

VANISHING SHORES:

Inside Goa's race

TO SAVE ITS BEACHES

Goa is losing its beaches—fast. With 34% of the coastline under threat of being eroded, scientists and the government are racing to contain the damage before it's too late. The battle for the shore has begun, and the stakes are nothing less than Goa's identity and tourism economy. Will the efforts be enough? Only time will tell. **KARSTEN MIRANDA** finds out more

As Goa's coastline continues to face erosion, the urgency of the crisis has led to a strategic collaboration between scientific institutions and the state government. Experts have now pinpointed nine high-risk erosion zones requiring immediate attention—separating them from stretches that still follow manageable, natural erosion cycles.

In a significant step forward, the Chennai-based National Institute of Ocean Technology (NIOT) has launched an extensive bathymetric survey of Goa's coastal waters. Using advanced mapping tools, scientists are analysing wave action and underwater currents up to 20 metres offshore. The project, part of the World Bank-funded National Hydrology Project, signals a long-awaited shift from reactive crisis response to predictive, science-based coastal planning.

A scientific mapping revolution

NIOT's study isn't limited to the coastline. It also examines how sediment flow from the Mando-vi and Zuari river basins affects shoreline stability. The Water Resources Department has tasked NIOT with preparing an Integrated River Basin and Shoreline Management Plan to bridge key knowledge gaps—particularly around sediment supply and longshore drift.

This includes detailed bathymetric mapping and wave-height analysis to formulate what officials describe as "stabilised, long-term solutions for coastal protection." A senior department official confirmed that final NIOT reports are awaited, and their findings will directly inform future action.

Incorporating five decades (1970–2024) of high-resolution satellite imagery, NIOT's shoreline change analysis aims to differentiate long-term erosion trends from short-term, cyclical changes that have complicated planning in the past.

Among the beaches identified for urgent intervention are Ashwem, Coco, and Talpona, with tailored engineering solutions being developed. NIOT brings prior experience in coastal projects across Puducherry, Odisha, and other Indian states.



LATEST DEVELOPMENTS

- National Institute of Ocean Technology launches comprehensive 20-metre depth bathymetric survey across entire Goa coastline
- Expert panel identifies nine priority beach stretches requiring urgent anti-erosion measures
- Pilot project using Dutch sand

- motor technology approved for single beach demonstration
- Chief Minister announces comprehensive sand erosion management plan citing tourism industry survival
- World Bank-funded study integrates five-decade shoreline analysis with upstream river basin dynamics



The study highlighted encouraging trends: satellite imagery from 1985–2020 shows stabilisation in northern beaches like Querim, Mandrem, and Morjim, with the latter even showing accretion through sand accumulation. In South Goa, the Velsao–Benaulim stretch has shown a mix of erosion and recovery in natural cycles. While Palolem's erosion appears to follow a natural rhythm that may not warrant intervention, the Colva–Cavelossim stretch has emerged as an area of concern requiring further study

Expert panel: A manageable crisis with targeted focus

In a notable shift in tone, a government-appointed expert panel has reframed the erosion crisis as serious but not unmanageable. Based on inputs from NIOT, ISRO, the National Centre for Sustainable Coastal Management, and the National Centre for Coastal Research, the panel recommended interventions in nine high-risk

zones—declaring the rest of the coastline stable or recoverable through smaller, focused efforts.

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Strategic priority zones now include Morjim, Anjuna, and the southern belt from Colva to Cavelossim—enabling smarter allocation of resources without overstretching efforts across the entire coastline.

Dutch expertise and Goa's first sand motor pilot

The Dutch coastal engineering firm Deltares has been roped in to evaluate the root causes of Goa's erosion problem. Emphasising clarity of goals and collaboration, Deltares has begun planning pilot interventions, marking a move from research to action.

One such pilot—using sand motor (or mega-nourishment) technology—has received state approval for implementation on a selected beach. This will be Goa's first experiment with the Dutch innovation, which involves depositing large quantities of sand that naturally redistribute along the coast, reinforcing beach resilience.

Intervention strategies include both soft measures like beach nourishment, shoreface replenishment, and sand motors, as well as hard options such as seawalls, revetments, and groynes for sites under immediate threat.

Experts stress that intervention decisions must weigh multiple factors: the severity of erosion, flood risk, physical characteristics, and economic significance—especially in terms of tourism and local livelihoods.

