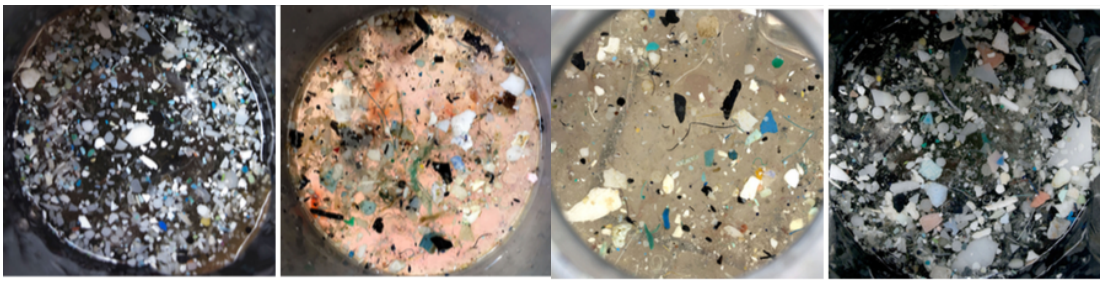
Press Release, 4th April 2025

Microplastics, the hidden face of global pollution

In a special issue of Environmental Science and Pollution Research (ESPR) bringing together 14 scientific articles devoted to studying the source, fate and effects of plastic waste in the European land-sea continuum, scientific discoveries lift the veil on microplastic pollution that crosses ecosystem boundaries. This unique compilation highlights the major discoveries made during the Tara Microplastics Mission (2019) to study the origin and flows of plastic pollution in 9 European rivers: the Loire, the Seine, the Rhine, the Elbe, the Thames, the Ebro, the Rhône, the Tiber and the Garonne.



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The main findings of scientific analysis :

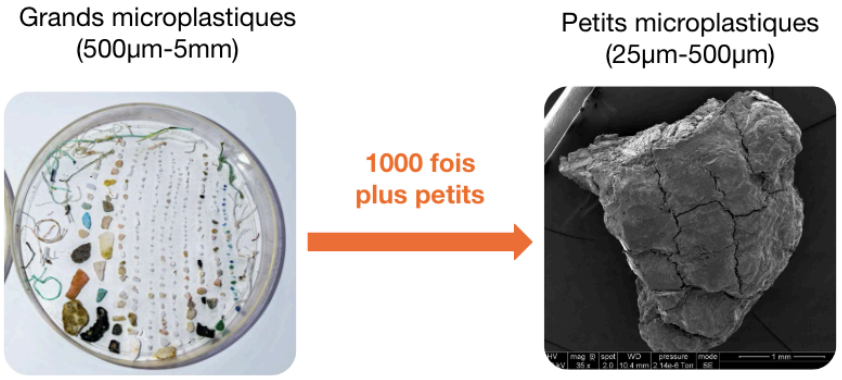
- **All European rivers are polluted by microplastics**

The average is 3 large microplastics per cubic metre in Europe.
These findings confirm that Europe is not immune to microplastic pollution.

- **An alarming concentration of small microplastics in number and mass**

A number and mass up to 1,000 times greater of small microplastics, invisible to the naked eye, than large microplastics was discovered in the 9 rivers studied. These small microplastics are much less studied, whereas these results show that they represent **the submerged part of the iceberg**. Scientists are underlining their concern about these alarming concentrations in rivers.
These small microplastics are even **more likely to be ingested** at all levels of the food chain, from microzooplankton to fish.
This discovery has been made possible by **advances in technology and precision** in analysis methods, in particular the use of mass spectrometry after pyrolysis of

microplastics, a system that pushes back the limits to the infinitely small and makes it possible to establish mass balances with ever greater precision.



