



RESEARCH SERVICE  
OF THE VERKHOVNA RADA OF UKRAINE



Round-Table Discussion

# The environmental impact of the war on the Black Sea

Friday 22 May 2026, 10.00 – 12.00 EEST | Hybrid format



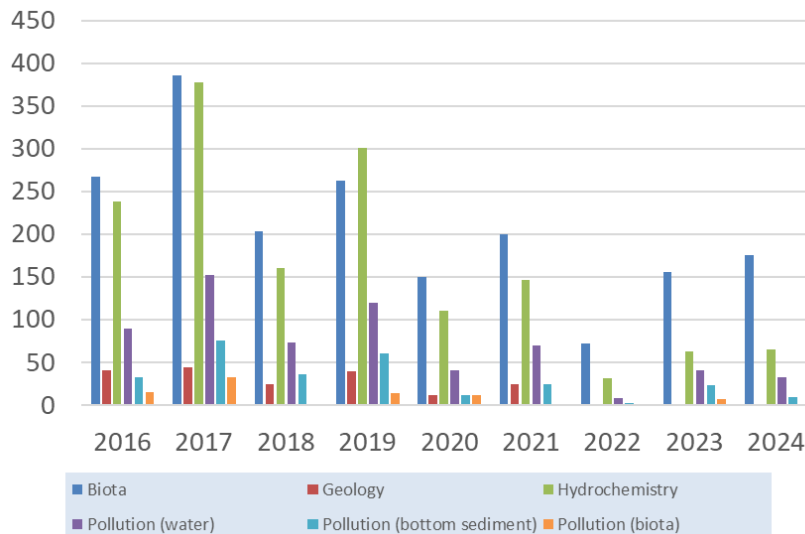
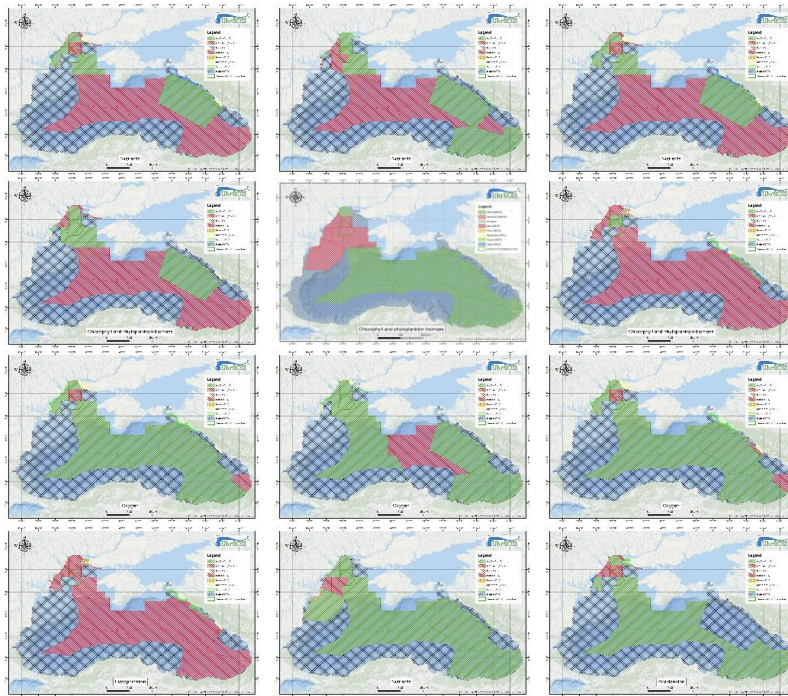
## Impact of the War on the Black Sea Environment



