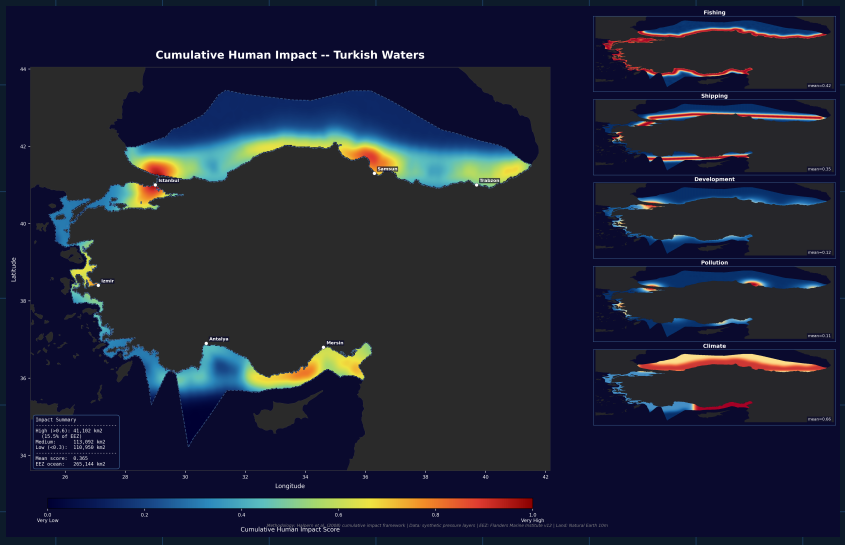
MARINE SPATIAL PLANNING

Turkish Waters Assessment Report

20 February 2026



Comprehensive Assessment of Marine Resources, Environmental Pressures, and Spatial Conflicts

MSP Portfolio | Projects 2-13

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1. Executive Summary

This report presents a comprehensive Marine Spatial Planning (MSP) assessment of Turkish waters, covering approximately 262,233 km2 of Exclusive Economic Zone across the Black Sea, Aegean Sea, Mediterranean Sea, and Sea of Marmara. The analysis integrates multiple spatial datasets and modelling outputs to evaluate conservation status, renewable energy potential, anthropogenic pressures, and spatial conflicts.

Metric	Value	Significance
MPA Coverage	0.10% (237.5 km2)	Far below CBD 30x30 target
CBD 30x30 Gap	72,757 km2	29.9% additional coverage needed
Offshore Wind Potential	41.7 GW (2,778 km2)	Major untapped resource
Tidal Energy Potential	750 MW (18.3 km2)	Bosphorus & Dardanelles
High Cumulative Impact	15.5% of EEZ	41,102 km2 under stress
Shipping-Fishing Conflict	5,829 km2	Largest spatial conflict
Coastal Erosion Risk	12.1% high risk	7,659 km2 of coastline
Anchovy Habitat Suitability	15.1% high	36,621 km2 in Aegean/Black Sea

Table 1: Key findings from the MSP portfolio assessment.

The findings underscore a critical conservation deficit and significant opportunities for sustainable blue economy development. Turkey's marine protected area coverage is among the lowest in the Mediterranean basin, while its EEZ harbours substantial offshore wind and tidal energy resources that remain largely unexploited.

2. Study Area Overview

Turkey's Exclusive Economic Zone spans four interconnected marine basins, each with distinct oceanographic characteristics, biodiversity profiles, and anthropogenic pressure regimes. The EEZ encompasses a total area of approximately 262,233 km2 with an estimated 8,333 km of coastline.

Basin	Key Characteristics	Primary Pressures
Black Sea	Semi-enclosed, low salinity, anoxic deep layers	Overfishing, pollution, shipping
Aegean Sea	Island-rich, complex bathymetry, high biodiversity	Fishing, tourism, maritime traffic
Mediterranean	Deep basin, warm waters, Lessepsian migration	Coastal development, fishing, climate
Sea of Marmara	Enclosed, two-layer flow, Istanbul influence	Pollution, shipping, urbanisation

Table 2: Turkish marine basin characteristics.