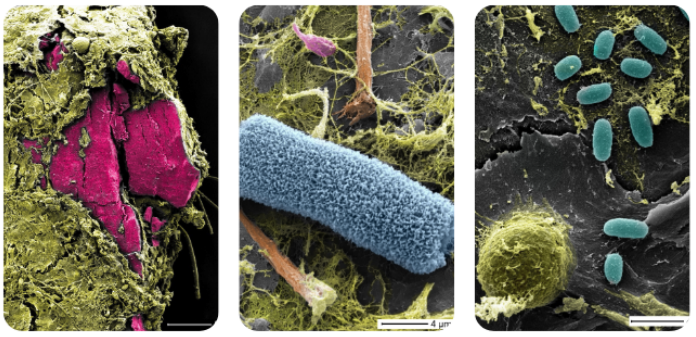
Comparison of large and small microplastics ©Laboratoire Softmat, CNRS
µm = micromètre / 1 µm = 0,001 mm

- **An even distribution of small microplastics in the water column, affecting all ecosystems from the surface to the depths.**

While large microplastics are mainly found at the surface, the research has made it possible to track the dispersion of large microplastics in the Mediterranean Sea. A 3D simulation revealed that 65% of fluvial microplastics float on the surface, while **35% sink to the depths**, moving with ocean currents.

- **Microplastics are rafts for micro-organisms, some of which are pathogenic.**

During the *Tara Microplastiques Mission*, the **presence of a virulent pathogenic bacterium for humans (Shewanella putrefaciens)** was detected on microplastics in rivers. This bacterium is responsible for bacteremia, ear infections, soft tissue infections and peritonitis in humans.



Bacteria that live on plastics: the "plastisphere"©Laboratoire Softmat, CNRS

- **Plastic acts as a ‘pollutant sponge’, combining with heavy metals, hydrocarbons and pesticides in particular.**

The impact of microplastics on river and ocean fauna was assessed by exposing stranded plastic granules to mussels, which are filter feeders particularly sensitive to the ingestion of microplastics and the release of potentially toxic mixtures of intrinsic and extrinsic chemical compounds. The analyses highlight both the **‘pollutant sponge’ effect of plastics and the toxic impact of the chemicals added during their design** (over 16,000 chemical additives, 3,000 of which are known to have toxic effects).

- **A quarter of the large microplastics collected** on the banks of French rivers **are not waste, but primary plastics or ‘mermaid tears’**.

A participatory science initiative with schoolchildren, Plastique à la loupe, was also introduced in this special issue. For the first time, it compared the distribution of different sizes of waste (macro-, meso- and micro-plastics) on a wide range of coastal shores and beaches in France. This initiative, which currently involves more than 12,000 schoolchildren a year (i.e. 400 classes each year), has revealed **major pollution in France by primary plastic granules (mermaid tears), which are the basis for the manufacture of plastic products marketed by the plastics industry.** These granules, also known as ‘mermaid tears’, make up a quarter of the large microplastics collected on the banks of French rivers. The study also revealed that riverbanks are mainly polluted by single-use plastics, most of which are foodstuffs, while shorelines are polluted by fragmented debris larger than 2.5 cm.

What analysis has the Tara Ocean Foundation made of these results?
This invisible pollution represents a real threat to the health of terrestrial and marine ecosystems, as well as to human health, which are inseparable concepts. This special issue highlights the need to deepen our understanding of plastic pollution and to continue to carry out reliable ecological risk assessments across ecosystem boundaries.

The Tara Ocean Foundation has drawn four key lessons from the results:

1. **A mass mainly made up of small microplastics** → The impact of such pollution on the planet's overall health (from marine ecosystems to our own health) can be very different, given the size of the particles, their fragmentation and dispersion, and must continue to be studied. This result also demonstrates the futility of ocean clean-up projects that deal with the problem downstream from production, rather than at its source: global annual plastic production continues to rise, and is expected to triple by 2060, leading to a threefold increase in plastic leaks into the environment.
2. **A preponderance of primary plastics on riverbanks** → This massive presence of production waste (even before an object is manufactured) shows that the solutions for combating plastic pollution are to be found on land and

must absolutely include the production phases, in particular with a drastic reduction in plastic production.

3. **Pollutant sponges** → The impact of plastics is not limited to the chemical composition of the plastic, but also to the chemical cocktail that the plastic picks up, known as unintentionally added substances or NIAS. It is therefore necessary to take into account the systemic dimension of plastic pollution (toxic, chemical and, of course, climatic).
4. **Proven presence of human pathogens** → This discovery demonstrates the link between plastic pollution and the overall health of the planet, which unites environmental and human health. So it is life as a whole that is exposed to and unbalanced by plastic pollution.

The Tiber ©François Aurat

Rhone Estuary ©Samuel Bollendorff

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About us

The Tara Ocean Foundation

The **Tara Ocean Foundation** is the first public interest foundation in France dedicated to the Ocean.

