Litter clean-ups will not solve the marine plastics crisis

The ecological, technical, and economic constraints of seabed clean-ups

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Coastal clean-up movements to counter waste littered in the environment have become widespread. Such clean-ups (including 'fishing-for-litter' schemes) are increasingly included in European Union government policies and programmes as one of the solutions for mitigating the impacts of marine litter, mostly within the context of the EU Marine Strategy Framework Directive.[1] Despite their growing popularity, however, such clean-up measures are not a viable means of addressing the immense problem of underwater plastic pollution.

In recent decades, great strides have been made in improving at-sea exploration technology, some of which may be applied to at-sea clean-up efforts. Some initiatives to collect floating litter have gained extensive media and public attention, as well as funding. Emerging devices have been seen as potential tools to collect litter, but they have failed to consider a key point: most plastics lie on the seabed. Globally, 80 % of marine litter items are made of plastic[2] and the vast majority of this waste lies on the seabed.[3] It is estimated that floating plastic may represent as little as 0.2 % of the total plastic input to the sea, while most of the non-fibrous plastics buried in marine sediments have been found at depths of between 200 m and 2000 m.[4] Clearly, most clean-up efforts – which focus on removing plastic litter from beaches and shallow waters – can do very little to remove most of the plastic that enters the ocean.

Clean-up projects have led the wider public to believe that the problem of ocean plastic pollution is easily fixed, which has also likely resulted in delayed government actions to address the root causes (e.g., excessive packaging, overuse of single-use plastics, and littering).

However, the limitations of seabed clean-ups show that these approaches cannot be used as a justification to continue with a business-as-usual scenario of plastic production.

Here, we provide a brief overview of the limitations of clean-up technologies, based on a more comprehensive research study commissioned by Oceana.[5]

Ecological limitations: damage to vulnerable ecosystems

Litter accumulation on the sea bottom can be influenced by a range of factors, such as geomorphological features of the seabed, and by litter size and density. For example, seafloor litter tends to accumulate in "plastic traps", such as seamounts, canyons, and other areas characterised by rugged topography.[6,7,8]

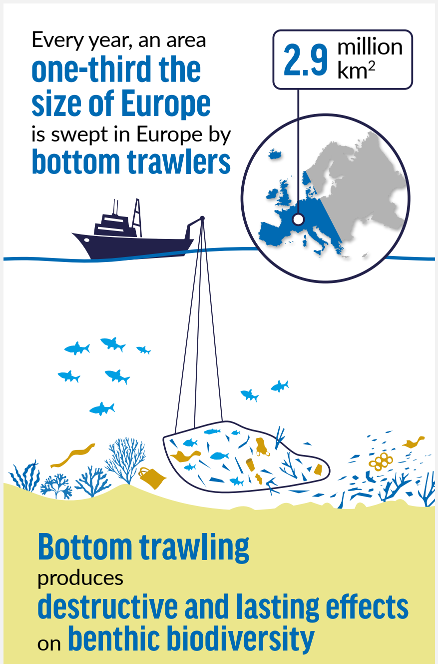
Litter becomes entangled in benthic habitats such as cold-water coral reefs and sponge aggregations.[9,10] Such habitats are particularly vulnerable to physical impacts,[11] and efforts to remove entangled plastics from these systems may cause damage, ranging from habitat destruction to disturbance of ecosystem functioning. Clean-ups should therefore be planned and carried out with careful consideration of ecological limitations. In addition to direct environmental damage, it is worth noting that clean-ups using technologies such as heavy underwater vehicles with cameras and sonar or remotely operated vehicles often require vessels whose carbon footprint should be considered as a major associated environmental impact.

Critically endangered bamboo coral partially covered by a plastic sheet at 654 m depth.

FISHING-FOR-LITTER: MARINE LITTER REMOVAL vs. SEABED INTEGRITY:

Programmes involving 'fishing-for-litter' are mostly carried out by trawl vessels, either collecting seabed litter while bottom trawling, or opportunistically collecting data on seabed litter during fisheries research campaigns. In recent years, the promotion and financing of fishing-for-litter activities within the fishing sector have flourished under regional plans and national measures aimed at tackling ocean litter and plastics.

