CleanAtlantic

Tackling Marine Litter in the Atlantic Area

Operational guide for the clean-up of marine litter on the coastline

WP	WP 7 – TACKLING MARINE LITTER
ACTION	7.4 - BEST PRACTICES FOR BEACH MARINE LITTER CLEAN-UP AIMED AT LOCAL AUTHORITIES
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DISCLAIMER

SUMMARY

This guide addresses routine beach litter collection operations, including manual pick-up and mechanical clean-up, particularly on sedimentary substrates which are more prone to stranding and more likely to suffer deleterious impacts caused directly by cleaning operations, whether manual or mechanical.

Firstly, the guide introduces the coastline and its dynamic environment. It describes the various substrates than can constitute specific types of coastline, actions of waves and swell, sedimentary movements and tides. The currents near the coast, winds and beach exposure are also discussed.

The guide also presents what is beach litter and its behaviour in the environment. Trapped or in transit, from different sources, beach litter is composed of a large variety of litter types mainly made of plastic. It is found everywhere on the coastline, of various shapes and various sizes. However, it is heterogeneously distributed on the coast, depending on various parameters such as local activities or local meteorological conditions. It can arrive on site by several pathways: deposited directly on site by users or transported by winds and currents. Beach litter pollution is known to cause proven impacts on the coastal environment.

Contributing to overall clean-up of the marine environment, beach clean-up limits the impact of litter pollution and preserves ecological functions of the beach. It also ensures economic and leisure functions, especially for beaches used for tourism activities. The guide describes what manual and mechanical beach clean-ups are, the specific equipment that can be used for clean-up operations and associated risks for the beach environment that should be taken into consideration. Then, the guide details what to do before, during and after cleaning operations, focusing on the importance of preparing plans in advance taking into account several determining factors such as the environment of the beach, resources available, authorities to contact, etc.

Finally, the guide presents additional approaches that encourage citizen initiatives and promote responsible collection actions.

Overall, this guide reminds that there is no standard method for beach clean-up, but it provides guidelines of how to conduct clean-up operations from the planning stage to the processing of beach litter collected in order to assist competent authorities, NGOs or volunteers in their approach.

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PRELIMINARY REMARKS

This guide was written as part of the CleanAtlantic project by Cedre with the support of the project partners. The aim is to produce a user guide for preparing and carrying out beach clean-up operations.

Although they are inevitably mentioned here because they may be associated with litter collection operations, this guide does not deal with the monitoring of litter on the shoreline or with awareness raising of the public about this pollution.

This guide deals with routine macrolitter clean-up operations, including manual and mechanical cleaning, on the coastline and more particularly on sand and pebble beaches, which are more prone to littering and more likely to be directly impacted by cleaning operations, whether manual or mechanical.

The guide briefly introduces the elements needed to understand how the shoreline works, and how litter behaves in this dynamic environment, more specifically in the context of the European coastline of the Atlantic Area (Ireland, the United Kingdom, France, Spain and Portugal) which is the geographical framework of the Interreg CleanAtlantic project.

This guide does not consider the case of massive arrivals of litter on the coast, particularly microplastics. In such an emergency situation, a specific organisation (quite similar to the ones triggered in the event of a major oil spill, for example) must be put in place by the authorities, so as to provide an effective response using appropriate procedures and resources (material and human), in order to limit counterproductive disorganised actions and possible adverse effects on the environment following burial and dissemination.

WHAT YOU NEED TO KNOW ABOUT THE COASTAL ENVIRONMENT

2. General

The morphology of shorelines varies according to their geological history, their exposure to waves, the nature of their substratum and, more specifically for sediment accumulations, the size of their mid-grain (ranging from mud to boulders) and the volume of sedimentary stock.

Waves and tides - and the currents they respectively induce - are the main forces acting on the coastlines, shaping and modifying them.

3. A dynamic environment

3.1. A mosaic of diverse environments

The general configuration of the coastlines is linked to the geological history of the submarine and continental spaces they delimit. The geological characteristics explain the great diversity of the coastlines, which alternate between low and high coasts, straight coasts and indented coasts, bordered by a plunging or moderately sloping fore-coast, sometimes dotted with islands or reefs. As a result, they define the structuring features of the coastline: bays, cliffs, estuaries, peninsulas, islands, dune systems, etc. (Figure 1)

Figure 1: Example of shoreline facies (©Cedre)

3.2. The coastal system

Three sectors can generally be distinguished along the coastal profile:

- the nearshore, or the subtidal zone, is located below the level reached by the lowest spring tides;
- the foreshore, or the tidal zone, is the area bounded by the levels reached by the lowest and highest spring tides. The length, width and slope of the intertidal zone vary according to its nature (sedimentary and/or rocky) and its exposure to the swell;
- the backshore is located above the level reached by the high tides.

The hydrodynamic and morpho-sedimentary relationships within this triplet define what is known as the beach system, which corresponds to the space in which longitudinal and vertical sedimentary movements, even if significant, take place without jeopardising the equilibrium of the whole: this is how, for example, after the massive natural retreat of sand, which can sometimes cause the beach to “disappear”, the sediments naturally return to the top of the beach, as they have remained in the system. This is no longer the case, if they have left the system, because they have migrated either to too great a depth or beyond the physical framework of the beach - a promontory for example - towards a neighbouring system which they now feed. In this case, in the absence of a new supply of sediment, the sediment balance of the system is out of balance, a situation which can lead to erosion of the coastline.

3.3. The substrates

The coastline is made up of fixed materials (bedrock or anthropogenic structures) and/or more or less loose materials (sediments) (Figure 2). These substrates constitute specific types of coastline:

- **rocky coasts:** platforms, cliffs, creeks, coves, caves, etc. (to which can be associated the man-built structures of harbours or defences against erosion: jetties, walls, quays, riprap, groynes, etc.);
- **sedimentary coasts:** boulder beach, pebble beach, mudflat, marsh, estuary bank, sandy beach, dune ridge, etc.

The sediments are classified, according to their grain size, in different categories: boulders (> 256 mm); cobbles (64-256 mm); pebbles (4-64 mm); granules (2-4 mm); very coarse to medium sand (0.25-2 mm); fine to very fine sand (0.062-0.25 mm); silt (0.004-0.062 mm); clay (≤ 0.004 mm).

Figure 2: Example of sandy coastline with man-made sea defence structures (©Cedre)

3.4. The waves and swell

Waves, originating from the wind sea or swell, dissipate their energy both in the shallows (by refraction on the bottom) and on the shoreline (by diffraction and refraction).

The intensity of this energy is a function of the distance of the wind's path (or fetch), its duration and its average speed, which means that, depending on their orientation and their openness to the sea, some coastal sectors, or even some facades, are more exposed or battered than others which are naturally more sheltered from the swell.

Waves are at the origin of coastal and submarine geomorphology. They control the movements of the sedimentary stock (transport, sedimentation and remobilisation). They build up sediment accumulations (of mud, sand, gravel or pebbles) and feed them by clearing and redistributing the mobile materials carried by rivers or released by the erosion of the coast, which they continuously carry out. The sedimentary stock of a coastal sector is in equilibrium with the predominant hydrodynamic forces (swells, currents and tides) that characterise it; the local coastal geomorphology results from this equilibrium. This equilibrium is regularly disrupted, either episodically (e.g. during a storm) or seasonally (e.g. change of swell regime): part or all of the sedimentary stock of the beach is then put back in motion.

3.5. The sedimentary movements

The beach experiences natural cycles of erosion and accretion of sediments. These phases of beach accretion and de-accretion correspond to the activity of waves which are sometimes erosive (storm waves or long winter swells, for example), sometimes constructive (short pre-summer swells, for example). The sedimentary stock of the upper beach, which is at its maximum in summer, migrates after the summer season to the lower beach where it is at its maximum in winter, and from where it gradually rises around spring.

This seasonal cycle is superimposed by small episodes of notable sedimentary movement, linked to sudden and punctual processes of erosion or accretion.

3.6. The tides

The tides expose the intertidal zone to the action of the waves in a more or less regular way, flooding it and uncovering it alternately at variable heights.

The rhythmic displacement of water masses, generated by these incessant rise and fall of the sea, generates currents which, although not very important in open sea, may be significant in the narrow passes and shallow bays of the coast.

3.7. The currents near the coast

The local currents to be taken into account are of various types:

- tidal currents which vary according to the type of tide (diurnal, semi-diurnal) and whose intensity increases with the tidal range (whose importance varies according to the coast) and in the constricted places of the coast;
- currents induced by the swell or the waves which are of two types:
  - the longshore currents which, more or less parallel to the shoreline, result from an oblique attack of the coastline by the swell, which determine the transport and the general

direction of the migration of the sedimentary stock along the large linear littoral sectors, of the dune (sand) or cliff (pebbles) type;

    - the return currents, oblique or perpendicular to the coastline, which allow the backflow towards the open sea, in forced passage, of important masses of water which are sometimes propelled in series to the coast, at rising tide, by a train of very strong waves.
- river-induced currents, which can be felt beyond the estuarine system itself, vary according to the seasons (flooding and low water periods) and the local rainfall conditions of the moment.

3.8. The winds

Winds play an important role in the generation of swell and waves.

3.9. The exposure

This defines the amount of wave energy that is dissipated at the coast. Shorelines are thus classified according to their exposure mode, ranging from exposed (e.g. rocky promontory) to sheltered (e.g. marsh). When this energy is strong, it is synonymous with pounding on hard surfaces and, in the presence of fine sediments, with strafing and abrasion, and for sediments, with regularly repeated mixing and remobilisation. Exposure controls the distribution of sediments along the beach, as on the coastline in general; this distribution is a function of the energy available, i.e. the wave's capacity to mobilise and then move the sediments it encounters on the foreshore. The sea thus sorts the sediment: the characteristics of the sediment must be in line with the forces at work. At the scale of the beach, the average energy dissipated varies along the beach profile; consequently, the distribution of sediments is generally at well-marked preferential levels along the profile (e.g. pebble ridge in the upper part of a sandy beach) (Figure 3a). On less exposed sites, where hydraulic sorting is less effective, the beach is made up of a mixture of heterogeneous sediments of various sizes.

Exposure can be assessed, in a first approach, using various indicators of a morpho-granulometric or biological nature:

- the existence of muddy deposits (synonymous with a sheltered mode);
- the size of the average grain, according to the principle that the coarser the elementary grain, the greater the energy and therefore the more exposed the beach (this parameter can, however, only be significant if the sedimentary stock on the beach is relatively homogeneous. Indeed, the granulometric homogeneity of the sediment, which characterises the efficiency of the sorting exerted by the waves, is a more reliable indicator of high energy);
- the shape or bluntness of the grains also gives a good indication of the type of exposure of the beach: angular and chipped shapes indicate very low energy, while blunt and rounded shapes are the result of strong mechanical abrasion of the sediments;
- the slope of the beach, which results from the interaction of grain size and wave energy. As a general rule, the more exposed the beach is to waves, the coarser its average sediment and the higher its slope;
- the predominance of plant and animal species, characteristic of battered environments (e.g. barnacles, *Perforatus perforatus*) or sheltered environments (e.g. knotted wrack, *Ascophyllum nodosum*) (Figure 3b).

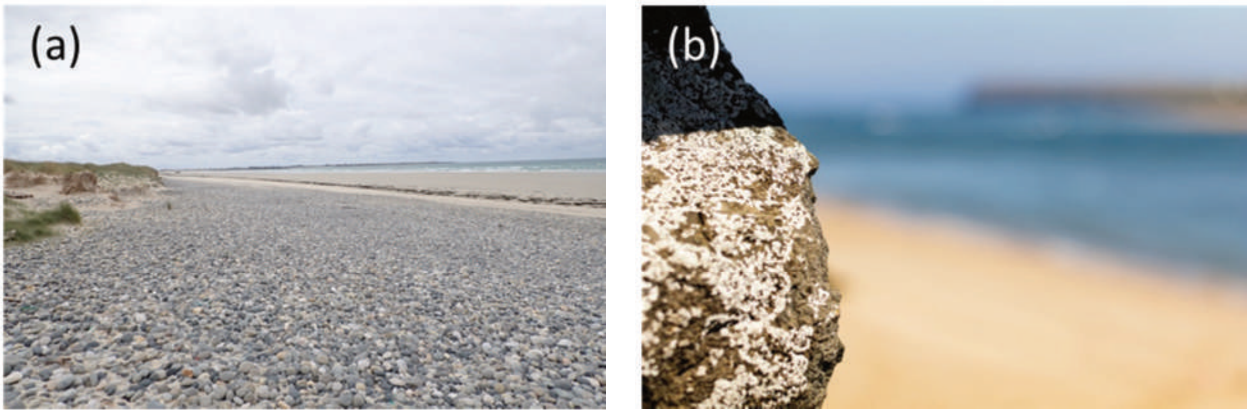


Figure 3 (a) Example of an exposed coastline with pebbles at the top of the beach (©Cedre)
(b) Photo of Perforatus perforatus *(copyright free)*

4. A living and fragile environment

Situated at the interface of the sea, the land and the atmosphere, the coastline shelters or is frequented by a very rich and diverse fauna and flora, very often interdependent, conferring on this restricted space an ecological sensitivity of the first order.

All this richness ranges from the infratidal to the supratidal, a profile along which it nevertheless shows great differences.

The **least biologically rich part**, whatever the substratum, corresponds (and even more so in the exposed sectors) to the upper part of the foreshore which is subject to greater hydric and thermal stress (because it is exposed for longer periods) and is subject to more violent physical disturbances (erosion; massive natural sedimentary movements). These harsh conditions limit the number of marine species to a few very tolerant and adapted species known as opportunistics, essentially detritus feeders (e.g. sand hopper, *Talitrus saltator*).

