



# REST-COAST

LARGE SCALE RESTORATION OF COASTAL ECOSYSTEMS  
THROUGH RIVERS TO SEA CONNECTIVITY

# NAHAL DALIA

## RESULTS & ACHIEVEMENTS REPORT



### SUMMARY

The Nahal Dalia pilot site addresses the long-term degradation of a coastal wetland system shaped by intensive aquaculture and competing land and water uses. The intervention focuses on interconnected challenges, including biodiversity loss, altered hydrology, water pollution, groundwater pressure, and governance complexity.

Implementation progress varies across themes, with biodiversity restoration achieving the most

advanced results. Key outcomes include 3.5 km of restored riverbanks, the construction of two nesting islands, and the recording of 53 breeding bird species, including several threatened species. Hydrological management in the southern Difleh nature reserve is now largely guided by ecological principles. In parallel, governance has been strengthened through coordinated stakeholder processes and agreement on a regional water allocation framework.



Funded by  
the European Union

This project receives funding from the European Union's Horizon 2020 Innovation Action under grant agreement No 101037097.

## THREATS AND PRESSURES ADDRESSED

Severe biodiversity degradation driven by habitat fragmentation, altered water regimes, invasive species, and loss of nesting and breeding habitats

Over-abstraction of groundwater and salinization risk driven by external national water policies

Altered hydrology and loss of river–sea connectivity due to dams, water-control structures, and operational management for aquaculture

Governance and policy misalignment between conservation objectives and agricultural, aquaculture, and water-management interests

Water pollution from fishery effluents entering the nature reserve water bodies

Physical and operational risks associated with legacy infrastructure and visitor pressure

## BASELINE CONDITION

Nahal Dalia is a coastal wetland system in Israel comprising the Difleh nature reserves and the Dalia estuary. Decades of intensive aquaculture and competing water uses have severely degraded the site. The nature reserve water bodies were effectively repurposed as operational reservoirs and effluent treatment ponds for the adjacent fishpond system — a condition written into the reserve’s founding agreement.

Dams and water-control structures fragment the stream system, blocking ecological connectivity, restricting fish movement, and disrupting sediment transport. Groundwater abstraction has reduced spring discharge and elevated the risk of saltwater intrusion. The result is a self-reinforcing cycle of ecological decline: degraded hydrology suppresses biodiversity, which in turn reduces the system’s resilience to further pressures.

## RESTORATION STRATEGY SELECTED AND WHY

The project selected a multi-challenge strategy addressing the root causes of wetland degradation rather than treating symptoms in isolation.

Hydrological interventions, including the disconnection of the southern Difleh from the fishpond system and a new embankment dividing the northern Difleh into flow-based and seasonal habitat zones, aimed to restore more natural water regime dynamics. A regional water planning process was initiated to reallocate surface water among competing users and reduce groundwater abstraction pressure through a linked desalination initiative.

Nature-based solutions (constructed wetlands) were co-designed with fishpond operators to treat effluents outside the reserve boundary.

Physical habitat restoration, bank reshaping and construction of nesting islands provided direct biodiversity benefits and broke the cycle of habitat loss.



Daily activity on the islands, July 2025. Credit: David Rezek

# HOW THE CHALLENGES WERE ADDRESSED AND KEY RESULTS ACHIEVED

75%  
Implemented

## Severe biodiversity degradation

Physical habitat restoration delivered measurable biodiversity outcomes. A total of 3.5 km of river-bank was reshaped in the northern and southern reserves (2.7 km and 0.8 km, respectively), creating stable vegetated banks, nesting areas for Softshell turtles, and muddy, organic-rich banks for shorebirds. Two artificial nesting islands (each approximately 500m<sup>2</sup>) were constructed for tern nesting. Bird monitoring (2022–2025) recorded 53 breeding species, including 15 confirmed breeders and 8 threatened species (2 Endangered, 2 Vulnerable, 4 Near Threatened). Nesting attempts by Common and Little Terns were observed, and Softshell Turtle nests were located in 5 clusters. The submerged aquatic plant *Ruppia maritima* was recorded, indicating improved water conditions.

50%  
Implemented

## Altered hydrology and loss of river–sea connectivity

Hydrological management capacity improved substantially. The southern Difleh was disconnected from the fishpond operational system, allowing water levels to be managed almost entirely on eco-hydrological grounds. A new embankment in the northern Difleh divided the water body into a flow-based and a seasonal habitat zone. Continuous water-level monitoring (every 5 minutes), piezometers, and monitoring wells were installed. A regional water plan was initiated to reallocate surface water among agriculture, aquaculture, and nature, underpinned by a kibbutz-led desalination initiative. A floodwater reservoir is in detailed planning, designed to capture excess winter runoff and reduce groundwater abstraction pressure. No measurable restoration of river–sea connectivity has yet occurred.

0%  
Implemented

## Water pollution from fishery effluents

Monthly monitoring of eastern fishpond water quality was initiated, and a green-basin treatment

pilot was co-designed with fishpond operators. The pilot uses constructed wetlands within the Ma'ayan Zvi fishpond area, outside the reserve boundary, to treat effluents through nature-based solutions. A bypass pipeline is planned so that polluted water no longer flows through the southern Difleh. Discussions are underway with Kibbutz Ma'ayan Zvi for a 20-year agreement covering approximately 20 ha around the northern Difleh, under which fish farming would cease and the ponds would be managed as open water bodies for biodiversity and water quality. Implementation of these solutions is scheduled for 2026.