Every year, 2.9 million km² of seabed (an area one-third the size of the European continent) are swept in Europe by bottom trawlers.[12] However, this widespread trawling has not prevented marine litter accumulation in the deep, which continues to increase exponentially due to a lack of policies to establish reduction targets, and the limited implementation of reduce and reuse measures. Although **bottom trawling** can collect large quantities of litter, **its destructive and lasting effects on benthic biodiversity mean that it should not be considered a solution to marine litter**.



Technical difficulties: from paper to reality

Seawater turbidity is a constraint for underwater cleanups conducted by divers.

Clean-up methodologies reviewed in our research included divers, underwater vehicles with cameras and sonar, and vessels with a remotely operated vehicle (ROV) equipped with grippers.

All these methodologies have limitations. Cleaning activities that only involve divers are non-systematic and are inconsistent in time, because they largely depend on volunteers. Additionally, divers can only work a limited number of hours per day, and they require good weather conditions.

More advanced approaches, using clean-up technologies that are currently being developed, are meant for areas no more than 40 or 100 m deep. This means that such methods can be used in only a small portion of EU waters: approximately 900 000 km^2 out of a total of 5 300 000 km^2 of European seas are shallower than 100 m. Small devices supported by vessels with an overall length of under 30 m are commonly used in these shallow waters. However, several of the devices assessed by the study are either still in their prototype phase or have only a limited collection capacity (e.g., 800 pieces in 16 hours). Furthermore, evaluations of their performance are largely based on assumptions of ideal oceanographic conditions, and flat sea bottoms.

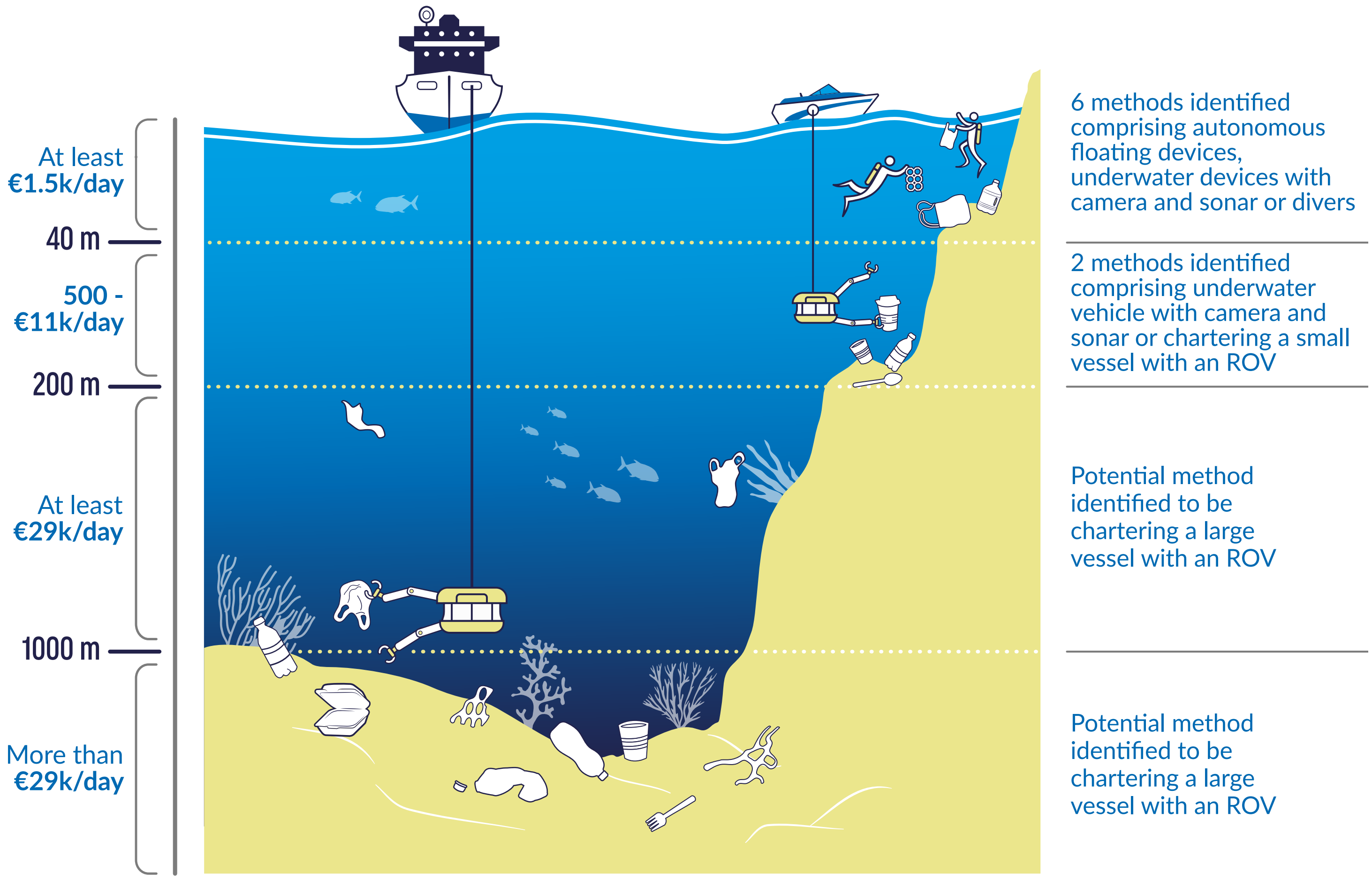
Seafloor observation, especially in the deep-sea, can be challenging and costly, and finding litter using remote control devices is also dependent on environmental conditions (e.g., turbidity, current speed). For instance, assuming favourable weather conditions, it can take roughly one hour for an ROV to land at 1000 m depth, while an average of at least 6-12 hours per location would be needed to comfortably reach the bottom and carry out a few dives aimed at an effective clean-up.

