

# RESPONSE

Building Response Frameworks under existing  
& new Marine Pollution Challenges in the Black Sea



Deliverable D 2.1

## Report on co-creation process of advanced training curricula



Co-funded by  
the European Union

The RESPONSE project is funded by the European Union under Grand Agreement no. 101124661. Views and opinions expressed are however those of the beneficiaries only and do not necessarily reflect those of the European Union or European Climate, Infrastructure and Environment Executive Agency (CINEA). Neither the European Union nor the granting authority can be held responsible for them.



## DOCUMENT INFORMATION AND VERSION CONTROL

<b>Project Acronym</b>	RESPONSE
<b>Project Title</b>	Building Response Frameworks under existing and new Marine Pollution Challenges in the Black Sea
<b>Grant Agreement Number</b>	EU grant agreement No 101124661
<b>Work Package</b>	WP2
<b>Related Task(s)</b>	T2.1
<b>Deliverable Number</b>	D2.1
<b>Deliverable Name</b>	Report on co-creation process of advanced training curricula
<b>Due Date</b>	31 March 2025
<b>Date Delivered</b>	31 March 2025
<b>Dissemination Level</b>	Public — fully open (automatically posted online on the Project Results platforms)

## VERSION CONTROL

Revision-N°	Date	Description	Prepared By	Reviewed By
V1.0	10.03.2025	1 <sup>st</sup> Draft	NIMRD/Razvan Mateescu	Anastasia Tsavdaridou
V2.0	20.03.2025	2 <sup>nd</sup> Draft	Anastasia Tsavdaridou	
	30.03.2025	Final	Anastasia Tsavdaridou	

## Executive Summary

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This report aims to define the co-creation process for developing advanced training curricula, a key phase of which involved four national and one regional workshop. These workshops were conducted in close collaboration with stakeholders engaged in marine pollution preparedness and response in the Black Sea region.

This report presents the findings and specifications that establish the foundation for implementing advanced training activities within the project. The national and regional workshops conducted in the riparian countries outlined key provisions, which will be further developed in WP2. This process will enable project partners to identify the necessary tools, including software and digital resources, and compile a comprehensive list of curricula required for procurement.

Following the national and regional co-creation workshops, curriculum outlines have been defined, with specifications extracted to address stakeholder needs identified in Task 1.1/1.2. This document serves as a foundational deliverable for the RESPONSE project, acting as a reference point for all activities across WP1, WP2, WP3, and WP4.

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## Project background and context

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The RESPONSE, supported by the European Union EMFAF, under Grant Agreement no 101124661 has a duration of 36 months, starting from 01.10.2023. The project consortium involves six partners from five different countries: Greece, Bulgaria, Romania, Ukraine and Georgia. Five of the participants are based in countries bordering on the Black Sea, and the lead beneficiary, the Aristotle University of Thessaloniki (AUTH), has a long history of working with the region and with members of the consortium. The partnership includes one university, two research institutes and three environmental NGOs: the Black Sea NGO Network (BSNN) regional NGO network based in Varna, Bulgaria; the National Institute of Marine Research and Development (NIMRD), based in Constanta, Romania, leading research institute for the Black Sea; the Institute of Market Problems and Economic-Ecological Research (IMPEER), Odesa, a public institution, part of the National Academy of Sciences of Ukraine; the Black Sea Branch of Ukrainian Environmental Academy of Sciences (BSBUEAS) is Odesa-based NGO with a team of professional researchers; and the Greens Movement of Georgia / Friends of the Earth (GMG/FoE) – Georgia, an NGO, part of the international environmental network. All three beneficiaries from EU Member States have extensive experience in marine pollution projects under the Horizon 2020 and Horizon Europe programs.

RESPONSE aims to identify and promote the development and establishment of new-generation advanced training schemes and curricula to support early warning, region-wide mechanisms for monitoring natural and man-made disasters. Various training programs, platforms and curriculum have been implemented to monitor marine pollution and ensure knowledge integration and dissemination. Still, training material, best practices, standards and protocols often differ among platforms and programs, hindering progress towards implementing an integrated, transdisciplinary and multidisciplinary marine pollution training system. Peculiar events, such as armed conflicts, create new environmental and societal challenges that call for international, coordinated responses.

RESPONSE acknowledges the importance of deeper understanding of marine ecosystems and river-delta-sea connections, the need for development of harmonized procedures, standards and methodologies in marine monitoring across the Black Sea countries to support healthy and resilient seas and foster integrated marine governance. The sustainable changes that are required for the establishment of efficient, advanced training schemes that would be integrated with the challenges, goals and specificities of the scientific and social context and make the most of the untapped capacity of stakeholders to promote regional awareness in the field.

In view of the background and context described above, the four overarching objectives of RESPONSE are: 1) IDENTIFY and UNDERSTAND the institutional and societal gaps and needs for effective, integrated, transdisciplinary and multidisciplinary marine pollution training systems; 2) DEVELOP effective training programs by assembling, integrating, and improving the most promising approaches and results into a comprehensive framework that consists of a set of methodological training tools, databases, policy recommendations, and background information; 3) SUPPORT the implementation of the EU and Regional Strategies, by developing operational guidelines for effective application, updating, monitoring and management of training programs on marine pollution; 4) EMPOWER marine pollution training, monitoring and mitigation by involving, inspiring and influencing stakeholders through a *broader vision of co-design, co-creation, co-*

*establishment, co-implementation and co-assessment of the training programs.*

## Table of Contents

Document information and version control .....	i
Version control .....	i
Executive Summary .....	ii
Project background and context .....	iii
Aim of the Deliverable .....	vi
Contributors .....	vi
Introduction .....	1
1. The National Co-Creation Workshops .....	3
1.1. National Co-Creation workshop in Bulgaria .....	4
1.2. National Co-Creation workshop in Georgia .....	14
1.3. National Co-Creation workshop in Romania .....	35
1.4. National Co-Creation workshop in Ukraine .....	44
2. The Regional Co-Creation Workshops .....	58
3. Participant Feedback and Testimonials .....	62
4. General Conclusions from National and Regional Co-Creation .....	65
Appendix 1 – The proposed training curriculum at national co-creation workshops .....	68
Appendix 2 – The training curricula as adjusted during the national co-creation workshops .....	73

## Aim of the Deliverable

The purpose of this report is to present the activities and results that surround the design and development of the RESPONSE advanced curricula on preparedness and response to marine pollution. Considering the co-design workshop outcomes, the toolkit software in conjunction with its accompanying modules will be developed, focusing on it being reconfigurable and providing interactive professional experience. Another important aspect that was developed is the co-creation workshops is related to training material for the professionals. This, along with the course curricula, was designed for a general understanding to serve stakeholders involved in MP across the Black Sea. The selection and description of a comprehensive curriculum outline that sets out the general objectives, content/training course modules, instruction methods and assessment for an advanced training programme adapted to various institutions requirements/needs are the outcome of this deliverable.

**Aim:** Defines what various professionals of the BS stakeholders should learn on a specific rapid intervention programme or at a particular level of preparedness in MP, The curricula content: Includes the general objectives, training modules associated to MP, teaching methods, assessment strategies and required informational resources, for a limited duration covering short intense trainings or a longer period of time, such as a semester, a school year or a full programme of study of a technical university.

The work performed in this task will support the rest of the project activities in WP2 and WP3. Thus, indirectly, all further tasks are influenced by the designs stated in this stage/document.

## CONTRIBUTORS

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## Introduction

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The RESPONSE Project aims to enhance preparedness and response mechanisms for marine pollution in the Black Sea (BS) region. Within Task 2.1, the project focuses on developing advanced training curricula through a stakeholder-driven, collaborative approach.

Building upon the findings of WP1 and its related tasks (1.1, 1.2, and 1.3), RESPONSE integrates, here, identified needs, best practices, and innovative solutions to propose clear and complementary training programs. A **key element** in this process is the implementation of **four national workshops** (one per BS partner country) and a **regional workshop**, all designed to co-create the new training curricula in close collaboration with relevant stakeholders.

The co-creation process for the advanced training curricula followed a structured series of steps (Fig. 1):

### 1. Step 1: State of play

- **Stakeholder engagement** (Task 1.1/Del 1.1): Ongoing communication and engagement with identified stakeholders ensured their active participation in shaping and accessing the new training curricula.
- **Assessment of marine pollution types and impacts** (Task 1.3/Del 1.3): A comprehensive assessment identified major marine pollution sources, their effects, and associated risks. This evaluation, in combination with the findings from Task 1.2, helped pinpoint key gaps and priorities for curriculum development across a broad thematic spectrum.
- **Review of existing training programs** (Task 1.2/Del 1.2): The assessment of current training plans revealed their limitations in addressing marine pollution challenges. This analysis, together with insights from Task 1.3, informed the development of targeted new curricula to bridge existing gaps.

### 2. Step 2: Propose new curriculum framework

- **Development of a training curricula framework:** A preliminary framework (Annex I) was designed, integrating findings from the above assessments and ongoing stakeholder consultations. This framework served as a foundation for discussions and adjustments based on stakeholder feedback.

### 3. Step 3: Tailor new proposed curriculum framework

- **National co-creation workshops:** Four national-level workshops—one in each BS partner country—facilitated discussions, collaboration, and the exchange of expertise. These workshops helped tailor the proposed curriculum to the specific needs and profiles of stakeholders in each country.
- **Synthesis of national workshop findings:** The outputs of the national workshops were analyzed to generate conclusions on training needs and curriculum structures relevant to each BS country.

- **Regional co-creation workshop:** A regional workshop in Constanta, Romania, gathered key stakeholders to review the findings from national workshops and further refine training needs, best practices, and innovative methodologies for marine pollution preparedness and response. The event facilitated cross-border knowledge exchange, with contributions from the Black Sea Commission providing a policy-level perspective.

#### 4. Step 4: Finalize new curriculum framework

- **Finalization and adaptation of training curricula:** Insights from both the national and regional workshops were consolidated to finalize the advanced training curricula. These activities also established the process for the continuous updating and modernizing of the training tools, which will serve as the basis for implementing training programs under WP3.

A key achievement of RESPONSE has been the establishment of a continuous and open dialogue with stakeholders. This engagement has not only ensured their involvement at every stage but has also provided a detailed understanding of their actual needs, challenges, and priorities in marine pollution preparedness and response. This collaborative approach enhances the relevance and effectiveness of the proposed training curricula, strengthening regional capacity to address marine pollution incidents in the Black Sea.

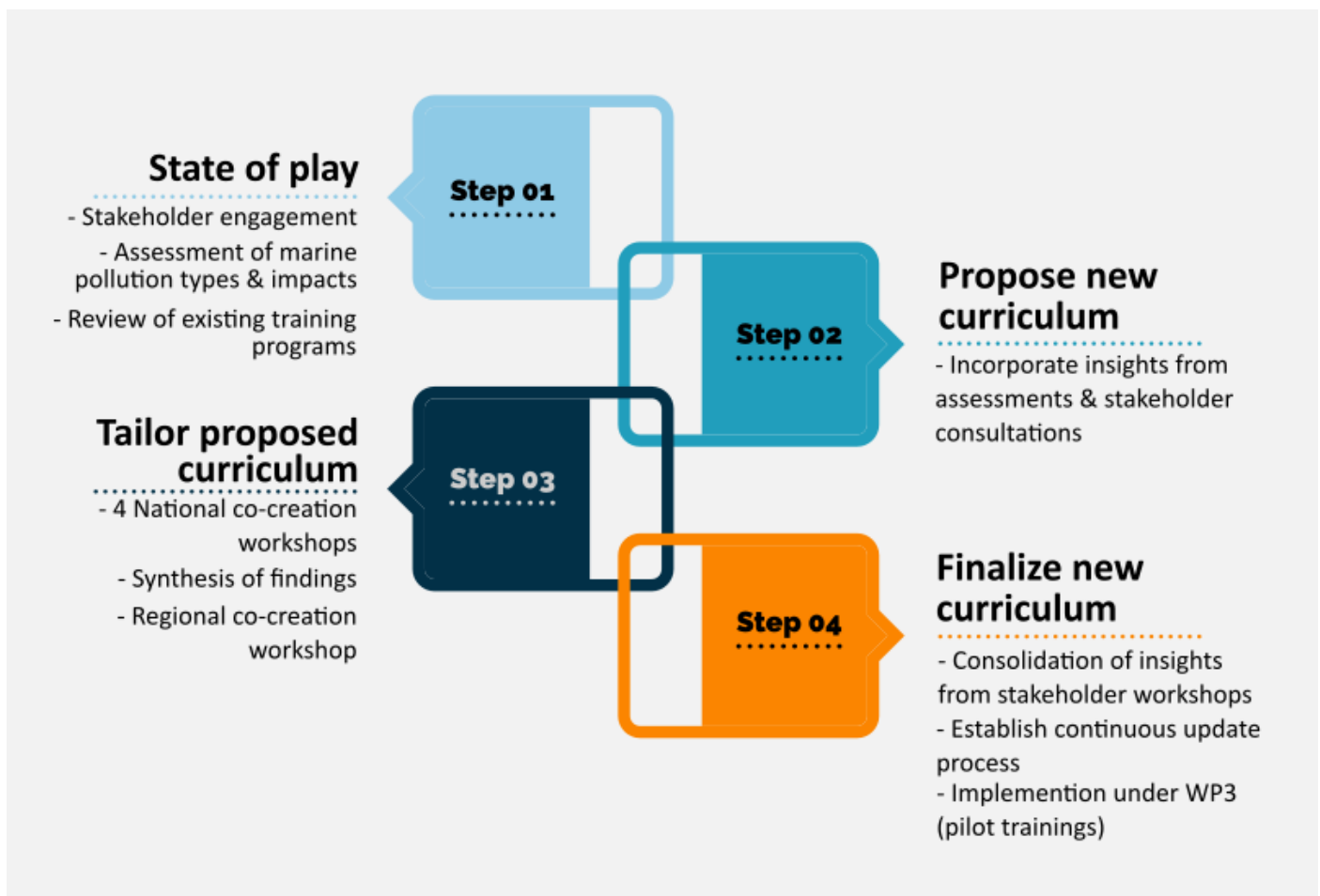


Figure 1. The steps followed for the implementation of the co-creation process for the design and development of the advanced training curricula framework.