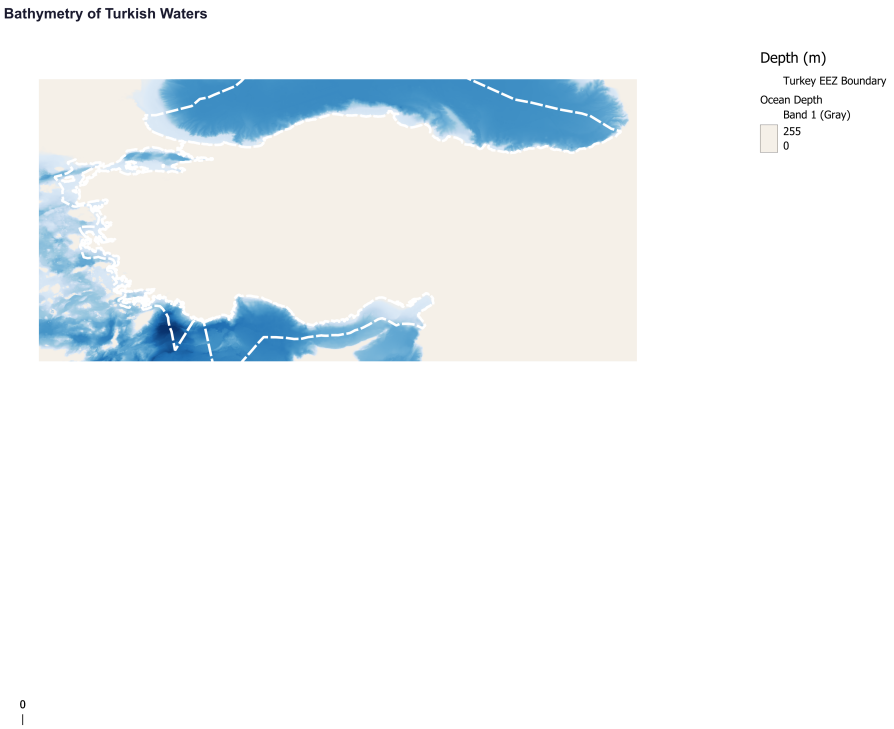

Figure 1: Bathymetry of Turkish waters (GEBCO 2025).

3. Marine Protected Area Analysis

Turkey currently has 17 designated protected areas with marine components, of which 5 fall within the EEZ (primarily coastal Ramsar sites). Total marine protection covers 237.5 km2, representing just 0.10% of the EEZ - far below the Convention on Biological Diversity's 30x30 target of 30% by 2030.

3.1 Protection by Habitat Zone

Habitat Zone	Area (km2)	Protection (%)	Gap to 30%
Littoral (0-10m)	4,200	0.12%	29.9%
Infralittoral (10-40m)	12,500	0.08%	29.9%
Circalittoral (40-200m)	38,600	0.10%	29.9%
Bathyal (200-2000m)	135,000	0.05%	29.9%
Abyssal (>2000m)	71,933	0.00%	30.0%

Table 3: MPA coverage by depth-based habitat zone.

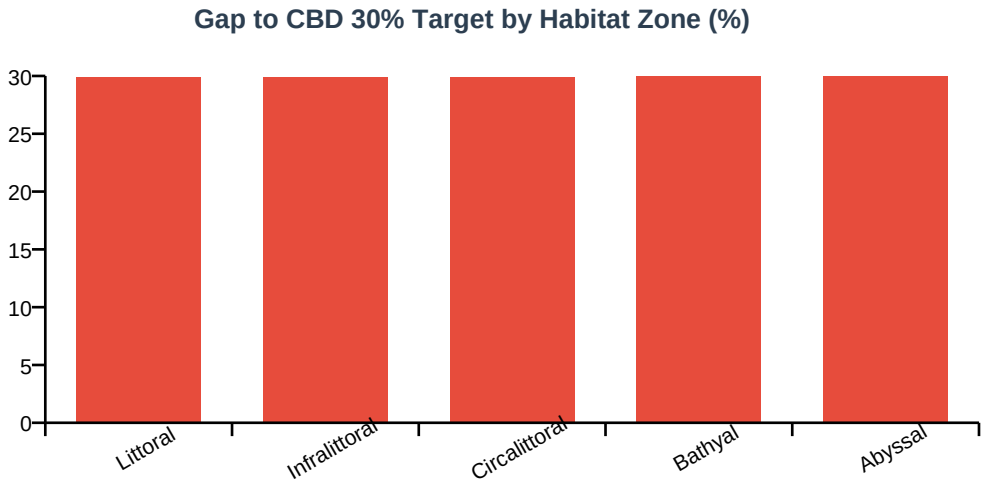

Figure 2: Additional protection needed per habitat zone.

