treatment plants can act as pathways or point sources of plastic pollution (Rasmussen et al., 2021). Based on evidence showing that sewage overflows and wastewater treatment plant outlets can act as point sources of plastic pollution, we conducted camera-based observations of macrolitter at these discharge points.

Large Micro- and Mesolitter

Since the TREASURE observations focused on riverine and coastal litter rather than marine litter, the following microlitter sampling methodologies commonly deployed from ships or vessels were adapted to be deployed from land (e.g., pontoons, wave breakers) in harbors, marinas and estuaries: Ferry Box, Manta Net, Quadrat Sampling (micro- and mesolitter), Aquatic Drone for micro- and mesolitter sampling, and Van Veen grab for sediment sampling. The observation activities were also supported by the EU Plastic Pirates citizen science project for micro-and mesolitter observations (Schönberg et al. 2024).

1. Foreword

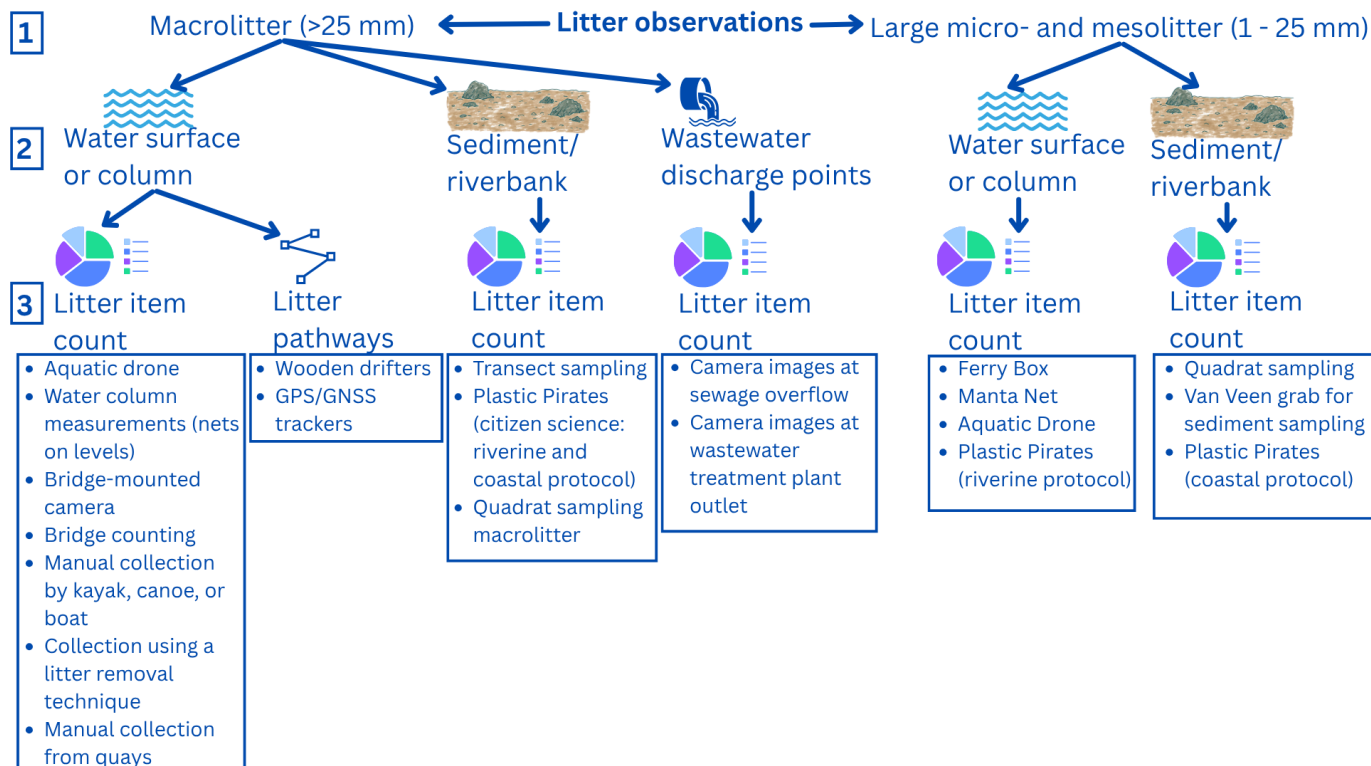


Figure 1: Classification of the litter observation methods according to (1) size classes, (2) environmental matrix (observation location), and (3) litter observation objective (e.g., litter item counts or litter pathways).

Using the Methodological Factsheets

The methodological factsheets form part of the TREASURE Decision Support Tool, developed as an output of the TREASURE project, and are available at <https://www.noria.earth/decision-support-tool-treasure/>. The factsheets are intended to support researchers and decision-makers in identifying the most suitable observation methodology for their specific plastic pollution monitoring needs. To facilitate comparison between methods, each factsheet follows a common structure and summarizes key criteria under four main categories: **Resources & Expertise**, including required equipment, personnel and expertise; **Application & Scale**, covering spatial and temporal scale, application area as well as time requirements; **Performance**, describing coverage, accuracy and known limitations; and **Output & Use**, including expected outputs, relevant references and standard operating procedures (SOPs), and experience within the TREASURE consortium, i.e. which project partners have applied the method. The factsheets are deliberately concise to provide users with a rapid overview of established, tested and, where available, standardized methodologies; more detailed methodological guidance can be found in the references and SOPs listed under “Output & Use”.