## 1. The National Co-Creation Workshops

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Following the findings of Work Package 1, which mapped the legislative, institutional, and operational frameworks for marine pollution preparedness and response across BS countries and at the regional and international level (Del. 1.1), RESPONSE has identified existing training plans and curricula, pinpointed gaps, limitations and challenges and documented best practices (Del. 1.2). This process led to a comprehensive needs and capacity assessment, as well as an analysis of current and emerging types, causes, and impacts of marine pollution, including those resulting from armed conflicts (Del. 1.3).

With this groundwork established, RESPONSE now moves to the next phase—collaborating with BS stakeholders to co-create training curricula that strengthen preparedness and enable effective responses to pollution and environmental safety challenges. This is achieved through the organization of four (4) co-creation workshops at national scale, one in each BS partner country, i.e. Bulgaria, Georgia, Ukraine, Romania. These key objectives of these workshops were to:

- Identify key training needs and curriculum gaps/limitations/challenges for marine pollution preparedness and response.
- Engage stakeholders (government agencies, academia, NGOs, industry experts) in co-developing the training framework.
- Integrate scientific advancements in EO/modeling/EWS and digital tools into training programs.
- Develop training curriculum frameworks tailored to the needs and profiles of the engaged stakeholders.
- Establish a collaborative framework for continuous curriculum improvement and regional adaptation.
- Ensure long-term transferability of the training curricula across BS countries.

## 1.1. National Co-Creation workshop in Bulgaria

**Place:** Varna, hall of the Graffit Gallery Hotel

**Date:** 01.11.2024

**Attendance:** The co-creation workshop was attended by 23 participants from Varna, Burgas and Sofia representing key stakeholders from the RESPONSE perspective: Varna Municipality, Institute of Oceanology – BAS, Executive Agency Maritime Administration, Navy, Ministry of the Interior, General Directorate 'Fire Safety and Civil Protection', Bulgarian Ports Infrastructure Company - Sofia, Black Sea Basin Directorate, Healthcare Inspectorates from Varna and Burgas, Technical University of Varna, Department of Ecology and Environmental Protection, NGOs and maritime professionals.

**Implemented by:** Black Sea NGO Network (BSNN)

### CURRENT STATE OF TRAINING PROGRAMMES IN BULGARIA

Previous analyses have shown that very few institutions have in-house training programmes, e.g. Bulgarian Ports Infrastructure Co. A very limited number of multi-institutional programmes support coordinated actions in the event of marine pollution accidents, the only notable example being the annual marine Breeze Exercise, with navy, maritime administration, border police, Black Sea Basin directorate and other institutions taking part, often involving foreign participation. Training for seagoing jobs is traditional and meets international IMO and EU standards, but it is related to routine work on board commercial vessels, e.g. applying the Marpol 73/78 convention etc. The training programmes for seamen are not directly related to monitoring of the Black Sea environment and emergency response obligations of national institutions. Some of the employees in maritime and port administrations and government structure have been trained as sea going professionals. That, however, does not include all employees and does not involve regular update of their training. International cross-border projects provide (multi)-institutional training support, most often oriented to specific topics, e.g. vessel traffic monitoring system.

The publicly available training plans and curricula on preparedness and emergency response to nature and man-incited technogenic disasters (with some relation to marine pollution) are those of technical universities, the naval academy, training centres for seamen, universities, and training centres of the interior ministry. They are mostly oriented to disaster response plans and institutions, as designated in the National Disaster Response Plan. Monitoring and emergency response to marine pollution of the marine environment is covered rather briefly in some programmes and is not included in others. Therefore, existing training programmes need to be updated and developed further.

In Bulgaria, there are contingency plans for dealing with oil pollution at sea. The National Black Sea Oil Spill Emergency Plan for Bulgaria, part of the National Disaster Protection Plan, was adopted on 01.12.2011. Some of its provisions are reflected in the disaster protections plans for the coastal area. However, other pollutants remain outside the scope of current plans and training programmes, resulting in lost time and delays in decision-making when institutions face new challenges. There is

also a recently adopted National Plan for Search and Rescue in the Bulgarian Maritime Search and Rescue Response Area, effective as of 14.08.2024. It focuses on search and rescue of human life and property/vessels and pollution prevention remains in the province of other institutions.

Most institutions are not involved in the development of training materials especially on marine pollution and emergency response and pollution remediation, except for oil pollution. Many institutions however apply collaborative efforts with other official institutions, such as ministries, state agencies, involved in activities addressing marine pollution from the military conflict in the Black Sea. Few key experts have specific expertise on specific marine pollution topics and the Marine Strategy Framework Directive (MSFD) descriptors, related to the National Marine Strategy of Bulgaria, mostly marine researchers from the Institute of Oceanology – BAS.

The project team has not identified any Life Long Learning programmes focused specifically on preparedness and emergency response to marine pollution for employees of the key stakeholders (transport administrations, local and regional authorities). The project team has not identified extracurricular programmes on RESPONSE issues to support gaining job experience and qualification for employees of the same key stakeholders.

Given the above, and considering that a key objective of the project's new-generation training programs and curricula is to complement and support existing initiatives, the workshop introduced a structured set of topics in the form of a curriculum framework. This framework covers key RESPONSE-related issues and serves as a foundation for the development, testing, refinement, and continuous improvement of the training programs over time.

### **AIM OF THE WORKSHOP IN BULGARIA**

To design structure and contents of advanced training schemes and curricula to address preparedness and emergency response to marine pollution in the BS. The schemes and curricula will support early warning region-wide mechanisms for monitoring natural and man-made disasters.

### **PREPARATION PHASE**

The BSNN team conducted the workshop planning, prioritizing key stakeholders such as:

- decision-makers in marine pollution response,
- relevant administrations and agencies,
- research institutes, universities,
- training centers,
- marine business associations,
- NGOs, and
- volunteer groups.

Invitations and a preliminary agenda were sent to over 50 stakeholders across Sofia, Varna, Burgas, and Dobrich. A second round of invitations was followed by direct calls to key contacts, facilitating discussions on the workshop topics. Additionally, stakeholders who confirmed their participation were engaged in conversations about the co-creation process.

The preparation phase lasted approximately six weeks.

## WORKSHOP PROCEEDINGS – A REVIEW

The workshop was implemented in accordance with the following agenda:

1. Opening of the workshop – review of RESPONSE – aim, objectives, activities. What will be produced and why it is necessary. Presentation from BSNN.
2. Review of the project outputs: mapping of stakeholders and existing training curricula, common types of pollution for the Black Sea – brief overview from BSNN. The team presented the background information, which served as introduction and review of the deliverables.
3. Aim of the workshop (explained to the participants): To work together and design structure and contents of advanced training schemes and curricula that will address preparedness and emergency response to marine pollution in the BS. The aim of the RESPONSE training curricula—to complement existing national training courses and programs on marine environment monitoring and emergency response to marine disasters and accidents—was emphasized. The key objectives of these new-generation curricula was also introduces - to enhance current national training frameworks by addressing gaps in marine environment monitoring and improving preparedness and operational response to marine pollution. Additionally, they will integrate existing experience and best practices to enhance overall response capabilities.

The target audience for future training was identified, including decision makers at all levels, practitioners, professional communities, students, local communities, media, volunteers (with reference to Del. 1.1 and stakeholder lists in national plans).

Structure of the training curricula has been discussed after presentations by participants and comments from the other attending experts and the project team. The workshop was organised into two thematic parts: monitoring the state of the marine environment and responding to pollution incidents/accidents.

### Part 1 - Monitoring the state of the marine environment

The first part included presentations and discussions related to monitoring and available training programmes in monitoring of the marine environment.

- *Presentation* by the representative of the Institute of Oceanology - BAS about statutory obligations and responsibilities of the Institute of Oceanology – BAS for monitoring the marine environment. Demonstration of model for deposition of marine litter on the seabed for training purposes.

Discussion followed:

**Suggestion for topics** in the new training curriculum:

- MSFD indicators;
- National Marine Strategy of Bulgaria and specifically the Second Assessment of the state of the marine environment (available in Bulgarian);
- formulation of written instructions or a plan in the case of marine pollution accident, identification of pollutant(s), expertise and resources to remedy pollution, plan for work with media and local communities.

- *Brief review* of the obligations of the Black Sea Basin Directorate (BSBD) for monitoring of the marine environment from project team and participants.

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**Suggestion for topics:**

- MSFD;
- National Marine Strategy of Bulgaria and updated, monitoring reports;
- Monitoring Programmes under Article 11 of the Marine Strategy Framework Directive;
- Utilization of data and reports available at the institutional website of BSBD.

- *Discussions on the obligations of the Regional Health Inspectorates in the coastal area – Dobrich, Varna, Burgas. Note: the inspectorates, subordinate to the Ministry of Health, are responsible for the monitoring of the marine bathing waters.*

- *Presentation by the representative of Technical University – Varna, Environmental Department about monitoring of the state of the marine environment included in the training programmes of environmental and risk management courses at TU – Varna.*

*Note: The Technical University in Varna provides training in Engineering Ecology, Professional qualification: "Environmental Engineer" Bachelor and Master Degrees. Professional area (national labour code list for professions): Transport, navigation and aviation. The TU – Varna is the only technical university in Bulgaria training environmental engineers for this professional area. For RESPONSE purposes, it offers possibilities for co-creation and working together in the next stages of the project. RESPONSE preparedness and emergency response topics can be used for extracurricular training, for supplementing specific topics about the Black Sea environment, biodiversity, pollution etc.*

*The TU - Varna second environment-related specialty: Protection of the population in disasters and accidents; Educational qualification degree: "Bachelor"; Professional qualification: "Risk Engineer" can also benefit from the new training activities/platform. The TU, Environmental Department would regard the RESPONSE training courses as an option for extracurricular activities, but it is not ready to include them in the regular training courses. The university conducts theoretical and practical training. New technologies are employed for training in monitoring, e. g. drones used to monitor for marine litter.*

**Suggestion for topics and areas of interest for TU – Varna:**

- marine ecology;
- Black Sea biodiversity protection;
- pollution of waters and fluids and associated problems;
- definition(s) for nature disaster, ecological damage and classification of damages, assessment of damage and impacts of natural disasters, accidents and catastrophes;
- reaction to emergency pollution at sea (operational failure, damage from).

**Topics from previous training(s)** (complementarity potential): training programs on marine pollution response (implemented as part of other cross-border projects e.g. LeNetEco 2, BSB-1088) with target groups students, media representatives, local authorities and local (fishing) communities. The topics can be considered for inclusion in the RESPONSE trainings framework, but need to be extended, revised and adapted to the needs of professional target audiences. Topics:

- ecological monitoring and ecosystem approach in waters management and protection of the marine environment;
- monitoring and protection of rivers and the marine environment in the Black Sea region.

**General discussion within the First interactive session** - identification of existing trainings/courses and needs for new and additional trainings and programmes. Two sets of issues were offered to the participants for discussion.

### **First set of issues: Existing trainings/courses and needs for new or additional programmes**

As part of the co-creation process, existing training courses were thoroughly examined to identify their limitations, opportunities for improvement, and potential for complementarity. To guide the discussion, participants and representatives from stakeholder organizations were asked to consider the following key questions:

- What parameters of the marine environment does your organisation monitor?
- With what frequency is monitoring carried out?
- What techniques are used (sampling, remote methods, in situ measurements)?
- What data analysis methods are used?
- Is there training related to marine monitoring (episodic, regular; within the organisation, with other organisations)?

### **Second set of issues: Need for new and additional training programmes**

Similarly, the feasibility of adopting new training schemes and their acceptance by stakeholder organizations was explored through the following questions:

- Do you see a need for new or updates to existing training programs?
- What should they include: new monitoring techniques; analytical methods for contaminant analysis; data analysis methods; pollution prevention strategies; development of the legal framework for marine environmental protection?
- Which organisations should undertake such training?

### **Stakeholders' responses**

The stakeholders' responses and key conclusions drawn from these discussions, providing insights into both the current state of training and the identified needs for future programs are summarized below:

- o The Burgas and Varna health inspectorates reviewed their monitoring function of bathing waters and sampling activities (traditional sampling of waters and classical analysis). Sampling was conducted frequently to monitor if there had been pollution from the destruction of the Kakhovka Dam in Ukraine. The health inspectorates can only inform regional governors about problems but do not have instruments to solve them and issues are most often connected with land use. Issues of interest may be Marine Strategy of Bulgaria, most recent version, maritime spatial planning, land use planning and the associated problems.
- o Varna Municipality needs both resources and training for its civil defence department, working mostly with volunteers and summoned to react in case of emergencies on land and sometimes on the coast. The municipal authorities monitor the state of facilities within its territory of jurisdiction – for proper functioning, or damage. The failure of the sewerage system in the Varna Lake provided an example for comments. The municipal authorities organised the repair work and the health

inspectories were sent to the area for monitoring the state of the lake and the adjacent sea area.

○ General comments from administrations, including Varna Municipality department for civil defence action followed. The need for training programmes that need to be institutionalized was identified.

○ Comments were made that the unified rescue system for disaster and emergency response very often relies on volunteers for support. Training for civil servants/other personnel employed by the interior ministry is better organized. This is not the case with administrations of the environment, transport, health and other agencies.