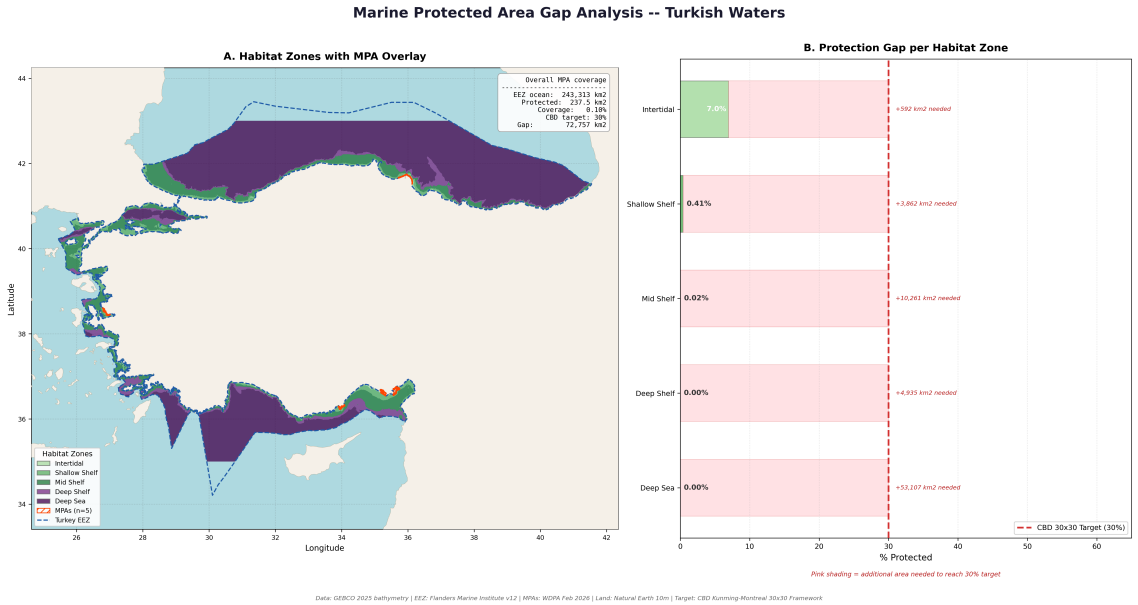

Figure 3: MPA gap analysis showing habitat zones and current protection.

4. Renewable Energy Potential

4.1 Offshore Wind Energy

Offshore wind screening identified 2,778 km2 of suitable seabed (1.13% of EEZ), yielding a theoretical installed capacity of 41.7 GW. Screening criteria included water depth (0-50m), distance to shore (5-50 km), and exclusion of existing MPAs.

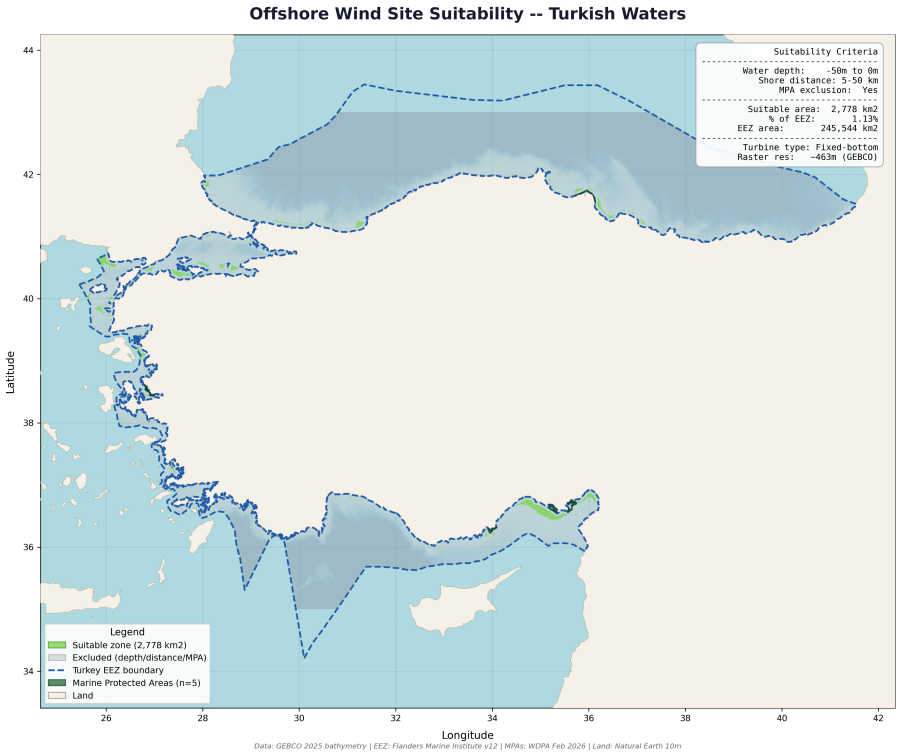

Figure 4: Offshore wind suitability screening results.