For methodologies that require subsequent classification of macrolitter, we recommend using the EU-standardized Joint List of Litter Categories for Marine Macrolitter Monitoring (Fleet et al. 2021), or alternatively the OSPAR litter classification list (OSPAR Commission 2025). Finally, to facilitate harmonized data management and reporting after observations have been conducted, users are encouraged to apply the TREASURE dataset templates for metadata and data reporting, which were developed in collaboration with related projects within the TREASURE framework. The dataset templates are available for both macrolitter and meso- and microlitter observations. In particular, the microlitter templates make use of the standardized NERC vocabularies for litter-related terminology [<https://vocab.nerc.ac.uk/collection/?filter=litter>], supporting consistent description, classification and reporting of microplastic observations across datasets and projects. The diagram above (Figure 1) categorizes litter observation methodologies according to three criteria: first, their size classes; second, their environmental matrix (observation location); and third, their litter observation objective. Some methods can be used for observations of both macrolitter, and micro- and meso-litter (Aquatic Drone, Plastic Pirates, Quadrat sampling).

2. Macrolitter in the water column

2.1 Aquatic drone



RESOURCES & EXPERTISE

Equipment

Aquatic drone, 1 cm mesh nets, flowmeter

Personnel

Low; 2 people

Expertise

Medium to high

APPLICATION & SCALE

Spatial scale

Surface and subsurface; 100–250 m² transects or 30–50 m³ filtered water

Application area

River, canal, harbor, lake, ocean (current independent)

Temporal scale

Occasional or regular sampling

Time requirements

20–30 min per 500 m transect; ~2 h laboratory analysis per transect

PERFORMANCE

Coverage and accuracy

Filtering surface water for litter abundance independent of ambient currents due to the device's motorized operation, controlled by a joystick from land or a boat, litter abundance can be expressed as items/m² or items/m³; collected plastics can be analysed in a laboratory setting

Limitations

A 50 cm-wide net samples only part of the river width; replicates are needed for representative results across river sections

OUTPUT & USE

Outputs

Quantification, categorisation, polymer identification, pathways and source assessment

References and SOPs

Pasquier et al. (2022)

Experience

ULCO (France)

2. Macrolitter in the water column

2.2 Water column measurements (nets on levels)



RESOURCES & EXPERTISE

Equipment

Nets, boat, water-column measurement device

Personnel

Low; 2-3 people for deployment, 2-3 people for litter counting

Expertise

Low-medium; small-boat operation and litter counting

PERFORMANCE

Coverage and accuracy

Captures macro-litter distribution across water-column depths

Limitations

Covers only a small section of the river/canal; extrapolation is required

APPLICATION & SCALE

Spatial scale

Samples different water depths from surface to bottom at a defined location

Application area

River, canal

Temporal scale

Momentary measurement

Time requirements

Approximately half a day per sampling set (observation time)

OUTPUT & USE

Outputs

Quantification and categorisation of litter by water depth

References and SOPs

Oswald et al. (2025); Oswald, Oldenhof, et al. (2026); Oswald, Vriend, et al. (2026)

Experience

Noria (The Netherlands)

2. Macrolitter in the water column

2.3 Bridge-mounted camera



RESOURCES & EXPERTISE

Equipment

Camera, camera mount and energy supply

Personnel

Low; mainly required for initial installation and digital image analysis

Expertise

High; hardware installation, mounting permissions and image-analysis skills, particularly for AI-based analysis

APPLICATION & SCALE

Spatial scale

Single location; covers part of the river/canal width depending on camera coverage

Application area

River, canal, harbour

Temporal scale

Potentially continuous, depending on budget

Time requirements

Low; one-time installation and potentially automated image analysis

PERFORMANCE

Coverage and accuracy

Detects floating macro-litter over part of the river width and observation period

Limitations

Limited spatial and daily coverage, but greater temporal coverage than manual bridge observations. In tidal rivers and estuaries, changing water levels can reduce visibility from fixed cameras, and tidal movements may result in repeated observations of the same litter items.

OUTPUT & USE

Outputs

Quantification of floating litter

Reference/SOP

González-Fernández et al. (2025)

Experience

Noria (the Netherlands)

2. Macrolitter in the water column

2.4 Bridge counting



RESOURCES & EXPERTISE

Equipment

Observation sheet or monitoring app

Personnel

Medium; number of volunteers depends on river width

Expertise

Low-medium; ability to identify and categorize litter

PERFORMANCE

Coverage and accuracy

Litter identification can be influenced by bridge height, water flow, observation duration and observer experience

Limitations

Distinguishing litter from natural objects may be difficult under some observation conditions

APPLICATION & SCALE

Spatial scale

Single location; proportion of river/canal width covered depends on the number of observers

Application area

River, canal, harbour

Temporal scale

Momentary observations

Time requirements

Medium; generally limited to a few hours per day due to observer attention

OUTPUT & USE

Outputs

Quantification and categorisation

References and SOPs

van Emmerik et al. (2018, 2019)

Experience

KIMO (Denmark)

2. Macrolitter in the water column

2.5 Manual collection by kayak, canoe, or boat



RESOURCES & EXPERTISE

Equipment

Boat, canoe or kayak with safety equipment, bags/bins, gloves, dip nets or grabbers and optionally a tarp

Personnel

Depends on operation size and objectives; kayak operations require a team, while boat operations require crew including a pilot

Expertise

Collection requires limited expertise; however categorization and sourcing require greater knowledge and experience. Boat operations additionally require a boating license

PERFORMANCE

Coverage and accuracy

Manual collection of trapped litter along riverbanks, vegetation and branches and partially submerged litter, hundreds of meters to a few kilometres. Collected litter can be assessed for abundance, composition and potential sources, long-term monitoring can also identify accumulation trends; good capture of accessible, trapped litter

Limitations

Sampling effort and coverage area may be difficult to assess; based on visual identification, not all litter may be observed consistently (submerged or inaccessible areas).

APPLICATION & SCALE

Spatial scale

Objective-dependent; hundreds of metres to a few kilometres in rivers, or across port areas.