Furthermore, all of these clean-up approaches are focused only on macrolitter, which represents only one type of marine plastic pollution. This means that these approaches are further limited in their usefulness for remediating the accumulation of litter on the seafloor.

EU waters have a surface area of 5.3 million km^2 and an average depth of 2100 m, but current clean-up technologies are meant for depths of no more than 100 m.

The cost of technology applied to clean-ups

Findings from Oceana's research reveal that seafloor clean-ups are extremely expensive, and that these costs clearly increase with depth. The estimated cost for using these methods could rise to over € 29 000/day to reach polluted areas deeper than 1000 m, which may include chartering a large vessel over 60 m long, equipped with an ROV.



Schematic overview of marine litter clean-up technologies and estimate costs, by depth.
Source: Alicia Mateos Cárdenas / OCEANA.

Don't polluters pay?

Who is willing to make such a high investment in cleaning litter – including plastics – from the seabed? When it comes to assuming the cost and the ecological risks of conducting these types of sea bottom clean-ups, extended producer responsibility (EPR) should also be directly linked to this measure, and in line with the effective implementation of the 'polluter pays' principle.

For the time being, EPR at sea is still a gap to be addressed from a legal perspective, in part because the alarming plastic crisis beneath the ocean surface is out of sight. Producers are not held accountable for it, even though they choose to base their business model on single-use products. Marine pollution is destroying Europe's natural marine heritage, yet polluters do not pay for it.

In view of the current situation, Oceana recommends that:

Current efforts, funding, and regulations must be targeted at upstream (pre-consumption) solutions to stop plastic pollution at the source, rather than methodologies that are not currently on the market or have clear limitations in terms of underwater clean-ups.

Producers must be required to apply all existing mechanisms to prevent littering, such as deposit return systems, prevention of unnecessary packaging, and reusable and refillable solutions. Throw-away items must become the exception.

Clean-ups can be used to remove litter that has already accumulated on the seafloor, provided they do not damage habitats and species.

How much does it cost to remove from the seabed?

Figures based on Oceana's research

Soft drink can and plastic items among algae and Posidonia seagrass.

- Cost at retailer (beverage can, wraps, and bags): < € 5
- Clean-up cost: up to € 680/day (Recreational divers)

  Includes:
  - 4 divers
  - up to 3 dives
  - materials
  - insurance

Soft drink can on sandy seabed with algae.

- Cost at retailer (beverage can): € 0,26
- Clean-up cost: up to € 1480/day (Professional divers)

  Includes:
  - 4 divers
  - up to 3 dives
  - small vessel
  - materials
  - insurance

Beverage containers and other single-use plastic items at 264 m depth.

- Cost at retailer (wine bottle, soft drink cans, beverage bottle, plastic cups, and dish): < € 50
- Clean-up cost: Starting from € 11 000/day

  Includes:
  - chartering a vessel
  - ROV equipped with a gripper

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