Paradoxically, this biologically poor fringe plays a major ecological role in the coastal zone, especially in the upper levels of the sedimentary foreshores: pebble ridge and especially dune ridge).

Several functions are carried out there, including:

- habitat: home to the marine debris line (**Appendix 2**) which traps sand, attracts and shelters many animal species (especially terrestrial: insects, birds, etc. which come to lay eggs, feed, etc.) and plants (developing on the algae in the pebble strips for example) (Figure 4a);
- nesting: nesting area for some sea bird species, on the ground or in the cliff (sometimes using litter to build their nests);
- buffer against coastal erosion: site of the colonisation of vegetation (or embryonic dune) which by reinforcing the foot of the dune stabilises the coastline (Figure 4b).

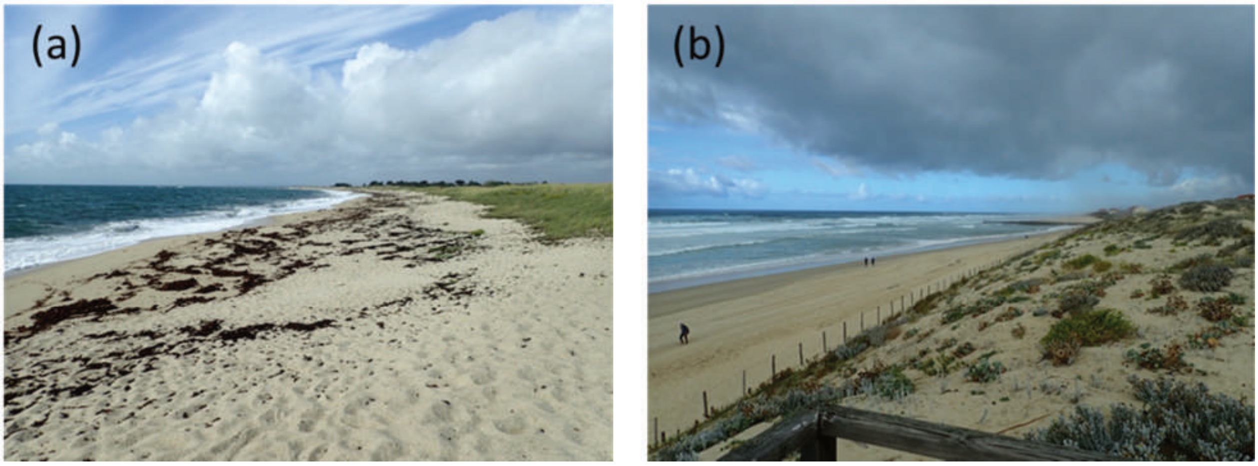


Figure 4 (a) Photograph of marine debris line (©Cedre)
(b) Example of littoral vegetation on the upper beach (©Cedre)

This upper part, however, is also the most fragile part of the foreshore. Indeed, this part of the foreshore is the most vulnerable to marine erosion: any physical modification is most often definitive and results in the receding of the coastline, or at least in the weakening of the sedimentary environments (dune, pebble beach) with possible irreversible effects on the long term.

WHAT YOU NEED TO KNOW ABOUT LITTER

1. Trapped or in transit, but everywhere on the coastline

Marine litter is present on all types of coasts but its duration of stay varies according to the configuration of the coast and its exposure to waves. It can remain trapped for a certain period of time in coastal crevices that constitute a natural trap (cave, cove, small closed beach) or transit more regularly along long shores (especially dunes) where the longshore drift is not blocked by a rocky promontory or a jetty, for example. In addition, due to sudden or seasonal sedimentary movements, litter may be covered by sand in the space of one or two tides and thus remain buried for several weeks or months, only to reappear later when the sedimentary stock migrates down the beach (Figure 5).

Litter is visible all along the coastline. The foreshore is the preferred stranding place for all kinds of natural debris and marine litter which tend to accumulate at the upper beach level under the combined effect of waves, tide and wind. The nearshore is locally, in shallow waters (< 15 m), the site of accumulations of litter which are generally waiting for waves powerful enough to have an effect on the bottom (by diffraction) and thus push them over the bottom towards the foreshore. The backshore also very often displays litter either from the sea (due to the effect of storms or wind) or from the land (abandoned on site or brought by the wind) (Figure 5).

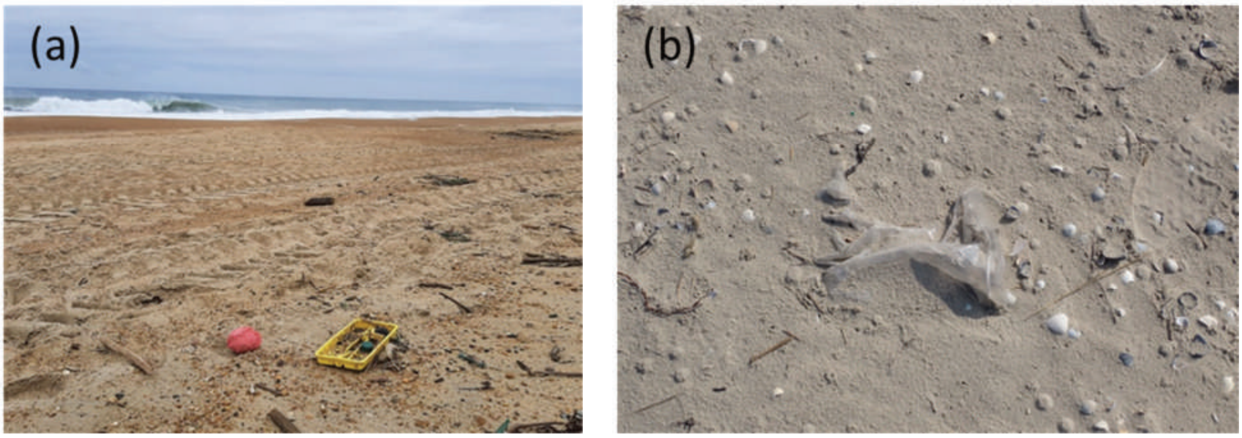


Figure 5 (a) Example of beach litter stranded at the top of the beach (©Cedre)
(b) Example of litter covered by sand (©Cedre)

2. From different sources, variously located

The intensity of the many activities carried out in the marine environment and on the coast varies according to the region and country. Whether they are directly linked to the sea (maritime transport, tourism, fishing, shellfish farming, aquaculture, water sports, etc.) or more terrestrial (urban agglomeration, water treatment, industry, commerce, agriculture, energy, etc.), most of them are subject to seasonal variations which are sometimes very marked (tourism in particular): all of them are, to varying degrees, sources of litter.

The occupation of the coastal area varies greatly from one sector to another, depending on the share of the different functions attributed to it locally: urban, agricultural, industrial, leisure, port, nature.

Sectors with a high population density are followed by others that are much less populated, or even almost deserted, sometimes for tens of kilometres. In these sparsely populated areas, access to the coastline is, for various reasons (geomorphology, risks, remoteness, environmental protection, military area, etc.), rare and several kilometres apart from each other.

3. Of various types and differently distributed on the coast

Beach litter is abundant on the coastline. According to the assessement performed by the CleanAtlantic projet over the period 2016-2019[1], a median abundance of 172 litter items/100 m is observed on the Atlantic Area coastline, which is much higher than the adopted European threshold value[2] of 20 litter items/100 m. Unsurprisingly, plastic litter items represent the major part of the pollution with 90% of litter collected on the Atlantic area coastline being plastics.

Beach litter is composed of a large variety of litter types with various shapes and sizes going from several meters (e.g. a trawl, etc.) to a few milimeters (e.g. cigarette filter, plastic fragment, etc.). Beach litter is thus complex with a large diversity of littrer types as presented Figure 6.

Figure 6: Large variety of litter that can be collected on the beaches (©Cedre)

At the Atlantic Area level, single-use plastics and maritime related items represent 39% and 19% of total litter collected respectively. Among the top litter types, small items are mainly collected: strang and cords with diameter less than 1 cm, cotton bud sticks, caps and lids, cigarette filters, etc. In addition, non-identifiable plastic fragments represent nearly 20% of beach litter observed on Atlantic Area coastline. This

[1] André, S., Lacroix, C., Kerambrun, L., Gago Piñeiro, J., González Nuevo, G., Pérez, P., Fernández, M., Russel, J., 2020, *Overview of marine Litter Status in the Atlantic Area: Beach Litter.* CleanAtlantic Project. http://www.cleanatlantic.eu/wp-content/uploads/2021/04/CleanAtlantic-4-1-Overview-of-marine-litter-status-in-the-Atlantic-area-beach-litter.pdf

[2] Van Loon, W., Hanke, G., Fleet, D., Werner, S., Barry, J., Strand, J., Eriksson, J., Galgani, F., Gräwe, D., Schulz, M., Vlachogianni, T., Press, M., Blidberg, E. and Walvoort, D., 2020. *A European Threshold Value and Assessment Method for Macro Litter on Coastlines*. EUR 30347 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-21444-1, doi:10.2760/54369, JRC121707

characterises the incidious nature of marine litter pollution which makes it more difficult to identify and determine possible sources, but also makes clean-up operations more complex. Indeed, small litter items and fragments can easily get buried in the sediment or being trapped in natural or artificial structures.

Finally, geographical differences are observed in terms of beach litter composition at the scales of marine sub-regions and local moniroting sites. These differences can be due to many factors: local activities that may generate litter, the morphology of the site and the coastal environment, the local weather, etc. The regional and local characteristics therefore lead to different types of beach litter pollution which may require specific cleaning methods and equipment.

4. Roughly churned up in a very dynamic environment

Marine litter that washes ashore does not only come from the sea or the coastline: a very large proportion is brought in from the land, notably by rivers, to a lesser extent, by the wind, or directly deposited deposited onsite by users. Not all litter has a local origin: much of it may have travelled a long distance on currents and wind before being washed up. The behaviour and fate of litter in the marine environment are determined by the same hydrodynamics that shape the coastline (tide, current, wind, swell and waves).

Whole objects or parts of objects - and often just fragments - marine litter comes in a wide range of shapes, weights and sizes (Figure 7); all characteristics that give it a variety of behaviours at sea: sinking, floating, subfloating, running aground, flying away, being re-mobilised, etc.; and this on variable scales of time and distance.

Figure 7: Examples of litter from various origins: industrial plastic pellets and macrolitter (biomedia, hunting cartridge, pallet) (©Cedre)

Litter can very quickly be transported by the sea well beyond the boundaries of the municipality where it has been discarded. Thus, the coastlines of urbanised areas are not necessarily the most contaminated by marine litter (litter momentarily present on urban beaches is generally removed very quickly by the municipalities or citizens), and there are often significant accumulations in remote, little-frequented sites.

The **tides** have a particular influence on the distribution of natural debris - and marine litter - that the sea deposits at the end of the flood and beginning of the ebb tide, when the waves fade and lose their ability to mobilise it. These deposits at the high tide of the day are made along a line marking the maximum level reached by the sea that day; this linear deposit is called the marine debris line (**Appendix 2**).

General and then near-shore **currents** drive the drift of litter out to sea. The currents induced by watercourses (especially torrential rivers) transport litter well beyond the estuarine system, which is picked up at sea by general and coastal currents.

Through the combination of these local general and coastal currents, and the turbulence at the coast due to the topography of the coastline, litter "favours" certain stranding sites. Like wreck seaweeds and posidonia leaves (which, however, drift less), litter tends to accumulate in the same places. The permanence of preferential accumulation sites can be explained by the simple fact that they correspond to the average result of the meteorological and oceanic factors (wind, current, swell) prevailing in these sectors (Figure 8).

Figure 8: Examples of areas where litter accumulates on the Crozon península and at the exit of Canche Bay, France (©Cedre)

Waves affect marine litter in different ways, depending on whether it is floating on the surface, sub-floating in the water column, resting on the shallows or washed up on the shoreline:

- as it approaches the coast:
  - the swell, together with the wind, controls the trajectory of the drift of litter abandoned or lost at sea, or washed up by rivers, as well as the point at which it washes up on the coast;
- in shallow waters (less than 15 m):
  - the well-formed swell moves the sunken litter, in the same way and at the same time as the seaweeds and posidonia leave regularly torn from these depths, which, like them, end up stranded on the beach;

- on the shoreline:
  - the waves roll the litter into the surf zone at each rising tide; on the long dune foreshores, the litter, in transit, migrates like the sediments, in the direction of the longshore drift, constantly going up and down the slope of the beach to the rhythm of the ebb and flow of the waves;
  - the waves mix the litter into the pebble strips, within which, like the pebbles, it moves, undergoing compression and abrasion for as long as it remains stuck there;
  - they bury the litter within the beach by covering it, following a substantial input of sand, either temporarily or seasonally in the spring (natural accretion phase known as beach nourishment); and make it reappear on the surface some time later, during a sudden erosion episode (storm for example) or during the seasonal phase of the natural erosion of the beach;
  - they wedge the litter under boulders that it may have exceptionally lifted during a storm, within a riprap (groin, jetty) or at the foot of a rocky cliff; and block them in major anfractuosities of a cliff (fault, cave);
  - they sometimes throw the litter, during a gale or storm, beyond the foreshore, into the supratidal zone (at the top of the dune, for example), from where it can no longer be remobilised by the sea and where it will be momentarily strongly exposed to atmospheric factors, in particular to the sun's UV rays, a major factor in the photochemical degradation of plastics in particular; the litter will then be transported by the wind or buried by wind-blown sand.

Waves can break, fragment or at least erode litter as it travels along the coastline. Waves can also modify the buoyancy of certain litter by dislocation of constituent elements of different materials (e.g. fishing traps), by piercing of containers (bottles, cans, etc.) or even probably by unscrewing of caps due to excess pressure.