Application area

River, canal, harbour, lake

Temporal scale

From one-off collection events to long-term monitoring

Time requirements

A few hours to a full day, including identification; effort increases with survey extent and frequency

OUTPUT & USE

Outputs

Quantification, categorization, and source identification, suitable for hotspot analysis and repeated monitoring (trends)

References and SOPs

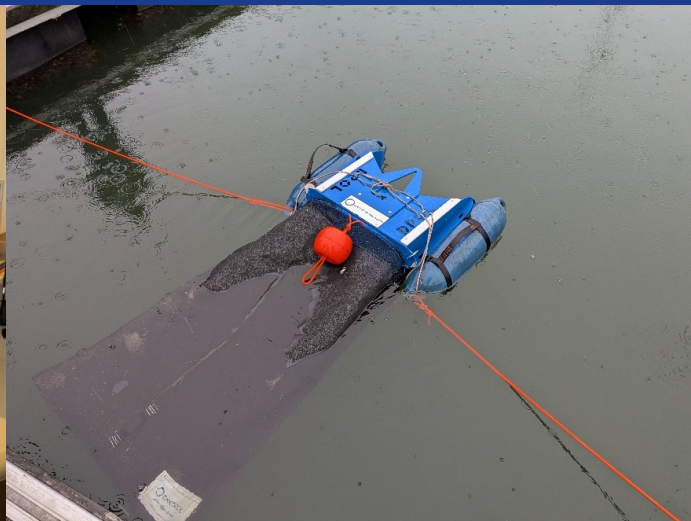
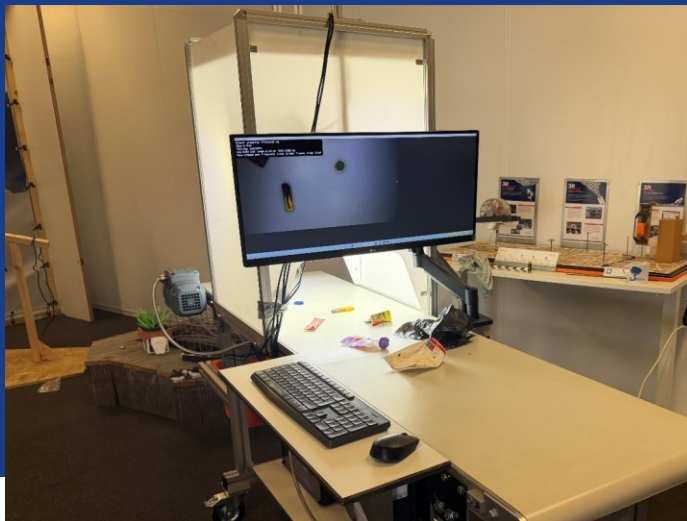
No standard operation procedure, mentioned in the literature (Bellert, Bert et al. 2016; Tasseron et al. 2020; Garcés-Ordóñez et al. 2026)

Experience

Cedre (France), KIMO (Denmark), VLIZ (Belgium)

2. Macrolitter in the water column

2.6 Collection using a litter removal technique



RESOURCES & EXPERTISE

Equipment

Removal system

Personnel

Low; around 2 persons (trained volunteers or waste collectors)

Expertise

Knowledge of how the removal system operates is required for litter collection; expertise is low for manual counting and low to medium for automated conveyor-belt analysis.

PERFORMANCE

Coverage and accuracy

Floating litter collected by the removal system; collected litter can be further analysed

Limitations

Dependent on the removal technique's efficiency for litter collection, and whether the removal technique can cover the whole river width

APPLICATION & SCALE

Spatial scale

Depends on the coverage of the removal system

Application area

River, canal, harbour

Temporal scale

Potentially continuous during system operation, but budget-dependent

Time requirements

Variable; litter drying may take several days, organic material separation about 1 day, and conveyor-belt analysis around 1–2 h per batch

OUTPUT & USE

Outputs

Quantification, categorisation and source assessment

References and SOPs

Helinski, Poor and Wolfand (2021); Maglič et al. (2022); Leone et al. (2023); Leone (2025); Papparotto et al. (2025); Cedre (2026; in preparation)

Experience

Cedre (France) and Noria (The Netherlands)

2. Macrolitter in the water column

2.7 Manual collection from quays



RESOURCES & EXPERTISE

Equipment

Dip nets, safety equipment and bags/bins

Personnel

Variable; depends on port size and available human and financial resources

Expertise

Low-medium; macro-litter identification may be needed for composition or source assessment

PERFORMANCE

Coverage and accuracy

Collected litter can be assessed for composition and potential sources

Limitations

Limited to floating litter accessible from quays

APPLICATION & SCALE

Spatial scale

A couple of meters to a few kilometers (depending on accessibility)

Application area

Harbour or marina

Temporal scale

From one-off collection events to long-term monitoring

Time requirements

Variable; one-off operations typically last several hours to one day, including litter identification

OUTPUT & USE

Outputs

Categorisation and source assessment

References and SOPs

No standard operation procedure.

Experience

CEDRE (France)

2. Macrolitter in the water column

2.8 Wooden drifters



RESOURCES & EXPERTISE

Equipment

Branded wooden drifters with ID/QR code, transport for release, Web GIS/website and communication campaign

Personnel

Low personnel requirements, as a single person can deploy many wooden drifters. However, deployments are often conducted with groups of volunteers to facilitate larger-scale releases and promote public engagement.

Expertise

Low for deployment; high for GIS/spatial data analysis

PERFORMANCE

Coverage and accuracy

Around 30% of released drifters are found/reported

Limitations

Results depend on citizen reporting accuracy; false entries require validation. Larger numbers of drifters improve robustness. Over time, the text and QR code on the drifters may become faded, damaged, or otherwise more difficult to read. Drifters can also become caught in vegetation or stranded on riverbanks.