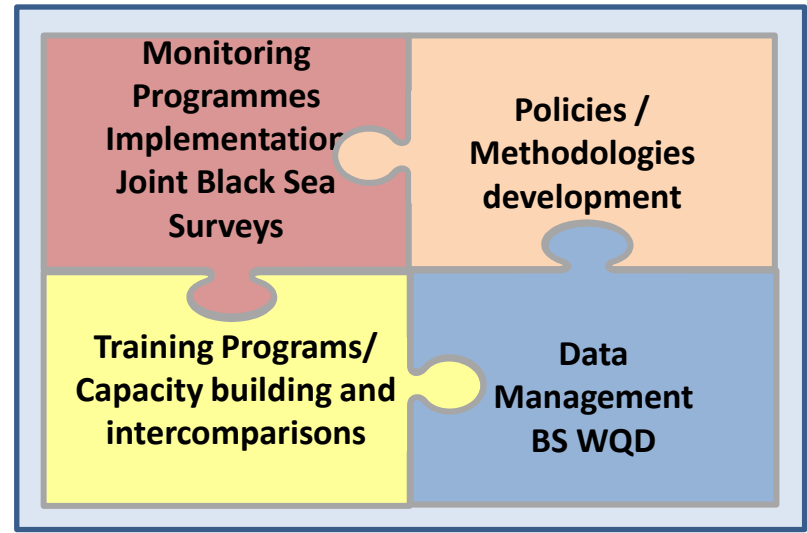
Viktor Komorin

Ukrainian Scientific Centre of Ecology of the Sea (UkrSCES)

# The initial assessment and number of marine monitoring samples



- 1) Marine environmental monitoring is the basis for environmental assessment and decision-making. MSFD defines Good Environmental Status (GES) through 11 descriptors
- 2) Breakdown of sampling efforts by parameter group within national and international programmes (EMBLAS, State Monitoring):
  - Regular sampling of biota, hydrochemistry, and pollution in water, sediment, and organisms
  - Notable decline in most categories since 2022 due to security-related constraints on offshore operations
  - Partial recovery of biological sampling observed in 2023–2025 under adaptive coastal monitoring schemes



# Black Sea Environmental Data Platform (BS e-DataPlatform)

## Platform overview

### Black Sea Environmental Data Platform (BS e-DataPlatform)



#### Black Sea Environmental Data Platform (BS e-DataPlatform)

##### Overview:

The Water Quality Database (WQDB), initiated under the auspices of the **EMBLAS project**, stands as a leading repository designed for collating and analyzing water quality data pertaining to the entire Black Sea region. By integrating modern technologies and methodologies, it aligns seamlessly with the principles and approaches of European directives, especially the WFD (Water Framework Directive) and MSFD (Marine Strategy Framework Directive). The data access interface is available [here](http://blackseadb.org).

##### Development history:

- EMBLAS I (2010): the conceptual foundation for the WQDB was laid during the inaugural phase of the EMBLAS project.
- EMBLAS II: as the project transitioned to its next phase, the database was augmented with comprehensive data sourced from multiple expeditions and thorough ecological monitoring across the Black Sea.
- EMBLAS plus: functional capabilities such as Chemical GIS, Phytoplankton GIS, Integral Zooplankton Index, and others have been developed.

##### Content & Data Features:

The WQDB caters to an extensive range of water quality indicators, in line with the descriptors of the MSFD EU directive. This encompasses:

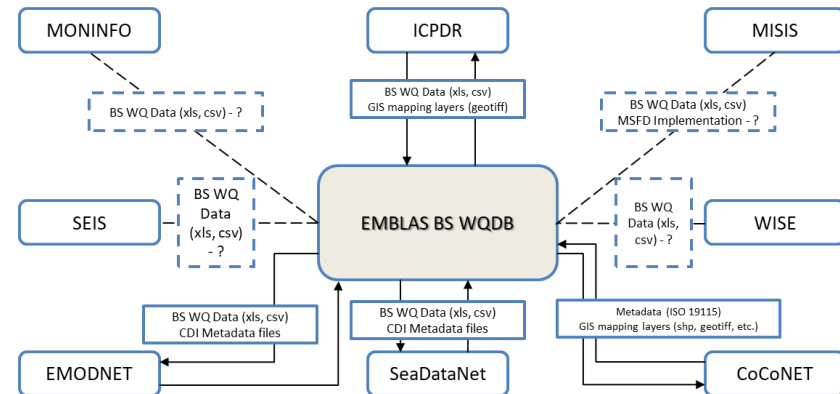
- **Biodiversity:** Information on the state of various marine species and habitats.
- **Non-indigenous Species:** Data on invasive species and their impacts.
- **Population Dynamics:** Metrics related to the population and health of commercial fish species.
- **Food Webs:** Data showcasing the health and balance of marine food chains.
- **Eutrophication:** Information on nutrient levels and their potential impacts.
- **Sea Floor Integrity:** Metrics that provide insights into the state and health of the seabed.
- **Hydrographical Changes:** Data pertaining to changes in the Black Sea's hydrography.
- **Contaminants:** Information on pollutants in the water and marine life.
- **Marine Litter:** Data on the amount and types of waste present.
- **Energy:** Sustainable freshwater bodies, metrics related to water utilization and the impact of desalination.

<http://blackseadb.org/login.php>  
>200,000 data entries

### Key facts (UkrSCES):

- 400+ parameters
- 100+ years of observations
- interoperability with regional/EU data systems

## Interaction with regional data-management infrastructures



- Biodiversity:** Phytoplankton, Zooplankton, Meiobenthos, Macrophytobenthos
- Eutrophication:** general physico-chemical parameters, nutrients
- Contaminants:** water, sediments and biota
- Hydrography:** meteorology and hydrology

The platform consolidates long-term Black Sea environmental data and supports MSFD-aligned assessment, reporting and regional data exchange.

## War as a Source of Environmental Pressure

### Bombardments & Explosions



### Sea Mines



### Infrastructure Destruction



### Hazardous Debris

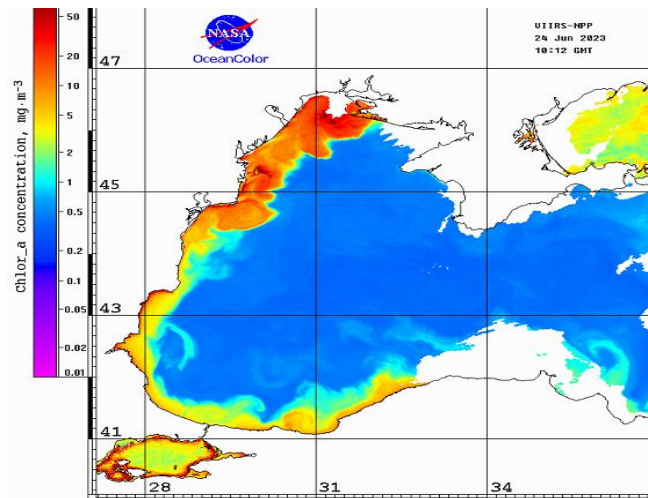
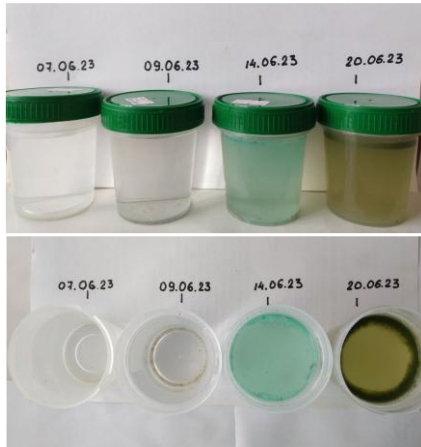
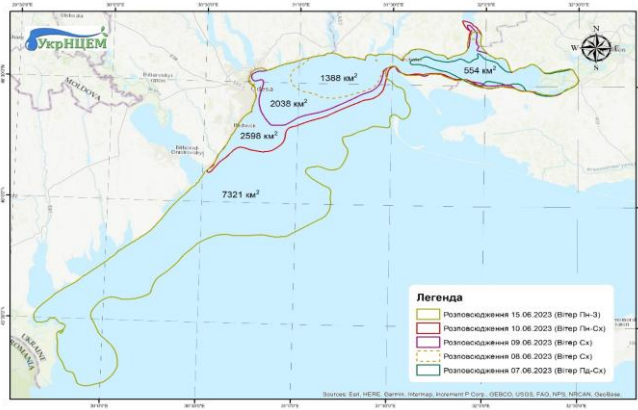