Winds also contribute to the distribution of litter on the coastline:

- they have a direct influence, in association with currents, on the drift of litter at sea;
- they can carry light litter inland, and conversely, in an onshore wind, bring litter to the beach;
- coming from land, they can facilitate the remobilisation by the sea, at high tide, of stranded litter and its subsequent redistribution;
- they can bury litter on the beach, tearing away the dry sand from the foreshore and tending to level out the roughness of the foreshore by accumulation (eolian sand).

5. Weathered with time

The vast majority of marine litter washed up on the coast is made up of all types of plastic: hard or soft (polypropylene, polyethylene, polyurethane, polyethylene terephtalate, foamed polystyrene, rubber, etc.) enriched with different types of additives depending on their use. This variety of materials implies a diverse fate, in terms of mechanical resistance (shocks, abrasion, breakage, tearing, fragmentation, etc.) and degradation (photochemical, etc.) and consequently variable life spans that are impossible to determine with precision, particularly due to the wide range of possible scenarios of exposure to ageing agents.

6. Causing proven impacts on the coastal environment

The ecological and toxicological impact of marine litter appears to be less onshore or at least less visible than at sea, where evidence of ingestion (macro- and microlitter), intoxication (additives and chemicals) and entanglement is well documented. However, similar impacts obviously occur in the tidal zone (especially with microplastics) when the foreshore is submerged. The litter accumulates with the natural debris on the upper part of the foreshore (Figure 9a), which is in fact the least biologically rich part of the beach. The ecological impact of stranded macrolitter is therefore a priori low, but it is not zero. Various deleterious scenarios are possible: chemical contamination of birds' eggs (which use plastic macro-waste to build their nests); chemical contamination of the environment (following the spillage on the beach of the contents of certain stranded containers: cans, drums, etc.); suffocation of the fauna (in the event of a massive arrival of certain types of litter and its maintenance over a long period), etc. The most obvious potential impact is an indirect impact caused by the systematic removal of the sea line during a not recommended or poorly explained clean-up operation (mainly mechanical, but also manual).

From an economic point of view, the presence of litter on the coast has a negative effect on the image of the site, and the presence of certain types of litter amplifies this effect; this is the case of sanitary litter items (syringes, cotton buds, face masks, etc.) or water treatment items (filter media, etc.), for example (Figure 9b). As a result, litter can lead to a drop in the number of visitors and thus to a significant economic loss, particularly in the tourism sector. To remedy this situation, the local authorities are forced to carry out curative measures - and increasingly preventive and incentive measures - which are costly. The consequent effort cannot be limited to the budget allocated by the state and local authorities alone, but must also include the participation of the various voluntary associations and the involvement of individual citizens.

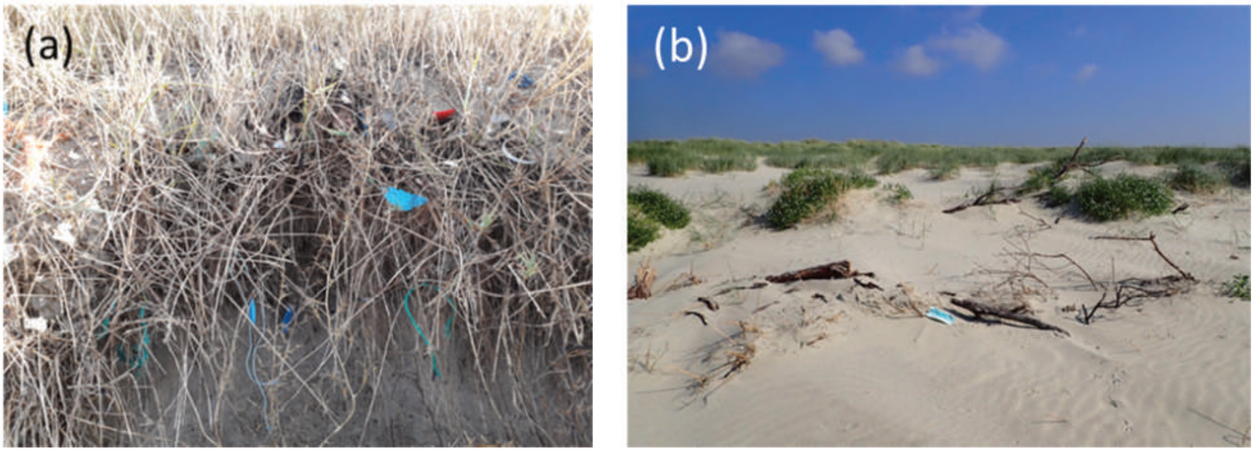


Figure 9 (a) Dune fauna covered by litter (©Cedre) (b) Beached mask (©Cedre)

7. A stock of litter to be reduced?

The local stock of litter on the coast should tend to be reduced in the long term; at least this is the optimistic impression that emerges from a double observation:

- **less and less litter is being thrown away and it is being collected more systematically (citizen observation):**
  The numerous measures, campaigns, initiatives and actions against marine litter carried out at local, national and international levels have made society aware of the harmful effects of marine litter pollution, particularly that caused by plastics. The increasing rejection of plastics by authorities, NGOs and consumers has led to changes in legislation, the attitude of producers and distributors of consumer goods and the behaviour of citizens.
  There are several converging reasons why marine litter, including plastics, should be expected to be less in the environment in the future: (i) the production of certain plastics should slow down (apart from the pandemic impact) as a result of the ban on the production of certain single-use items, the expected sharp reduction in plastic packaging, and the increasing reuse and recycling of used plastics; (ii) the loss, dumping and abandonment of litter in the environment should be reduced as a result of a greater sense of citizenship; (iii) more and more people, including individuals, are systematically picking up litter in nature, not only on beaches, but increasingly in cities, along rivers, roads, in the woods, in the mountains, etc.
- **the more you clean, the less you remove (cleaner's statement):**
  At the scale of a coastal sector, the more a site is cleaned, the more the volume of litter collected decreases over time. The local stock corresponds to the litter accumulated, sometimes for several seasons, within the beach system (space including the nearshore, the foreshore and the backshore). Litter that was previously inaccessible because it sank to the bottom or was buried in the sand and pebbles is periodically re-mobilised, for example during erosive storms, and returned to the surface of the beach, from where it can be either removed by the sea or man-collected.

8. Or a long-term challenge?

Other findings, however, predict a less optimistic situation in the years to come, with the flow of litter continuing to wash up on the coast:

- **plastic production is not yet set to decrease**, but on the contrary to increase;
- **only a very small proportion of this production will be recycled**, despite the efforts made in this area;
- **objects will inevitably continue to end up at sea**:
  - from accidental losses at sea (on-board objects, packages and containers, fishing gear, etc.) that will always occur;
  - from the regular tearing up by storms of various infrastructure elements, harbours, boating, shellfish farming, urban development, etc.;
  - with climate change (notably the concomitance of rising sea levels and major meteorological phenomena), the occurrence of destructive natural disasters, major sources of marine litter, will increase (hurricanes, floods, submersion, etc.).

WHAT YOU NEED TO KNOW ABOUT THE CLEAN-UP

1. Why to clean up the shoreline?

The purpose of a shoreline clean-up is manifold:

- To contribute to the overall clean-up of the marine environment by (i) limiting the spread of litter in the marine environment, and (ii) not just waiting for the sea to do the work and for the litter to remove itself from the coastline;
- Limit the ecological impact of litter and preserve the ecological functions of the coastline, by reducing (i) the time litter remains in the marine environment, (ii) the interactions of litter with fauna and flora, and (iii) the risks of fragmentation and dissemination of litter;
- Ensure the proper functioning of the (economic and leisure) uses of the coastline, by ensuring the cleanliness and healthiness of the coastline, particularly the beaches, so that they can be visited without risk to users, including tourists.

2. Manual or mechanical collection?

There are two ways of cleaning the coastline: manually or with the help of mechanical equipment. Although manual collection is the most common technique, it is often the case that both techniques are carried out in a complementary manner. The implementation of operations, whether manual or mechanical, is dependent on weather and sea conditions, as:

- breaking waves can compromise the safety of the operators and prevent operations from taking place, or require them to be brought forward beyond a certain time of the tide;
- the time of the tide often determines the possibility of starting or continuing clean-up operations, and may require adjustments to be made.

2.1. Manual collection

Manual collection should be envisaged on small beaches, especially when they are located on a wild coastline with high ecological issues. Apart from small beaches, which are very touristic and generally urban and easily accessible to machinery, manual collection is the only feasible technique on small beaches. For large dune areas where mechanical cleaning is used, manual collection should always be combined with in order to selectively clean the foot of the dunes (Figure 10Figure 10).

Most of the time, it is done simply by hand, and sometimes with manual tongs; the operator must wear basic personal protective equipment (gloves and shoes at least).

Manual collection is very flexible (can be deployed anywhere) and normally has the major advantage of being environmentally friendly as it is very selective and only removes the litter, not the sand, natural debris or plants. However, it is relatively inefficient and can become physically demanding for some operators beyond a certain distance, time or quantity of litter to transport. Bulky litter or long distances on the beach often require logistical support to transport the litter, either manually (stretcher, wheelbarrow, etc.), motorised (quad, 4x4), and/or animal (horse) (Figure 10).

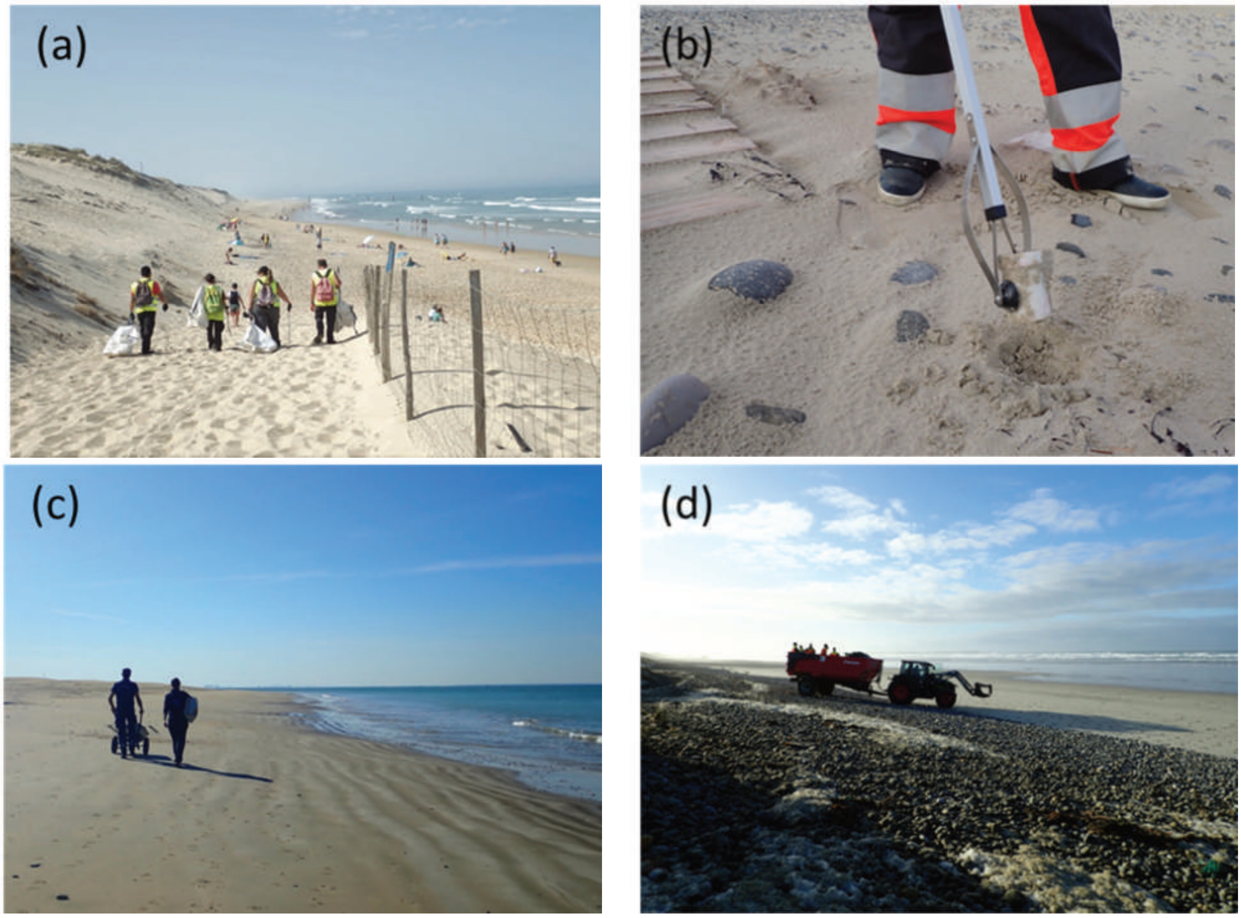


Figure 10 (a) Beach clean-up by a social insertion association team (©Cedre)
(b) Removal of macrolitter from the dune using a pair of pliers (©Cedre)
(c) Use of a wheelbarrow to transport the beach macrolitter (©Cedre)
(d) Use of a tracted trailer to transport large quantities of beach macrolitter (©Cedre)

2.2. Mechanical cleaning

The use of mechanical equipment to clean a beach is sometimes justified. The large sandy areas of the dune massif type are perfectly suited to the use of mechanical equipment, provided that it is used appropriately and that it is not used systematically, i.e. overly for tourist reasons, as was done a few years ago in certain coastal areas. The cleaning of this type of sector, which is very often far from urban areas, is most of the time operationally complicated, due to the poor accessibility of the coastline, its potential danger at high tide, and the limited human resources compared to the distances to be cleaned and the volumes of litter to be collected and transported.