APPLICATION & SCALE

Spatial scale

Potentially unrestricted travel distance; recovery/reporting by citizens

Application area

River, canal, harbour, ocean

Temporal scale

Days to years; wood may persist for up to ~5 years

Time requirements

Low-medium; preparation and analysis require most effort

OUTPUT & USE

Outputs

Pathways, transport speed, accumulation zones and remobilisation

References and SOPs

Meyerjürgens et al. (2023)

Experience

Lemvig Vand & KIMO (Denmark), University of Oldenburg (Germany)

2. Macrolitter in the water column

2.9 GPS/GNSS trackers



RESOURCES & EXPERTISE

Equipment

GPS tracking equipment, floating containers, boat/kayak retrieval and retrieval software

Personnel

Medium; deployment is accessible but retrieval can be resource demanding

Expertise

Low for deployment/retrieval; medium–high for data retrieval, cleaning and visualisation

APPLICATION & SCALE

Spatial scale

Typically 1–10 km travel distance

Application area

River, canal, harbour, ocean

Temporal scale

Few weeks to few months

Time requirements

Medium; retrieval may take several hours, and analysis effort depends on automation

PERFORMANCE

Coverage and accuracy

Provides direct coordinate data and can give a good estimate of litter transport trajectories when several trackers are deployed

Limitations

Tracker loss and poor data transmission are possible; performance depends on the GPS sensor

OUTPUT & USE

Outputs

Pathways, transport speed, accumulation zones, remobilisation and effects of hydrological conditions

References and SOPs

Tramoy et al. (2020)

Experience

ULCO (France), VLIZ (Belgium), Noria (The Netherlands)

3. Stranded macrolitter

3.1 Transect sampling



RESOURCES & EXPERTISE

Equipment

Measuring and marking equipment, collection bags or containers, gloves, field documentation or classification tools/apps

Personnel

Programme- and area-dependent; requirements may range from a minimum of two people (for safety reasons) to an extensive volunteer network

Expertise

Low for collection to moderate/high for classification and source identification; litter classification (e.g. J-List, OSPAR) requires training

APPLICATION & SCALE

Spatial scale

Adapted to local conditions, transect length 30–100 m, hotspot sampling may use smaller defined areas

Application area

Riverbank, beach, harbour or marina (specifically slipways)

Temporal scale

Twice-yearly to year-round/seasonal observations with (3–4 per year)

Time requirements

20–30 min per 20 m² at hotspots or ca. 2–3 h per 100 m transect; subsequent sorting and classification can require more time than collection

PERFORMANCE

Coverage and accuracy

Captures visible surface litter >2.5 cm with high accuracy when sampling areas and external influences such as clean-ups are well controlled

Limitations

Human classification errors, uncertain litter origin and substantial time requirements

OUTPUT & USE

Outputs

Quantification, categorization, and source identification; suitable for spatial comparisons and repeated monitoring when the same sampling area and method are maintained

References and SOPs

OSPAR protocol (OSPAR Commission 2025), VLIZ internal protocol (pending)

Experience

ULCO (France), VLIZ (Belgium), University of Oldenburg (Germany), Stichting De Noordzee (The Netherlands), KIMO (Denmark), CEDRE (France)

3. Stranded macrolitter

3.2 Plastic Pirates



RESOURCES & EXPERTISE

Equipment:

Sampling: project booklet, buckets, gloves, camera/smartphone, measuring tape; data processing: platform for uploading and hosting the data

Personnel:

Group of students and teachers, experts for project and data management and data analysis

Expertise:

No specific expertise needed for sampling; expertise needed to validate/verify the data and for data management (QC/QA, harmonization, standardization)

APPLICATION & SCALE

Spatial scale

Small local sites (100 m–few hundred meters), but large overall coverage (Europe-wide); sampling sites need to be accessible for students

Application area

Riverbanks or coastal areas and beaches

Temporal scale

According to the protocols sampling should take place during two seasons per year; It is aimed to have sufficient samplings in a certain region over time

Time requirements

Half a day to one day for sampling and processing the results by the students and teachers but validating and verifying the data by an expert can be time consuming.

PERFORMANCE

Coverage and accuracy

Large-scale citizen science approach that enables wide spatial coverage, suitable for hotspot detection; lower accuracy since the litter categories used in Plastic Pirates are less detailed as the OSPAR or Joint List categories

Limitations

Partial collection (transect-based): only the items along the transect and in the defined circles are being collected; requires expert validation (QC/QA)

OUTPUT & USE

Outputs

Quantification and categorization, hotspot identification

References and SOPs

Plastic Pirates standardized riverine and coastal protocols (DLR 2024)

Experience

VLIZ (Belgium), Nausicaa (France), Lemvig Vand (Denmark)

3. Stranded macrolitter

3.3 Quadrat sampling



RESOURCES & EXPERTISE

Equipment

Bags, gloves, measuring tape, sticks or quadrat frame (for example 50 cm by 50 cm) to mark the area

Personnel

Low (1 person sufficient)

Expertise

No specific expertise needed

APPLICATION & SCALE

Spatial scale

Variable and depending on the defined quadrats (e.g. 25 cm², 50 cm² or 1 m²)

Application area

Riverbank, beach, harbour or marina (specifically slipways)

Temporal scale

Occasional for a short overview of plastic pollution in a given area or regular (e.g. monthly observations) to follow trends and to gain insights into present types of litter

Time requirements

Low (~20 minutes to 1 hour per quadrat)

PERFORMANCE

Coverage and accuracy

Full collection of defined quadrat area, standardised and comparable results, high accuracy (100%),