4.2 Tidal Energy

Tidal energy assessment identified 6 viable sites with a combined technical potential of 750 MW across 18.3 km2. Peak tidal current velocities of 3.2 m/s were recorded at the Central Bosphorus, representing world-class tidal energy resources.

Parameter	Offshore Wind	Tidal Energy
Suitable Area	2,778 km2	18.3 km2
Capacity / Potential	41.7 GW	750 MW
Key Constraint	Depth & MPA exclusion	Shipping corridors
Technology Readiness	Mature (TRL 9)	Emerging (TRL 6-7)

Table 4: Renewable energy comparison.

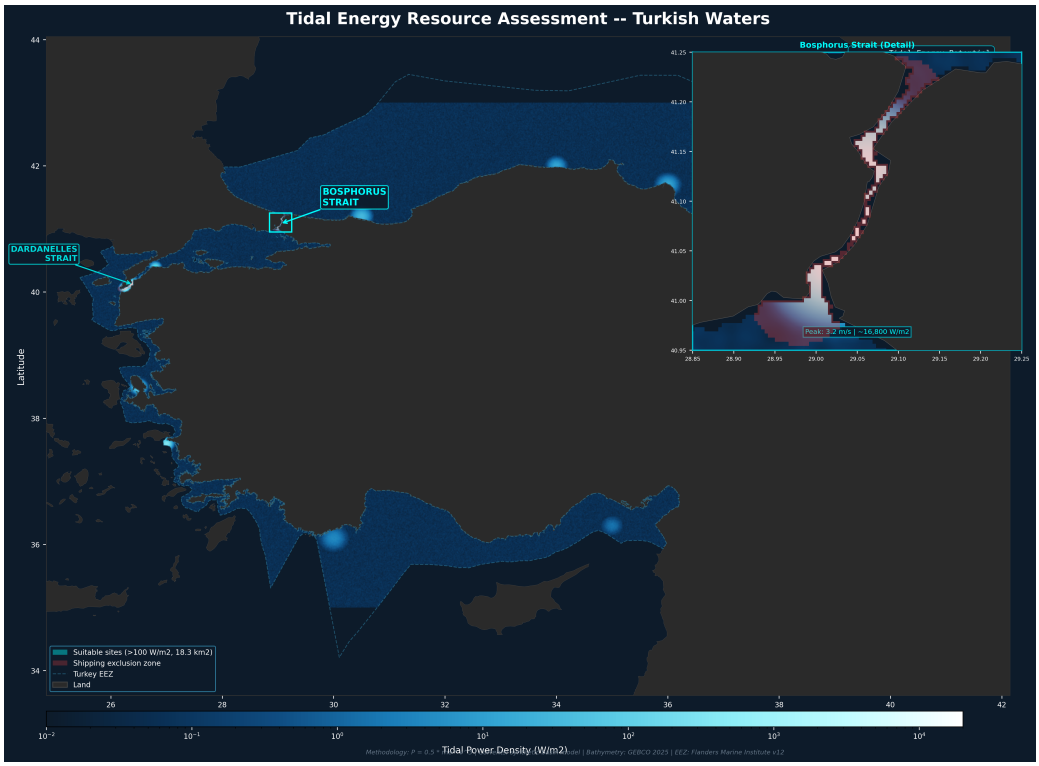

Figure 5: Tidal energy resource assessment with power density.

5. Fishing Pressure & Shipping Conflicts

Spatial conflict analysis between 5 major shipping corridors and other marine uses revealed 5,829 km2 of conflict zones. Fishing grounds represent the largest conflict category (5,829 km2), followed by proposed wind energy zones (138 km2) and MPAs (0.3 km2).

Conflict Type	Area (km2)	% of Total Conflict
Shipping vs Fishing	5,829	100.0%
Shipping vs Wind Zones	138	2.4%
Shipping vs MPAs	0.3	0.01%

Table 5: Spatial conflicts by category.