Cleaning an urban beach is easier than cleaning a remote wild dune area: accessibility and traffic are much easier and, as these are generally highly anthropised sites, the ecological sensitivity and environmental constraints are much less. On these beaches, where there is a lot of public use, mechanical cleaning is the most common option.

Different types of equipment are generally used, including (i) equipment that is very common in activities other than cleaning (such as public works, agriculture, etc.), and (ii) mobile equipment specifically developed to remove macrolitter from beaches.

In the presence of large volumes of stranded litter or large-sized litter (ghost net, wood logs, etc.), public works or agricultural type machinery is needed to carry out various operations, handling (arms, etc.), concentration for an initial roughening (agricultural claw, rake, etc.), and then evacuation off the beach (trailers, dumpers, etc.). For less coarse cleaning, there are specific mechanical rolling machines, specially designed to be selective (i.e. limiting sand removal) while having a high output.

3. Specific equipment

The use of specific equipment is possible under certain conditions:

- the existence of a sufficiently wide access;
- a beach that is large enough and free of rocks to allow easy circulation;
- a relatively fine, homogeneous and slightly humid to very dry sediment, to be selective and collect only litter (without sand);
- outside any area that is momentarily or constantly colonised by vegetation, so as not to damage the coastal environment.

Two specific types of machines are commonly used: raking machines and screening machines (Figure 11). A wide variety of models are available on the market. The larger units are usually towed. They are based on a fairly similar basic principle comprising (i) a rotating mesh belt (around 2 or 3 axes) inclined on which the litter rises and through which the sand flows to fall back onto the beach, and (ii) a collecting tray, (iii) 2 or more shafts that both rotate the belt and vibrate (shake) it to break up and spread the sand clumps to improve screening.

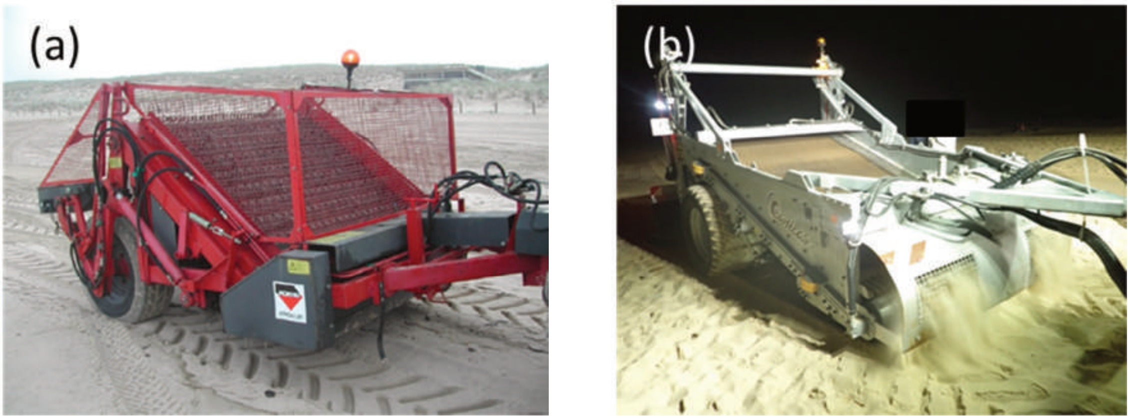


Figure 11 (a) Example of a raking machine (©Cedre) (b) Example of a screening machine (©Cedre)

The mesh belt of the **raking machines** is equipped with claws, or soft teeth, which both remove the coarsest litter from the surface of the beach by scratching the very first few centimetres, and hold it as it rises on the belt. They ensure a coarser cleaning than the screening machines. In areas of high tourist interest, they are often used in conjunction with screening machines, in order to prepare and optimise the work of the latter.

By design, raking machines have several advantages over screening machines: they lift less sand; they can operate at a higher forward speed; they can work effectively on wet and even relatively more heterogeneous sand. For these reasons, they are often the only machines used on wilderness sites that are removed, especially outside the tourist season. Some raking machines are now equipped with a front-end device that allows them to work in the first 20 cm of the surface.

Screening machines are used to lift smaller litter sizes than screening machines can, and with their adjustable cutting blade, they penetrate the sand to a depth of 0 cm to 30 cm. A screening machine generally consists of:

- a front blade that scours the surface layer of the beach to an adjustable thickness of 0 to 30 cm) forms a bead of sand in front of the mat;
- a rotary pick-up (front sand feeder) located at the leve of the blade, which destroys the bead by throwing the sand back onto the screening belt, either of the beater type (claw, paddle, etc.) or the bar cylinder type;
- a mesh screen belt, without claws, rotating around 2 axes to ensure both its rotation and its vibration (by shaking) to break up and spread the sand clusters in order to improve the screening. The screening mesh, which is much smaller than that of the raking machine, varies from 15 to 40 mm. The machines are supplied with a set of interchangeable mats of different mesh sizes to adapt to the conditions encountered (type of sand, humidity, etc.);
- and sometimes a finisher (such as a toothed bar, flap, chain, etc.), towed at the rear of the machine to flatten the fluffy sand from the sieve.

Some design elements vary according to the manufacturers who propose several variants concerning the locomotion (e.g. self-propelled tracked screening machine), the screening (instead of the belt: an inclined truncated cone screen, equipped with internal gyudes to facilitate the upward movements of the litter, or a horizontal screened hopper fed by a conveyor belt for example), or the sand supply (front pick-up composed of two augers, for example), etc.

Screening machines can be grouped into 4 categories according to size, which offer particular conditions of intervention, in terms of working width and depth, circulation/rotation, screening fineness, etc.:

- *tractor-towed screening machines:* these are large to medium-sized screening machines towed by a tractor; this combination is the most commonly used device for beach cleaning, particularly the large tourist beaches and also the wilder and more remote ones. The 4-wheel drive tractor, either agricultural or construction type, must have a minimum power of 150 hp to pull the larger screeners over large areas. These screening machines - some of which have a double screening belt - offer a sweeping width of 1.50 m to 2.50 m, and a maximum working depth of 15 to 30 cm.
- *tractor-mounted screening machines:* these are medium-sized belt screening machines (with a screening width of 1.50 m and a maximum depth of 15 cm) mounted on the 3-point linkage of a less powerful tractor, which make it possible to clean smaller areas that are inaccessible to towed screening machines thanks to a reduced turning radius. There are also smaller screeners which are not fitted with a belt but with simple shaking baskets;
- *self-propelled screening machines:* these are motorised machines (some of which are tracked) generally corresponding to small screening machines (exceptionally large models) used on certain tourist beaches - as well as on sandy areas other than beaches (golf courses, equestrian areas, etc.);
- *mini-self-propelled screening machines (or mini-screeners):* these are small garden mower type machines, very often used by beach attendants. Screening is usually done using shaker baskets. Easy to handle, they allow access to places inaccessible to other screening machines and finer screening (up to a mesh size of 3mm) on a maximum dry sand layer thickness of about 5 cm.

Performance depending on several factors

The performance and efficiency of large screening machines depend primarily on the environmental conditions and the triplet that defines the combination: tractor, screening machine, and operator.

The environmental characteristics are decisive in that they determine the feasibility of using the screening machine. These include:

- the granulometry: the quality and selectivity of the mechanical equipment - especially the screening machines - are all the better when the sand is fine and homogeneous;
- the hygrometry of the sand: ideally, the sand should be dry; sand that is too wet tends to clump and clog the belt, particularly that of the screening machines: the speed of advance of the machine must be reduced accordingly;
- the slope of the beach: an excessively steep slope, common towards the top of the beach, causes the towed equipment to be off-centre ("crabbed") due to the imbalance of the equipment when attacking the sand, which sinks more on one side than on the other. This is more noticeable with tractor-towed screening machines; this disadvantage is less pronounced with mounted screening machines, which can be used on slopes that are inaccessible to towed models.

The tractor unit must have the following characteristics:

- 4-wheel drive (for towing large and medium-sized units);
- three-point drive (for tractor-mounted screening machines);
- sufficient power: 150 HP minimum required for large towed screening machines;
- the ability to work at sometimes very low speeds, especially when the sand is wet, while maintaining power (hydraulic transmission and viscous coupling);
- tyres adapted to relatively soft soils (dry sand) and at the right pressure: inflation or ballasting with water (i.e. filled to ¾ of water) is often carried out.

The driver, who is the key element of the device: he is the one who optimises the raking and screening, by constantly seeking the appropriate adjustments, which guarantee the quality of the work:

- the speed of rotation of the pick-up;
- the rotation speed of the sieve, generally around 500 rpm;
- the forward speed of the tractor, which is optimal between 1 and 4 km/h, depending on the characteristics of the sand and litter;
- the working depth.

4. Operations that can have negative impacts on the environment

Cleaning operations, whether mechanical or manual, can have negative effects on the beach environment. If they are poorly implemented or inappropriate, they can lead to erosion of the dune, either directly (as a result of inappropriate sand removal, for example) or indirectly (as a result of the disappearance of pioneer plants that stabilise the dune, for example.

The potential impacts of poorly organised **mechanical cleaning** are numerous; they can have a double effect:

- **a physical impact** (which may favour the erosion of the coastline) due to:
  - the widening and potential (de)compacting of the beach access, and possibly the degradation of the dune to reach the beach if this is done outside the accesses provided for this purpose (Figure 12a);
  - the uprooting or destruction of vegetation leading to the destructuring of the foot of the dune when the machine is used too high on the foreshore (Figure 12b, Figure 12c);
  - abusive removal of sediments, particularly when used on a beach that is unsuitable for screening (presence of mixed coarse sediments, etc.), or poor practices (incorrect adjustment of the forward speed of the tractor or the machine: depth of the cutting blade, speed of the screening belt, etc.) causing increased erosion of the coastline (Figure 12d);
  - other physical impacts are sometimes mentioned by critics of mechanical cleaning, although their real negative impact has not been demonstrated:
    - the fragmentation of the sand by repeated passage, which can only occur essentially at the beginning of the penetration of the blade or claws and more particularly on the shell fraction of the sand;
    - the decompacting of the sand, which favours wind deflation; this can only occur in the event of strong winds on the finest grains, which are momentarily brought to the surface; the swelling of the sand is temporary (between now and the next tide) and levelling after mechanical cleaning reduces the possibility of this happening.
- **a biological impact** (which could lead to a possible decrease in biodiversity in the long term due to the rarefaction of certain species that are dependent on the seashore and the embryonic dune) due to:
  - the removal of the stranded sealine;
  - the uprooting of pioneer plants of the yellow dune;
  - the depletion of the seed bank.

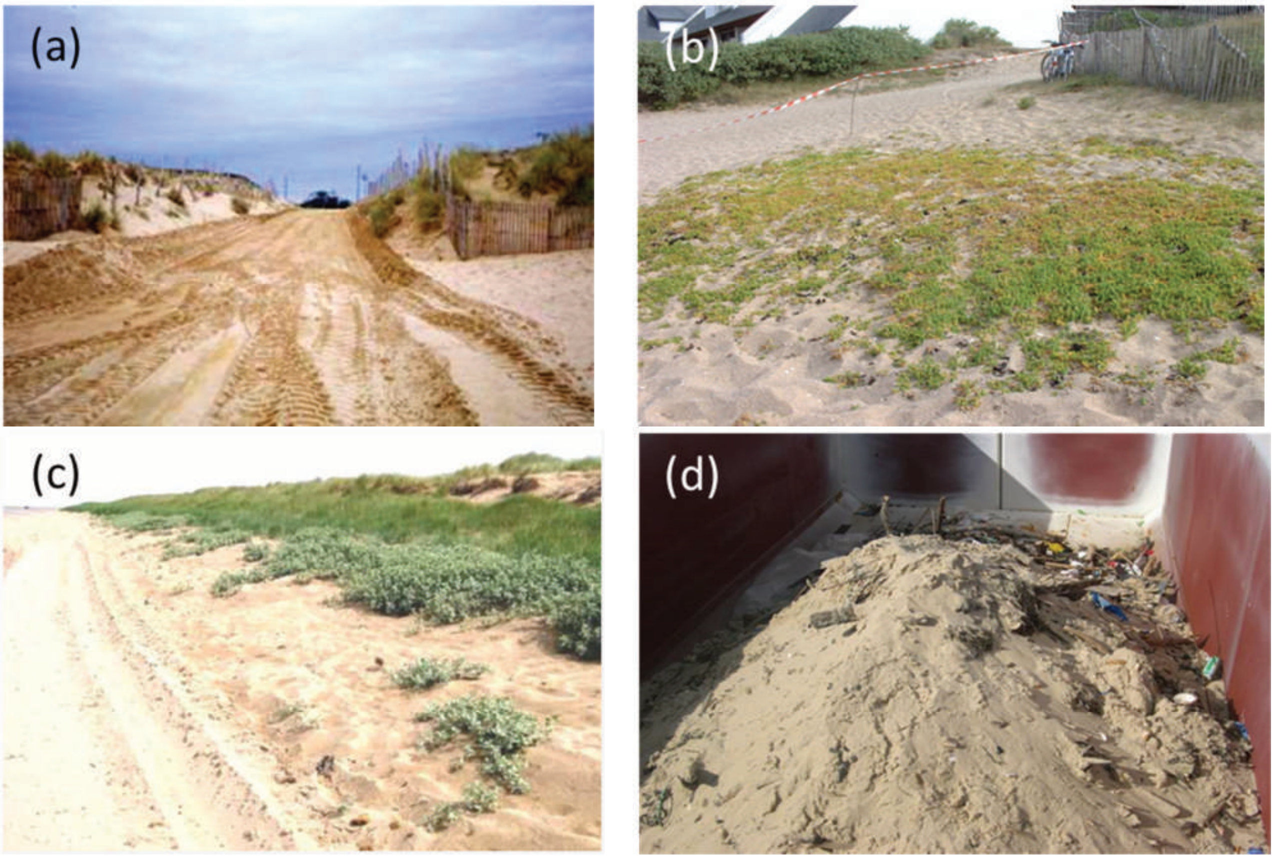


Figure 12 (a) Degradation of beach accesses (©Cedre)
(b,c) Destruction of beach top vegetation following a passage too high on the foreshore (©Cedre and ©CNBNB)
(d) Excessive removal of sand (©Cedre)

Mechanical equipment is more likely to cause these negative effects than **manual collection**, but the latter, poorly done, especially on the dunes, is not exempt from the same types of impacts:

- a biological impact (on the vegetation of the embryonic dune and the yellow dune), due to:
    - over-trampling leading to the destructuring and breaking of the aerial plants and the root system;
    - the uprooting of vegetation;
- a physical impact (contributing to the fragility of the dune) due to:
    - the crumbling of the sand and the digging of the dune that the wind then widens;
    - the removal of sand, which is not negligible (particularly wet sand contained in certain types of litter: containers, etc.).