Limitations

Very small spatial coverage, effort increases with repeated sampling

OUTPUT & USE

Outputs

Quantification, categorization (J-List, OSPAR), polymer identification, suitable for detailed local assessments and observations

References and SOPs

Standard Operating Procedure (SOP) for micro-and mesolitter (Miranda, Bossaer, et al. 2026); Catarino et al. (2021), Frias et al. (2018)

Experience

ULCO (France), VLIZ (Belgium)

4. Macrolitter at wastewater discharge points

4.1 Camera images at sewage overflow



RESOURCES & EXPERTISE

Equipment

Camera, camera mount, energy supply, lamps, infrared light options

Personnel

Low, required for installation and image analysis

Expertise

High; hardware knowledge and knowledge on image analysis needed (if analysis by AI)

PERFORMANCE

Coverage & accuracy

Camera-based continuous observations of floating macrolitter, uncertain accuracy (few insights available so far)

Limitations

Only floating macro litter, limited spatial coverage

APPLICATION & SCALE

Spatial scale

Fixed point (overflow location), only partial observation of river width

Application area

Sewage overflow

Temporal scale

Continuous (budget-dependent)

Time requirements

Low (one-time setup and automated digital image analysis)

OUTPUT & USE

Outputs

Detection, quantification of floating litter, suitable for event-based observations (e.g. overflow events)

Reference/SOPs

van Lieshout et al. (2020); Jia et al. (2024)

Experience

Lemvig Vand (Denmark)

4. Macrolitter at wastewater discharge points

4.2 Camera images at wastewater treatment plant outlet



RESOURCES & EXPERTISE

Equipment

Camera, camera mount, energy supply, lamps, infrared light options

Personnel

Low, required for installation and image analysis

Expertise

High; hardware knowledge and knowledge on image analysis needed (if analysis by AI)

APPLICATION & SCALE

Spatial scale

Fixed point (overflow location), only partial observation of river width

Application area

Wastewater treatment plant outlet

Temporal scale

Continuous (budget-dependent)

Time requirements

Low (one-time setup and automated digital image analysis)

PERFORMANCE

Coverage & accuracy

Camera-based continuous observations of floating macrolitter, uncertain accuracy (few insights available so far)

Limitations

Only floating macro litter, limited spatial coverage

OUTPUT & USE

Outputs

Detection, quantification of floating litter, suitable for event-based observations (e.g. overflow events)

Reference/SOPs

van Lieshout et al. (2020); Jia et al. (2024)

Experience

Lemvig Vand (Denmark)

5. Large micro- and mesolitter

Nitschke, T., Maas, G., Dhondt, C. a. L., Heisel-Sure, Y., Laschinger, J., Bartos, L., Albrecht, N., et al. (2026) 'Methodological factsheets: Litter observations in river-sea interfaces'. Available at: <https://doi.org/10.48470/140>.

5.1 Ferry Box



RESOURCES & EXPERTISE

Equipment

Ferrybox, stainless steel sieve set (sieves of three different size fractions), hose connectors (3/4" or 19 mm), hoses inlet and outlet tubing (19x24 mm), water pump, water pump floating cage (optional), generator or electricity connection, rope(s) (with sampling depth marked), small stainless-steel funnel, wash bottle I L, (MilliQ) ultrapure water, pre-rinsed glass bottles and caps, including for blanks, aluminum foil, paper/towel, large tweezers (optional), boxes to transport materials and the sample bottles, vessel with water inlet (if not sampled from a pontoon)

Personnel

Low (1–2 people)

Expertise

Medium (internal training recommended)

APPLICATION & SCALE

Spatial scale

Spot sampling (350 L water filtered in 15 minutes with a flow rate of 21.7–22.6 L/min) or continuous sampling on vessel

Application area

River, canal, harbor, lake, ocean; using the ship inlet or a submersive pump

Temporal scale

Momentary, seasonal measurements and replicates recommended

Time requirements

Low sampling time: recommendation 15 minutes per replicate depending on the flow rate, tidal cycle sampling recommended in areas with tidal influence (ports/estuaries); Laboratory processing and analysis is time consuming

PERFORMANCE

Coverage and accuracy

High sampling efficiency, suitable for controlled, repeatable measurements, sample processing enables subsequent polymer identification (Raman-spectroscopy, micro-FTIR or ATR-FTIR), medium accuracy (the higher the less microlitter contamination, i.e., atmospheric microplastics, microfibers of synthetic clothing)

Limitations

Limited representativeness, not representative of the complete river cross-section or water column

OUTPUT & USE

Outputs

Quantification of plastic particles within a given water volume (items/m³ or items/L), subsequent polymer identification (potential source or origin insights derived from this)

References and SOPs

ANDROMEDA and INSPIRE SOPs (De Witte et al. 2024; Miranda, Meyers, et al. 2026)

Experience

VLIZ (Belgium)

5. Large micro- and mesolitter

5.2 Manta Net



RESOURCES & EXPERTISE

Equipment

Manta net frame, Manta net and soft bucket (spare sets), pre-rinsed glass bottles containing 500mL MilliQ water and bottle caps, including for blanks, aluminum foil, large stainless-steel funnel, wash bottle 1L, stainless-steel bucket, ropes, MilliQ water, Zip bags, large tweezers, paper towel, vessel with a crane (when not operating from a pontoon)

Personnel

Low, 1-2 persons, more people necessary when operating from a vessel

Expertise

Medium (internal training recommended)

APPLICATION & SCALE

Spatial scale

Momentary, seasonal measurements and replicates recommended

Application area

River, canal, harbor, ocean (currents necessary)

Temporal scale

Momentary (seasonal sampling with replicates recommended)

Time requirements

Low sampling time: recommendation 15 minutes per replicate depending on the flow rate, tidal cycle sampling recommended in areas with tidal influence (ports/estuaries); Laboratory processing and analysis is time consuming