➤ There was broad consensus that the topics presented by the speakers could be structured thematically into one or more training programs tailored for students, administrations, media, and potentially volunteers. These topics were further discussed in the final part of the workshop, guided by the suggestions of the BSNN teams.

## Part 2A – Response to pollution incidents/accidents

The second part of the workshop included presentations and discussions related to real events of pollution trainings/exercises related to marine pollution emergencies in case of accidents.

- *Presentation* by the representative of the Directorate "Strategic Development, Port Services and Ecology" at the State Enterprise "Port Infrastructure" BPI Co. – Sofia. The presentation was entitled "Means to combat oil spills and the organization for their mobilization" and presented an account of the purpose, organisation and technical means for reaction to oil pollution in the Bulgarian Black Sea and Danube public transport ports.

*Note: BPI Co. is in charge of port reception and handling of waste resulting from shipping activities in public transport ports. It also maintains forces and means to participate in rescue and emergency recovery works carried out in the water areas of public transport ports, in accordance with the National Disaster Protection Plan.*

*The BPC Co. has received EU and national support aiming to bring Bulgarian ports in line with the requirements of the European Union in the field of environmental protection, the environmentally friendly implementation of waste activities arising from European policies and directives, as well as international conventions and standards in the field of water transport.*

*Of particular interest to RESPONSE are the training exercises held five times annually three at Black Sea ports and two at river ports on the Danube. Those are practical technical exercises held in cooperation with other institutions, local authorities and environmental agencies, universities. In Varna and Russe there are two mobile oil spill response centres equipped with sufficient and modern equipment - booms, skimmers, collection arm, staging vessels, and sufficient storage volumes for the collected oil or solid waste. The focus of training is on oil pollution and effective use of the available technology, mostly related to activities on land and nearby port areas. Exercises are planned and funded by the BPI Co. budget.*

*Another area of interest for RESPONSE is the company's Integrated Information Platform. It aims at integrating all available information systems that are operated by BPI Co. and whose data are processed and analysed in direct contribution to environmental protection objectives. **The Directorate performs function of Bulgarian Vessel Traffic Services Authority – Black Sea.***

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**Suggestion for topics:**

- national and regional plans for oil pollution response;
- EU and national legislation for ports environmental protection;
- modern methods for monitoring (sensors) the environment to signal pollution;
- port environmental practices and projects (e. g. use of dredged material from harbours to create wetland islands and bird habitats).

- *Brief review of the functions and responsibilities of the Executive Agency Maritime Administration, Directorate "Maritime Administration - Varna" by its representative.*

*Note: Maritime Administration, among its numerous obligations, is responsible for the qualification and registration of Bulgarian seafarers serving on board commercial vessels, for survey, certification and registration of Bulgarian ships and ship-owners. The Maritime Administration has control functions and approves training programmes for professional seamen but it is not involved in trainings of representatives of other administrations. Its own personnel have been involved in international cross-border projects for the Black Sea for the introduction of the Vessel Traffic Management and Information Systems (VTMIS) in Bulgaria, Romania and other Black Sea partner countries. Maritime Administration has central role in emergency response and search and rescue operations activities in the event of accidents. The BPI co performs the function of Bulgarian Vessel Traffic Services Authority – Black Sea and operates the communication facilities.*

**Suggestion for topics:**

- Maritime Administration Agency in the operational response to accidents and disasters at sea (Bulgarian Maritime Search and Rescue Response Area);
- pollution of the marine environment by accidents and disasters (review of accidents and analyses);
- information platforms and services for maritime data, traffic monitoring activities;
- emergency response systems in the Black Sea.

- *Presentation by a TU - Varna lecturer and volunteer club chairman related to volunteer activities and formations - training of certified personnel and specialists to support actions of state authorities in cases of emergencies and disasters, training program for Club "Extremen", at the Tourist Society "Rodni Balkani" – Varna. He presented the process of developing a training programme for rescue workers including theoretical and specific practical modules (alpine climbing techniques, practical rescue activities) and incorporating it into the curriculum for the risk-engineer specialty at the TU - Varna. He showed pictures and videos from exercises at sea and on the coast, training of children, clean up activities for solid waste in places with difficult access.*

**Suggestion for topics:**

- volunteer support to rescue operations;
- training of schoolchildren in rescue techniques and activities.

- *Brief review of the participation of the Navy in joint marine exercises, by a representative from Navy Headquarters in Varna and Sector 'Liaison and Coordination' on the holding of the annual Breeze Joint Naval Exercise in the territorial sea, contiguous zone and EEZ of Bulgaria.*

*Note: The exercise is held annually, with participation of the navy and the other military branches and institutions, government agencies, naval academy, border police and counter terrorism units from the interior ministry, volunteers, visiting officers from NATO and Black Sea countries and agencies etc. The navy has central role in the planning and conducting the exercise. Environmental agencies, like the BSBD – Varna, take part in the planning and conduct elements of emergency response, most often elimination of oil pollution and conducting remediation activities. The European Maritime Safety Agency (EMSA), which monitors the implementation of relevant legislation related to the reduction of the risk of maritime accidents, pollution of the sea by ships and loss of life at sea, is regularly involved in the exercise. The main objective of the exercise is to enhance interoperability and interaction between the participating countries by practicing joint tasks and conducting a wide range of combat actions at sea in emergency response, crisis response and recovery operations.*

### **Suggestion for topics:**

- legal framework for the Black Sea protection;
- national plans for emergency response to oil pollution;
- search and rescue in the Bulgarian response area.

### **Part 2B - Improving marine pollution response preparedness**

**General discussion within the Second interactive session** was held on pollution response preparedness to answer questions like: are additional training, drills, equipment needed, in which areas are they needed, are marine monitoring and risk management affected

#### **Second set of issues: Steps/Measures to improve marine pollution response preparedness**

Key questions were revisited with stakeholders to provide a clearer picture of the current situation:

- What responsibilities does your organization have in the event of marine pollution?
- Are additional resources needed to improve response preparedness (personnel, equipment)?
- Is there a need to update response plans? In what direction?
- Are joint exercises needed to improve coordination and response preparedness in the event of pollution?

#### **Stakeholders' responses**

The participants have been unanimous that additional training exercise are needed to improve capacity of local authorities, administrations, volunteers. The participants believe that there should be written plan and clear written instructions for action to follow in the event of emergency pollution of the marine environment.

The responsibilities of the organisations involved as principal stakeholders depend on the place where the emergency/accident takes place – at sea or on land. Responsibilities for reaction to pollution emergencies at sea also depend on the type of pollution. There is National Black Sea Oil Spill Emergency Plan for Bulgaria, with funding allocated for it. For other type of pollutants there is no clear outline of planning and pollution response, or funding sources.

The participants consider it is necessary to update response planning so to envisage response preparedness for pollution with hazardous and noxious substances (HNS) and emergency response to it.

Launching emergency response operations at sea takes a long time because the procedure requires the head of the operation to be a high-ranking official, the Minister of Transport.

The Maritime Administration does not have the equipment and an accredited laboratory to measure oil pollution in order to impose fines on offending vessels. There is a need for better vessels, equipment for lifeguards and volunteers, sensors to measure parameters of the marine environment, improvement of the platform of the unified information system, etc.

Participants have suggested that there is a need for specialized training to respond to pollution from warfare. There is a need to become familiar with new types of pollution from the military conflict in Ukraine, such as marine debris in the form of mines, parts of military hardware and equipment, noise pollution, pollution from demolitions and pollution from chemical substances.

Participants have also suggested supporting preparedness and planning with risk-assessment identifying by statistical analysis the top ten cargoes of commercial vessels in the Black Sea and focus on them.

Training need for employees of private companies associated with emergency response, subcontractors of maritime administration, port operators, port infrastructure environmental activities has been identified.

### FURTHER CO-CREATION SUGGESTIONS AND DISCUSSION

The project team and the stakeholders discussed and agreed on the **structure of the curriculum** which would consist of **Annotation (Introduction) and Modules**. The curriculum shall have title, general aim and specific purpose, target audience. The Annotation shall explain the purpose of the training course(s), the contents, the expected learning outcomes, the methods of learning and using the interactive tool, the evaluation methods/options, the materials for the course available – modules, reports, videos, links to content etc., the options for further co-creation and improvement of the training course and its components.

Next element is the **curriculum outline** – the Modules with titles and numbers, basic information, number of hours work, contents outline, references, and essential reading list.

#### Stakeholder target groups:

- 1) decision makers, representatives of administrations and institutions, especially people participating in civil defence units and teams, emergency response teams, businesses involved in training activities, local communities, volunteers, NGOs, media etc. – interested in short 1 to 1.5 day courses, problem oriented training, use of the project online platform and tools;
- 2) representatives of education institutions and academia, university students, distance learning students, other maritime professionals - interested in extracurricular programmes and studies, use of combinations of modules, use of the online platform and tools of the project.

## BULGARIAN CO-CREATION WORKSHOP SUMMARY

### Key discussion points:

- Existing training gaps and monitoring challenges with the goal of identifying recommended curriculum topics.

### Identified training gaps and monitoring challenges:

- Oil spills are the focus of most in-house training.
- Few comprehensive programs address pollution in a broader sense (chemical spills, garbage, hazardous substances).
- Maritime academies are in compliance with IMO/MARPOL standards for seafarers, but do not thoroughly cover multi-agency response or advanced surveillance.
- Data collection is fragmented and carried out by different agencies (e.g. Black Sea Basin Directorate, Institute of Oceanology, Health Inspectorates).
- There is a need to integrate the indicators of the Marine Strategy Framework Directive (MSFD) and to ensure synergy with the National Oil Pollution Emergency Plan for the Black Sea.

### Stakeholder Recommendations:

- ❖ Marine strategy and legislation (EU and national frameworks, e.g. MSFD).
- ❖ Monitoring techniques (modern sampling, remote sensing, data management).
- ❖ Contingency planning (oil + chemical + litter incidents).
- ❖ Multi-stakeholder coordination (navy, port authorities, communities).
- ❖ Public communication (media handling, volunteer engagement, local community outreach).

### Key outcomes highlighted by participants:

- The value of modular curriculum including advanced monitoring and response simulations,
- A potential synergy with Varna Technical University to integrate modules into engineering and risk management programs
- The need for practical exercises (field exercises, multi-institutional simulations).

## 1.2. National Co-Creation workshop in Georgia

**Place:** Batumi, Georgia (hosted at Batumi Shota Rustaveli State University, Auditorium 32, with hybrid participation)

**Date:** 3.02.2025

**Attendance:** The co-creation workshop was attended by 28 participants (18 in-person and 10 online), representing Georgian stakeholders in marine pollution management – including government agencies, academia, port and maritime authorities, NGOs, and independent experts.

**Implemented by:** Greens Movement of Georgia/Friends of the Earth Georgia (GMG/FoE-GE)

### CURRENT STATE OF TRAINING PROGRAMMES IN GEORGIA

RESPONSE project's central premise is that despite various national plans and regulations, significant gaps remain in practical capacity and inter-agency coordination when facing marine pollution emergencies. For instance, prior analyses in Bulgaria showed that very few institutions had in-house training programs on marine pollution response and only limited multi-institutional exercises took place – a situation mirrored in other Black Sea states, including Georgia.

Georgia's Black Sea coast, while shorter than that of some neighbours, is ecologically and economically important, supporting fisheries, tourism, ports, and unique habitats. It faces a range of pollution issues: oil pollution (from passing ships and offshore oil activities), plastic and marine litter (due to inadequate waste management and river inputs), eutrophication (nutrient run-off causing algal blooms), and chemical contaminants from agricultural industrial and sources. These problems threaten biodiversity and human uses of the sea – causing biodiversity loss and habitat damage, and impacting fisheries, tourism, and public health. Existing regulatory frameworks include international conventions (MARPOL, the Bucharest Convention, etc.) and Georgia's own laws – for example, Georgia adopted a National Oil Spill Response Plan at Sea in 2016 (Government Resolution No.195) to handle marine oil pollution emergencies. This plan, akin to Bulgaria's 2011 Black Sea oil spill plan, provides a basis for oil spill response. However, other pollutants (chemical spills, hazardous substances, drifting marine debris, etc.) remain outside the scope of specific contingency planning and training. As in Bulgaria's case, this gap can lead to delays and uncertainty when authorities face unconventional or non-oil pollution incidents. Moreover, while agencies like the Maritime Transport Agency's Maritime Rescue Coordination Center (MRCC) conduct search-and-rescue and spill response exercises, their resources are limited. Georgia has some strengths – a core of trained personnel and access to regional support – but also weaknesses such as limited equipment, technology gaps, and insufficient funding for environmental response. There is no regular life-long learning program in Georgia to continually train professionals in marine pollution response (similar to the lack observed in some other Black Sea counties), and the concept of integrated, multi-agency training curricula is new. These factors highlighted the need for a coordinated curriculum that can be used to build capacity across institutions. By situating Georgia's experience within the Black Sea context, the RESPONSE project also stresses shared challenges (for example, the ongoing military conflict in the Black Sea region has introduced new pollution risks).

Overall, the workshop's background underlined that improving marine pollution response is both a national priority and part of a broader regional effort to protect the Black Sea through education, innovation, and collaboration.

### AIM OF THE WORKSHOP IN GEORGIA

To design the structure and content of advanced training schemes and curricula that enhance preparedness and emergency response to marine pollution in the Black Sea, ensuring that the training programs address real-world needs and strengthen Georgia's capacity to prevent and respond to marine pollution incidents.