5. What to do with the collected litter

The litter collected on the beaches must be sorted in order to be integrated into the local management (sorting, grouping, transfer) and disposal system for household and similar waste in order to be recycled or recovered in accordance with local regulations.

Waste treatment centres do not all have the same technologies and procedures; they have different acceptance conditions - in terms of type of litter (materials, etc.) and quality of the litter (presence of sand, salt, biological film, etc.) - and reception (in terms of storage capacity).

It is therefore necessary to get information locally, from the competent authorities, to know what is possible to consider in order to directing the litter to the appropriate local waste channels.

Mechanical cleaning operations can produce significant volumes of litter as they generally concern a large linear area. This litter is a priori well managed insofar as this cleaning is almost exclusively carried out by the local authority, either by municipal employees or by a subcontractor. Recovered litter management is part of the cleaning contract and is now a key element in the selection of companies. The large volumes involved make it possible to envisage or impose the implementation of an optimal evacuation and treatment chain, contributing to reducing the negative impact of pollution (Figure 13a).

Collected litter from manual collection operations - other than a one-time collection from a remote, rarely cleaned accumulation site, for example - is generally relatively small in volume and is composed of litter from a variety of materials whose respective percentages vary widely over time and space (Figure 13b).

The destination of this collected litter is the nearest local waste collection centre. Recyclable waste must be separated from the general litter: it is generally metals (especially cans), wood, and certain plastics, especially PET bottles (depending on their state of freshness and contamination).

As the waste disposal centre is sometimes a long way from the collection site - and sometimes has to be paid for and is only accessible with an individual pass - it is recommended that the organisers of these manual collections systematically contact the municipality to agree on a point where the bags of litter can be deposited, outside their site, so that the local services can pick them up quickly.

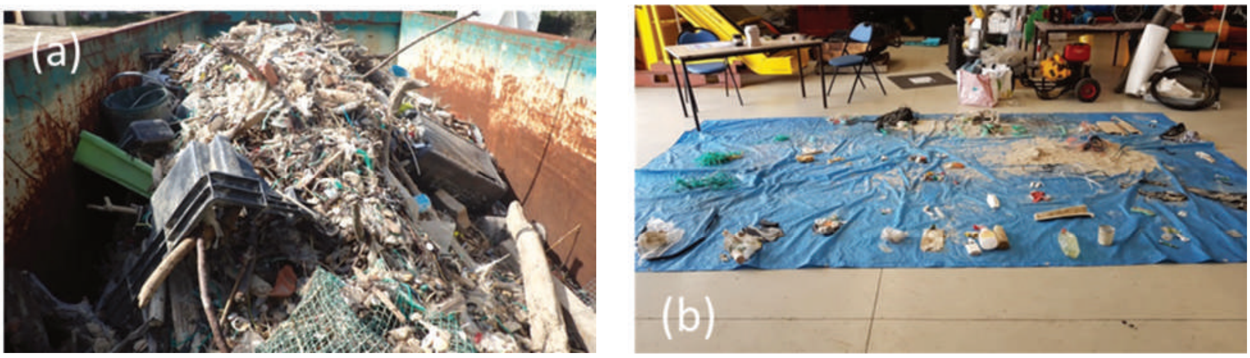


Figure 13 (a) Example of litter recovered by mechanical cleaning over 100 m of linear space (©Cedre)
(b) Example of litter recovered by manual cleaning over 100 m of linear space (©Cedre)

WHAT TO DO BEFORE CLEANING

1. For municipalities: establish an appropriate beach cleaning plan in advance

In order to optimize the cost and efficiency of beach clean-ups and to limit their potential impact on the environment, local authorities generally define a clean-up plan, either on a local scale (commune or group of communes) or on a wider scale.

To this end, local authorities in some countries (e.g. France) have opted for a "reasoned" or "wise" beach cleaning approach. This approach consists in implementing cleaning operations that are differentiated in time and space, i.e. adapted according to the ecological sensitivity, usages and frequentation of the coastline.

This type of planned clean-up includes both manual and mechanical collection operations, as well as the management of the collected litter. The following steps are necessary to establish such a plan.

1.1. Know the local coastline to preserve the environment

The first step in a wise clean-up is to know the coastline well (Figure 14a). Initiated by a local authority (either the authority responsible for coastal clean-up - generally the mayor of the commune (at least in France), or the authority in charge of the clean-up - group of communes or county for example - in the case of a clean-up involving several communes, etc.), it involves as many relevant stakeholders as necessary (economy; environment; natural resources; waste, etc.): elected representatives, public establishments (patrimony, water, forestry, etc.), professions linked to the sea, managers of natural sites, scientific bodies, associations, etc.

This study phase consists of:

- making an inventory of:
  - the environmental and economic issues at stake in the coastal area concerned:
    - types of coastline;
    - existing protected or of interest areas and species;
    - uses likely to produce litter and/or justify a certain frequency of cleaning;
  - the various constraints and risks likely to:
    - penalise or prevent clean-up operations (accessibility to certain coastal sectors: ownership and occupation of space, etc.; type of access to the beach; crossing of rivers or channels; etc.);
    - present a danger to operators (linked to the topography: marshes, cliffs, etc.; or linked to the sea at a given moment: tide, breakers, etc.);
  - main sites of litter accumulation on the coastline;
    - locate them and evaluate the volumes involved;
- maping and scheduling these inventories (with required seasonality).

1.2. Define the components of the cleaning plan

Depending on the characteristics and seasonality of the issues at stake, the constraints of intervention, the possible dangers for operators, and the volumes of litter, define:

- prioritised areas of intervention:
  - the most appropriate techniques and means for each of these (this may include testing and adapting existing equipment);
  - evaluate their costs in order to make comparative assessments;
  - the seasonal timing of operations;
- the logistics of managing the collected litter:
  - provide for evacuation logistics adapted to the volume;
  - provide for storage sites (particularly in the case of large volumes): study the locations, their dimensions; make these sites safe (fenced areas) to prevent the skips from becoming unauthorised dumps (by individuals and companies);
- the fate and recovery of litter:
  - identify local and regional recovery, recycling and treatment channels.

1.3. Order the necessary resources

- Define the resources required by sector and according to the season;
- Pool the resources as much as possible on a scale other than communal (grouping of communes, county if possible) to harmonise techniques and reduce costs and impacts;
- Ensure the availability of the required resources: if necessary, contract or subcontract with competent organisations: social integration organisations, environmental NGO, etc. for manual collection; private cleaning, transport or waste companies for mechanised collection, transport and litter treatment.

1.4. Raising awareness among operators

Once the plan has been validated, the authority in charge:

- informs the various actors (and beyond that, the general public) on the procedures for implementing clean-up operations;
- takes the necessary steps to train the operators (Figure 14b): local authority employees, private subcontractors (work integration organisations, private companies), volunteers from NGOs, etc.

1.5. And a few days before organizing the operations site by site

As the day of cleaning approaches, the authority should specify in detail, in view of the conditions at the time, the conduct and organisation of manual and mechanical operations, at the site level. This involves:

- assess the possible impact of coming weather and sea conditions on the conduct of operations (tide times, tidal range, wind, rain, etc.);
- check the possible constraints and disturbances resulting from recent events:
  - storms (erosion; state of access and beaches, etc.);
  - sea events (possible arrivals of mass or specific litter);
  - frequentation of the coastline: tourist influx, festive events, etc.;
- adapt the time slots and resources accordingly (including those for litter management);
- inform stakeholders and the public accordingly (especially for mechanical collection).

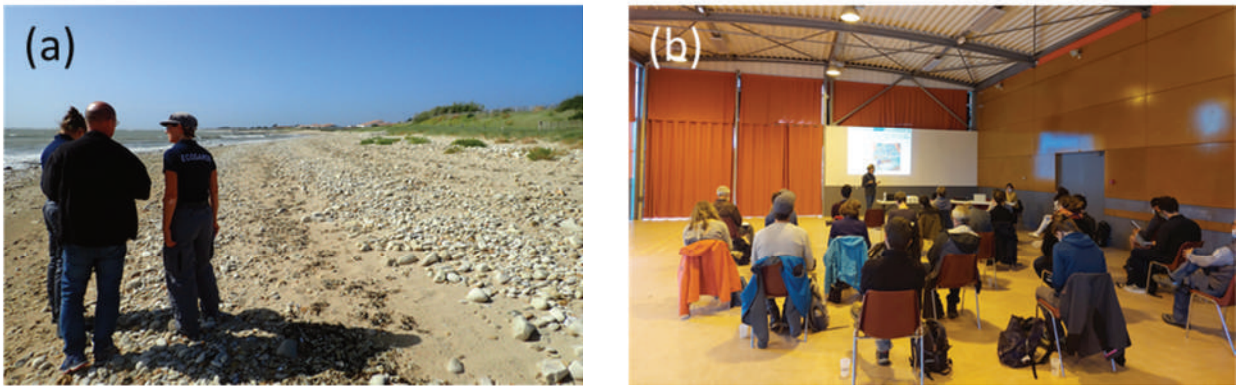


Figure 14 (a) Reconnaissance of a site with a local ecoguard (©Cedre)
(b) Training and awareness rising of beach cleaning operators (©Cedre)

2. For associations: organise operations and inform

More and more organisations are organising manual collection operations, which are often carried out without any coordination between them or even any contact with the commune, at the risk of penalising the handling of the litter collected.

The following elements, which are not exhaustive, contribute to the successful organisation of a citizen clean-up by integrating it into the local or even wider system:

- define the site and date of the operation;
- contact the commune:
  - for information or validation of the clean-up;
  - to settle the fate of the litter.
- find out about:
  - tide times, access to the beach;
  - the sensitivity of the shoreline (sensitive habitat, presence of protected or emblematic species, etc.), particularly in spring during the bird nesting period (**Appendix 2**);
  - potential risks of the site: dangerous areas (landslides, etc.);
  - possible prohibitions on access to certain sectors (military zone, temporary shooting zone, protection of nesting sectors, etc.);
  - possible accidental arrivals of certain litter, etc.
- contact specialist beach litter collection platforms:
  - inform them of this operation and make sure that there is not a similar operation going on at the same site;
  - ask them, as far as possible, how to make the most of the results of the collection (protocol to be followed in particular, to evaluate the litter: total quantity, or detailed by type, etc.).

Country	Platform dealing with beach litter clean-up organising
Ireland	http://coastwatch.org/europe/survey/
UK	https://www.mcsuk.org/
France	https://www.zero-dechet-sauvage.org/
Spain	https://visor.marnoba.vertidoscero.com/
Portugal	https://www.geota.pt/projetos/coastwatch

- provide:
    - the necessary protective equipment (gloves at least, possibly a chasuble, first aid kit) in addition to clothing adapted to the weather conditions and the environment (participants should be reminded of this: sunglasses, sun cream, hat, cap, windbreaker, raincoat, sturdy closed shoes, boots, etc.);
    - means of storage and transport: plastic bags, disposable or reusable (indelible marker for marking the bags), possibly, depending on the nature of the coast and the litter: dustbins, wheelbarrow, quad, 4x4;
    - one or two small specific containers for potentially dangerous litter (e.g. syringes, batteries, etc.);
    - various hand tools: litter picker, possibly knives, saw;
    - means of communication (telephone + emergency contact list);
    - catering (water, coffee and snacks).