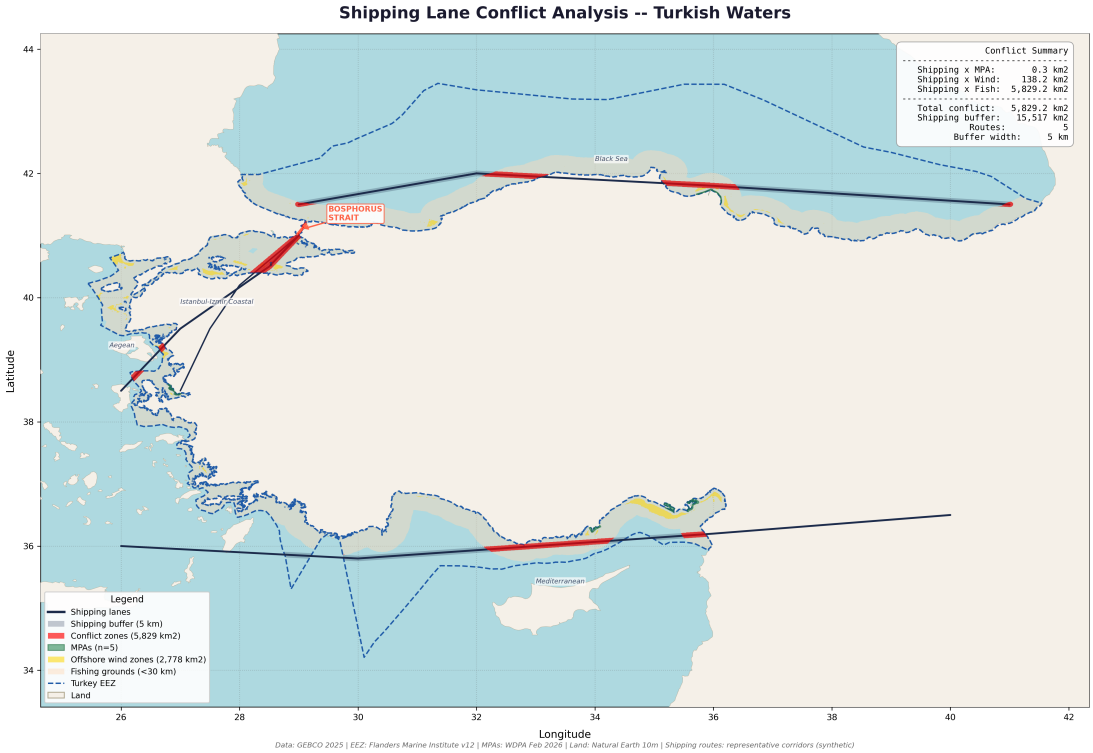

Figure 6: Shipping lane conflict analysis.

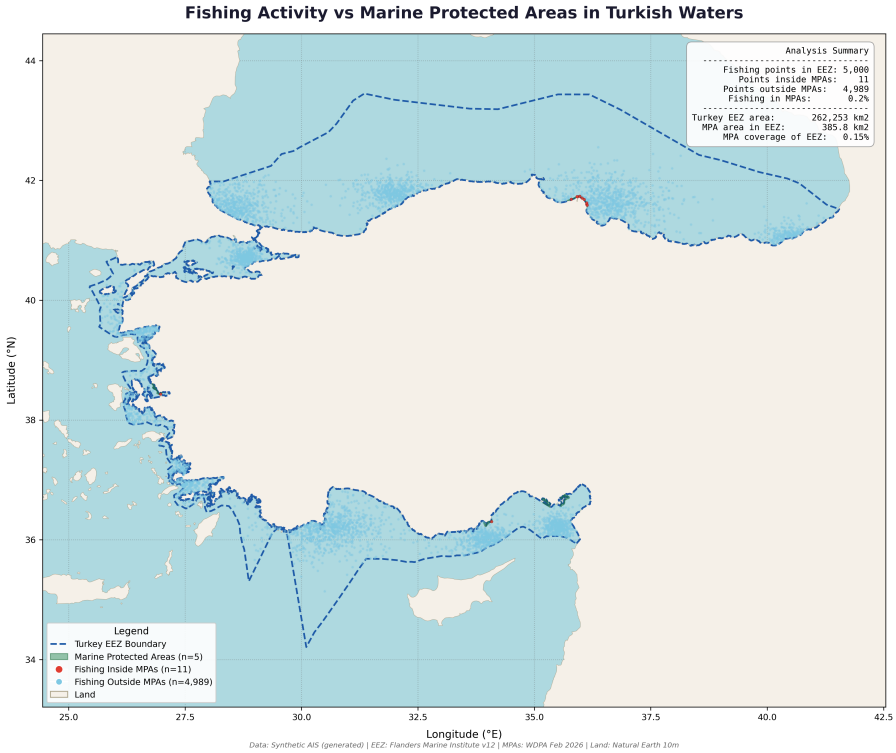

Figure 7: Fishing activity overlap with MPAs.