### PREPARATION PHASE

The Greens Movement of Georgia/Friends of the Earth Georgia (GMG/FoE-GE), RESPONSE partner in Georgian, in cooperation with Batumi Shota Rustaveli State University's CARE SEA project, the event's primary purpose was to collaboratively suggest refinement of the advanced training curricula for **marine pollution monitoring and response**, drafted by RESPONSE partners. This initiative is significant in the context of the Black Sea, a region facing persistent and emerging pollution challenges, including pollution from warfare. By engaging stakeholders in co-creation, the workshop aimed to ensure that the resulting training programs address real-world needs and bolster Georgia's capacity to prevent and respond to marine pollution incidents. The workshop is part of a series across Black Sea countries (a similar workshop was conducted in Bulgaria, Romania and Ukraine in the period of October 2024-2025 February) to shape a region-wide response curriculum, underscoring the collective commitment to protecting the Black Sea's marine environment.

The preparation for the Batumi co-creation workshop was thorough and inclusive. GMG/FoE-Georgia, as the national project partner, led the planning in close cooperation with Batumi State University (BSU), hosting the event at no cost.

### Invitations and Agenda

An official invitation letter was circulated on 27 January 2025 to dozens of stakeholders across Georgia's marine and coastal sectors. Recipients included government ministries (Environment, Economy, Interior), agencies (National Environmental Agency, Maritime Transport Agency, Emergency Management Service), port authorities, coastal municipality representatives, academic institutions (universities and maritime training academies), research institutes, NGOs, and independent experts. The invitation outlined the workshop's objectives – specifically, to collaboratively develop and refine training curricula for marine pollution monitoring and response, addressing critical pollution challenges in the Black Sea region while incorporating modern tools, simulations, and innovative approaches. A preliminary **agenda** was attached, highlighting key sessions: an introduction to the RESPONSE project, a review of marine pollution issues in the Black Sea, and interactive review of training curriculum content drafted by RESPONSE with the purpose of stimulating the co-creation process at the regional scale. Invitees were asked to register via an online form by 31 January, which helped organizers anticipate attendance and gather participant profiles. Follow-up emails and phone calls were made to ensure broad participation, similar to the approach used in Bulgaria and Romania where over 50 stakeholders were contacted in advance. GMG/FoE-GE also coordinated with the BSU CARE SEA project team (co-organizers) to handle on-

site logistics, venue setup, and the hybrid Zoom connection for remote attendees, all hosted at BSU premises.

### **Stakeholder Engagement**

The preparation phase identified and targeted those stakeholders considered most relevant to marine pollution response training – akin to the criteria used in the Bulgarian and Romanian workshops (decision-makers in marine pollution response, agencies responsible for marine environmental state and emergency response, research and academia, maritime businesses, NGOs, volunteer groups). In Georgia's case, key organizing stakeholders included GMG/FoE-GE lead by Chairperson and former Minister of Environment Ms. Nino Chkhobadze who extended personal invitations to high-level officials, and Dr. Izolda Matchutadze of BSU, whose involvement through the CARE SEA project helped attract local academic and student participation. By the day of the event, a diverse group of participants had confirmed, representing entities such as: the Ministry of Environmental Protection and Agriculture (and its departments for water, biodiversity, and fisheries), the Ministry of Economy and Sustainable Development (specifically the Maritime Transport Agency and its MRCC), the Ministry of Internal Affairs' (MIA) Emergency Management Service, the National Environmental Agency (which handles environmental monitoring), Batumi State Maritime Academy, BSU and other universities (from Batumi, Tbilisi), environmental NGOs (GMG/FoE-GE itself, the Global Water Partnership representative in Georgia, etc.), and independent experts in marine ecology and pollution. The breadth of invitees and attendees ensured that the workshop would capture a broad overview of current practices and needs. Preparations included inviting presenter from responsible authority (MTA MRCC) to share at the workshop national expertise in the National Oil Spill Contingency Planning referencing various activities and policies, and informational briefs on topics like bioremediation (one invitee, an expert in bioremediation, was encouraged to present insights on that topic). This groundwork helped set the stage for a well-informed and collaborative meeting.

### **WORKSHOP PROCEEDINGS – A REVIEW**

The co-creation workshop in Batumi ran from 11:00 to 16:00, structured into three main sessions according to the agenda.

#### **Opening Session**

- *Presentation of the RESPONSE Project* – The workshop opened with welcoming remarks at 11:00. Nino Chkhobadze, Chair of GMG/FoE-Georgia, greeted participants and thanked BSU for hosting. A representative of BSU's also gave a brief welcome, emphasizing the university's commitment to environmental education and the significance of hosting this discussion in Adjara, a coastal region directly affected by Black Sea pollution. Following the welcomes, Mamuka Gvilava (Project Manager at GMG/FoE-GE and Georgia's coordinator for RESPONSE) delivered a presentation introducing the RESPONSE project and its deliverables. This 30-minute talk outlined the project's framework, partners, and goals. Speaker highlighted that RESPONSE is developing new curricula for marine pollution monitoring and response, and described the various work packages and activities (stakeholder mapping, curriculum design, pilot trainings). He noted how the project aligns with addressing Black Sea pollution challenges and mentioned Georgia's role. For example, he explained that the project will produce advanced training modules that complement existing national training (or lack thereof) and will be tested in each partner country. He also touched on

the importance of considering recent events such as the war in Ukraine, which has led to novel pollution concerns (e.g., unexploded ordnance or sunken military equipment), echoing the project objective to focus on pollution caused by armed conflicts. This context set the tone for why a fresh training curriculum is needed. After the overview of RESPONSE, Ms. Chkhobadze took the floor again to present the workshop's specific agenda and objectives, ensuring everyone understood the collaborative process ahead and encouraging active participation. A short Q&A followed, where participants sought clarifications on the project timeline and how the curriculum outputs would be used by national institutions. The organizers clarified that the curricula developed would be available for incorporation into university programs, agency training schedules, and even community training events, thus inviting stakeholder ownership from the outset.

## Session 2: Marine Pollution Monitoring and Response Issues in the Black Sea

Mamuka Gvilava delivered a detailed presentation titled “*Marine Pollution Monitoring and Response: Challenges and Current Practices.*” This talk served to review the current state-of-play of marine pollution in the Black Sea – both regionally and in Georgia – as a basis for identifying training needs. He began with an **overview of key pollution types** in the Black Sea: major points included **oil pollution** (frequent minor spills and occasional accidents in busy shipping lanes, and potential spills from offshore oil fields, such as recent major spill in Kerch area); **plastic waste and microplastics** (accumulating due to river inputs, urban runoff, and maritime activities); **eutrophication** (nutrient overload from agriculture and untreated sewage causing episodic algal blooms); and **chemical contaminants** like heavy metals and pesticides (stemming from industrial discharges and legacy pollution). He also mentioned concerns about **bathing water quality**, noting that microbial pollution at popular beaches can have public health and tourism impacts. Each type of pollution was illustrated with local examples – for instance, the occasional oil slicks observed near port terminals, or the recently encountered nuisance of algal blooms.

Speaker then discussed the **ecological and socio-economic impacts** of these pollution issues. Ecologically, he emphasized biodiversity loss (the Black Sea's endemic species and habitats under stress) and habitat degradation (e.g. damage to seabed and coastal wetlands), as well as altered food webs due to over-enrichment or contaminants. Socio-economically, he highlighted impacts on **fisheries** (declining fish stocks affecting coastal communities), **tourism** (polluted beaches and water deter visitors), and **public health** (risks from contaminated seafood or poor bathing water). These points reinforced why effective response and mitigation are crucial, tying back to the rationale for improved training.

Next, the presentation reviewed **current monitoring and response practices**. It was outlined that Georgia participates in **national monitoring programs** (e.g. the National Environmental Agency conducts seawater quality sampling), and is involved in **regional collaborations** under the Black Sea Commission framework (e.g. coordinated pollution monitoring exercises and data sharing among Black Sea countries). He noted, however, that Georgia's capacity is still developing: while data is collected, there remain significant **gaps in knowledge and coverage**. On pollution response capabilities, he cited some **strengths**: Georgia has trained personnel in agencies like the MTA MRCC and MIA Coast Guard, and can draw on regional resources in case of a large incident (through Black Sea and EU support). At the same time, he pointed out **weaknesses**: **limited specialized equipment** (oil skimmers, containment booms, or marine pollution labs) and **technological gaps** (such as insufficient use of modern tools like aerial drones or real-time sensors). A slide summarizing “**Challenges and Gaps**” highlighted technical issues (aging monitoring equipment, limited spatial

coverage of observations), financial constraints (environmental programs often underfunded), data management needs (the importance of a centralized database portal and better inter-agency information flow), and policy/enforcement issues (laws exist but are not always effectively implemented or updated). The speaker also introduced the **Marine Strategy Framework Directive (MSFD)** – an EU directive setting 11 descriptors of Good Environmental Status – noting that while Georgia is not an EU member, the MSFD principles are relevant and binding as goals set out in Association Agreement with EU. He mentioned that Georgia's progress on these descriptors is generally **weak or in early stages** across the board, reflecting the need for capacity building. This part of the presentation underscored that any new training curriculum must be cognizant of these real-world gaps and aim to build knowledge and skills to address them.

Finally, presented were some **response strategies and opportunities**. The speaker talked about the regulatory frameworks (Georgia has acceded to key international conventions like MARPOL for ship pollution and is party to the Bucharest Convention for Black Sea protection) and national policies (laws such as the Maritime Code and regulations on waste management). He briefly mentioned technological solutions that could enhance monitoring and response – for example, using **remote sensing and satellite imagery** for oil spill detection (he showed small video produced using publicly and freely available European radar satellite images of recent Kerch oil slick, demonstrating how remote sensing satellite instruments like ESA's Sentinel-1 and Sentinel-2 can aid in spotting pollution from space), and the potential of **GIS and modelling** for predicting pollutant spread. Community engagement was noted as well: the role of **awareness campaigns and citizen science** (e.g. volunteer beach monitoring) to complement official efforts.

By the close of Session 2, participants had a common understanding of the status quo and challenges, which set the stage for the co-creation discussion. The session was interactive, with a few clarifying questions from the audience: one participant asked about the status of MSFD Directive compliant Georgia's National Marine Environment Strategy (as required by the Association Agreement) – to which it was noted that Georgia has developed one with EU support but never adopted yet, and the new training curriculum would support its objectives. Another question touched on the **role of local governments** in pollution response, sparking a brief discussion on how cities like Batumi manage beach pollution (e.g. through municipal services and environmental departments). As a conclusion of this session, it was noted that the insights from delivered presentation pointed to many areas where training could improve knowledge or coordination.

### **Session 3: Co-creation of Marine Pollution Response Training Curricula**

This session was the core participatory component of the workshop. Facilitated by Nino Chkhobadze, it began with a presentation by Mamuka Gvilava on *“Marine Pollution Monitoring and Response: Training Needs and Curricula.”* In this talk, speaker outlined initial proposals for the structure and content of the training curriculum, based on prior research and the project team's ideas, effectively giving the participants a starting point to react to. He explained, that proposed is a **modular training program** that would supplement existing education and training programs in Georgia. The presented curriculum (Appendix 1) is organized into several **modules**, each focusing on a thematic area. For example, **Module 1** covers “Pollution in Context: Causes and Effects,” giving an overview of different marine pollution types common to the Black Sea (oil spills, marine litter, eutrophication, hazardous substances, pollution from armed conflict, ballast water, etc.). **Module 2** could address “Legislation and Governance,” reviewing international conventions (MARPOL,

London Convention, Ballast Water Management Convention, OPRC, etc.) and national laws, as well as governance approaches for marine and coastal management. Further modules (3, 4, and beyond) would delve into **Monitoring Techniques and Tools** (covering monitoring program design, water/sediment sampling, remote sensing, data management), **Emergency Response Practices** (oil spill response tactics, use of equipment, incident command systems, health and safety, also response to non-oil incidents like chemical or plastic pollution), and **Restoration & Mitigation** (covering post-spill environmental remediation, bioremediation techniques, habitat restoration, etc.). Cross-cutting topics such as climate change impacts, ecosystem-based management, and public communication are interwoven as well. Notably, mentioned were emerging issues that stakeholders often overlook in traditional training – for instance, **underwater noise pollution and vibrations** affecting marine life (sometimes termed “physical pollution”), and **ocean acidification** trends in the Black Sea – reflecting a forward-looking curriculum. The proposed curriculum was intended to be **“new-generation”**: interactive (using simulations, case studies, project’s online platform/tools), modular for flexibility, and complementary to existing national courses (like those for disaster response or maritime professionals). Speaker emphasized that the training should target **two main audience groups**: (1) practitioners and decision-makers (e.g. agency staff, local authorities, emergency responders, NGO activists) who may prefer short, focused trainings or workshops; and (2) academic and professional learners (e.g. university students, young professionals, researchers) who might engage in a more extensive program or integrate modules into formal education. This dual approach ensures both immediate capacity building for current officials and long-term educational integration for future generations.

After setting this stage, the session transitioned to an **open discussion and co-creation exercise**. Participants were invited to comment on the proposed curriculum structure, suggest additional topics or modules, identify priorities, and share their on-the-ground perspectives of training needs. The discussion was lively and participatory: stakeholders from different sectors each brought their unique insights, ensuring a rich exchange of ideas. Where useful, parallels were drawn to experiences from the Bulgarian and Romanian workshops to generate ideas. For instance, Bulgarian stakeholders had unanimously called for more joint training exercises and clearer emergency response instructions, a need that also appears relevant for Georgian stakeholders.

By the end of this session, the group had collaboratively identified numerous critical points to incorporate into the curriculum and wider project efforts. The session concluded with a sense of accomplishment and next steps: the project team would consolidate all input into a draft curriculum document for further refinement, and participants were encouraged to remain engaged (with the possibility of reviewing materials or joining future pilot trainings). One week was provided to participants to provide their feedback in comments of the draft RESPONSE curriculum. The workshop ended with and a collective commitment to advancing the marine pollution response capacity in Georgia.

