

Tailored designs to facilitate beach clean-ups

Case study from Pattinampakkam, Chennai

The Chennai metropolitan coast is the second-longest urban beach in the world, stretching from Fort St George in the north to Besant Nagar in the south, covering 13 Kms. The estuarine ecosystem of the river Coovum and the Adyar harbours migratory birds, and Neelankarai beach, south of the Adyar river delta, is a nesting site for turtles. Sadly, these rivers also carry domestic and industrial sewage, as well as solid waste, from the city to the beach. The 5 km stretch of this coastline (locally known as Marina Beach) attracts a commercial and recreational crowd and, inevitably, a lot of beach litter. In addition to recreational litter, after a spell of heavy rain, flooding of waterways causes large amounts of garbage to pile up along the coastline. The channels running through the city's dumpsites carry solid waste to the coastal waters via the Cooum and Adyar rivers.¹

Litter along the Chennai coastline

A study conducted in Chennai in 2016 reported 3.24 kg of beach litter per 100 m of shoreline during March-April and 5.72 kg/100 m during June-July, with 50% of this being plastic.² In 2025, the Greater Chennai Corporation (GCC) commenced a beach clean-up program at Marina, with around 100 workers to ensure regular litter clearance. GCC also procured 22 all-terrain vehicles (beach sand sweepers) for waste collection and litter clearance on the beaches. Later, GCC outsourced daily beach clean-up in 10 beaches, including Marina, Elliot's (Besant Nagar), and Thiruvanmiyur Beach, to a private contractor (Chennai Enviro).³ The workers work on shifts between 6 AM and 1 PM. In addition, IEC boards on anti-littering are placed along the shoreline to reduce littering by tourists.

Pattinampakkam Beach, also known as Foreshore Estate, is a non-commercial segment of the Chennai coastline home to residential and fishing communities. While the main Marina Beach is dominated by consumer and tourist litter from commercial promenade activities, Pattinampakkam's waste profile is driven by occupational litter (such as abandoned fishing nets and ropes), riverine plastic inputs from the adjacent Adyar River estuary, and localised dumping from the fish market. Although mechanical sand sweepers are deployed for cleanup, fishing boats and equipment stationed along the shoreline frequently obstruct their path. Furthermore, these vehicles fail to capture smaller particles, such as bottle caps and multi-layer packaging sachets; hence, the workers (engaged by the external agency)

¹ [\(1\) \(PDF\) Marine litter: Post-flood nuisance for Chennai beaches](#)

² [Preliminary study on marine debris pollution along Marina beach, Chennai, India - ScienceDirect](#)

³ [GCC begins Marina cleanup | Chennai News - Times of India](#)

manually collect them. These distinct operational and spatial constraints necessitated a tailored design for litter-removal equipment at Pattinampakkam Beach.



Understanding this need, the Saahas team, working under the Neela Kadal Thooimai Pattinam (NKTP) project, explored solutions to simplify beach clean-up. The team has been working in Pattinampakkam for the past 3 years, supported by the CSR initiative of Société Generale to streamline solid waste collection in the region and to promote source segregation practice among waste generators.

Sand comb rakes modified with a new purpose

Along the tourist-heavy coastlines of Indonesia and Mexico, it's a common practice to sand-comb or treasure-hunt with sand scoops or sand-comb rakes. The NKTP team set out to repurpose the sand-sifting scoops, traditionally utilised by coastal hobbyists, into targeted ergonomic manual litter-interception tools to trap smaller litter particles. Sand scoops are specifically engineered with a perforated mesh grid (usually made of lightweight stainless steel, aluminium, or titanium) that allows heavy sand to drain immediately under gravity, isolating only solid objects. These handheld, modified

treasure scoops allow workers to easily navigate and manoeuvre tight spaces around active fishing infrastructure.

To develop a tailored model for Pattinampakkam, the team approached a local fabrication vendor specialising in upcycled waste art installations. Referencing traditional sand-comb rakes, the initial prototype featured a durable stainless-steel cuboid scoop with a 2 mm mesh pore size and dual vertical handles. While functional, the prototype's structural weight and the rectangular head's lateral resistance made it difficult for female sanitation workers to retract and manoeuvre through loose sand.

To address these ergonomic challenges, the design of the second model was modified. While retaining the 2 mm stainless steel sieve mesh, the design was optimised by switching to a single handle and a triangular prism-shaped scoop comb. This geometric modification significantly reduced the overall weight and minimised resistance during retraction. This modified sand comb proved versatile across two distinct coastal zones: in loose, dry sand and near the shoreline, where incoming wave currents naturally flushed sand grains, isolating the trapped macro- and micro-litter within the sieve. The litter trapped in the sieve is emptied into a bag, then into the all-terrain collection vehicle.



The initial prototype was a pilot, and only a single piece was fabricated; the cost was Rs 15,000. Ten units

of the second model were fabricated, and the price per unit was Rs 10,500. This can go down to Rs 7000 per unit for bulk orders (25+ units).

While the modified sand comb is highly effective across the intertidal and dry zones of beaches, its application in riverine environments is severely constrained by the sediment characteristics. Unlike loose marine sand, which behaves like a fluid when dry, river silt and clay have high cohesion. When the rake is pushed into the sand, the sediment packs tightly within the 2 mm pores rather than flowing through them, effectively turning the sieve into a solid, heavy shovel.

Current usage and scale-up

The 10 sand comb units were initially used by workers at Pattinampakkam beach. Typically, around 1-1.5 Kg of litter is collected per 500 m of operational run along the shoreline of Pattinampakkam beach using the comb (trapping efficiency varies based on the actual litter density of the shoreline). After seeing the efficiency and ease of cleanup with the sand comb rake, the workers at Marina Beach also started using it. To maximise resource utilisation, teams across both beaches currently share the 10 units, alternating deployment schedules based on cleanup needs. The NKTP and Chennai Enviro team have plans to present this model to the GCC and scale it up across all coastal locations in Chennai.

The success of the Pattinampakkam intervention highlights the need for human-centric, tailored interventions rather than capital-intensive, mechanised infrastructure in different terrains for solid waste management. Scaling this model offers urban local bodies an immediate, cost-effective interception system to reduce the litter load on our coastal ecosystem.