

Reporting Summary

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Statistics

For all statistical analyses, confirm that the following items are present in the figure legend, table legend, main text, or Methods section.

n/a Confirmed

- | | | |
|-------------------------------------|-------------------------------------|--|
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | The exact sample size (n) for each experimental group/condition, given as a discrete number and unit of measurement |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | A statement on whether measurements were taken from distinct samples or whether the same sample was measured repeatedly |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | The statistical test(s) used AND whether they are one- or two-sided
<i>Only common tests should be described solely by name; describe more complex techniques in the Methods section.</i> |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | A description of all covariates tested |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | A description of any assumptions or corrections, such as tests of normality and adjustment for multiple comparisons |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | A full description of the statistical parameters including central tendency (e.g. means) or other basic estimates (e.g. regression coefficient) AND variation (e.g. standard deviation) or associated estimates of uncertainty (e.g. confidence intervals) |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> | For null hypothesis testing, the test statistic (e.g. F , t , r) with confidence intervals, effect sizes, degrees of freedom and P value noted
<i>Give P values as exact values whenever suitable.</i> |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | For Bayesian analysis, information on the choice of priors and Markov chain Monte Carlo settings |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | For hierarchical and complex designs, identification of the appropriate level for tests and full reporting of outcomes |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | Estimates of effect sizes (e.g. Cohen's d , Pearson's r), indicating how they were calculated |

Our web collection on [statistics for biologists](#) contains articles on many of the points above.

Software and code

Policy information about [availability of computer code](#)

Data collection

SQL Server 2014 Management Studio, QGIS 3.4 and Microsoft Excel 2010 were used to obtain and organize the data.

Field data was collected and reported using a non-published mobile computer application, the JRC Floating Litter Monitoring app, developed by the Joint Research Centre of the European Commission. This app is currently being updated to produce a public version. The software version we used to collect the field data included in this manuscript is not available since the end of the RIMMEL project in 2017. The corresponding author can provide access to this non-published version of the software via a personal Dropbox link.

Data analysis

This study was conducted using basic packages of QGIS 3.4, Microsoft Excel 2010 and R 3.6.1.

For manuscripts utilizing custom algorithms or software that are central to the research but not yet described in published literature, software must be made available to editors and reviewers. We strongly encourage code deposition in a community repository (e.g. GitHub). See the Nature Research [guidelines for submitting code & software](#) for further information.

Data

Policy information about [availability of data](#)

All manuscripts must include a [data availability statement](#). This statement should provide the following information, where applicable:

- Accession codes, unique identifiers, or web links for publicly available datasets
- A list of figures that have associated raw data
- A description of any restrictions on data availability

The data that support the findings of this study are available at <https://marinelitterlab.eu/> and from the corresponding author upon request. Datasets include a GIS shapefile for the estimates of 'annual Floating Macro-litter Loading' (FML) obtained in the modelling output.

Field-specific reporting

Please select the one below that is the best fit for your research. If you are not sure, read the appropriate sections before making your selection.

Life sciences Behavioural & social sciences Ecological, evolutionary & environmental sciences

For a reference copy of the document with all sections, see [nature.com/documents/nr-reporting-summary-flat.pdf](https://www.nature.com/documents/nr-reporting-summary-flat.pdf)

Ecological, evolutionary & environmental sciences study design

All studies must disclose on these points even when the disclosure is negative.