### STAKEHOLDER CONTRIBUTIONS

During the interactive co-creation session, and in writing within one week of the workshop completions, stakeholders provided a wealth of specific inputs. Their contributions highlighted current challenges in marine pollution response and proposed practical solutions, which are essential outcomes of the workshop. Below is a detailed account of these contributions, organized by thematic areas:

## Existing Response Frameworks & Gaps

Representatives of the **Maritime Transport Agency (MTA)** and its **Maritime Rescue Coordination Centre (MRCC)** in a special invited presentation described Georgia's present capacity for oil spill and maritime emergency response. The MRCC official outlined the **functions and structure** of their institution – they coordinate search and rescue at sea and handle oil spill response operations using available specialized equipment (dispersants, booms, skimmers) and by mobilizing external resources if needed. They noted that Georgia's **National Oil Spill Contingency Plan** (approved in 2016) provides a formal framework for responding to marine oil pollution. Under this plan, the MRCC leads the response to offshore oil spills, and cooperation protocols exist with other agencies (like the Coast Guard under the Border Police, and the Emergency Management Service for onshore impacts). However, the MRCC representatives also pointed out **challenges**: the national plan covers primarily oil spills, whereas no specific contingency plans exist for other pollutants (e.g. chemical leaks, hazardous and noxious substances, large marine litter incidents). They emphasized the need to periodically **update and expand contingency planning** to encompass these scenarios and potentially even to integrate the marine pollution response plan with Georgia's general civil emergency response capacities. This integration would ensure that in events like a chemical spill at sea, there is clarity on which agency is lead and how support is coordinated, rather than treating it as a completely *ad hoc* situation. Moreover, they mentioned that operationally, **time is of the essence** in marine emergencies, and any bureaucratic delays (for example, requiring high-level government approval to initiate response operations) need to be minimised – a concern similarly raised in Bulgaria, where the procedure requiring a Minister's sign-off was seen as a hindrance to rapid response. The MTA/MRCC team also discussed resource limitations: Georgia does not yet have a dedicated oil spill response vessel, and **equipment inventories are limited**, which could be problematic in a major incident. They lack some advanced tools – for instance, no dedicated aerial surveillance for spills aside from what the Border Police can provide, and no local accredited laboratory to quickly analyse pollutant samples.

Given these gaps, **training was seen as critical**: the MRCC staff advocated for more frequent **joint drills and exercises** involving multiple agencies (MTA, Coast Guard, NEA, local authorities). While Georgia has conducted regional and national search-and-rescue and oil spill exercises (the cited were regional GEODELTA 2011, national Geo SAR & OSR 2014, 2017, 2019, 2023, 2024 drills), they felt that expanding such drills to include scenarios of chemical spills or mass debris cleanup would build preparedness. They also suggested that the new curriculum should train participants on the practical aspects of existing plans – e.g., how the incident command system outlined in the National Plan works, roles and responsibilities – so that all relevant personnel can confidently execute those plans. Romanian OSR web training resources found extremely useful to replicate, perhaps as part of the curriculum under development. In summary, the government maritime officials contributed a clear message: *we have a basic framework for response, but it needs to be broadened, better integrated, and supported by continuous training and resources.*

## Environmental Monitoring & Agency Perspective

Officials from the **Ministry of Environmental Protection and Agriculture (MEPA)** and its **National Environmental Agency (NEA)** – the key bodies responsible for environmental monitoring and assessment – shared their insights on monitoring-related challenges. They noted that Georgia's marine monitoring programs, though established, have **significant gaps**. For example, NEA conducts chemical and biological water quality monitoring in coastal waters, but due to **limited**

**laboratory capacity and outdated equipment, and lack of specialised research vessel** they cannot analyse all relevant parameters or cover the entire coastline at sufficient frequency and spatial coverage. One specialist mentioned that their monitoring of bathing waters and seafood for contaminants, important for public health, could be enhanced with better methodologies and training of staff. **Data management** was a recurring theme: currently, data on marine pollution (from different projects, agencies, research studies) are fragmented and not collated into the publicly accessible portal. Participants from NEA recommended creating a **centralized database or information system** that all stakeholders can contribute to and use, improving inter-agency collaboration in accessing pollution data. They pointed out that training should include data handling and reporting skills – for instance, teaching how to use GIS mapping for pollution hotspots or how to report incidents to international bodies. Regional developments such as the Black Sea System of Systems (available at DOORS project website <https://doors.viewer.brockmann-consult.de>) could indeed form the initial backbone for the national marine data portal for Georgia, but this needs strong leadership and coordination at the national and international levels to mature and materialise. Another challenge highlighted was **financial constraints**: environmental monitoring and response units often operate on tight budgets, which affects their ability to procure new tools or even to retain specialized personnel. This was a reminder that while training is necessary, it should be coupled with advocacy for better funding and policy support (a point taken up later in recommendations). The MEPA representatives also discussed **climate change implications** for pollution: with changing climate, extreme weather events like heavy rains are becoming more frequent and can exacerbate pollution (e.g., stormwater flushing litter and pollutants into the sea, overflow of sewage systems). Thus, they argued, training modules should touch on climate resilience – for example, planning for how to handle pollution after extreme weather or integrating climate predictions into risk assessments (an idea captured in the concept of linking pollution sources to climate change, one of the findings). Additionally, the **monitoring of sensitive areas** was brought up: Georgia has marine and coastal protected areas (like parts of Kolkheti National Park in the Black Sea coastal zone). Stakeholders from the national park and academia suggested **strengthening monitoring in Marine Protected Areas (MPAs)** and using them as living laboratories for training – e.g., trainees could learn to monitor water quality or biodiversity in an MPA, which both builds capacity and benefits the park management. A specific suggestion was to include a module or sub-topic on **coastal wetlands** (such as the Kolkheti wetlands), highlighting their role in filtering pollution and the concept of “rewetting” degraded wetlands as a restoration measure. Overall, the environmental contributors stressed the need for the curriculum to improve technical knowledge (sampling and monitoring methods, lab analysis, use of new techniques like environmental DNA (e-DNA) including data processing for detecting impact of persistent pollution on species compositions) and to promote a more integrated approach across agencies for data and response. They also expressed willingness to collaborate with academic institutions in developing case studies or practical components for the training.

### Academic and Training Institutions

Representatives from **Batumi State Maritime Academy, Batumi Shota Rustaveli State University (BSU)**, and other universities contributed a perspective focused on education and research. State Maritime Academy lecturers noted that current maritime education in Georgia primarily covers **standard maritime safety and pollution prevention topics** (aligned with IMO conventions like MARPOL 73/78 for ship operations) – for instance, cadets learn about preventing oil discharge from vessels, handling ship waste, etc. – but these programs do **not deeply address monitoring of the**

**marine environment or inter-agency emergency response duties.** This echoed a situation documented in Bulgaria, where training for seafarers meets international standards for routine operations but doesn't cover the broader obligations of national institutions in environmental monitoring and response. The State Maritime Academy representatives supported incorporating **specialized modules or short courses** on marine pollution response that could be offered to students and professionals. They suggested that some modules from the RESPONSE curriculum could even be integrated as elective subjects in their academy or as part of continuous professional development for alumni. For example, a module on oil spill response operations (covering booming, skimming, etc.) could be valuable for deck officers and port facility managers.

BSU faculty, particularly from environmental science departments, emphasized the importance of **interdisciplinary training** – marine pollution response requires knowledge of oceanography, chemistry, engineering, law, and crisis management. They lauded the modular approach as it allows assembling experts from different fields to contribute to each topic. One BSU professor mentioned that the university had recently been involved in the **CARE SEA** project focusing on coastal resilience, and they have expertise in areas like coastal processes, which could feed into training content about shoreline clean-up or habitat impact assessment. Academy scientists brought up emerging research topics that the curriculum should include, such as **underwater noise pollution** and **vibration impacts**. They explained that increasing shipping traffic and coastal urbanization in Georgia has led to more underwater noise (from ship engines, sonar, construction) that can affect marine mammals and fish. This kind of “**physical pollution**” is often overlooked; hence they recommended that training programs include at least an introduction to underwater acoustic monitoring and mitigation measures – a suggestion directly aligned with adding a noise/vibration topic, which indeed appears in the draft curriculum structure. Another academic contribution concerned **ocean acidification** and **atmospheric deposition** of pollutants: a scientist pointed out that the Black Sea is experiencing gradual acidification (due to absorbing CO<sub>2</sub> and other processes) and that airborne pollutants like nitrogen and sulphur from industrial activities can settle into the sea, contributing to nutrient loading or contamination. Including these topics in the training would ensure that participants understand long-term changes and the broader context of marine pollution.

On the practical side, academic participants strongly advocated for incorporating **field exercises and simulations** into the curriculum. For instance, they proposed scenario-based training: a simulated oil spill drill for students in collaboration with the MRCC and/or Coast Guard, or a mock beach litter survey to teach monitoring techniques. These hands-on activities could be done in partnership with institutions like the State Maritime Academy or NEA, providing mutual benefits (students get real experience; agencies get help with data collection). The academics also offered to contribute content and teaching to the curriculum development – for example, BSU's oceanography experts could help design the monitoring module, and State Maritime Academy trainers could assist with the response operations module. Their contributions underscored an opportunity to **institutionalize the curriculum** by embedding it within Georgia's higher education and vocational training systems, ensuring sustainability beyond the project's life.

### **NGOs and Civil Society, Authorities**

Environmental NGOs (notably GMG/FoE-Georgia itself) and civil society participants brought forward the community and advocacy perspective. They highlighted the importance of **public awareness and community involvement** in marine pollution prevention and response. The NGO

representatives stressed that while training government staff is crucial, the curriculum should also be accessible (or adapted) to **local communities, volunteers, and even media**, as these groups play a role in early warning and response. For example, along Georgia's coast, local fishermen or beachgoers are often the first to notice pollution (such as an oil sheen or unusual algae bloom). Empowering them through basic training or informational sessions – an approach aligned with the concept of **citizen science** – could improve reporting and initial reaction to pollution events.

The NGOs also pointed to **beach litter** as a domain where volunteer action and training intersect. Georgia has periodic beach clean-up campaigns (often led by NGOs or schools), but NGO speakers suggested a more structured approach: developing a training component on **marine litter monitoring and clean-up** techniques. This could involve teaching volunteers how to conduct standardized beach litter surveys (for data that feeds into national or Black Sea regional and even pan-European assessments) and safe clean-up practices (handling hazardous items, etc.). Such training could be a module that stands alone for community use or is included as part of the broader curriculum for professionals to learn how to engage communities.

Additionally, **light pollution in coastal areas** was brought up by a representative of the Ministry of Environmental Protection and Agriculture - MEPA. It was noted that increased construction and lighting along coastline has created bright skies at night which can confuse marine life and affect bird migration. This issue of **coastal light pollution**, while not conventionally part of marine pollution training, was mentioned to broaden the thinking of what environmental factors need management. The suggestion was that the curriculum's environmental context module might briefly mention such emerging concerns, or at least instill the mindset that pollution is not just oil and chemicals. It was also suggested that there could be space for *ad hoc* additions to the curriculum. For example, the MEPA representative highlighted the need for short-term training for government officials, providing an in-depth introduction to the MSFD requirements, such as how to interpret correctly and apply MSFD descriptors and sub-criteria.

The MEPA representatives were also keen on the **"source-to-sea" approach**. They argued that the curriculum must emphasize that marine pollution often originates on land – for example, river-borne waste or agricultural runoff – and thus management must connect with upstream efforts. One speaker gave the example of the rivers: heavy rains can wash tons of plastic waste from inland towns into the Black Sea. Therefore, training should encourage participants to think beyond their silo and consider watershed management (echoing integration with **Integrated River Basin Management (IRBM)** concepts) and **Integrated Coastal Zone management (ICZM)** as part of pollution prevention, as well as bettering the governance with **Marine Spatial Planning (MSP)**. In the same vein, they highlighted the need for inter-sectoral cooperation: for instance, working with agriculture authorities to reduce fertilizer runoff, or with city waste departments to stop trash entering the sea.

The meeting also touched on **Nature-based Solutions (NbS)** as a key area of opportunity. They suggested including content on using natural systems for pollution control – e.g., restoring wetlands to filter water (as was also mentioned by academics), creating green buffers in coastal cities, or mussel farming as a way to bio-remediate nutrients, or resorting to constructed wetlands to treat wastewater of coastal communities. They referenced resources like the World Bank's recent **Blueing the Black Sea (BBSea)** initiative and its NbS guidelines, implying that Georgia could learn from and contribute to such regional knowledge. Another important point from civil society was regarding **Blue Flag beaches** – an international eco-label for clean and well-managed beaches. One

responder noted that Georgia has been striving to get some of its beaches Blue Flag certified, which requires meeting strict criteria for water quality, safety, and education. It was suggested that the training curriculum include an element on **bathing water monitoring and beach management best practices**, so that local authorities and communities can work toward certifications like Blue Flag. This would not only improve environmental quality but also benefit tourism. In summary, both governmental and non-governmental actors and volunteer contributions promote for the curriculum to be **inclusive and holistic** – covering public engagement, preventative thinking (source-to-sea), and innovative solutions, not solely emergency response after damage has occurred.