PERFORMANCE

Coverage and accuracy

Widely used and standardized method, sampling of surface water, high sampling efficiency, sample processing enables subsequent polymer identification (Raman-spectroscopy, micro-FTIR or ATR-FTIR), medium accuracy (the higher the less microlitter contamination, i.e., atmospheric microplastics, microfibers of synthetic clothing)

Limitations

Not representative of the complete river cross-section or water column

OUTPUT & USE

Outputs

Quantification of plastic particles within a given water volume (items/m³ or items/L), subsequent polymer identification (potential source or origin insights derived from this)

References and SOPs

Bouwens et al. (2021)

Experience

VLIZ (Belgium)

5. Large micro- and mesolitter

5.3 Quadrat sampling micro- and mesolitter



RESOURCES & EXPERTISE

Equipment

Quadrat (wooden frame of chosen size, i.e., 50 cm by 50 cm, 20 by 20 cm etc.), tweezers, sampling container, measuring tape

Personnel

Low (1–2 persons)

Expertise

No specific expertise needed

PERFORMANCE

Coverage and accuracy

Full collection within the quadrat, suitable for detecting small particles and monitoring plastic pellets/nurdles loss, good for monitoring trends, high accuracy

Limitations

Very limited spatial representativeness

Time-intensive processing (e.g., ATR-FTIR analysis)

APPLICATION & SCALE

Spatial scale

Variable, small area, limited to the defined quadrat (e.g. 25 cm², 50 cm² or 1 m²)

Application area

Riverbank, beach, harbour or marina (specifically slipways)

Temporal scale

Occasional for short overview of plastic pollution in a given area or regular (e.g. monthly observations) to follow trends and to gain insights into present types of litter

Time requirements

Low (~20 minutes to one hour per quadrat), sampling in the field can take longer if pellets and nurdles are present, sample processing and polymer identification (ATR-FTIR) in the laboratory are time consuming

OUTPUT & USE

Outputs:

Quantification (extrapolate to larger areas), polymer identification (potential source or origin insights derived from this)

References and SOPs:

SOP from the INSPIRE project (Miranda, Bossaer, et al. 2026); Catarino et al. (2021), Frias et al. (2018)

Experience:

ULCO (France), VLIZ (Belgium)

5. Large micro- and mesolitter

5.4 Aquatic Drone for micro- and mesolitter sampling



RESOURCES & EXPERTISE

Equipment

Aquatic drone, nets (300 µm or 150 µm mesh size), flowmeter, wash bottle 1L, MilliQ water, Zip bags, pre-rinsed glass bottles, including for blanks, aluminium foil and bottle lids, paper towel, large tweezers, boxes to transport materials and the sample bottles

Personnel

Low; 2 persons

Expertise

Medium to high

PERFORMANCE

Coverage and accuracy

Filtering surface water for microplastics independent of ambient currents due to the device's motorized operation, controlled by a joystick from land or a boat; plastic particle abundance can be expressed as items/m² or items/m³; collected plastics can be analysed

Limitations

The 50 cm-wide net opening samples only part of the river width; replicates are needed for representative results

APPLICATION & SCALE

Spatial scale

Surface and subsurface sampling; 100–250 m² transects or 30–50 m³ filtered water

Application area

River, canal, harbor, lake, ocean (current independent)

Temporal scale

Occasional or regular sampling

Time requirements

20–30 min per 500 m transect (30 m³ filtered water);
~2 h laboratory analysis per transect

OUTPUT & USE

Outputs

Quantification, polymer identification using Raman-spectroscopy, micro-FTIR or ATR-FTIR (potential source or origin insights derived from this), litter pathways and source identification

References and SOPs

Published method available (Pasquier et al. 2022)

Experience

ULCO (France)

5. Large micro- and mesolitter

5.5 Plastic Pirates (micro- and mesolitter)



RESOURCES & EXPERTISE

Equipment

Riverine protocol: Small manta net (mesh size 1 mm), string/rope to cast the net, stopwatch/ smartphone, measuring tape or string (20 m length), three sticks of similar size (may be found at the sampling site), dissecting microscope or magnifying glass, sealable bag to send off the sample; sieve and bucket; **Coastal protocol:** Sampling sieve with mesh width 1 mm, seawater filtering sieve with mesh width 100 – 300 microns, bucket for filtered sea water, measuring tape, small spade or tub to dig out the sand

Personnel

Medium; group of students and teachers, experts for project and data management and data analysis

Expertise

No specific expertise needed for sampling, but teacher training is necessary; expertise needed to validate/verify the data and for data management (QC/QA, harmonization, standardization)

APPLICATION & SCALE

Spatial scale

Limited to filtered water volume (depending on net opening and water flow), the more schools participate the bigger the spatial scale

Application area

Riverbanks or coastal areas and beaches

Temporal scale

One-off sampling (can be repeated); according to the protocols sampling should take place during two seasons per year; it is aimed to have sufficient samplings in a certain region over time.