Government backs long-term strategy

Speaking on World Environment Day at Raj Bhavan, Chief Minister Pramod Sawant underlined the urgency of beach preservation, directly linking it to Goa's tourism economy. "If beaches are not saved, tourists will no longer visit Goa," he warned, pledging a comprehensive sand erosion management plan.

This announcement marks a pivot away from piecemeal responses toward a more strategic, long-term coastal management framework. Water Resources Department official Gipson Miranda confirmed that beaches like Velsao, Varca, Colva, and Mobor are now priority zones for intervention. Batalbatim—where earlier anti-erosion efforts were made—has also been flagged for immediate restoration.

Regional erosion trends and scientific insight

North and South Goa show differing erosion dynamics. While North Goa has seen a gradual rise in low-to-moderate erosion since the 1990s, high erosion levels have emerged post-2010. South Goa faces more acute challenges, with 11% of its shoreline affected compared to 6% in the north.

Accretion patterns also vary: North Goa reports a 2% gain, while South Goa lags behind at 1%. However, both regions benefit from naturally resilient rocky headlands that act as anchors for shoreline stability.

Sandy beaches, however, remain highly dynamic, shaped by both natural forces and human actions. This complexity under-

GOA'S SAND DUNES

According to a study by the National Centre for Sustainable Coastal Management (NCSCM), the length of sand dunes in the State is 22.62 km, of which about 15.72 km is in South Goa whereas North Goa has 6.90 km. The total sand dune patches number 99, of which 75 are in the South and 24 in the North. In South Goa, 99 percent of the sand dunes are found along the 25 km coastal stretch from Betul to Cansaulim, while in North Goa, major sand dunes are located in Candolim, Morjim and Arambol. NCSCM has stated that Goa's sand dunes have an estimated economic value of Rs 861.27 crore/year.

HUMAN ONSLAUGHT

Coastal sand deposits have been under constant human onslaught for various reasons:

(a) industrialists and builders plunder sand which is used as a raw material for a variety of major purposes such as buildings,

(b) all coastal resorts and hotels are located in sandy areas and find sand as a readily available resource,

(c) levelled dunes can be converted into plots for further development



lines the importance of grounding intervention plans in scientific understanding of sediment flow, wave action, and river-coast interactions.

Climate change: The accelerating force

While the expert assessment offers cautious optimism, the broader context of climate change continues to cast a long shadow. A 2024 national workshop highlighted how rising sea levels and intensifying weather events are accelerating erosion beyond historical norms.

Since the industrial era, sea-level rise has increased tenfold, driven by greenhouse gas emissions. Cyclones like Ockhi, Tauktae, and Maha have shown how extreme weather can quickly reshape coastlines, pushing them into crisis territory.

This evolving climate landscape makes it imperative to blend short-term mitigation with long-term adaptive planning.

Integrated planning and data-driven action

Unlike earlier fragmented efforts, today's coastal strategy is increasingly systemic. NIOT's integration of river basin science with shoreline processes offers a more complete picture—tracking how upstream sediment disruption contributes to downstream erosion.

Underwater mapping up to 20 metres deep is now capturing essential data on seabed contours that influence wave energy and sediment transport. These previously undocumented elements are key to designing effective coastal defences.

Findings also point to cumulative impacts from sand mining, beach construction, drainage channels, and human encroachment, all of which demand coordinated management across departments and jurisdictions.

Economic stakes: Livelihoods on the line

The economic case for action is clear. With 60–70% of Goa's population residing in coastal talukas, and thousands of families dependent on beach-related livelihoods, the consequences of inaction are steep.

The government's focus on nine critical areas allows for targeted, cost-effective interventions that protect both natural assets and local economies—without overextending limited resources.

Next steps: From crisis to coordination

The current phase marks a transition from assessment to action. NIOT's survey will underpin evidence-based interventions, while the Dutch-backed sand motor pilot will test sustainable technologies on Goan shores.

What's encouraging is the collaborative framework now in place—linking national scientific institutions, global coastal experts, government authorities, and local communities. It sets the stage for smarter, sustained, and scientifically grounded coastal protection.

The goal is no longer just to respond to erosion—but to manage it systematically. The stakes are high, but with science, political will, and international support aligned, Goa has a clear path forward to preserve both its beaches and its economy.