### Innovative Techniques and Solutions

A notable contribution came from an **independent expert in bioremediation**, who shared a specific solution for oil pollution clean-up. He introduced the **bioremediation technology** that he and colleagues have been developing in Georgia. The method involves using naturally occurring microorganisms to degrade oil pollutants – essentially an accelerated natural attenuation process. The speaker explained that this technology was originally formulated around the time of constructing the Baku–Tbilisi–Ceyhan pipeline, anticipating possible land spills; it has since been refined and could be applied to coastal soils or even open water scenarios. The method's **history and rationale** were described: starting in 1999, Georgian scientists sought a clean-up approach that would be **ecological, fast, tailored to each ecosystem, and long-lasting**. They developed a technique to boost the activity of local (autochthonous) bacteria that can digest hydrocarbons by adding specific nutrients and conditions favourable to those microbes. In practice, this means when an oil contamination occurs on a coast or marshland, the area can be treated with a biostimulation mixture that significantly speeds up the breakdown of oil, with minimal chemical additives. The expert highlighted the advantages: it avoids the use of harsh chemicals or expensive equipment, harnesses natural processes, and results in sustainable remediation with less ecological side-effects.

This presentation was essentially a **solution proposal**, demonstrating the kind of content that could enrich a training curriculum. Participants showed keen interest – some were hearing about this local innovation for the first time. Questions were asked about how this could be implemented operationally during a spill response and whether it had been officially adopted or tested by Georgian authorities. The expert noted that while the method is proven in pilot studies, it hasn't been fully integrated into national response protocols, largely due to lack of awareness and training. This directly underscored the value of including **bioremediation and modern remediation techniques** in the curriculum, so responders know of alternatives beyond mechanical recovery and dispersants. It also highlighted an opportunity for Georgia to lead with home-grown expertise in certain areas of marine pollution response.

Another innovative tool mentioned by a participant was the use of **environmental DNA (eDNA)** monitoring – collecting water samples and analysing DNA fragments to detect what organisms are present, which can serve as an advanced monitoring technique for biodiversity and possibly pollution tracing. These contributions on innovation ensured that the workshop outcomes were not only about addressing gaps but also about incorporating forward-looking practices into training.

### Legal and Policy Coordination

Some participants, particularly those with background in law or administrative roles, contributed thoughts on the policy framework. One important suggestion was to **augment the international legal**

**coverage in the training.** For example, they pointed out that Georgia is working towards implementing the **Ballast Water Management Convention** (which helps prevent the spread of invasive species through ships' ballast water) – both by accession and by aligning national regulations. It was recommended that the curriculum explicitly include this convention and associated best practices, since ballast water and sediments can be a significant pollution vector and training on its management would benefit port authorities and shipping companies. This suggestion aligns with the idea of covering all relevant global frameworks in the legal module (and indeed, the draft curriculum had a section on ballast water as a pollution source).

Additionally, stakeholders discussed **governance integration**. The suggestion to adopt a “**source-to-sea**” approach has a governance angle: it means coordinating policies across freshwater and marine authorities. Trainees, especially those in government, should be made aware of how river basin management plans connect to marine pollution outcomes. Moreover, Georgia's involvement in regional agreements, like the **Black Sea Commission's Emergency Response Activity (under the Bucharest Convention's Emergency Protocol)**, was mentioned – the training could cover Georgia's international obligations in spill response and avenues for requesting international assistance. On the national level, participants concurred that there is a need for **harmonization of plans and roles**. For instance, if a major marine pollution event occurs, how do the National Oil Spill Plan, the National Disaster Response Plan, and various sectoral plans work together? It was proposed that one of the curriculum outcomes should be to educate officials on the **national response system** in a holistic way, perhaps via case studies of past incidents. In fact, as a gap, it was noted that Georgia had not faced a large-scale marine pollution disaster in recent years – which is fortunate, but also means experience is low; hence training and drills are even more crucial to prepare for a scenario that hasn't yet happened, but there are grave recent examples like Kerch accidents in December 2024.

Finally, enforcement issues were raised: environment inspectors and maritime authorities sometimes struggle to enforce anti-pollution laws (for instance, detecting illegal discharges from ships or ensuring industries comply with waste regulations). Stakeholders recommended that training include aspects of **compliance monitoring and enforcement** – for example, how to conduct a ship inspection for MARPOL violations, or how to gather evidence for prosecuting polluters. This also touches on building **laboratory capacity and protocols** (again linking back to equipment and training). In synergy with that, a participant noted the importance of the **Marine Strategy Framework Directive (MSFD)** descriptors as a guide to what “good environmental status” entails. While Georgia is not bound by MSFD (through Association Agreement with EU makes it legally binding for Georgia to harmonise with MSFD requirements), aligning training to those descriptors (e.g. one descriptor is marine litter minimization, another is contaminants at safe levels, etc.) ensures that the curriculum is comprehensive and in line with modern environmental management principles. The consensus was that robust legal knowledge and inter-agency policy understanding should be a cornerstone of the curriculum so that graduates of the program can champion policy improvements and cross-agency cooperation in their day-to-day jobs.

In summary, the stakeholder contributions were extensive and insightful. **Challenges highlighted** included: gaps in existing training and contingency planning (beyond oil spills), limited equipment and funding, data fragmentation, and emerging threats like climate change impacts and military conflict-related pollution. **Solutions and ideas proposed** ranged from very specific (e.g., include ballast water management, use bioremediation, train for beach litter monitoring) to broad strategic approaches (integrate plans, use nature-based solutions, foster community involvement). There was

a strong shared sentiment that **additional training and regular exercises** are needed at all levels – local, national, and regional – to improve preparedness. Stakeholders also agreed on the value of continued collaboration: many expressed that this workshop was a good opportunity for all relevant parties to sit together, and that this network should be maintained (perhaps through further meetings or an online platform for exchange) as the curriculum gets developed and implemented.

## FINDINGS AND KEY INSIGHTS:

The co-creation workshop yielded several **critical findings and insights** into the state of marine pollution response training in Georgia and the way forward:

- *Gaps in Training and Preparedness:* It became clear that **Georgia currently lacks specialized, up-to-date training programs** for marine pollution monitoring and response. Most agencies rely on on-the-job experience or *ad hoc* trainings, and multi-agency drills are infrequent. This is a regional problem, not just national – as evidenced by similar workshop findings in project partner countries. The workshop confirmed a pressing need to institutionalize training to cover not only oil spills, but also the full spectrum of marine pollution scenarios. Participants identified that **critical knowledge gaps** exist in areas like handling hazardous chemical spills at sea, responding to mass plastic pollution events, and using modern monitoring tools. **Opportunities:** The broad interest and expertise present at the workshop is an opportunity to fill these gaps by pooling knowledge into a formal curriculum. Institutions like BSU and the State Maritime Academy are willing to host and integrate additional trainings, which is a positive sign for sustainability.
- *Challenges in Inter-Agency Coordination:* A key insight was that **coordination among various institutions needs improvement**. Roles and responsibilities can overlap or fall between cracks, especially for non-routine incidents. For example, who takes charge if a harmful algal bloom affects fisheries – is it an environmental issue or a disaster response? The workshop highlighted that even though a national oil spill plan exists (for clear maritime emergencies), other events are not well covered by protocols. The finding is that **contingency planning should be permanently updated and integrated:** marine pollution response must be woven into the national disaster management system, with clear communication channels. As one insight, participants echoed that having **clear, written instructions and communication plans** in advance is vital to avoid confusion during emergencies. On the positive side, the workshop itself fostered inter-agency dialogue, which is a step toward better coordination.
- *Content Priorities for the Curriculum:* The stakeholders' responses confirm a consensus on several **priority topics** that the new curriculum must address. These form a checklist of sorts for curriculum developers. They include: **comprehensive coverage of pollution types** (oil, chemicals, litter, wastewater, noise, etc.), **modern monitoring methods** (remote sensing, eDNA, GIS mapping), **early warning and risk assessment** (including climate change projections and scenario planning), **emergency response techniques** (from containment and recovery to public communication and health & safety during incidents), and **post-incident remediation** (such as the bioremediation methods and habitat restoration). Additionally, **legal and governance aspects** are a priority – trainees should learn UNCLOS and many other international conventions (including those not fully implemented yet, like Ballast Water Management), regional agreements, and national laws, as well as how to apply them practically. The workshop also illuminated the need for topics like **marine**

**pollution and the Blue Economy**, to illustrate the economic stakes of environmental protection. By highlighting, for example, how pollution events can cripple tourism or fisheries, the training can motivate participants with real-world implications. Another insight was to incorporate **adaptation and resilience strategies** alongside response: this means training people not just to react to pollution, but also to take proactive measures (like restoring natural buffers, or creating contingency plans that consider future climate conditions). The breadth of suggested content is large, but it offers a roadmap to ensure the curriculum is robust and future-proof.

- *Stakeholder Consensus and Enthusiasm*: An important outcome was the strong **buy-in and enthusiasm** from all stakeholder groups for developing the curriculum. There was an agreement on the workshop's main aim – that advanced, structured training will significantly benefit Georgia's preparedness for marine pollution emergencies. Stakeholders did not just enumerate problems; they actively proposed solutions and expressed readiness to contribute expertise. This sense of co-ownership is a crucial insight: any curriculum or initiative will be more successful if those who must implement it (agencies, educators, etc.) feel they had a hand in shaping it. The workshop thus served to build a network of “champions” for marine pollution response training. Participants also recognized that **continuing the co-creation process** is necessary. The one-day workshop is the beginning; several attendees volunteered to review draft materials (and several indeed provided valuable feedbacks) or host pilot sessions. The diversity of perspectives (from policymakers to field volunteers) enriched the findings, and a takeaway is that future training should maintain this multi-stakeholder approach, perhaps through mixed-class compositions or joint training exercises that bring different sectors together.
- *Alignment with Regional and International Context*: The findings reinforced that Georgia's effort must align with regional Black Sea initiatives and international standards. For example, the Black Sea countries share many pollution challenges (oil spills, nutrient pollution, floating litter) that are transboundary by nature. There was an insight that **regional cooperation** – such as through Black Sea Commission programs or projects like **EMSA (European Maritime Safety Agency) involvement** in drills – should be leveraged. Similarly, adopting frameworks like the MSFD descriptors as reference points can guide Georgia in setting targets (even voluntarily) for good environmental status. One gap identified is that Georgia's progress toward these international benchmarks is currently limited, which in itself is a finding: it indicates where training and capacity building efforts should focus (for instance, improving Descriptor 8: Contaminants, or Descriptor 10: Marine Litter). Another insight is the value of **cross-border learning**: experiences from Bulgaria, Romania and Ukraine (as shared in their workshop reports) and the upcoming regional workshop (noted to be held in Constanța, Romania in late February) are valuable for Georgia. The Georgian stakeholders appreciated hearing that colleagues from partner countries faced similar issues (like needing to train for new warfare-related pollution or to involve private sector responders). This knowledge reduces duplication of effort and fosters a sense of a Black Sea community addressing these problems together.

In essence, the findings of the Georgian co-creation workshop underscore gaps, but also clear pathways to improve marine pollution response training. The insights gathered form a comprehensive checklist that will inform both the curriculum development and broader capacity-

building efforts. The critical gaps (training, equipment, coordination) are now well-documented, and the solutions (curriculum topics, policy integration, stakeholder cooperation) have been articulated by those who will be involved in enacting them.

### RECOMMENDATIONS

Building on the workshop discussions and findings, the following recommendations are proposed to advance marine pollution response preparedness in Georgia, focusing on curriculum development, policy improvement, and inter-agency cooperation:

#### 1. Curriculum Development and Implementation:

- **Develop a Modular Curriculum Reflecting Identified Needs:** Proceed with creating the training curriculum structured into modules that cover all key topics highlighted by stakeholders. Ensure modules address practical skills (e.g. oil spill response tactics, water quality sampling) as well as theory (e.g. laws, environmental impacts). For example, include dedicated modules on *Marine Pollution Types & Effects* (covering oil, chemicals, litter, etc., including new threats like underwater noise and military conflict-related debris), *Monitoring & Early Warning* (modern monitoring techniques, use of remote sensing and citizen reporting), *Emergency Response & Operations* (incident command system, use of equipment, safety protocols), *Mitigation & Remediation* (clean-up methods including bioremediation, habitat restoration), and *Policy & Governance* (international conventions like MARPOL and Ballast Water, national contingency plans, integrated management concepts like MSP/ICZM/IRBM). The curriculum content to explicitly incorporate the solutions and topics suggested during the workshop – for instance, training materials on **beach litter monitoring** protocols, case studies on **climate change impacts** (like extreme weather event scenarios), and an overview of **nature-based solutions** for pollution control.
- **Tailor to Multiple Target Audiences:** Develop different delivery formats of the curriculum to suit the two main audience groups. For decision-makers and practitioners (agency staff, responders), create **short-course formats** or workshops (1-2 days) focusing on problem-solving and drills. These can be standalone trainings each covering one or two modules of the curriculum. For students and academic learners, integrate modules into **university courses or certificate programs** (e.g., a semester-long elective on Marine Pollution Response using the curriculum, or an online course open to various Black Sea countries). By addressing both groups, the curriculum ensures immediate capacity building and long-term educational impact. It's recommended to collaborate with training centres of relevant agencies (for example, the Emergency Management Service's training division, or the Maritime Transport Agency's training unit) to adapt modules for in-service training of their personnel. Likewise, coordinate with universities like BSU and Batumi State Maritime Academy to include parts of the curriculum in their syllabi for environmental science and maritime studies. Bleu Economy curricula under development by H2020 DOORS and BRIDGE projects would become important educational assets as well.
- **Interactive and Practical Learning Methods:** Incorporate interactive pedagogies – simulations, tabletop exercises, field trips, and group problem-solving – to enrich traditional lectures. For example, as recommended by participants, conduct **joint simulation exercises** as part of the training: one module could culminate in a mock oil spill response drill at the port of Batumi or a beach clean-up exercise with volunteers. Use scenario-based learning (e.g., "a chemical

spill has occurred – walk through the response steps”) to build confidence and teamwork among participants from different agencies. Leverage the project’s planned online platform and tools for some modules, allowing for e-learning components or virtual simulations. Ensuring that the training is not just theoretical will directly improve operational readiness, addressing the needs for more hands-on exercises.