WHAT TO DO WHEN CLEANING

1. Many factors influence cleaning

There are many factors that influence the degree of difficulty and the expected performance of the collection:

- **the site**: its location (urban or remote), its type (tourist or wild), the nature of the substrate, the slope of the beach, the distance to be covered, etc. define more or less difficult conditions (Figure 15);

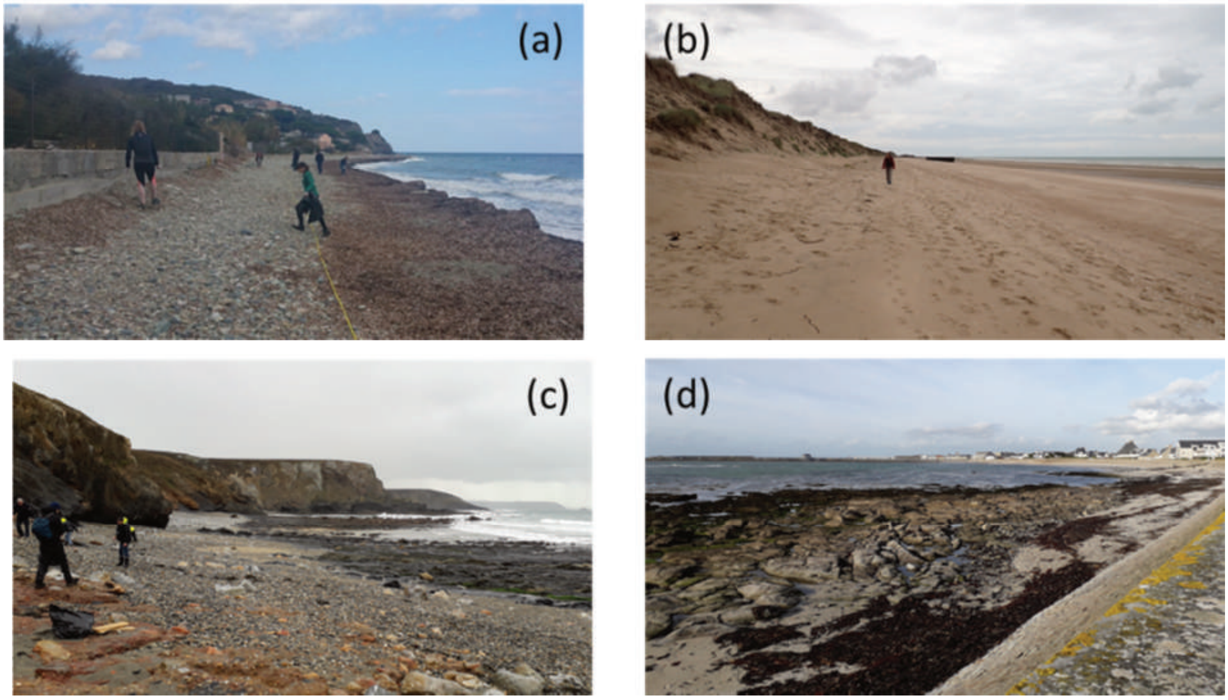


Figure 15 (a) Pebble beach with a short foreshore and very limited tide (Sisco, Mediterranean Sea, France; ©Cedre)
(b) Long Sandy dune beach (Zuydcoote, France; ©Cedre)
(c) Mixed site at the foot of a Cliff (Crozon, France; ©Cedre)
(d) Rocky site bordered by houses (Le Guilvinec, France; ©Cedre)

- **the litter**: its nature (type, size and volume), its distribution along the beach, its possible burial in the sand or in a pebble beach;
- **the weather conditions**: those of the day of the collection, making it pleasant or painful, as well as those of the previous days, a storm could have modified the morphology of the beach (erosion, accretion, etc.) as well as bringing a lot of litter or, on the contrary, "cleaning" the beach;
- **the season** which, in addition to the weather conditions, defines the frequentation of the site, and possibly the amount of litter as well as the fact of possibly being obliged to pass between the towels and to make awareness or to shift the operations outside the hours of frequentation of the site (Figure 16);

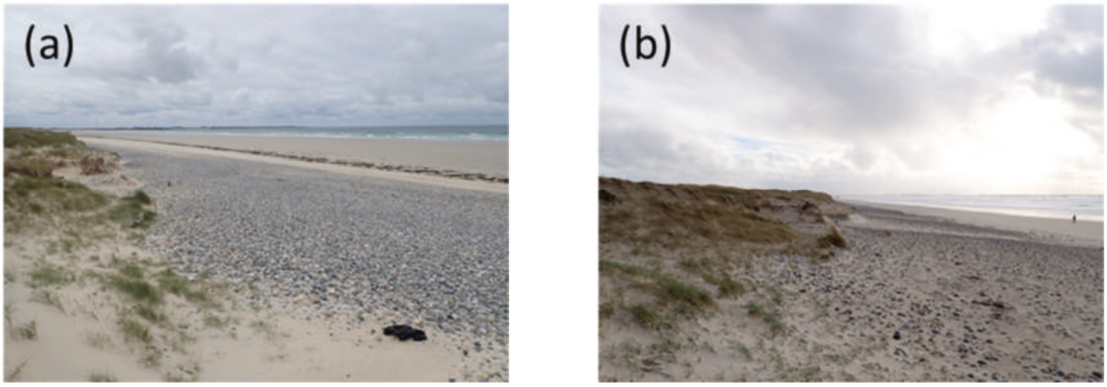


Figure 16 (a) Pebble beach in June 2020 ("Le Stang", Saint-Jean-Trolimon, France) (©Cedre)
(b) Sand accumulation on pebbles in January 2021 ("Le Stang", Saint-Jean-Trolimon, France) (©Cedre)

- **the cleaning team**: the number of participants, and especially the type of people involved, depending on whether they are professionals or volunteers, whether they are old or very young, physically more or less at ease, and whether they are used to cleaning, the site, working together, etc.;
- **the equipment**, including logistics, made available;
- **the objective** set, depending on whether it is an order within the framework of a cleaning contract that sets out means and results, or a civic action that either really targets the complete cleaning of a particular site, or mainly focuses on raising awareness rather on a complete cleaning, etc.

2. There is no standard method

As a result:

- it is not always easy to estimate the time needed to clean up a site on the day:
    - in the case of agents or subcontractors, the means must be adapted accordingly;
    - in the case of a citizen's clean-up, it is a question of doing what can be done with the people present and according to their wishes;
- there is no standard method for cleaning a beach (Figure 17):
    - this does not prevent you from proceeding methodically, adapting to the conditions of the moment and using the resources available;
    - teams with experience of cleaning and/or sites know where the accumulations are a priori, how to proceed, etc.

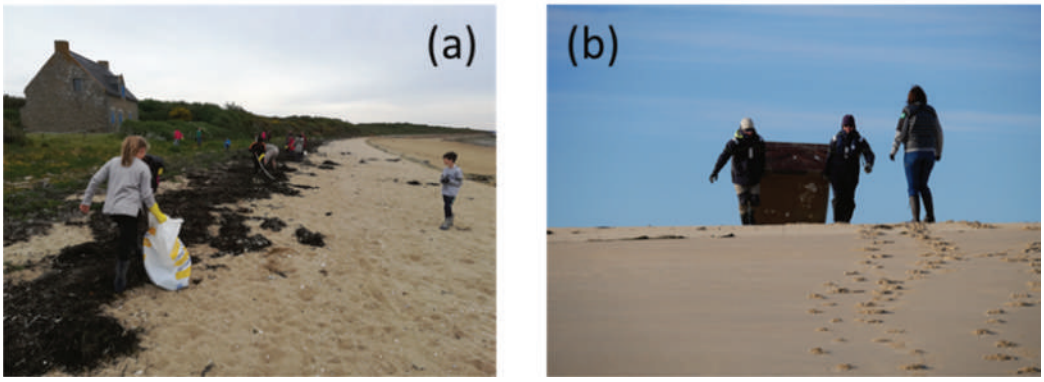


Figure 17 (a) Beach clean-up conducted by a group of children under supervision (©Bretagne Vivante)
(b) Beach clean-up conducted by a small team of professionals (©Parc natural marin du Bassin d'Arcachon)

3. What to do just before starting a manual beach clean-up

Just before starting the clean-up, certain actions are necessary to ensure that the clean-up goes smoothly: this includes explaining the operation in detail to the people gathered at the beach entrance. The following sequence (which is not exhaustive) can help to do this:

- inform about the particularities of the site and the possible risks:
  - the different sectors, with particular attention to those most likely to be littered (riprap, pebbles), to their burial, etc.;
  - the sensitivity of the site: marine debris line, foot of the dune, animal and plant presence, etc.;
  - the potential risks of the site: tides, waves, falling rocks, sinking, crossing, etc.;
  - possible local constraints on access: sector temporarily closed (shooting zone, nesting zone - with defences) or permanently prohibited (private property, military zone, etc.);
  - the risks (cuts, stings, burns) associated with certain specific litter (sharp debris, syringes, toxic barrels, etc.);
- explain the process of on-site operations:
  - purpose, timing, route;
- define the method(s) that seem(s) best suited to the participants the site and the conditions at the time (and which generally result(s) from past experience):
  - define the area to be cleaned first according to the tide schedule;
  - define the method of advance for the operators:
    - by frontal progression via parallel passes; ladder-shaped or concentric progression etc.;
    - by crossing teams or retracing their steps (forgotten litter is easier to see with a different incidence of light);
    - on sectors heavily laden with litter: divide the upper beach into small sectors, each of which is assigned to a single operator; do not hesitate to delimit the area materially (traces of stakes, etc.) to avoid unnecessary passages or uncovered sectors;

- possibly form small groups, assigned to:
    - sections of beach, by substrate type, etc.; o (awareness option) by categories of waste: material, origin, etc.;
    - (awareness-raising option) by categories of litter: material, origin, etc.;
    - a first sorting, with a view to recycling, can be carried out at the time of collection, by dedicating certain bags to recyclable materials;
- define where the bags of litter are to be deposited;
- provide the equipment:
    - Plastic bags, gloves at least; litter picker if necessary; and others depending on the characteristics of the site (wheelbarrow, etc.).

4. What to do and not to do during manual collection

During pick-up, the efficiency of the collection depends on the method chosen at the outset, which can only be refined or revised during use. To facilitate cleaning and especially for the safety of the workers and the environment, it is recommended to consider the following "do"s and "don't"s.

Not to be done during manual collection
• Leaving a person alone in a potentially dangerous area; • Opening a closed container (drum, can, etc.) with suspicious liquid or solid contents in order to smell it; or emptying it on the beach; • Removing marine debris line, including animal debris (exuviae, eggs, corpses, etc., some of which are sometimes mistaken for plastic litter) or natural driftwood; • Removing dune vegetation at the same as litter (ropes or nets, etc.); • Trampling on the pioneer part (embryo dune) of a yellow dune; • Walking on eroding part of a dune; climbing the slope of the bare dune is synonymous with a sand fall and the digging of a 'whistle' that will be widened by the wind; • Walking without care on the upper part of the sandy or pebbled foreshore of wild beaches during the nesting period; • Forget to remove sand stuck or trapped inside the litter; this sometimes represents in the end a lot of sand unnecessarily lost for the coastline; moreover, the presence of sand makes difficult the treatment and subsequent recycling of the litter; • Trying to pull out a rope or an object stuck under boulders with arms: It is better to come back with adapted means or wait for the next storm; • Spending too much time trying to reach litter scattered within a massive seaweed wreck[3]; • Trying to remove a large piece of litter (e.g. a net) that is already buried in the dune at all costs. Scouring or over-excavating the dune over a large area will destabilise and destroy the dune, favouring erosion (i.e. natural bulky debris (e.g. tree trunks and logs) washed up on a sand dune complex are very often used locally to stabilise the dunes (transfer to the dune with a heavy machine); • Burning litter on the beach; • Getting tired of carrying bags full of litter; • Leaving the bags of litter collected anywhere in the dunes, believing that the commune will come and remove them; • Forget to bring snacks and drinks (water, coffee).

[3] In some rocky coastal areas, large brown (and red) seaweeds, mainly from the subtidal (kelp) and also from the intertidal (wrack), regularly run aground, following their complete removal during a storm or the natural seasonal loss of their blades. These seaweeds decompose rapidly within such stranded accumulations: the putrid juice and decomposition fragments are taken up by the sea during the next high tide.

To be done during manual collection
- Respect the safety, protection and prohibition instructions;   - Respect the marine debris line, the fauna and the animals; keep your dog on a leash, especially during the nesting season;   - Respect the exclusion zones for nesting (now marked in some countries, notably France) even if there is litter inside;   - Move away if a bird appears to be injured or is calling repeatedly (this is an alarm indicating the presence of a nest or chicks, or a diversionary tactic to keep you away from the nest);   - Leave litter that is more or less buried partially covered by vegetation;   - Limit the trampling of pioneer dune plants (oyats, etc.); if necessary to go there: - sectorise this area and assign only one person per sector;   - walk carefully, on the sand and longitudinally to the vegetation axes;   - Avoid walking on the bare slope of eroded dunes; if necessary: - only an agile and light person can go carefully, stopping before causing the sand to crumble;   - beyond this limit, to retrieve litter out of reach, use a litter picker or a pike pole, and throw the litter back onto the beach, where it will be retrieved later;   - Place full bags in easily accessible, identifiable locations, for collection on return or pending collection by a third party;   - Remove the sand from the litter: - rub or shake them so that the dry sand falls out;   - narrow-mouthed containers containing wet sand can be cut to facilitate the removal of the sand (use a knife);   - In the presence of ropes trapped under boulders: - remove the accessible parts: a knife is most of the time necessary but not always sufficient;   - wait until the next storm moves the boulders;   - for large ropes or nets: a specific operation with appropriate means should be considered;   - For litter trapped inside large stranded accumulations of seaweeds: - remove visible litter from the surface;   - to remove the litter embedded inside, wait for the sea to reshuffle the decomposed stranding (next high tide): the trapped litter will be redistributed by the waves (like the fragments of decomposing seaweed but differently) and will then be clearly visible and easier to recover on the foreshore at low tide. In the case of a lot of litter: plan to be on the spot, on high tide days, before the litter is totally disseminated or permanently exported off the beach;   - In the case of a large piece of buried litter (e.g. a fishing net), it is preferable to wait for a storm to partially or totally uncover it before removing it or cutting out the part that has been freed up (ask a local geomorphologist for advice beforehand);   - Inform (and then warn the competent authorities), in case of discovery of: - dead animal (bird, mammal, or turtle, etc.) or, in case of an abnormal number of dead shellfish, crustaceans, fish, etc. (**Appendix 3**);   - unusual objects, notify the competent authorities (**Appendix 4**).

5. What to do at the end of a manual beach clean-up

At the end of the collection, the fate of the collected litter must be settled and the cleaning must be valorised.