25%  
Implemented

## Over-abstraction and salinization driven by external policies

A framework for allocating 2 million cubic metres of supplied water was agreed. Two monitoring wells and piezometers were installed for continuous measurement of groundwater levels and electrical conductivity. A preliminary minimum groundwater level threshold of 2 metres was defined, and an operational rule established: pumping is to halt if electrical conductivity rises. Desalination initiatives were integrated into broader regional planning as a strategic lever to reduce pressure on the aquifer.

25%  
Implemented

## Governance and policy misalignment

A multi-stakeholder Steering Committee met 8 times, a structured stakeholder engagement plan was developed, and a regional water plan involving cross-sector actors was initiated. Principles for a discharge permit to the sea from within the reserve were agreed with the Ministry of Environmental Protection, a significant outcome given that the reserve is currently classified as a pollution source. The agreed principles refer to the reserve's anticipated future condition once restored, establishing a forward-looking regulatory framework. Governance structure was significantly strengthened, though no quantified policy realignment outcomes have yet been recorded.



## Physical and operational risks

No implementation data was reported for this challenge category in the current pilot period. Risks associated with legacy infrastructure and visitor pressure were noted but not yet formally addressed through on-the-ground actions.

### SPECIFIC SOLUTIONS IMPLEMENTED

#### Morphological bank restoration

3.5 km of riverbank reshaped to create stable vegetated banks, seasonal habitats, nesting areas for Softshell turtles, and shorebird foraging zones; expanded buffer between fishponds and ecological core.

#### Artificial nesting islands

Two islands (~500m<sup>2</sup> each) constructed in the reserves for tern nesting and biodiversity enhancement.

#### Hydrological disconnection

Southern Difleh disconnected from the fishpond operational system, enabling independent eco-hydrological water-level management.

#### Northern Difleh embankment

New embankment was constructed to divide the water body into a flow-based habitat zone and a seasonal habitat zone.

#### Monitoring infrastructure

Continuous water-level sensors, piezometers, and monitoring wells installed; monthly fishpond water-quality monitoring initiated.



Bird nesting islands (before)

#### Green-basin treatment pilot (planned 2026)

Constructed wetland water-purification system co-designed with fishpond operators for implementation within the Ma'ayan Zvi fishpond area, outside the nature reserve.

#### Regional water plan

Multi-partner planning process initiated to regulate surface water allocation between agriculture, aquaculture, and ecological needs, linked to a desalination initiative.

#### Floodwater reservoir (planning stage)

Designed to capture excess winter runoff, reduce groundwater abstraction pressure, and restore seasonal flow dynamics.

#### CORE-PLAT stakeholder engagement

Steering Committee convened 8 times; structured engagement plan developed; cross-sector partnerships with kibbutzim, water authorities, and civil society organisations established.

#### Birding hide (planned 2026)

Public engagement structure to make restored biodiversity value accessible to visitors, educators, and the birding community.



Bird nesting islands (after)



Habitat heterogeneity and structural complexity (before)



Habitat heterogeneity and structural complexity (after)

## KEY STAKEHOLDERS INVOLVED AND HOW

The project is led by the Israel Nature and Parks Authority, which is responsible for implementation within the reserve and plays a central role in coordination. Regional water planning is led by the Drainage Authority in collaboration with multiple partners, including water authorities, local stake-

holders, and kibbutzim. Private sector actors and NGOs contribute to implementation, negotiation, and long-term management planning. National authorities are engaged in regulatory alignment, particularly regarding water discharge policies.

## INFLUENCE ON DECISION-MAKING

Policy influence was primarily achieved at the national level. Principles for a future discharge permit to the sea from within the nature reserve were agreed with the Ministry of Environmental Protection. This is a significant regulatory milestone: the reserve is currently classified as a pollution source, and the agreed principles pertain to its anticipated future condition once restored, creat-

ing a forward-looking framework aligned with the restoration trajectory. At the regional level, the cross-sector water planning process initiated with the Drainage Authority represents an emerging governance option, though formal plan adoption is pending. No confirmed policy changes at local municipal, EU, or other scales were reported for this pilot period.

## RECOMMENDATIONS FOR FUTURE DEVELOPMENT

Future priorities include restoring connectivity between the estuary and coastal systems, implementing planned water treatment solutions, and completing hydrological restoration measures. Further work is needed to refine groundwater management, strengthen governance frameworks, and ensure long-term financial sustainability. Expanding ecological restoration while maintaining stakeholder engagement will be critical for achieving lasting outcomes.

## FINANCIAL MECHANISMS USED AND PROPOSED

Primary funding was provided through the EU Horizon 2020 REST-COAST project resources, supplemented by public funding from the Open Spaces Fund (including a dedicated climate track) and INPA institutional budgets. A cost-sharing model was applied for the floodwater reservoir, with Kibbutz Ma'ayan Zvi committing 50% of construction costs alongside public funding — creating joint financial responsibility and reducing dependency on any single actor. Two payment-for-ecosystem-services (PES) schemes were established with private landowners, offering long-term stable contracts as an economically attractive alternative to commercial fishing.

Long-term maintenance for the constructed wetlands and the Difleh disconnection will be financed

by embedding costs within the water tariff paid by INPA to local suppliers, ensuring a stable and predictable ongoing funding mechanism. The Fishing Park will contribute to part of the constructed wetland maintenance costs, aligning commercial interests with water quality goals. Under the proposed SPNI lease model, any future revenues from carbon sequestration credits within the leased fishpond areas would be transferred to Kibbutz Ma'ayan Zvi, introducing a potential carbon finance stream. INPA's regulatory influence over the kibbutz's desalination initiative was used as a strategic lever to facilitate broader restoration agreements, demonstrating how institutional influence can substitute for direct financial incentives in complex multi-stakeholder settings.



Dalia Stream and the Difleh Reserves, view from north to south. Credit: Aviv Kurt.

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