- **Bilingual Materials and Local Context:** Prepare the curriculum materials in both **English and Georgian** (and potentially other Black Sea languages for regional use). English materials allow incorporation of international best practices and facilitate regional exchange, while Georgian versions ensure accessibility for local officers and community members who may be more comfortable training in native language. All materials (slides, manuals, case studies) should be contextually adapted to Georgia and the Black Sea. For instance, use examples from **Georgian incidents or Black Sea case studies** rather than far-flung scenarios, to make training relatable. Include references to Georgian laws, local organizational structures, and cultural aspects of communication in emergencies. However, also include one or two international case studies (like the Deepwater Horizon spill or the Kerch oil spill exercise) to provide learning from global and Black Sea experiences.
- **Pilot Testing and Continuous Improvement:** Once draft modules are developed, conduct **pilot training sessions** with a mix of stakeholders (possibly the same individuals who attended this workshop) to test the curriculum. Gather feedback on the relevance of content, difficulty level, and training methodology. This approach follows the project’s objective to develop and test new training schemes. Use the pilots to refine the curriculum – for example, adjust modules that are too technical or add content if participants find something lacking. After the initial roll-out, establish a mechanism for regular updates to the curriculum. As one recommendation, the curriculum should be treated as a “living document” that can be updated yearly or as needed – especially to incorporate new developments (like new technologies, new regulations, or lessons learned from any actual pollution events). The workshop participants and their institutions could form an informal **advisory group** to review and suggest updates over time, ensuring the co-creation spirit continues beyond the project. This will also help fulfil the project aim that training schemes be updated on a regular basis for a long period. Apply AI (both ML and LLM type) to review the contents and keep solutions innovative and up-to-date.

## 2. Policy Improvement and Integration:

- **Permanently Update and Broaden National Contingency Plans:** Initiate a review and update of Georgia’s National Oil Spill Response Plan (2016) in light of the workshop findings. It is recommended to broaden the scope of national contingency planning to cover **Hazardous and Noxious Substances (HNS) spills and other marine pollution incidents** beyond oil. This might result in a more general **National Marine Pollution Contingency Plan** or annexes to the existing plan. Integration with the National Civil Emergency Plan is crucial. The updated plan should clarify the chain of command and cooperation mechanisms for scenarios like chemical spills, mass litter wash-ups (for example, in case of a flood that dumps waste on shores), or marine incidents resulting from extreme weather or warfare. The plan should also incorporate triggers for quicker response activation (possibly delegating some authority to regional centres to avoid waiting for central decisions). Alongside national planning, encourage **local (municipal/regional) contingency plans** for coastal areas, so that cities like Batumi, Poti, specific facilities such as those at Supsa and Kulevi etc. have tailored sub-plans consistent with

the national framework. This multi-tier planning will provide content for training (since trainees can then be taught using these updated plans) and ensure that learning translates into official policy.

- **Strengthen Legal Framework Enforcement:** While Georgia has adopted key maritime conventions (MARPOL, SOLAS, OPRC, etc.), enforcement can be improved. It is recommended that the government assess the current **compliance monitoring and enforcement regime** for marine pollution laws. For instance, ensure that the Maritime Transport Agency and Coast Guard have the legal mandate and resources to inspect vessels for illegal discharges, and that the environmental inspectors have clear procedures for investigating coastal pollution incidents. One specific policy improvement is to expedite Georgia's implementation of the **Ballast Water Management Convention** and enforce ballast water regulations at ports and terminals to prevent invasive species and microbial pollution. Another is to incorporate emerging issues like undersea noise into EIA (Environmental Impact Assessment) and SEA (Strategic Environmental Assessment) regulations for marine and coastal projects, plans, and programs, reflecting the concern raised about noise pollution. The training curriculum will help by educating officers on these laws; conversely, having stronger laws and enforcement protocols will give the curriculum real weight. In essence, training and policy should advance hand in hand. It's recommended that relevant ministries (Economy/Transport for shipping, Infrastructure/Environment for land-based sources) use the momentum from this project to push necessary legislative updates or the drafting of new regulations (e.g., on chemical spill response or on marine litter management).
- **Incorporate Climate Adaptation into Marine Environmental Policies:** The workshop highlighted links between climate change and pollution, and the need for adaptation measures. It is advisable that Georgia's policies on climate change adaptation (the national adaptation plan or national and sectoral strategies) explicitly recognize marine pollution risks under future climate scenarios. For example, include considerations for more frequent extreme weather events causing pollution in coastal zones. In parallel, integrate nature-based adaptive solutions (like wetland restoration for flood and pollution control) into environmental planning. On a policy level, this might mean supporting projects that restore coastal wetlands or implementing "building with nature" approaches for coastal defence that also mitigate pollution. The curriculum's recommendation to include **nature-based solutions and green infrastructure** training aligns with policy shifts that favour sustainable and resilient approaches. Thus, a recommendation is for policymakers to back pilot projects or funding for NbS in pollution control, which can serve as practical case studies for the training program. NbS can be integrated e.g. via SEAs of marine and coastal plans and programs.
- **Institutionalize Training and Capacity Building:** For long-term impact, it is recommended to institutionalize the marine pollution response training within government frameworks. For example, the MEPA and importantly Ministry of Education and Science, together with line ministries, could recognize the curriculum as a certified training program for professional development. Agencies like NEA, MTA, and MIA Emergency Management Service could incorporate it into their official training requirements (so that, say, every new environmental inspector or MRCC officer undergoes this training within their first year). The government might also consider establishing a **Marine Environmental Response Training Centre** or assigning this role to an existing institution (perhaps State Maritime Academy in Batumi or BSU) to ensure

continuity. This ties into policy as it may require official MoUs or decrees to set up. Additionally, ensure that there is a budgetary allocation for regular trainings and drills – a point implicitly made by stakeholders noting the need for resources. Policy support in terms of funding (possibly through state budget or seeking donor support) will be needed to maintain the program. Given the Black Sea is a shared resource, Georgia could also collaborate with neighbouring countries to seek regional funding for joint training (aligning with Black Sea Commission initiatives and/or EU cross-border programs, EMSA, IMO).

### 3. Inter-Agency and Cross-Sector Cooperation:

- **Establish a Formal Coordination Mechanism:** It is recommended to set up a **national inter-agency working group or task force on marine pollution response training and preparedness**. This body, perhaps chaired by the Ministry of Environmental Protection and Agriculture of Georgia or a cross-ministerial council, would include representatives from all key stakeholders (MTA, Coast Guard, Emergency Management, MEPA, NEA, local governments, academia, NGOs, private sector players). The working group can meet periodically (e.g., semi-annually) to plan joint exercises, evaluate readiness, and update each other on activities. It can also oversee the implementation of the workshop's outcomes – for instance, monitoring the progress of curriculum development and advising on its rollout. Such a mechanism ensures that the cooperation witnessed during the workshop continues and becomes embedded in institutional relationships. It would directly address the need for better inter-agency communication identified during the workshop. This group could also serve as the liaison with the Black Sea regional bodies, feeding national insights into the regional co-creation process and vice versa.
- **Conduct Regular Joint Exercises and Drills:** An important point from stakeholders was the value of hands-on joint exercises. As a recommendation, Georgia should schedule **regular multi-agency drills** for marine pollution emergencies. For example, plan an **annual national exercise** that simulates a marine pollution incident (rotating scenarios: one year an oil spill, another year a chemical tanker leak, another a marine debris crisis after a storm). Participants would include the MTA, Coast Guard, Emergency Management Service, NEA, local authorities (for shoreline response), and volunteer groups, practicing their coordinated response. These drills will test and reinforce the training curriculum's lessons and reveal any practical coordination issues to be fixed. They also strengthen personal working relationships across agencies. Ideally, such exercises can be scaled up to **regional, cross-border drills** (for instance, a joint exercise with Turkey if feasible, under Black Sea Commission facilitation). Since EMSA and other international entities have been involved in European Black Sea countries exercises, Georgia could likewise invite international observers or assistance for its drills to exchange best practices. Post-exercise debriefings should be used to update both the training content and the contingency plans.
- **Enhance Communication and Data Sharing:** To improve day-to-day cooperation, it's recommended to create an **information-sharing platform** among agencies. This could be as simple as a regular email newsletter or a shared online portal where agencies post updates on relevant incidents, monitoring results, or project findings. The workshop identified data fragmentation as an issue; an inter-agency data portal for marine pollution (which might house monitoring data, GIS maps of pollution hotspots, an inventory of response equipment, etc.) would be valuable. For instance, NEA could upload monthly water quality reports accessible to others, and MTA could log any minor pollution incident reports. Over time, this builds a

common knowledge base. Additionally, standard operating procedures for communication during an incident (whom to call first, how to activate others) should be agreed upon and practiced. The training curriculum can simulate these communications, but real agreements (like an inter-agency communication protocol or an MOU between, say, MTA and Emergency Service) should be in place so that everyone knows their counterpart. This was implicitly recommended by participants calling for clearer instructions and coordination.

- **Public-Private and Community Partnerships:** Inter-agency cooperation should extend to involve **private sector and community players**. The workshop noted the role of port operators, industrial zone representatives, and NGOs/volunteers. It is recommended to formalize their involvement: for example, invite oil terminal companies, shipping companies, and industrial facilities to be part of planning and drills – possibly through a corporate environmental partnership network. Many industries have corporate social responsibility interests in environmental safety; leveraging that can bring additional resources (like equipment or funding for training). Likewise, maintain ties with NGOs and volunteer organizations by involving them in training (perhaps as trainees in certain modules, or as co-organizers for community outreach events). The benefit of this broad cooperation is a more resilient network where, in the event of a major incident, external resources (a company's clean-up team or a volunteer corps) can be quickly marshalled under the guidance of authorities. This fulfils the workshop's idea that effective response requires "all hands-on deck," from official responders to citizen observers.
- **Regional Collaboration and Exchange:** Finally, under cooperation, a recommendation is to actively engage in **regional knowledge exchange** as the RESPONSE project continues. Georgia should share its curriculum developments and lessons learned with partners in Bulgaria, Romania, Ukraine, and Turkey (as applicable) and likewise learn from them. This can be done through the project's regional workshops, but also through bilateral visits or joint training events. For example, Georgian trainees or trainers could attend a session in Varna or Constanta to see how others are implementing similar curricula. The Black Sea Commission's Advisory Groups could be forums to present the outcomes of this national workshop and seek alignment with regional plans (like the regional contingency plan). Ultimately, pollution in the Black Sea knows no borders, and cooperation at that scale magnifies the impact of national efforts. The project itself fosters some of this; the recommendation is to ensure Georgian agencies remain proactive in regional initiatives even after the project ends.

By pursuing these recommendations, Georgia can significantly improve its marine pollution preparedness. The workshop has essentially provided a blueprint – the next steps involve turning that blueprint into tangible training programs, policy actions, and cooperative frameworks. These efforts will not only address the gaps identified but also capitalize on the stakeholder engagement momentum generated.

### CONCLUSION OF THE CO-CREATION PROCESS IN GEORGIA

The Batumi co-creation workshop was a **pivotal step** in advancing Georgia's capacity to monitor and respond to marine pollution. It successfully convened a broad spectrum of stakeholders to jointly assess needs and create solutions, demonstrating the power of collaborative approach in curriculum development. Through open dialogue, the workshop shed light **on the current**

**shortcomings** in training, planning, and coordination, but more importantly, it harnessed the collective expertise and commitment of participants to outline a path forward. In summary, the workshop reinforced the significance of marine pollution response training as a cornerstone for protecting the Black Sea environment and coastal communities. It highlighted those challenges such as oil spills, plastic debris, and chemical pollutants – exacerbated by climate change and new risk factors – can be effectively addressed only with well-trained personnel, robust inter-agency cooperation, and informed communities. The **outcomes** of this workshop, including the detailed stakeholder inputs and the agreed curriculum framework, will directly feed into the RESPONSE project's next phases. The immediate next step is for the project team (GMG/FoE-GE and partners) to synthesize these results into a draft curriculum and action plan. This report itself will be a key resource in that drafting process, ensuring that no valuable insight is lost.

Moving forward, **stakeholders have a crucial role** in implementing the workshop outcomes. Government agencies are expected to champion policy updates and allocate resources for training and equipment. Academic institutions will likely house and deliver the training modules, integrating them into educational offerings. Agencies and NGOs will send their staff and volunteers to be trained, thus building capacity on the ground. The participants of the workshop can act as ambassadors within their organizations to promote the adoption of the new curriculum and the practices it teaches. It will be important to maintain the enthusiasm – as noted, possibly through a working group or follow-up meetings – to keep stakeholders engaged as the curriculum is finalized and pilot trainings begin.

In conclusion, the national co-creation workshop in Georgia the **beginning of an ongoing process**. It strengthened networks among key actors who had rarely sat together before, aligning them toward a common goal of a cleaner, safer Black Sea. By co-creating the solutions, the stakeholders are more likely to support and implement them. The workshop's significance also extends beyond Georgia – it contributes to the regional mosaic of efforts under the RESPONSE project, ensuring that Georgia's perspective is included in the broader Black Sea curriculum development. Ultimately, the success of this initiative will be seen in the coming years when marine pollution incidents are met with prompt, coordinated, and effective responses by Georgian institutions, guided by the training and cooperation frameworks developed today. The workshop has laid a strong foundation for that future. The **next steps** involve finalizing the curriculum, securing institutional commitments, and rolling out training – actions which the project team and stakeholders are poised to undertake. With continued collaboration and dedication, the vision of a well-prepared response community in Georgia – capable of safeguarding the Black Sea's health and the coastal population's well-being – is well within reach.