### Industrial Fires & Pollution



Military activity generates multiple pressures affecting marine ecosystems and coastal environments

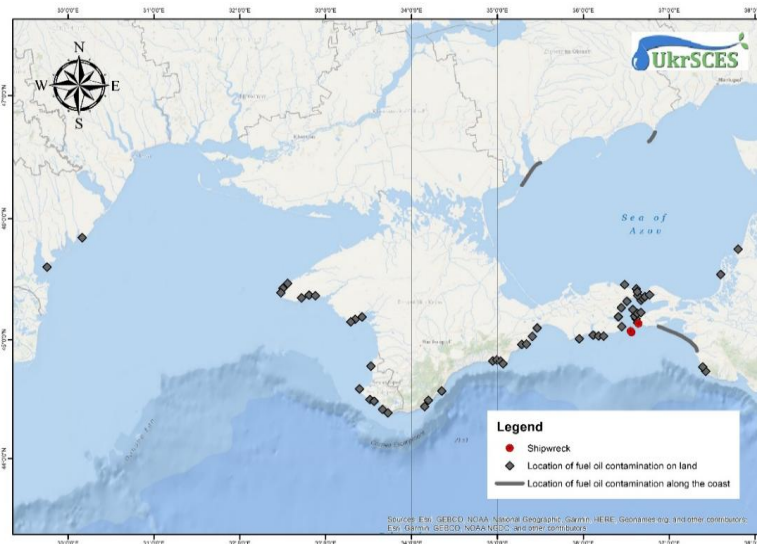
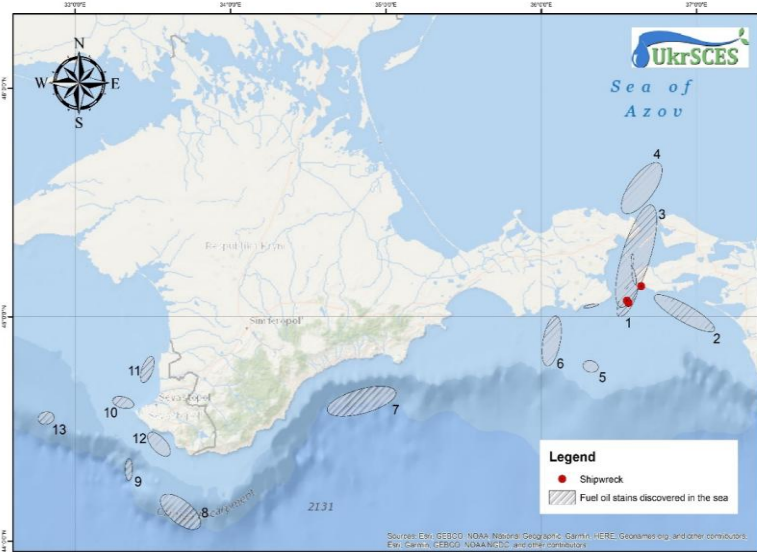
# Case Study: Kakhovka Dam Destruction



- Transport of polluted river water to the Black Sea
- Debris and organic material
- Phytoplankton blooms and water quality changes
- Satellite observations and field monitoring
- Toxic pollutions

