Scalable full-cycle marine litter remediation in the Mediterranean: Robotic and participatory solutions

SeaClear2.0

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Stakeholder Workshop in Tarragona, Spain
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The SeaClear2.0 stakeholder workshops

The SeaClear2.0 project takes a site-specific approach to developing solutions for preventing and mitigating the impacts of marine litter. This is done through the implementation of stakeholder workshops across the project's demonstration sites, pilot sites, and sites where SeaClear2.0 Associated Region projects have been funded. SeaClear2.0 partner ISOTECH is using its DeCyDe-4 decision support methodology to implement workshops with stakeholders in these 11 countries to identify site-specific marine litter problems, prioritise challenges, and co-design feasible interventions that reflect the local context.

The eleventh workshop: Tarragona, Spain

The eleventh and final workshop took place on 26 October 2026 in Tarragona, Spain. It brought together 15 stakeholders representing a mix of public bodies, industry, academia and civil society. The public body participants represented both local (Tarragona) and regional (Catalan) authorities, including the Tarragona City Council, the Port of Tarragona, the Government of Catalonia, the Catalan Water Agency and the Waste Agency of Catalonia. Civil society was represented by the organisation Plastic Free Wave, the academic sector by a stakeholder from the Rovira i Virgili University, industry by the companies TecnoConverting Engineering and Tecnosub, and the tourism sector by a representative of the Costa Daurada and Terres de l'Ebre Tourist Apartments Association.

Local Insights: Marine Litter Challenges in Tarragona

The stakeholders identified several important sources and gaps concerning waste management in Tarragona and more widely in Catalonia and ranked them according to their importance, as follows:

1. Plastic pellets: The most important issue according to the stakeholders was plastic pellets that find their way into the marine environment through the petrochemical industries located in the area. The existence of Operation Clean Sweep Certification[1] was noted, a code of conduct for factories handling plastic pellets to minimise their loss; however, stakeholders highlighted that adherence is voluntary. While larger factories might adhere to it, smaller factories or subsidiaries do not. This results in large quantities of pellets along Catalan coasts.
2. Waste transported via rivers and storm drains: The presence of wet wipes and other sewage-related litter on Catalan coasts was also identified as an important marine

[1] https://ocscertification.eu/

litter issue. This waste reaches the coast when sewage drains overflow during heavy storms. Similarly, waste that washes out to shore through rivers and litter from streets that is washed out to shore during storms were also identified as important sources of marine litter.

3. Single-use plastics from tourism: encompassing everything from plastic bottles to single-use toiletries, the stakeholders identified this as an important waste stream in the area due to the area's significant tourist sector.
4. Maritime-transport waste (domestic-type) & waste from recreational boats and cruises were also identified as contributors to the area's marine litter issue.
5. Fishing and aquaculture-related waste: The stakeholders noted that a system exists for fishermen to dispose of their waste free of charge, so it is unlikely for fishing-related litter to be disposed of purposefully. However, the area is home to a significant fleet of bottom trawlers whose nets tend to break off when they get caught on rocks found on the seabed. In terms of aquaculture waste, accidental loss due to storms was noted as a pathway to the environment.
6. Behaviour: Finally, the stakeholders noted that behaviour is also a problem, as it is not uncommon for large domestic appliances to be found in coastal areas

Following the identification and prioritisation of the main challenges, two emerged as priorities for the area: the presence of pellets and the transport of waste from rivers and storm drains, with a focus on sewage-related waste. Stakeholders, guided by the facilitators, co-developed and evaluated four potential solutions to address each of these two gaps/needs. The evaluation of the solutions was undertaken using the DeCyDe-4 multicriteria assessment.[2] The stakeholders evaluated the identified solutions across the criteria of 'Effectiveness' and 'Implementation'. The sections that follow present the outcomes of this evaluation. The numerical results of the multi-criteria assessment appear in Figure 1.

Solutions to address the loss of plastic pellets

Stakeholders proposed the following solutions to prevent the loss of plastic pellets and to minimise their impact on the environment:

[2] Loizidou, X.I., Orthodoxou, D.L., Loizides, M.I. et al. A community-based approach for site-specific policies and solutions on marine litter: the example of Paphos, Cyprus. Environ Syst Decis 41, 33–44 (2021). https://doi.org/10.1007/s10669-020-09786-9

1. Mandatory practices for the industry to prevent pellet loss: This concerns making the provisions of Operation Clean Sweep (or similar) part of law to ensure that they are transversally applied throughout the plastics value chain. This would ensure that pellet loss is addressed at the very beginning of the chain, minimising pellet presence in the environment. This was identified as both the most applicable and effective solution.
2. Filtration system in wastewater plants: this solution concerns the installation of specialised filters able to collect microplastics, including pellets, that find their way into wastewater treatment plants. Currently, the majority of wastewater treatment plants are unable to collect such plastics, which can then make their way to waterways and the environment.
3. Aspiration system in packaging: this solution involves the implementation of a technological system that would collect pellets spilt during the packaging process. While this solution was considered to be particularly effective, stakeholders noted that it would only solve part of the problem, as significant amounts of pellets are also lost during transport/logistics.
4. Innovative system to collect pellets from the environment: recognising the fact that important amounts of pellets are already present in the environment, the stakeholders identified the need for the development of innovative technologies that would be able to collect pellets from the environment with minimum impact on biodiversity.