Time requirements

Relatively low for sampling (1.5 h) but sample processing requires time and efforts, net needs drying in the school, participants need to check for microplastics and send the sample off to a scientific institution, subsequent ATR-FTIR analysis in the laboratory

PERFORMANCE

Coverage and accuracy

Large-scale citizen science approach that enables wide spatial coverage, suitable for hotspot detection

Limitations

Laboratory expert validation required, limited representativeness of the complete water body or beach area

OUTPUT & USE

Outputs

Quantification and categorization, hotspot detection, public integration, environmental education and literacy, awareness, prevention and behavior change

References and SOPs

Plastic Pirates standardized riverine and coastal protocols (DLR 2024)

Experience

VLIZ (Belgium), Nausicaa (France), Lemvig Vand (Denmark)

5. Large micro- and mesolitter

5.6 Van Veen grab for sediment sampling



RESOURCES & EXPERTISE

Equipment

Van Veen grab, vessel with crane or sampling from pontoon, ropes, stainless steel tray, stainless steel sampling containers

Personnel

Low (2-3 persons), ship crew required when sampling from (research) vessel

Expertise

No specific expertise needed for sampling, sample processing requires training and a well-equipped laboratory

APPLICATION & SCALE

Spatial scale

Spot sampling

Application area

River, canal, harbor, lake, ocean

Temporal scale

Momentary, seasonal measurements and replicates recommended

Time requirements

Low for sampling (5-10 min per sample), more time consuming: laboratory processing and analysis

PERFORMANCE

Coverage and accuracy

Commonly used and standardized method, sampling of submerged sediments, high sampling efficiency, sample processing enables subsequent polymer identification (Raman-spectroscopy, micro-FTIR or ATR-FTIR), medium accuracy (the higher the less microlitter contamination, i.e., atmospheric contamination, microfibers of synthetic clothing)

Limitations

Limited representativeness of the surrounding sediments

OUTPUT & USE

Outputs

Quantification of plastic particles within a given sediment sample weight (particles/mg or particles/g), subsequent polymer identification (potential source or origin insights can be derived from this)

References and SOPs

Bouwens et al. 2021, p. 17; De Witte et al. 2024, p. 46

Applied by

VLIZ (Belgium)

6. References

- Bach, Lis, Jakob Strand, Hadi Salame, Márta Simon, Janne Fritt-Rasmussen, and Pernille Erland Jensen. 2025. 'Wet Wipes in Untreated Wastewater Are a Source of Litter Pollution to the Arctic Marine Environment – a Case Study on the Loads of Litter and Microplastics in Wastewater Effluents in Greenland'. *Environmental Science: Advances* 4 (2): 223–34. <https://doi.org/10.1039/d4va00233d>.
- Bellert, Bert, González, Daniel, Hanke, Georg, Hohenblum, Philipp, Holzhauer, Marloes, Oosterbaan, Lex, Palatinus, Andreja, et al. (2016) Riverine litter monitoring: options and recommendations : MSFD GES TG marine litter thematic report. Publications Office of the European Union. Available at: <https://data.europa.eu/doi/10.2788/461233> (Accessed: 29 September 2026).
- Bouwens, Jan, Jana Asselman, Maaïke Vercauteren, Ana Catarino, and Gert Everaert. 2021. PLUXIN: Optimized Sampling and Sample Processing Protocol (for Microplastic). <https://doi.org/10.48470/12>.
- Catarino, A.I., Mahu, E., Severin, M.I., Annasawmy, P.A., Beckman, F., Monteiro, I., Neves Silva, P., et al. (2021) 'Citizen observation of local litter in coastal ecosystems: Standard operating procedure'. Available at: <https://marineinfo.org/doc/publication/359856> (Accessed: 29 September 2026).
- De Witte, Bavo, Orla-Peach Power, Eimear Fitzgerald, et al. 2024. ANDROMEDA Portfolio of Microplastics Analyses Protocols. <https://doi.org/10.13140/RG.2.2.21010.06088>.
- DLR. 2024. 'Download Materials | Plastic Pirates'. Deutsches Zentrum für Luft- und Raumfahrt e. V. (DLR). <https://www.plastic-pirates.eu/en/material/download>.
- Emmerik, Tim van, Thuy-Chung Kieu-Le, Michelle Loozen, et al. 2018. 'A Methodology to Characterize Riverine Macroplastic Emission Into the Ocean'. *Frontiers in Marine Science* 5. <https://www.frontiersin.org/articles/10.3389/fmars.2018.00372>.
- Emmerik, Tim van, Emilie Strady, Thuy-Chung Kieu-Le, Luan Nguyen, and Nicolas Gratiot. 2019. 'Seasonality of Riverine Macroplastic Transport'. *Scientific Reports* 9 (1): 13549. <https://doi.org/10.1038/s41598-019-50096-1>.
- Fleet, David, Thomais Vlachogianni, and Georg Hanke. 2021. Joint List of Litter Categories for Marine Macro-Litter Monitoring: Manual for the Application of the Classification System. Publications Office. <https://data.europa.eu/doi/10.2760/127473>.
- Frias, J., Pagter, E., Nash, R., O'Connor, I., Carretero, O., Filgueiras, A., Viñas, L., et al. (2018) Standardised protocol for monitoring microplastics in sediments. Available at: <https://doi.org/10.13140/RG.2.2.36256.89601/1>.
- Galgani, Francois, OREJON SANCHEZ PASTOR Luis Ruiz, Francesca Ronchi, et al. 2023. 'Guidance on the Monitoring of Marine Litter in European Seas'. JRC Publications Repository. <https://doi.org/10.2760/59137>.
- Helinski, O.K., Poor, C.J. and Wolfand, J.M. (2021) 'Ridding our rivers of plastic: A framework for plastic pollution capture device selection', *Marine Pollution Bulletin*, 165, p. 112095. Available at: <https://doi.org/10.1016/j.marpolbul.2021.112095>.
- Jia, T., de Vries, R., Kapelan, Z., van Emmerik, T.H.M. and Taormina, R. (2024) 'Detecting floating litter in freshwater bodies with semi-supervised deep learning', *Water Research*, 266, p. 122405. Available at: <https://doi.org/10.1016/j.watres.2024.122405>.

6. References

Kiessling, Tim, Katrin Knickmeier, Katrin Kruse, Dennis Brennecke, Alice Nauendorf, and Martin Thiel. 2019. 'Plastic Pirates Sample Litter at Rivers in Germany – Riverside Litter and Litter Sources Estimated by Schoolchildren'. *Environmental Pollution* 245 (February): 545–57.
<https://doi.org/10.1016/j.envpol.2018.11.025>.