# Case Study: Kerch Strait Oil Pollution

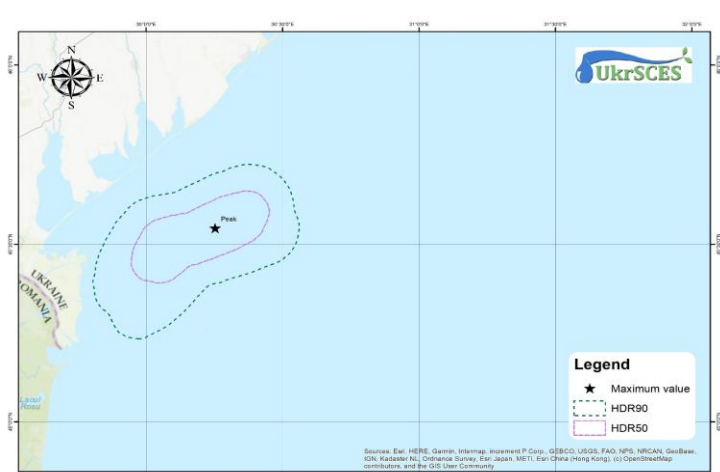
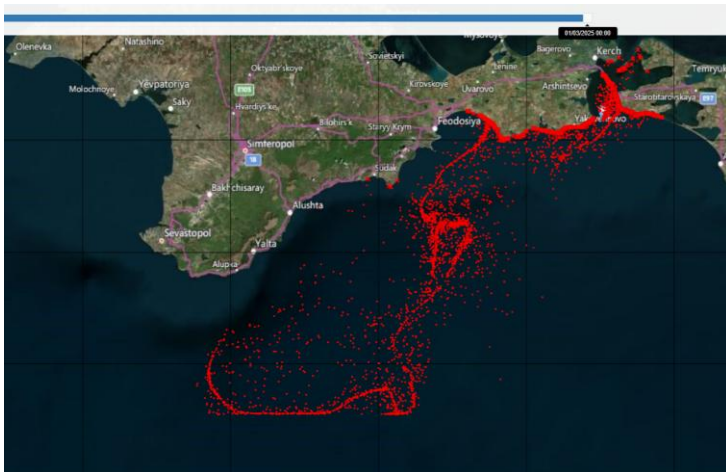
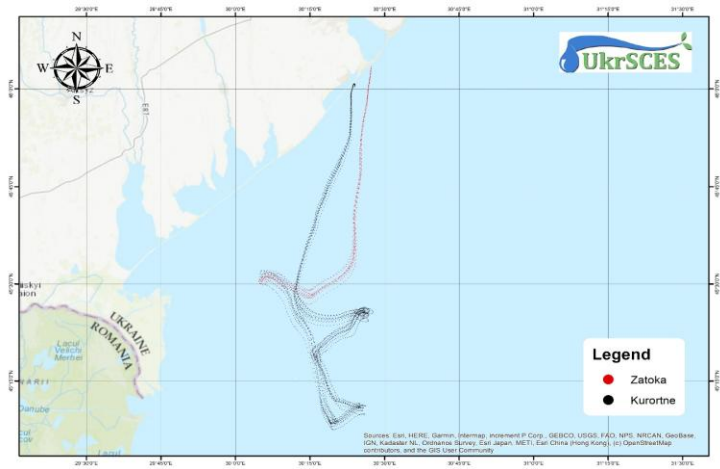
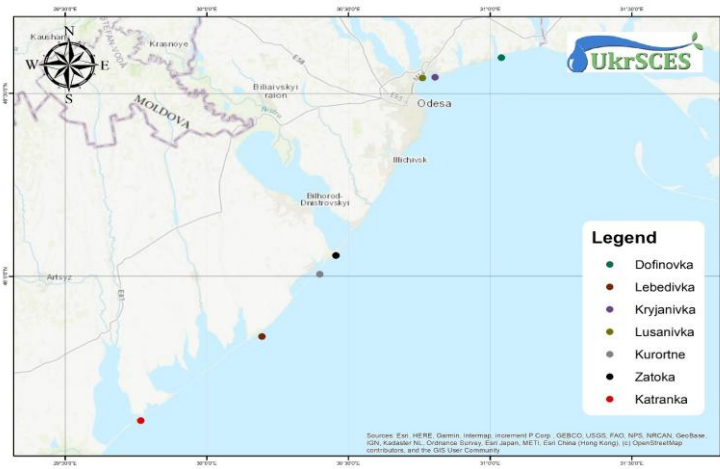
## Satellite Detection