For over 20 years, it has been striving for a revolution to preserve life, convinced that the Ocean is essential to the equilibrium of our planet. Exploring the Ocean and sharing scientific discoveries to raise collective awareness is at the heart of the foundation's mission.
It leads scientific expeditions, in partnership with leading international research laboratories, to study marine biodiversity and understand the impacts of climate change and pollution. It raises public awareness, from the younger generation to political decision-makers. Thanks to its UN Special Observer Status, the foundation plays an active role in international Ocean governance.
Exploring, sharing and protecting this living Ocean is more vital than ever. Together, let's defend Life. Let's protect the Ocean. Discover the foundation at **https://fondationtaraocean.org/ and on video.**

The National Centre for Scientific Research

A major player in fundamental research worldwide, the **National Centre for Scientific Research** (CNRS) is the only French organisation active in all scientific fields. Its unique position as a multi-specialist enables it to bring together the different scientific disciplines to shed light on and understand the challenges of today's world, in collaboration with public and socio-economic players.
Together, the sciences are at the service of sustainable progress that benefits society as a whole. **www.cnrs.fr**

Further information :
The Tara Ocean Foundation's actions and research on plastic:

Since 2010, the schooner Tara has been collecting microplastics (from 0.2 to < 5 mm in diameter) in its nets during its various expeditions. The findings are clear: these fragments of microplastic are omnipresent in the ocean. After focusing on this pollution in the Mediterranean Sea in 2014 (Tara Méditerranée), discovering the major accumulation zone in the Arctic Ocean in 2017 and identifying the associated biodiversity in the North Pacific 'Vortex' in 2018 (Tara Pacific), the Tara schooner and its scientific partners, notably from the CNRS, have launched the Tara Microplastics Mission in 2019. For the Tara Ocean Foundation, there is an urgent need to explore and describe the leakage of plastic waste into the sea to better stem this 'haemorrhage' from the Earth. The Foundation is also involved in the International Treaty against Plastic Pollution.

- The ***Tara Microplastics Mission*** was carried out by the Tara Ocean Foundation in scientific partnership with the French National Centre for Scientific Research (CNRS), the French Atomic Energy Commission (CEA), the European Molecular Biology Laboratory (EMBL) and the French National Research Agency (ANR). The objectives are to identify the sources of pollution, understand the fragmentation of microplastics in rivers, predict their dispersion towards the ocean, understand their impact on marine biodiversity and their effects on the food chain. Marine biologists, ecotoxicologists, oceanographers, modellers, chemists and physicists make up this interdisciplinary team.

Mission Tara Microplastiques - Key figures

Expedition :

- 6 months between land and sea - May to November 2019
- 9 European rivers / 9 countries
- 18 sailors
- 18 stopovers (including 12 in France)
- 17,000 km covered

Science :

- 19 laboratories involved
- 40 scientists
- 2,700 samples (45 sampling stations x 60 samples per station)
    - 36 stations at sea, off rivers
    - 24 shoreline sampling zones
- 300 samples per river
- 150 net hauls
- 500 samples sent to the CEA genoscope
- Over 6 billion DNA sequences expected

***Mission Microplastiques* scientific partners**

This research project, supported by the Tara Ocean Foundation and coordinated by the CNRS, is based on the complementarity of several institutional partners, including the Laboratoire d'océanographie microbienne (Lomic, CNRS/Sorbonne Université), the Laboratoire océanographique de Villefranche-sur-Mer (LOV - CNRS/Sorbonne Université, Banyuls-sur-Mer), the Laboratoire d'Ecogéochimie des Environnements Benthiques (Lecob, CNRS/Sorbonne Université, Banyuls-sur-Mer), the Institut de recherche Dupuy de Lôme (IRDL - CNRS/Université Bretagne Sud/UBO/ENSTA Bretagne), the Laboratoire universitaire de biodiversité et écologie microbienne (Lubem, Univ. Bretagne Occidentale), the Laboratoire des sciences de l'environnement marin (Lemar, Université Bretagne Occidentale/CNRS/IRD/Ifremer), the Centre de formation et de recherche sur les environnements méditerranéens (CEFREM - CNRS/University of Perpignan), the Génoscope (CEA Evry), the 'Environnements et paléoenvironnements océaniques et continentaux' (EPOC, CNRS/University of Bordeaux) laboratory, the Institute of Chemistry and Biology of Membranes and Nano-objects (CBMN, CNRS/University of Bordeaux/Bordeaux INP), the Provence-Azur-Corsica Environment and Resources Laboratory (Ifremer-Corsica), the Laboratoire d'aérologie (LA - CNRS/UT3 Paul Sabatier), the Institut de chimie de Clermont-Ferrand (ICCF, CNRS, Univ. Clermont-Auvergne, SIGMA), the Laboratoire 'eau, environnement et système urbain' (Leesu, CNRS/Univ. Paris Est Créteil), the Laboratory of Molecular Interactions and Chemical and Photochemical Reactivity (IMRCP, CNRS/UT3 Paul Sabatier), the company ImmunRise (Cestas) and the company Plastic@Sea (Sorbonne University, Banyuls-sur-Mer).