Leone, G. (2025) Decision support framework for plastic clean-up technologies in rivers and estuaries: Minimizing unintentional bycatch while maintaining efficient plastic removal under realistic environmental conditions. VLIZ PhD Theses. Ghent University, Faculty of Bioscience Engineering. Available at: <https://doi.org/10.48470/120>.

Leone, G., Moulaert, I., Devriese, L.I., Sandra, M., Pauwels, I., Goethals, P.L.M., Everaert, G., et al. (2023) 'A comprehensive assessment of plastic remediation technologies', *Environment International*, 173, p. 107854. Available at: <https://doi.org/10.1016/j.envint.2023.107854>.

van Lieshout, C., van Oeveren, K., van Emmerik, T. and Postma, E. (2020) 'Automated River Plastic Monitoring Using Deep Learning and Cameras', *Earth and Space Science*, 7(8), p. e2019EA000960. Available at: <https://doi.org/10.1029/2019EA000960>.

Maglič, Livia, Maglič, Lovro, Grbčić, A. and Gulić, M. (2022) 'Composition of Floating Marine Litter in Port Areas of the Island of Mallorca', *Journal of Marine Science and Engineering*, 10(8), p. 1079. Available at: <https://doi.org/10.3390/jmse10081079>.

Meyerjürgens, Jens, Marcel Ricker, Christian Aden, et al. 2023. 'Sources, Pathways, and Abatement Strategies of Macroplastic Pollution: An Interdisciplinary Approach for the Southern North Sea'. *Frontiers in Marine Science* 10 (April). <https://doi.org/10.3389/fmars.2023.1148714>.

Miranda, M. N., M. Bossaer, G. Everaert, and A. Catarino. 2026. 'Standard Operating Procedure (SOP): Riverbank quadrat sampling protocol for large micro- and mesolitter'. <https://marineinfo.org/doc/publication/440418>.

Miranda, M. N., N. Meyers, J. Grandjean, et al. 2026. 'Standard Operating Procedure (SOP): FerryBox sampling of microlitter in water from a pontoon or other platform'. <https://marineinfo.org/doc/publication/440417>.

Ó Briain, Oisín, Ana R. Marques Mendes, Stephen McCarron, Mark G. Healy, and Liam Morrison. 2020. 'The Role of Wet Wipes and Sanitary Towels as a Source of White Microplastic Fibres in the Marine Environment'. *Water Research* 182 (September): 116021. <https://doi.org/10.13025/18539>.

OSPAR Commission. 2010. Guideline for Monitoring Marine Litter on the Beaches in the OSPAR Maritime Area. <https://www.ospar.org/about/publications>.

OSPAR Commission. 2025. Appendix 1: OSPAR Beach Litter Survey List (Version 2025.01), Relation with J-Codes, Categories to Be Assessed in Beach Litter Assessments and Links with Existing Measures. OSPAR Commission. <https://www.ospar.org/documents?v=44122>.

Oswald, S.B., Oldenhof, E.S., Ragas, A.M.J., Schoor, M.M. and Collas, F.P.L. (2026) 'A Comprehensive Methodology for Estimating Yearly Plastic Pollution Loads in Rivers', *Water, Air, & Soil Pollution*, 237(20), p. 1154. Available at: <https://doi.org/10.1007/s11270-026-09816-3>.

Oswald, S.B., Ragas, A.M.J., Schoor, M.M. and Collas, F.P.L. (2025) 'Plastic transport in rivers: Bridging the gap between surface and water column', *Water Research*, 269, p. 122768. Available at: <https://doi.org/10.1016/j.watres.2024.122768>.

6. References

Oswald, S.B., Vriend, P., Ragas, A.M.J., Schoor, M.M. and Collas, F.P.L. (2026) 'Evaluation of riverine macro- and mesoplastic monitoring approaches', *Environmental Monitoring and Assessment*, 198(2), p. 134. Available at: <https://doi.org/10.1007/s10661-025-14889-4>.

Papparotto, M., Gavazza, C., Matteotti, P. and Fambri, L. (2025) 'Seasonal Comparative Monitoring of Plastic and Microplastic Pollution in Lake Garda (Italy) Using Seabin During Summer–Autumn 2024', *Microplastics*, 4(3), p. 44. Available at: <https://doi.org/10.3390/microplastics4030044>.

Pasquier, Gabriel, Périne Doyen, Nicolas Carlesi, and Rachid Amara. 2022. 'An Innovative Approach for Microplastic Sampling in All Surface Water Bodies Using an Aquatic Drone'. *Heliyon* 8 (11): e11662. <https://doi.org/10.1016/j.heliyon.2022.e11662>.

Rasmussen, Lasse Abraham, Lucian Iordachescu, Susanne Tumlin, and Jes Vollertsen. 2021. 'A Complete Mass Balance for Plastics in a Wastewater Treatment Plant - Macroplastics Contributes More than Microplastics'. *Water Research* 201 (August): 117307. <https://doi.org/10.1016/j.watres.2021.117307>.

Schönberg, Janto, Sinja Dittmann, Tim Kiessling, et al. 2024. Can We Investigate Microplastic Pollution with School Students? Experiences from Eight Years of Citizen Science Research. September 30. <https://doi.org/10.5281/zenodo.13860025>.

Tramoy, R., J. Gasperi, L. Colasse, et al. 2020. 'Transfer Dynamics of Macroplastics in Estuaries – New Insights from the Seine Estuary: Part 2. Short-Term Dynamics Based on GPS-Trackers'. *Marine Pollution Bulletin* 160 (November): 111566. <https://doi.org/10.1016/j.marpolbul.2020.111566>.