- Satellite detection of oil spills
- Spread of pollution along the northern Black Sea coast
- Impacts on marine fauna

# Case Study: Kerch Strait Oil Pollution

## Transport Modelling and Risk Zones



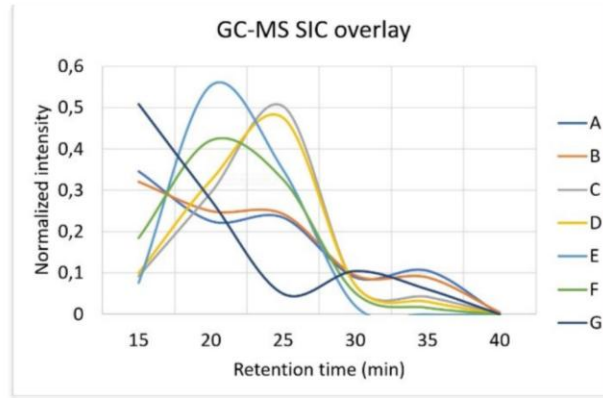
**Integrated approach: satellite + transport modelling (GNOME) to delineate risk zones and support response**

# Case Study: Kerch Strait Oil Pollution

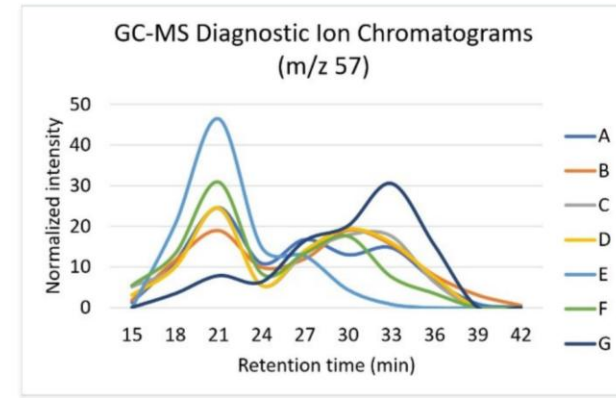
## GC-MS fingerprinting: separating residue classes

Chromatographic envelopes and diagnostic ions distinguish product families and weathering states.

### Implications for Response



Selected-ion chromatogram overlays

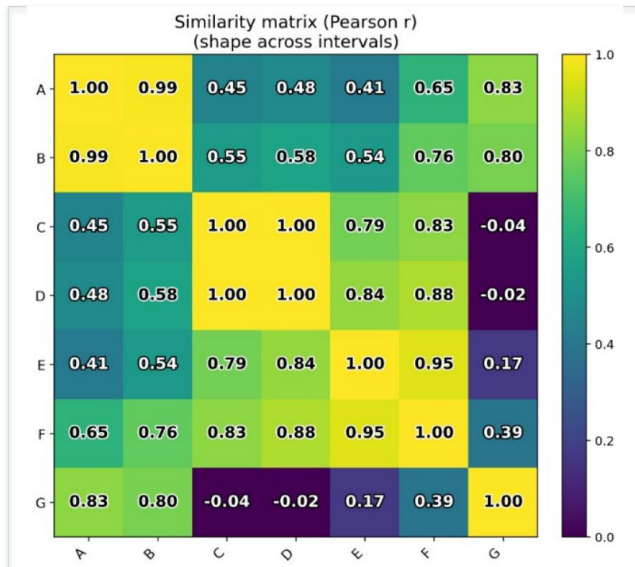


Diagnostic ion chromatograms (m/z 57)

**Scientific caution: fingerprinting narrows plausible scenarios, but weathering and mixing limit product-specific attribution without reference materials.**

## Similarity analysis and product heterogeneity

Pairwise profile correlations show which residues are similar and which likely represent independent sources/pathways.