Study description	In this study we present the most comprehensive results on floating macro-litter input from rivers to the marine environment across Europe. We analyze litter flux data to determine variability within rivers and to develop a regression model that allows up-scaling Floating macro litter annual loading for all rivers at European scale. Data was collected using a harmonized monitoring approach facilitating reproducibility and comparison at large spatial scale. Our results set a baseline for future research and monitoring under regulatory frameworks on plastic pollution.
Research sample	The RIMMEL database compiled 817 monitoring sessions in 53 rivers across 15 European and Eurasian countries, comprising a total of 471 hours of visual observation.
Sampling strategy	A harmonized approach was used for data collection. The method consisted of stationary-point visual observations on surface riverine waters by using a mobile computer application to collect data for quantification of floating litter fluxes. The monitoring network was built on a collaborative action including Scientific Institutes, Authorities, SMEs and NGOs, which collected data according to their availability of resources.
Data collection	The data collection was managed by the co-authors. The observers used the mobile computer application 'JRC Floating Litter Monitoring app' for a harmonized data collection and reporting.
Timing and spatial scale	Data collection started in September 2016 and finished in September 2017. Observers were asked to perform weekly or fortnightly observations, delivering an individual dataset for each monitoring session. However, there were institutions that could not perform their regular monitoring for RIMMEL as planned, resulting in several rivers covered by only few monitoring sessions. Spatial coverage in 15 EU and non-EU countries across the four European seas: Baltic Sea, Black Sea, Mediterranean Sea and North-East Atlantic Ocean (including the North Sea).
Data exclusions	Some rivers from the RIMMEL database were excluded prior to analysis because the monitoring set up did not fit the scope of quantifying litter flux input to the sea. To estimate litter flux, we selected 42 rivers, accounting for 710 monitoring sessions and 410 hours of observation. Further, only rivers with six or more valid monitoring sessions throughout the year were included in the regression model, resulting in 38 rivers with a total of 698 monitoring sessions and 398 hours of observation. Selected rivers and monitoring sessions are available in Supplementary Data 2. The spatial distribution of observation sites and river basins in the European Regional Seas are shown in Supplementary Fig. 1.
Reproducibility	The use of a harmonized approach for data collection and reporting allows performing a repetitive monitoring procedure to obtain field data for calculation of litter flux and annual loading based on mean and median values per river. The reproducibility of the analysis depend on the variability of litter quantities found during the actual monitoring sessions in the rivers and the amount of datasets collected per river to calculate litter flux mean and median values. Our litter flux analysis and regression model allow comparing future monitoring results for reproducibility and trend analysis purposes.
Randomization	Our study was based on available field data (riverine floating macro litter flux) collected by a monitoring network (a collaborative action) in rivers at European scale. The classification of litter items used a list of floating macro-litter items as agreed for the MSFD implementation in the 'Guidance on Monitoring of Marine Litter in the European Seas'. (MSFD stands for Marine Strategy Framework Directive, 2008/56/EC)
Blinding	Our study was based on available field data (riverine floating macro litter flux) collected by a monitoring network (a collaborative action) in rivers at European scale, and therefore blinding is not relevant.
Did the study involve field work?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

Field work, collection and transport

Field conditions	Field conditions were variable do to the different sampling locations across Europe and the timing of data collection, mainly weekly and fortnightly observations during 13 months.
Location	Monitoring sessions took place in the last reach of rivers to account for floating litter inputs to the marine environment. The RIMMEL

Location	database compiled 817 monitoring sessions in 53 rivers across 15 European and Eurasian countries. The spatial distribution of observation sites and river basins in the European Regional Seas used in the Litter flux analysis are shown in Fig. 3b.
Access & import/export	Data was collected electronically in EU Members States or through EC funded projects. No access or import/export issues were relevant to this study.
Disturbance	Monitoring based on stationary-point visual observations did not caused any disturbance

Reporting for specific materials, systems and methods

We require information from authors about some types of materials, experimental systems and methods used in many studies. Here, indicate whether each material, system or method listed is relevant to your study. If you are not sure if a list item applies to your research, read the appropriate section before selecting a response.

Materials & experimental systems

n/a	Involvement in the study
<input checked="" type="checkbox"/>	<input type="checkbox"/> Antibodies
<input checked="" type="checkbox"/>	<input type="checkbox"/> Eukaryotic cell lines
<input checked="" type="checkbox"/>	<input type="checkbox"/> Palaeontology and archaeology
<input checked="" type="checkbox"/>	<input type="checkbox"/> Animals and other organisms
<input checked="" type="checkbox"/>	<input type="checkbox"/> Human research participants
<input checked="" type="checkbox"/>	<input type="checkbox"/> Clinical data
<input checked="" type="checkbox"/>	<input type="checkbox"/> Dual use research of concern

Methods

n/a	Involvement in the study
<input checked="" type="checkbox"/>	<input type="checkbox"/> ChIP-seq
<input checked="" type="checkbox"/>	<input type="checkbox"/> Flow cytometry
<input checked="" type="checkbox"/>	<input type="checkbox"/> MRI-based neuroimaging