Valuing the collection:

- on the beach, evaluate the collection by sorting and quantifying:
    - either summarily in volume (number of bags, etc.);
    - or in a more detailed manner according to the procedure previously adopted (volume, weight per material, or number, etc.);
    - remove any sand still present;
- transmit the results at a later date to interested organisations or platforms.

Manage the litter collected:

- put it in bags and, if necessary, separate recyclable litter from general litter (identify the type of litter on the bags);
- collect it at the point agreed with the municipality, outside the beach;
- ensure that it does not fly away, or leak (e.g. upside down or leaking container) or creep in the sun (e.g. tar balls, paraffin lumps);
- inform the local authority of the end of the clean-up and give a summary report:
    - specify the total volume, any recyclable litter, etc.;
    - warn in the event of potentially problematic litter.

6. What to do just before starting mechanical cleaning

Mechanical cleaning is carried out by professionals (local authority staff or private contractors). These staffs are normally well trained in machine and beach work. These operators are familiar with the sites on which they operate. The tasks to be carried out and the area of action are duly defined and even stipulated in a contract.

Cleaning an urban beach is easier than cleaning a remote wild dune area: accessibility and traffic are much easier and, being generally highly anthropised, the ecological sensitivity and environmental constraints are much lower.

The following summarises the main elements to be considered:

- check the presence in number and working order of the equipment and logistics (fuel, litter bins, etc.), including the means of communication (and batteries);
- check for any unforeseen events on the coastline:
    - marked erosion (beach access, dune retreat);
    - massive arrival of natural debris;
    - festive event on or near the beach, official or impromptu (especially at night in this case);
- confirm/redefine the planned schedule.

7. What to do and not to do during mechanical cleaning

Not to be done during mechanical cleaning
• Leaving a driver and his vehicle alone without communication in a remote or potentially dangerous area; • Accessing the beach outside the accesses provided for this purpose; • Leave the initially defined work area; • Travelling in the immediate vicinity or on the dune; • Working on portions containing coarse sediments (small pebbles, etc.) not adapted to the screening mesh at the risk of removing this sediment - even if this portion is included in the initially defined work sector (sedimentary movements may have momentarily and locally modified the granulometry of the sediment); • Handling without precaution objects that are suspect or likely to contain a product that is potentially toxic for humans or the environment; • Open a closed container (drum, can, etc.) containing a suspicious liquid or solid content in order to smell it; or empty it on the beach; • Forgetting to check the tractor settings and speed; • Forget to check the selectivity of the screening; • • Want to work systematically at the maximum depth.
To be done during mechanical cleaning

• Respect the safety, protection or prohibition instructions;
• Respect the division of labour as initially defined;
• Do not drive over the litter areas unnecessarily;
• Proceed methodically in parallel, longitudinal, slightly overlapping passes;
• Do not work near people on the beach;
• If working at night: have sufficiently strong lighting to detect any lying persons or suspicious objects on the beach in good time;
• Respect the upper limit of the foreshore (5 to 10 m from the foot of the dune, possibly more if necessary);
• Make the necessary adjustments to be as selective as possible:
  o tractor forward speed;
  o speed of rotation of the belt;
  o depth of attack of the sand layer;
• Check regularly:
  o the result in the gear track;
  o the selectivity in the bin; if there is too much sand, dump the contents of the bin on the beach in a heap and sift it again, or put it back to the sea to be sorted by the waves and then collect the litter;
• Regularly empty the litter bin into the skips provided at the beach exit or into the truck provided for this purpose, which is supported on the beach;
• Inform of any discovery of an accumulation of litter (buried litter in particular) likely to influence the planning or requiring heavy means other than raking or sifting (buried net, for example);
• Inform (and then warn the competent authorities), in the event of the discovery of:
  o corpses of birds, mammals, turtles, etc. (or, in the case of an abnormal number of corpses of shellfish, crustaceans, fish, etc.) (**Appendix 3**);
  o unusual objects, notify the competent authorities (**Appendix 4**).

8. What to do at the end of the mechanical collection

Apart from the possible roughing phase, carried out with non-specialised equipment before the fine cleaning by raking or sifting, no sorting is envisaged on the beach due to the volumes involved and the overall removal of litter without the possibility of distinguishing between them.

The fate of the collected litter is subsequently settled on land:

- in the case of a cleaning operation restricted to a small area: litter is generally considered as simple rubbish and directly directed to the nearest waste disposal centre;
- in the case of large-scale clean-up operations: litter is managed in a more commendable way on a dedicated litter gathering area with a view to optimising the recycling of the material: metals, glass, sand (to be brought back to the coast) and increasingly plastics.

The volumes collected are not always well evaluated, particularly in the case of operations carried out by municipal staff, where the litter collected by the machines is generally dumped with the other general waste of various origins, and it is then impossible (except to ask for a systematic estimate at the exit of the beach) to appreciate the quality. This is different in the case of a contract with a subcontractor who generally has to issue a litter report, broken down by material.

WHAT TO DO IN ADDITION TO CLEANING

1. A very original way to contribute to the continuous manual collection

There is an effective and inexpensive way for a municipality to continuously remove some of the litter that washes up on its coastline: the **litter tide bin** (Figure 18). This is a device which, by providing the public with a dedicated bin at the end of the beach, encourages walkers and other users of the coastline to collect the litter they come across on the foreshore. The litter tide bin, first installed in the early 2010s, is becoming a common feature of the coastal landscape.

Figure 18: Litter tide bin (©Cedre)

2. Promoting curative, preventive and incentive actions

The fight against marine litter does not only consist of curative measures but also, and increasingly, of preventive and incentive actions. These actions are initiated by international organisations, governments (ministries, agencies, etc.), local authorities, professional organisations, research bodies, schools, various NGOs, individuals, etc. (Figure 19)

Figure 19: Tag "Here starts the sea" (©Cedre)

3. Bringing to light what is being done elsewhere

We must therefore not hesitate to encourage this type of initiative, whether institutional or citizen-based, and to make them known to as many people as possible. To this end, an inventory of initiatives, measures and actions (IMAs) essentially restricted to the Atlantic seaboard of the European countries of the Atlantic Area (Ireland, UK, France, Spain and Portugal) has been drawn up as part of the CleanAtlantic project, and is accessible in the form of an interactive platform http://www.argepol.com/cleanatlantic-initiative-database/index.html

APPENDICES

Appendix 1: A reasoned or wise cleaning

Appendix 2: The upper beach - a living space

Appendix 3: Unusual objects - Beware!

Appendix 4: In case of discovery of animal corpses

Appendix 1: A reasoned or wise beach cleaning

Reasoned beach cleaning is a way of defining the objectives, techniques and means, frequency and periodicity of cleaning, according to a methodology initiated in the 1990s by the Département of La Manche (County), France.

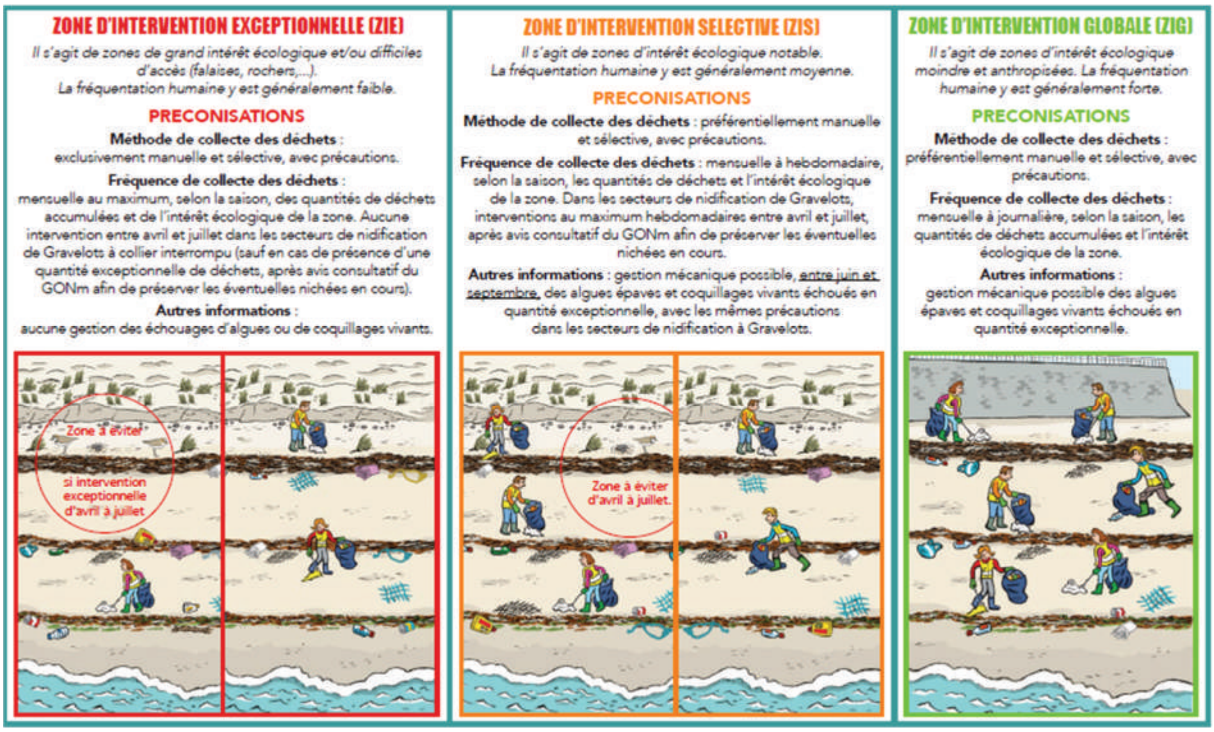
It is based on precise knowledge of the following elements:

- the sensitivity of the coastline (remarkable, heritage, endemic, protected habitats and species, etc.);
- the fragility of the coastline (types of substrates; erosion);
- the socio-economic uses of the coastline;
- the arrival of litter on the coast (quantity, types and location).

This overall knowledge of the environment in the broadest sense is based on the knowledge and practice of various actors who need to be involved in the process.

Additional studies are very often necessary, particularly to diagnose in detail the sensitivity and vulnerability of the coastline.

This diagnosis makes it possible to define clean-up objectives adapted to the ecological and economic issues of the sectors identified, depending on the season.



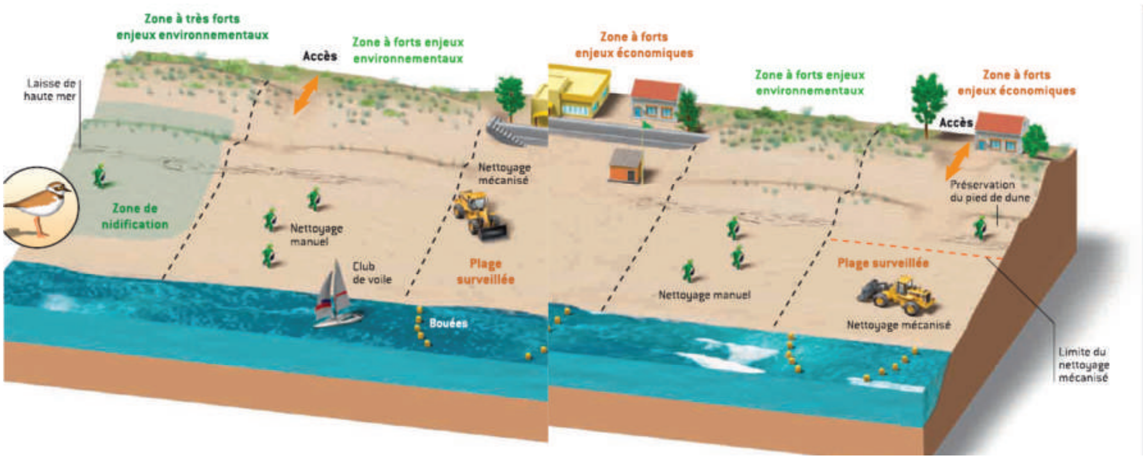
(Source: CPIE Vallée de l'Orne)

Three main types of cleaning objectives are formulated:

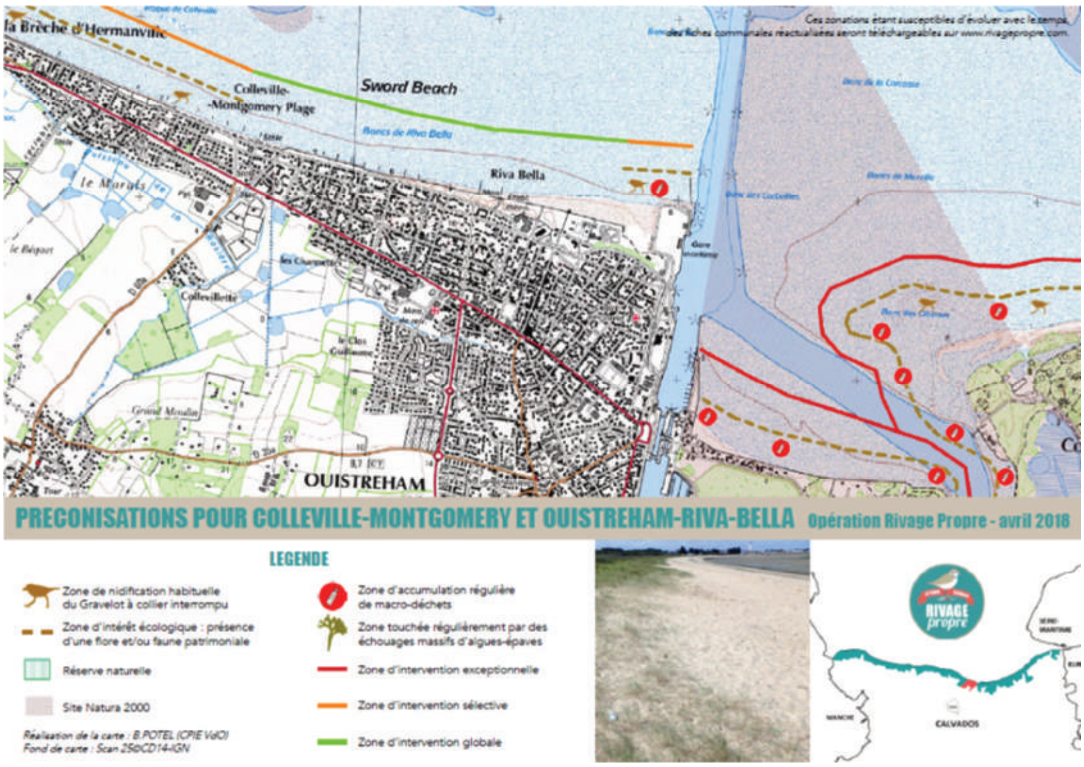
- exceptional intervention (in red in the figure): in sectors with very high ecological stakes and/or difficult access (cliffs, rocks, etc.) and generally low human attendance, where only manual collection is tolerated with caution (or even on the advice of environmentalists), at a low frequency (monthly) and outside the nesting period (April-July);

- selective intervention (in orange in the figure): in sectors with significant ecological issues and generally average human attendance, where only manual collection is tolerated with caution (or even on the advice of environmentalists), and carried out, depending on the issues, at a monthly to weekly frequency
- a global intervention (in green in the figure): in sectors with high economic stakes (high seaside activity, etc.) and low to very low ecological stakes (because they are anthropised), where mechanised cleaning can be envisaged, subject to certain precautions, in preference to manual collection, at a monthly to daily frequency.