### Strong grouping

Some samples cluster as related weathered residual fuel-oil-type material.

### Independent signatures

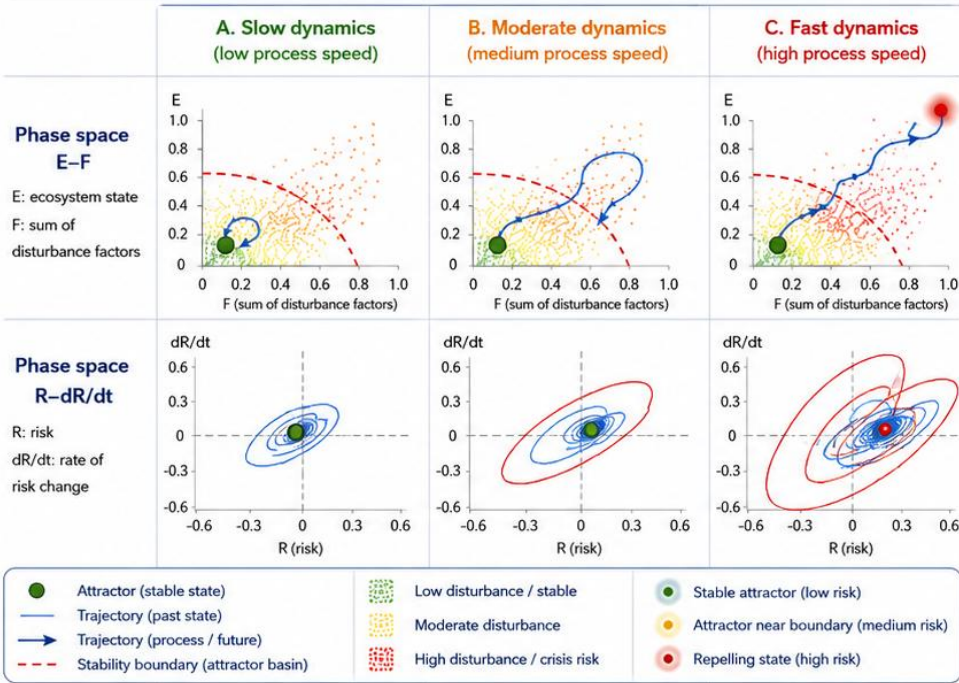
Other samples are not similar to the main group, supporting interpretation of separate product types or pathways.

### Why it matters

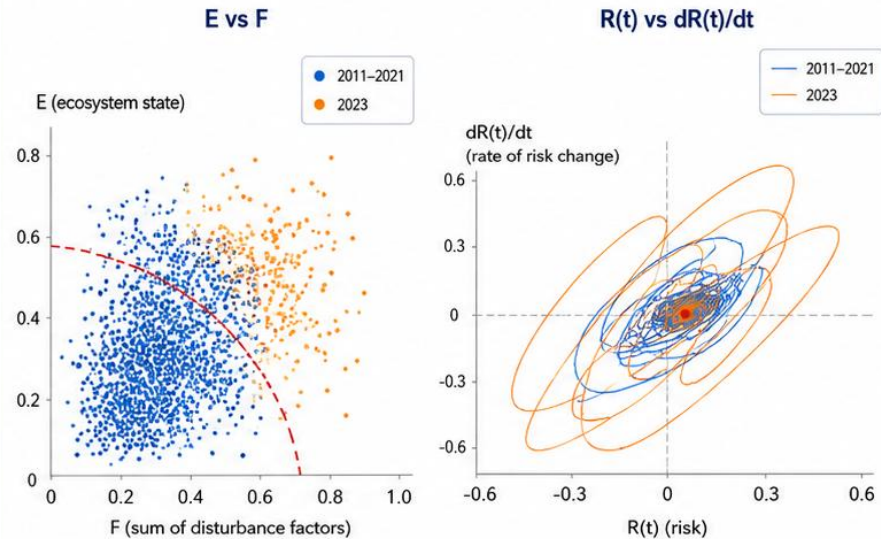
The coast may receive repeated deliveries and later remobilisation, so shoreline material should be treated as a secondary source.