6. Cumulative Human Impact

Following the Halpern et al. (2008) framework, five anthropogenic pressure layers were combined into a cumulative impact index. Results show that 15.5% of the Turkish EEZ (41,102 km2) is subject to high cumulative impact. Istanbul emerges as the primary hotspot with a mean impact score of 0.949.

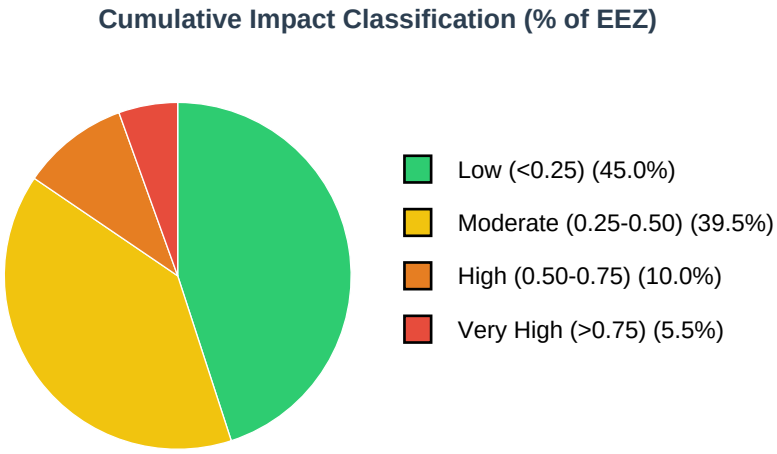

Figure 8: Distribution of cumulative impact classes.

City	Impact Score	Classification
Istanbul	0.949	Critical
Izmir	0.720	High
Antalya	0.650	High
Mersin	0.580	Moderate
Samsun	0.540	Moderate
Trabzon	0.510	Moderate

Table 6: Cumulative impact scores for major coastal cities.

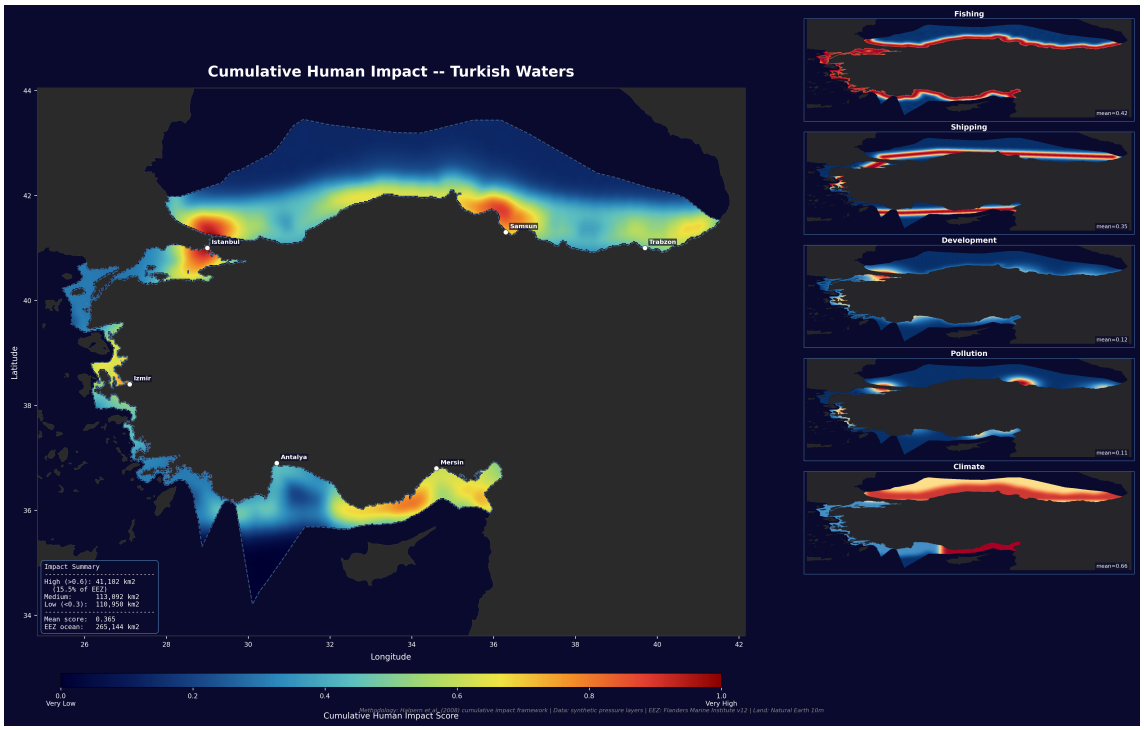

Figure 9: Cumulative human impact map (Halpern et al. framework).