This sectorisation is not simply along the coastline but also along the width of the beach, insofar as various issues may coexist along the profile of the sector, requiring a mixed type of intervention (e.g. on a very popular dune beach: mechanised cleaning on the foreshore and manual collection at the foot of the dune).



Source: Conservatoire du littoral (Guide de nettoyage des plages)



Source: CPIE Vallée de l'Orne

This basic approach obviously varies according to the type of coastline, the issues at stake, the clean-up objectives, the clean-up plan (municipal or extra-municipal plan, etc.), the volume of litter and the seasons. For example, a very similar approach is followed on the Landes county's coastline (France), which is subject to massive arrivals of various types of litter that require the use of mechanical equipment more often than in other areas.

The coastline of the Landes department, made up of more than 100 km of wild dunes which attract a very large tourist population in summer, has a departmental (county) clean-up plan (including the management and recycling of the litter collected), coordinated by the Department (County).

This plan differentiates the coastline into 2 main types according to the number of tourists during the summer period:

- the very busy sectors which are supervised for bathing (i.e. on 300m either side of the beach accesses),
- the rest of the coastline, which is unsupervised, wild without accesses and therefore little or not frequented.

Because of the extent of the coastline and the volumes of litter, cleaning is essentially based on mechanical collection, which is carried out up to a certain distance from the dune (limit established at 5 or 10m from the pioneer dune, or locally even more). Non-natural litter washed up at the foot of the dune is, in accretion areas, removed by hand and sorted on site by material: glass, metals, all waste (plastics, paper, cardboard, rubber) and waste from care activities.

The plan specifies the quality of mechanical cleaning (i.e. type of machine used: screening or raking machine) and the required seasonal frequency, as follows

- cleaning of high traffic areas:
  - by screening (2.5 cm mesh screen) every 3 days from June to September;
  - by raking (5 cm mesh screen) once a week from May to October;
- cleaning of unfrequented areas:
  - by raking (8 cm mesh screen) once a week from June to September, then once a month from May to October.

The collected litter is stored in about twenty fenced litter gathering sites, awaiting transfer to a sorting platform for reuse or recycling as much as possible by material. The sand is returned to the coastline, in the wave breaking zone, for perfect redistribution.

Appendix 2: The upper beach - a fragile living space to be preserved

A specific micro-habitat: the marine debris line

The marine debris line corresponds to the deposit of natural debris, of plant and animal origin, left by the sea at high tide on the shore at the end of the rising tide. For several decades, marine litter has been intermingling with the natural debris of the debris line.

This line evolves along the foreshore profile according to the tidal range. In the ascending phase of the tidal cycle, the deposits of the previous tide are generally taken up again at the next tide and, increased by the day's contribution, are deposited at a higher level, etc., and at the end of the cycle end up forming the high tide or spring tide marine debris line, in the upper part of the foreshore. This debris line will only be taken up by the waves during the next spring tide - about 3 weeks later, if the tidal range allows it. During this time, natural non-woody debris (seaweed, animal corpses, etc.) degrades - or even disintegrates, in the case of putrescibles - but not natural woody debris, and even less so marine litter.

The marine debris line plays an essential role in the coastal ecosystem, particularly sedimentary one. It contributes to the stabilisation of the bottom of the dune by encouraging:

- The accumulation of sand that gets trapped there;
- Then the colonisation of plants by providing them with soil and nutrients.

A micro-habitat to preserve

Most of the plant species that grow there are of great floristic interest and many are protected, locally or nationally, depending on their relative rarity.
Among others, we find:

- On sand:
    - *Elytrigia arenosa* (Common Couchgrass);
    - *Euphorbia peplis* (Purple Spurge);
    - *Polygonum maritimum* (Sea Knotgrass);
    - *Eryngium maritimum* (Sea Holly);
    - *Cakile maritima* (Sea Rocket);
    - *Crambe maritima* (Sea-kale);
- On pebbles:
    - *Crambe maritima* (Sea-kale);

Sea kale (*Crambe maritima)* (©Cedre)

Sea Holly (*Eryngium maritimum)* (©Cedre)

The debris line is a specific habitat for marine and terrestrial fauna, part of a coastal food chain, including micro-organisms, invertebrates (worms, molluscs, insects, etc.) and birds. Some species are strictly dependent on the debris line.

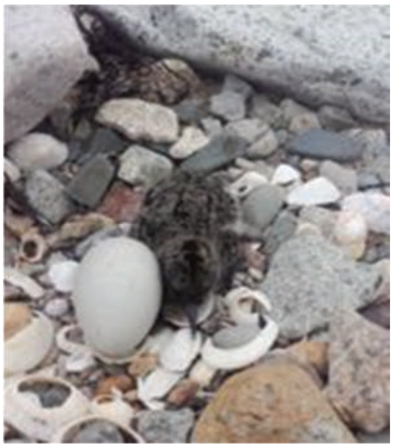
Birds to protect

Throughout the year, the coastline offers marine and coastal birds a mosaic of habitats and functions of the highest order (resting, migration, nesting, feeding, etc.).

Some birds nest on the ground, on sand or pebbles, or on a cliff top or wall. These include the following:

- on sand and pebbles:
  - *Charadrius alexandrinus* (Kentish plover / Gravelot à collier interrompu / Chorlitejo patinegro / Borrelho-de-coleira-interrompida);
  - *Sternula albifrons* (Little Tern / Sterne naine / Chorlitejo grande / Borrelho-grande-de-coleira);
  - *Charadrius hiaticula* (Common Ringed Plover / Grand gravelot / Chorlitejo grande / Borrelho-grande-de-coleira);
  - *Haematopus ostralegus* (Eurasian Oystercatcher / Huîtrier-pie / Ostrero euroasiático / Oostraceiro);
- in eroded friable cliff faces (periglacial head and dune):
  - *Riparia riparia* (Sand Martin / Hirondelle de rivage / Avión zapador / Andorinha-do-barranco - Andorinha-das-barreiras) ;
- on rocky cliff tops and coastal grasslands:
  - *Pyrrhocorax pyrrhocorax* (Red-billed Chough / Crave à bec rouge / Chova piquirroja / Gralha-de-bico-vermelho);
- in a rocky cliff face:
  - *Corvus corax* (Northern Raven / Grand corbeau / Cuervo grande / Corvo);
  - *Falco peregrinus* (Peregrine Falcon / Faucon pèlerin / Halcón peregrino / Falcão-peregrino).

*Haematopus ostralegus (*Eurasian Oystercatcher)
(Source: oiseaux.net)



Oystercatcher egg and chick
(Source: RN Sillon du Talbert)

Charadrius alexandrinus / Kentish Plover
(Source MNHN)

Pebble nest with macro litter *(Charadrius alexandrinus / Kentish Plover*)
(Source: Bretagne Vivante)

Red-billed Chough (*Pyrrhocorax pyrrhocorax)*
(Source: oiseau.net)

Bank Swallow (*Riparia riparia)*
(Source: oiseau.net)

Particular attention must therefore be paid to shoreline clean-up operations. Whether manual or mechanical, they can cause significant damage, particularly during the nesting period, such as disturbance, which can be very damaging to separated chicks, crushing of eggs, trampling of chicks, etc.

This must be avoided and can be done by contacting local environmental organisations or birdwatching centres to find out where the nesting areas are. In some countries, since 2020, these sites are now temporarily (from March to June approximately) and sometimes continuously protected by a fence.

Protection of nesting areas on the upper foreshore
(Source: Bretagne Vivante)

Appendix 3: Unusual objects - Beware!

UNUSUAL OBJECTS: BEWARE!
Sometimes, an unusual or suspicious object is discovered on the coast: can, barrel, wierd metal object, etc. Beware! It may contain liquid or solid content that is potentially harmful, even if only to breathe, or be an explosive device (old ammunition, etc).
WHAT NOT TO DO
• Pick it up carelessly, throw it away or bang them • Try to dig out it • Open the closed container (drum, can, etc.) to smell or see what is inside; even if it is almost empty, especially if it has a priori contained chemical products (gas) • Empty the liquid on the beach
WHAT TO DO
• Do not move it • Note any identifiers that may still be legible (label, paint, strapping or engraving): name, brand, symbol number, logo, etc. • Locate and trace it • Inform the authorities (town hall, fire service, Marine rescue coordination centre, etc.) • Make it roughly safe: circle drawn in the sand, stakes, windrow, etc.
WHO TO CONTACT?
Ireland: • *Local authority* • *Maritime rescue coordination center (MRCC)* • *Fire brigade* • *Emergency Services*
France: • *Local authority* • *Maritime rescue coordination center (MRCC)* • *Fire brigade* • *Cedre*
Spain: • *Local autority* • *Firebrigade* • *MRCC* • *Capitanías Marítimas* • *Sociedad de Salvamento y Seguridad Marítima (SASEMAR)* For Galicia: • *Servicio de Guardacostas de Galicia (Galicia's Coast Guard Service)* • *112 Civil Protection (Galicia)*.

Portugal:

- *Local authority*
- *Maritime rescue coordination center (MRCC)*
- *Fire brigade*
- *National authority: APA- Agência Portuguesa do Ambiente*
- *APML – Associação Portugesa de Lixo-Marinho*
- *Local autority*
- *Research centers*

Appendix 4: In case of discovery of dead animals

DISCOVERY OF DEAD ANIMALS
In case of discovery of dead birds, mammals, turtles, etc. (or in case of an abnormal number of dead shellfish, crustaceans, fish, etc.): inform the authorities, the appropriate local or national networks, or marine lab (university or institute).
WHAT NOT TO DO
• Birds: do not approach them if they are alive • Mammals: do not approach them if they are alive • Turtles: do not approach them if they are alive • Other animals: contact nearest university
WHAT TO DO
o inform the authorities o take photographs o identify the animal if possible o take characteristics o Locate it and mark it o Sanctuarise it roughly: circle in the sand, stakes, windrow, etc.
WHO TO CONTACT?
Ireland: • *Local authority* • *Maritime rescue coordination center (MRCC)* • *Fire brigade* • *National Parks* • *Wildlife Service* • *Environment Unit of the Local Authority* • *Seal Rescue Ireland: for stranded seal* • *Irish Whale and Dolphin Group: for stranded dolphin or whale*
France: • *Local authority* • *Maritime rescue coordination center (MRCC)* • *Fire brigade* • *Office National de la Chasse et de la Faune Sauvage (ONCFS)* • *MNHN (Muséum National d'Histoire Naturelle): for stranded marine turtle* • *Authorised NGO* *- LPO: for stranded bird* *-Volée de piafs: for stranded bird* Northern sea: • *Local authority*

• *Maritime rescue coordination center (MRCC)* • *Fire brigade* • *ONCFS* • *PELAGIS network: for stranded sea mammals* • *Réseau Tortues Marines Atlantiques Est (RTMAE): for stranded marine turtle* <u>Atlantic Ocean:</u> • *Local authority* • *Maritime rescue coordination center (MRCC)* • *Fire brigade* • *ONCFS* • *PELAGIS network: for stranded sea mammals* • *Réseau Tortues Marines Atlantiques Est (RTMAE): for stranded marine turtle* • *CESTM-La Rochelle: marine turtle care centre* • *Centre Vétérinaire de la Faune Sauvage et des Ecosystèmes des Pays de la Loire (CVFSE): wildlife care centre* • *Oceanopolis: seal car centre* <u>Mediterranean sea:</u> • *Local authority* • *Maritime rescue coordination center (MRCC)* • *Fire brigade* • *ONCFS* • *PELAGIS network: for stranded sea mammals* • *Réseau Tortues Marines de Méditerranée Francaise (RTMMF): for stranded marine turtle* • *CESTMed-Grau du Roi:* marine turtle care centre
Spain • *Dial 112*
***Portugal*:** <u>In Madeira:</u> • *Local authority* • *Maritime rescue coordination center (MRCC)* • *Fire brigade* • *The marine stranding network: managed by the Regional Institute for Forests and Nature (MBM Conservation (IFCN) Madeira Whale Museum): for stranded cetaceans* • *IFCN: for stranded Monk seals and birds* • *MBM or University of Madeira: for Stranded marine turtle*