Mission Microplastiques' financial partners

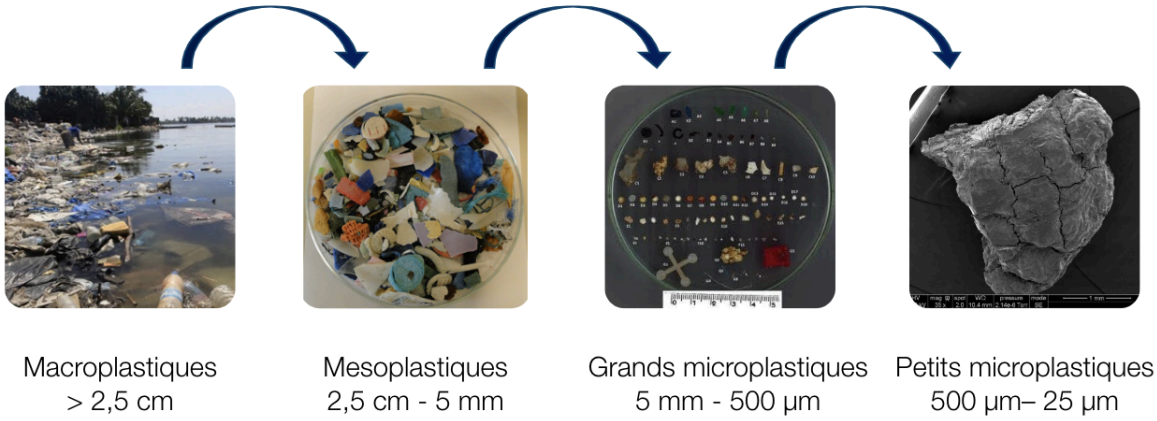
The Tara Ocean Foundation warmly thanks its public and private partners who made this mission possible: the Agence Française pour la Biodiversité, the Fonds Français pour l'Environnement Mondial, Lorient Agglomération, the Région Bretagne, the Région Nouvelle Aquitaine, the Région Sud Provence Alpes Côtes-d'Azur, as well as Agnès b., BIC, Billerud, Capgemini Engineering, Compagnie nationale du Rhône, the Prince Albert II of Monaco Foundation, L'Oréal/Biotherm and the Véolia Foundation.

- ***Plastique à la Loupe*** is an educational initiative run by the Tara Ocean Foundation to promote education in science and sustainable development. Pupils are invited to contribute to an inventory of plastic pollution on beaches and shorelines in France (metropolitan and overseas) and in certain European sites targeted by researchers. The resulting database will be used for scientific research. This educational operation uses participatory science as a lever to develop eco-citizenship, critical thinking and commitment among young people, and is in line with the sustainable development objectives set by the UN. Over 400 classes take part every year in France and abroad.

Microplastics: what are they?

Smaller than a grain of rice (<5 mm), they can be :

- Primary: small plastic products from domestic and industrial products. These include the granules used in the manufacture of almost all plastic objects (mermaid tears), or products deliberately added to cosmetic products (microbeads), or from the synthetic materials in our clothes and tires.
- Secondary: resulting from the fragmentation of macro-waste under the effect of sunlight (UV) and abrasion.



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Fragmentation of macrowaste into large microplastics, small microplastics and nanoplastics ©Laboratoire Softmat, CNRS