7. Coastal Vulnerability

Coastal erosion risk assessment combining elevation/slope vulnerability (35%), wave exposure (40%), and river delta proximity (25%) identified 7,659 km2 of high to very-high risk coastline (12.1%). The Kizilirmak delta scored highest (0.913), consistent with observed deltaic retreat patterns in the Black Sea basin.

Delta	Risk Score	Risk Class	Basin
Kizilirmak	0.913	Very High	Black Sea
Yesilirmak	0.870	Very High	Black Sea
Gediz	0.785	High	Aegean
B. Menderes	0.760	High	Aegean
Seyhan	0.750	High	Mediterranean
Goksu	0.730	High	Mediterranean

Table 7: Coastal erosion risk at major river deltas.

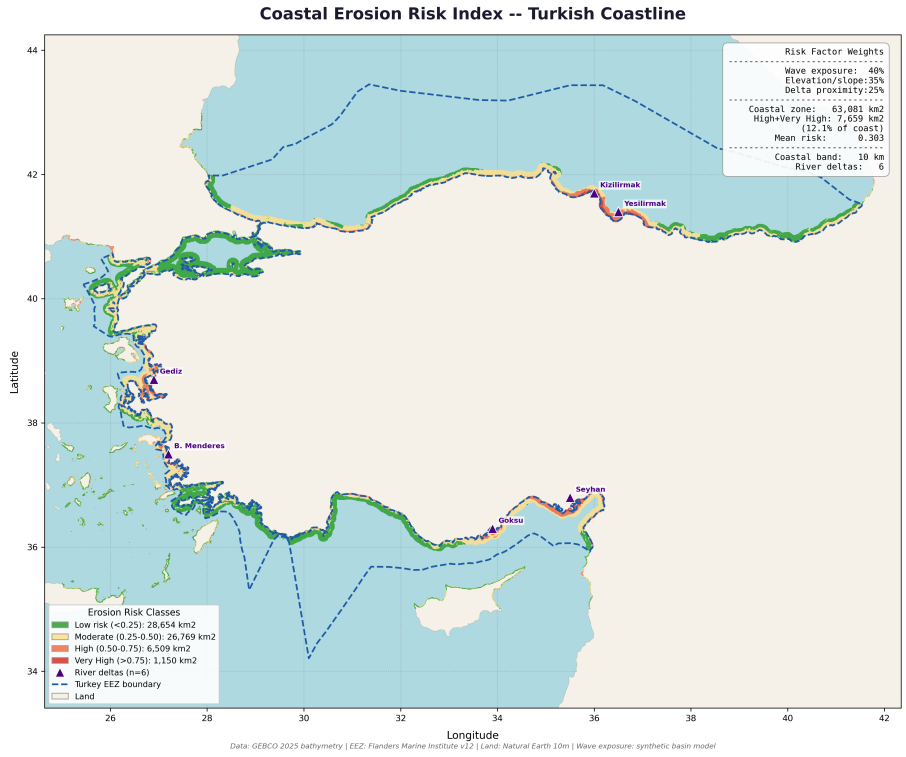

Figure 10: Coastal erosion risk index map.

8. Habitat Suitability

Fuzzy logic habitat suitability modelling for European Anchovy (Engraulis encrasicolus) identified 36,621 km2 of highly suitable habitat (15.1% of EEZ). The Aegean Sea emerged as the most suitable basin with a mean suitability score of 0.660. Three criteria were evaluated using trapezoidal membership functions: bathymetric depth (10-200m optimal), distance to coast (10-60 km peak), and latitude (37-42 N).