Addressing waste from storm drains and rivers, including sewage-related waste

To address these waste sources, the stakeholders identified the following solutions:

1. Education for prevention: this was identified by the stakeholders as the solution that was most immediately applicable, as it would raise awareness among the public about the importance of not discarding wet wipes, Q-tips and other similar waste into the sewage system or not discarding their waste (e.g. cigarette butts) on streets.
2. Better street cleaning: the stakeholders noted that ensuring that the streets are cleaned, both regularly and after the implementation of events, would be an effective and immediately applicable solution to prevent the transfer of municipal waste from storm drains onto coasts and the sea.
3. Regulations to prohibit wet wipes: recognising the environmental and economic impacts caused by discarded wet wipes, which frequently end up on coasts and also cause blockages in wastewater pipes and pumps resulting in significant economic

impacts, the participants identified the banning of wet wipes as a particularly effective solution, which could be implemented as an extension to the provision of the Single-Use Plastics Directive.

4. Control of small dump sites: this solution advocates for the better enforcement of waste laws through controls that would prevent waste dumps, which can be noted particularly in peri-urban and rural areas. According to the stakeholders, this would be an effective way of stopping certain waste streams from reaching rivers and subsequently the sea.

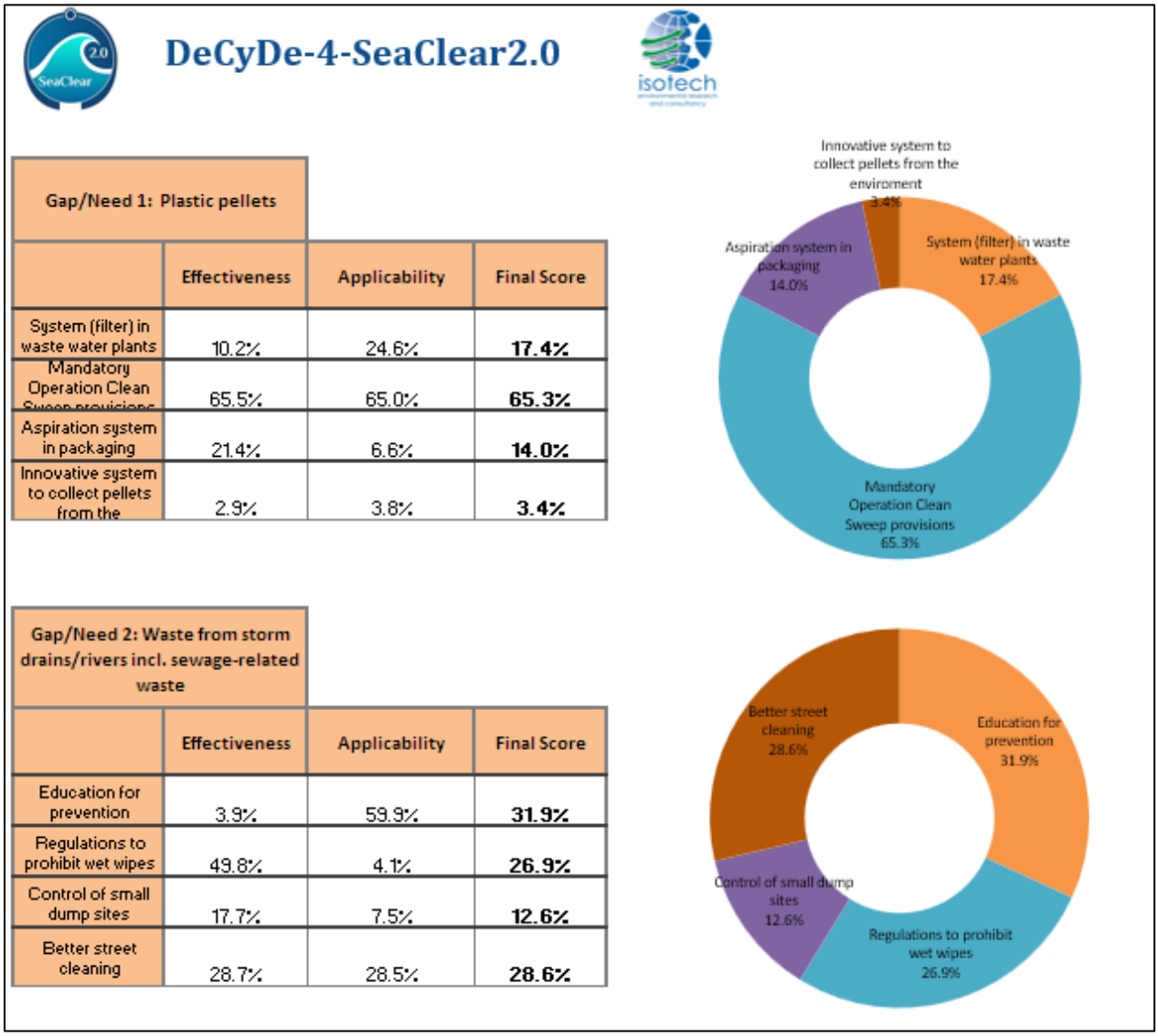


Figure 1 Results of the DeCyDe-4-SeaClear2.0 multicriteria assessment of the proposed solutions.

Conclusion

The Tarragona workshop marked the successful completion of SeaClear2.0's series of 11 stakeholder workshops, demonstrating the value of a site-specific, participatory approach to identifying and addressing marine litter challenges. The discussions highlighted the diversity of litter sources affecting the Tarragona area, ranging from industrial plastic pellet losses and sewage-related waste to tourism, maritime activities and fishing. The prioritisation and assessment of potential interventions also underscored the importance of combining preventive measures, effective regulation and enforcement, public awareness, and innovative technological solutions. In particular, stakeholders emphasised the need to make industrial pellet-loss prevention practices mandatory and to improve the management of waste entering the marine environment through rivers and storm drains. Overall, the workshop demonstrated how bringing together stakeholders from public authorities, industry, academia and civil society, supported by the DeCyDe-4 methodology, can generate locally grounded and actionable solutions, while strengthening collaboration and ownership of marine litter prevention and mitigation efforts.