# Ecosystem Risk Dynamics: 2023 Shift

## Conceptual framework: risk dynamics under different process speeds



## Observed dynamics: 2011–2021 vs 2023



Compared with 2011–2021, the 2023 trajectory indicates a shift toward higher disturbance and elevated ecosystem risk.

## Interpretation of Lyapunov $\lambda$

$$\lambda < 0$$

Disturbance decreases;  
trajectories tend toward a stable state;  
**low risk.**

$$\lambda = 0$$

Disturbance increases moderately;  
the system approaches a stability boundary;  
**medium risk.**

$$\lambda > 0$$

Disturbance increases;  
trajectories diverge from the attractor;  
**high risk, possible crisis or alternative regime.**

- E – ecosystem state (0–1)
- F – sum of disturbance factors (0–1)
- R – ecosystem risk (average deviation from stable state)
- dR/dt – rate of risk change
- $\lambda$  – largest Lyapunov exponent (indicator of stability/instability)

## What the comparison shows

- **2011–2021:** trajectories cluster around a lower-risk attractor.
- **2023:** higher disturbance values and wider dispersion indicate elevated ecosystem stress.
- **Risk dynamics:** larger oscillations suggest reduced stability and possible regime shift.
- **Interpretation:** supports risk screening and response prioritisation, not legal attribution alone.



## Safe Actions for Environment – Baltic Solutions to the Black Sea

### Why it matters for this presentation

- The war has increased risks from mines, munitions, hazardous debris and damaged coastal infrastructure.
- Regular offshore monitoring is constrained; risk-oriented and event-triggered approaches are needed.
- Baltic practice provides tested tools for screening, prioritisation and safe response.

### What SAFE-BS2BKS contributes

- 1 Capacity building**  
training of specialists; exchange of Baltic methods and operational experience
- 2 Baltic–Black Sea Action Plan**  
recommendations for public authorities, monitoring institutions and environmental responders
- 3 Communication and outreach**  
clear messages for stakeholders, coastal communities, protected areas and decision-makers

**Baltic knowledge → Black Sea application**

### Expected practical outputs

- ✓ adapted risk-screening approach for submerged munitions
- ✓ trained specialists and shared protocols
- ✓ joint Action Plan for authorities and monitoring institutions
- ✓ climate factor integrated into risk assessment
- ✓ stronger protection of marine protected areas and coastal communities



### Scan to learn more

SAFE-BS2BKS project  
information and updates

**Practical response layer for environmental security and recovery planning**

# Conclusions



**The Black Sea now requires not only environmental monitoring, but an integrated system of environmental security, evidence-based assessment and long-term ecological recovery.**

- The war has introduced new episodic pollution pathways while simultaneously limiting regular marine monitoring in the Black Sea.
- Integrated evidence from field observations, hydrochemistry, contaminant analysis, satellite data, oil-residue characterisation and transport modelling is essential for detecting and interpreting conflict-related environmental impacts.
- The results provide a practical basis for risk screening, scenario narrowing, emergency response and restoration planning, but should not be used alone for direct legal attribution.
- Future monitoring should be event-triggered, risk-oriented and supported by harmonised protocols, interoperable data systems and sustained international cooperation.



Thank you for your attention!

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