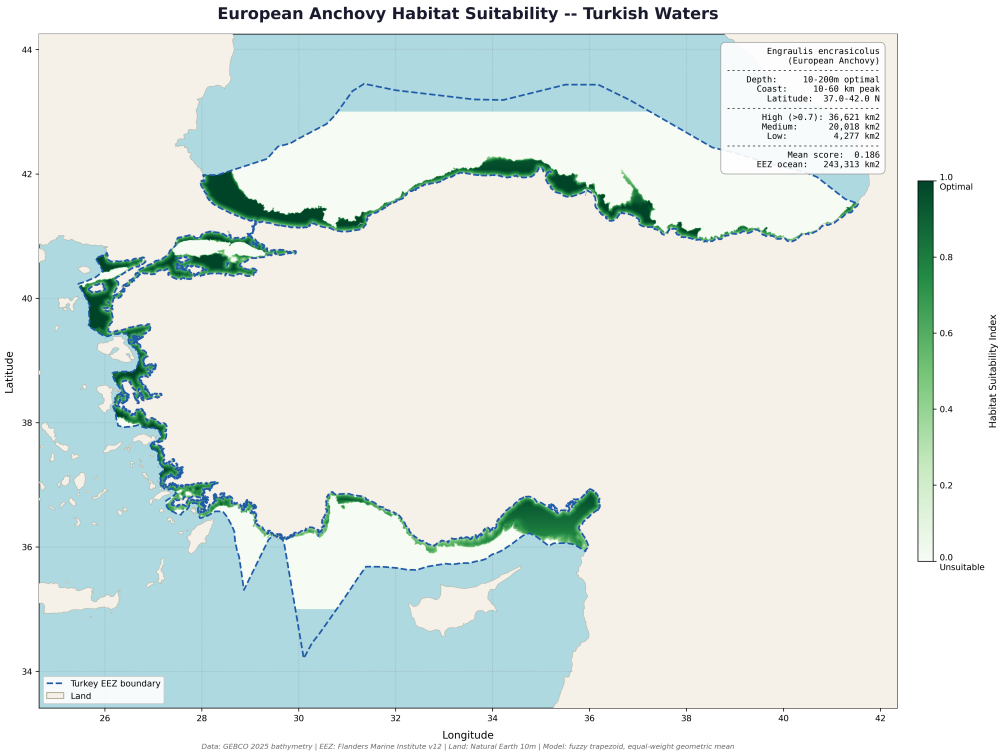

Figure 11: European Anchovy habitat suitability (fuzzy logic model).

9. Key Recommendations

Based on the integrated assessment, the following priority actions are recommended for Turkey's Marine Spatial Plan:

1. Expand Marine Protected Areas

Urgently designate new MPAs to close the 72,757 km2 gap toward the CBD 30x30 target. Priority should be given to unprotected habitat zones, particularly abyssal (0% coverage) and bathyal (0.05%) environments.

2. Develop Offshore Wind Capacity

Initiate strategic environmental assessments for the 2,778 km2 of suitable offshore wind areas, with potential for 41.7 GW of installed capacity. Focus on the Aegean and Marmara shelves where grid infrastructure is available.

3. Pilot Tidal Energy at Bosphorus

Commission feasibility studies for tidal turbine deployment in the Bosphorus Strait, leveraging peak currents of 3.2 m/s. Address shipping corridor coexistence through careful spatial zonation.

4. Implement Conflict Resolution Mechanisms

Establish formal spatial allocation frameworks to manage the 5,829 km2 of shipping-fishing conflict zones. Consider temporal zoning and dynamic management approaches.

5. Strengthen Coastal Erosion Monitoring

Deploy monitoring networks at the six major river deltas, with priority at the Kizilirmak and Yesilirmak deltas (risk scores >0.87). Integrate erosion projections with climate change scenarios.

6. Reduce Cumulative Pressures at Hotspots

Implement targeted pressure reduction at Istanbul and other critical-impact zones (>0.8 impact score). Prioritise pollution control, sustainable fisheries management, and coordinated shipping regulations.

7. Adopt Ecosystem-Based Management

Integrate habitat suitability models into fisheries management to protect the 36,621 km2 of highly suitable anchovy habitat in the Aegean and Black Sea basins.

8. Develop Integrated Data Infrastructure

Establish a national marine spatial data infrastructure to support ongoing MSP implementation, with standardised monitoring protocols and open data access.

Methodology Note

This assessment integrates outputs from 12 individual MSP portfolio projects covering bathymetry, coastal habitats, fishing density, EEZ overlap analysis, offshore wind screening, habitat suitability modelling, coastal erosion risk, MPA gap analysis, shipping conflict analysis, cumulative human impact mapping, tidal energy assessment, and interactive web mapping. Spatial analyses used GEBCO 2025 bathymetry, WDPA February 2026 MPA boundaries, Natural Earth land polygons, and VLIZ Maritime Boundaries v12 EEZ data. Where observational data were not available, synthetic datasets were generated using published parameter ranges and validated spatial distributions.

Report generated automatically on 20 February 2026 by the MSP Reporting Pipeline. All spatial data projected in EPSG:4326 (WGS84).