Attached to the Georgian report is also the draft curriculum (Appendix 2), with all suggestions received from Georgian stakeholders included via comments in the document.

## GEORGIAN CO-CREATION WORKSHOP SUMMARY

### Key discussion points were focused on:

- pollution context regarding oil spills (offshore, shipping), marine litter, eutrophication, chemical contaminants, and new threats from conflict (e.g. unexploded ordnance),
- the policy/legislative framework. It should be noted that Georgia is not a member of the EU, but is aligned with MARPOL, the Bucharest Convention, and guided by aspects of the MSFD through an Association Agreement.

### Existing training gaps and monitoring challenges accentuate:

- Limited specialized equipment (e.g., lack of a dedicated spill response vessel).
- Need for better coverage and data management in National Environmental Agency (NEA) programs.
- Georgia's National Oil Spill Contingency Plan (2016) does not yet cover hazardous and noxious substances or marine debris.

### Stakeholder recommendations and useful suggestions were:

- ❖ Expand contingency plans beyond oil to include chemicals, conflict-related pollution, and solid waste.
- ❖ Strengthening laboratory capacity for pollutant analysis and adopt modern technologies (satellite, drones).
- ❖ Integrate modules into university curricula (Batumi State Maritime Academy, BSU) and short courses for existing professionals.
- ❖ Focus on field training and inter-agency exercises.
- ❖ Address climate resilience (extreme weather events exacerbate pollution).

### Key outcomes highlighted by participants were:

- Broad stakeholder agreement on the modular approach; strong interest in applying these modules to both academic (semester-long) and short (1-2 week) training.
- Emphasis on the use of practical scenarios and live exercises to improve preparedness.
- Commitment to follow-up consultations and pilot sessions to further refine.

## 1.3. National Co-Creation workshop in Romania

**Place:** National Institute for marine Research and Development “Grigore Antipa” (NIMRD) at its conference hall situated at 300 Mamaia Blvd, Constanta

**Date:** 27.01.2025

**Attendance:** The co-creation workshop was attended by 35 participants from various institutions, including Governmental and regulatory authorities (Ministry of Environment, local environmental agencies, Romanian Naval Authority, Romanian Waters Authority), Academic institutions (Ovidius University of Constanța, Naval Academy), Non-governmental organizations (NGOs) (Mare Nostrum), but also Industry and business representatives (Chamber of Commerce, Industry and Navigation).

**Implemented by:** National Institute for Marine Research and Development “Grigore Antipa” (INCDM – NIMRD)

### CURRENT STATE OF TRAINING PROGRAMMES IN ROMANIA

Existing analyses indicate that while some institutions in Romania provide marine pollution monitoring and response training, in-house programs remain limited—particularly in multi-agency coordination and alignment with IMO preparedness modules. CERONAV, the Romanian Center for the Training and Improvement of Naval Transport Personnel, was established by the Ministry of Transport to address the training and development needs of maritime navigation personnel. In this regard, most training programs primarily focus on routine maritime operations and are aligned with IMO and EU standards. However, there is limited integration of marine pollution emergency response training within existing or mandatory curricula.

National contingency plans exist for oil spill response; however, broader pollution issues (e.g., hazardous substances, eutrophication, microplastics) require further training efforts to integrate the Marine Strategy Framework Directive (MSFD) indicators into Romania's training programs.

The co-creation workshop in Romania aimed to identify gaps and propose improvements for marine pollution preparedness and response through advanced training curricula and cross-institutional cooperation and networking at national level.

### AIM OF THE WORKSHOP IN ROMANIA

To enhance preparedness and emergency response to marine pollution in the Black Sea by supporting early warning mechanisms, fostering cross-agency cooperation, and the integrating modern monitoring and response technologies, while identifying gaps and proposing improvements through advanced training curricula and strengthened cross-institutional collaboration.

## PREPARATION PHASE

The preparation for the workshop was conducted by RESPONSE team, focusing on engaging key stakeholders from the maritime sector, environmental agencies, academia, and emergency response institutions. Invitations were sent to over 50 stakeholders, with follow-ups via direct communication to encourage participation.

Efforts were made to ensure the workshop included a diverse range of participants involved in marine pollution response, training, and policy development. The preparation phase lasted approximately four weeks, allowing sufficient time to structure the workshop's agenda and engage relevant experts.

## THE WORKSHOP PROGRESS – A REVIEW

The National CO-Creation Workshop followed a structured agenda, consisting of:

1. Introduction and Objectives – Overview of the RESPONSE project, its goals, and expected outputs.
2. Stakeholder Mapping and Training Needs – Discussion on existing training programs, institutional responsibilities, and identified gaps in the context of the MSFD and its Plan of Measures/POM implementation within national maritime space.
3. Monitoring the Marine Environment – Presentations and discussions on pollution monitoring techniques and the role of different agencies.
4. Response to Marine Pollution Incidents – Case studies, best practices, and technology integration for emergency response.
5. Interactive Discussions and Co-Creation – Development of training topics and structuring of future curricula.

The national workshop encompasses three parts as follows:

1. Part 1: Monitoring the State of the Marine Environment
2. Part 2: Response to Pollution Incidents/Accidents
3. Part 3: Improving Marine Pollution Response Preparedness

### **Part 1 - Monitoring the state of the marine environment according with MSFD and national legal frameworks**

An overview of the RESPONSE project was conducted at the beginning of the workshop, outlining its aim, specific objectives, activities, and expected outcomes within the Black Sea context. This was followed by the first session, which featured presentations and discussions on the Marine Strategy Framework Directive (MSFD) and national marine environment monitoring, specifically in relation to pollution in Romania's coastal and marine sectors.

- *Presentation* by NIMRDs experts involved in responsibilities of the Institute in MSFD's descriptors monitoring the marine environment, in relation with marine pollution.

The understanding Marine Pollution and the Need for Action in the Black Sea, one of Europe's most fragile marine ecosystems, faces increasing environmental threats due to pollution and human

activities. To protect it, the Marine Strategy Framework Directive (MSFD) establishes a set of 5 key descriptors that define the Good Environmental Status (GES) of marine waters affected by marine pollution. These selected descriptors help identify, monitor, and mitigate pollution sources and its impact on marine ecosystem:

1. Alien and invasive species (D2)
2. Eutrophication (D5)
3. Oil spills and chemical pollutants (D8, D9)
4. Plastic and microplastic pollution (D10)
5. Noise pollution (D11)

Each of these descriptors were presented as a significant threat to the health of the Black Sea, affecting marine biodiversity, water quality, and human livelihoods. The discussions emphasized the importance of understanding these challenges to support public awareness campaigns, strengthen legislation and regulations for the implementation of Programs of Measures (POM), and enhance environmental protection efforts. Additionally, the need for effective professional training programs was highlighted to improve preparedness, and ensure a rapid response to marine pollution incidents.

Discussion followed: Marine pollution in the Black Sea, its impact on Biodiversity, Ecology and Conservation of the Marine Ecosystems and its insertion in the new training curriculum - MSFD indicators, covered by the Second Assessment of the Good Environmental Status of the marine environment.

**Suggestion for topics** in the new training curriculum:

- Eutrophication. The new advanced training schemes could focus on the promotion eco-friendly manipulation practices that reduce fertilizer spreading in the port's areas; supporting investments in wastewater management on ships/delivery to wastewater treatment plants; awareness campaigns about the effects of chemicals and detergents on marine pollution; sustainable waste disposal methods in the coastal/marine areas.  
*Note: eutrophication in the BS is caused by excess nutrients—mainly nitrogen and phosphorus—entering the sea from river mouths (e.g. Danube), thus bringing fertilizers, sewage, and industrial waste from a huge basin. These nutrients feed algal blooms, which deplete oxygen levels in the water. As a result, vast areas of the Black Sea in the past were become "dead zones", where marine life cannot survive. In the present, this issue is not particularly severe in the northwestern Black Sea, where rivers like the Danube carry large amounts of agricultural and industrial runoff. Descriptor 5 of the MSFD aims to reduce eutrophication by controlling nutrient pollution and improving wastewater treatment, but also response to various maritime accidents – a close example, the case of Vera Su grounding in the vicinity of the southern border.*
- Oil Spills and Chemical Pollutants. The new training would be focused on stronger environmental monitoring of oil spills and ship discharges, promotion of eco-friendly maritime transport policies; supporting clean-up operations and oil spill response training for local communities, beyond the specialized professional training, and afferent POM enforcements in ports and coastal areas.

*Note: oil spills and chemical pollutants constitute persistent threats to the Black Sea and its maritime transport corridors, as hundreds of oil tankers passing through every year. Accidental oil spills and illegal discharges of chemical pollutants pose severe risks to marine life and coastal communities. Oil spills smother marine organisms, destroy seabird populations, and contaminate fish stocks, making seafood unsafe for human consumption, with the example of Kerch Strait accident from 15<sup>th</sup> of December 2024.*

*Chemical pollutants, including heavy metals, pesticides, and industrial waste, accumulate in the food chain, affecting both marine species and human health. The MSFD's Descriptor 8 focuses on keeping pollution levels below harmful thresholds, while Descriptor 9 ensures that contaminants in fish and seafood remain within legal safety limits.*

- Plastic and Microplastic Pollution. The new training scheme may include the importance of management/remove plastic waste plastic, beach clean-up campaigns; implementation of the existent legislation banning single-use plastics; promotion of the recycling programs and encourage the use of biodegradable materials; and for civil society organisations - campaigns of raising awareness about plastic contamination of the marine environment, including microplastics in cosmetics and synthetic clothing.

*Note: plastic and microplastic constitute a hidden danger, plastic pollution is one of the most visible environmental problems in the Black Sea. Every year, thousands of tons of plastic waste—from bottles and fishing gear to microplastics—accumulate in the water and on beaches. Plastic debris entangles marine animals, while microplastics—tiny fragments that come from cosmetics, textiles, and degraded plastic items—are ingested by fish, entering the human food chain. Descriptor 10 of the MSFD calls for urgent action to reduce plastic waste and prevent marine litter from damaging coastal and marine ecosystems, including the areas of touristic beaches.*

- Noise Pollution. The training for preparedness against marine noise pollution would include speed restrictions and quieter ship engines in marine protected areas; supporting scientific studies on underwater noise impacts; awareness about how human activities affect marine mammals; policies for limiting noise pollution from offshore industries.

*Note: general public/people are unaware that noise pollution is a growing threat to the Black Sea's marine life. The existent programme for monitoring encompasses: Ships, offshore drilling, and underwater construction which create intense noise that disturbs marine mammals, particularly dolphins and porpoises, which rely on sound to navigate and communicate. Presentation on Descriptor 11 of the MSFD seeks was aimed to show the harmful noise levels to protect marine species from disorientation, stress, and even death caused by high-intensity sounds.*

**Topics from previous training(s)** on marine pollution response with target groups of national and local authorities' representatives, were done/prepared by NIMRD in relation National Plan of Contingency: [https://www.rmri.ro/EU\\_2850/EU2850RO.html](https://www.rmri.ro/EU_2850/EU2850RO.html) The topics can be considered for inclusion in the RESPONSE trainings framework, but need to be extended, revised and adapted to the needs of present professional target audiences. Additional Topics:

- monitoring of the Oil spills impacts and the coastal/ports waters by EO/modern techniques;
- monitoring-Modelling and protection of the marine environment in the Romanian Black Sea region.

**First set of issues: Existing trainings/courses and needs for new or additional programmes**

- What legal framework would be assimilated in relation with MP parameters of the significant impact on marine environment does your organisation monitor?
- With what frequency of the preparedness/response exercise carried out?
- What tools/techniques are used (sampling, remote methods, in situ measurements)?
- What data analysis methods are used?

### **Second set of issues: Need for new and additional training programmes**

- The training needs on emergency situations: organisation of proper exercised in various scenarios
- What should be include: new monitoring techniques/EO; analytical methods for contaminant analysis and data analysis methods/NEBA; pollution prevention strategies; rigorous development of the legal framework for marine environmental protection?
- Institutional framework's optimisation should undertake such training?

### **Stakeholders' responses**

The representatives of NIMRD, together with ABADL reviewed their monitoring function of bathing waters and marine waters sampling activities. Authorities/ANR and ISU presented some cases of necessity for preparedness and rapid intervention in case of MP. They noted that some of the exercises were reduced in frequency due to economic constraints – in Danube area since 2009.

Civil Society/Mare Nostrum NGO emphasized that the MSFD provides a framework for governments and environmental organizations to take action, but real change depends on public engagement. So, the need of a Call to Action for awareness on MP, considering that the Black Sea is at a critical turning point, is essential in the context of BS habitat destruction, and climate change threaten its rich biodiversity and the livelihoods of millions of people. The role of NGOs was considered as crucial one, in protecting the Black Sea by:

- Raising awareness about marine pollution and its impacts.
- Advocating for stronger environmental laws and enforcement.
- Promoting sustainable business and tourism.
- Participating in community clean-up efforts/especially for plastics.
- Encouraging research and innovation for pollution reduction.

Thus, principal discussion points and recommendations, engage the stakeholders in interactive discussions to identify key areas for improvement in training programs, and the findings were related to:

- Monitoring efforts vary across institutions, with no standardized training approach.
- The MSFD indicators (D2, D5, D8, D9, D10, D11) are not fully covered in existing training programs.
- Data on microplastics and eutrophication are limited, requiring improved assessment methods.

Also, the need for new and additional training programs was delineated by chairman together with professional and academia participants, especially discussing the need for updated training programs, covering modern monitoring techniques (ML/AI-driven remote sensing, automated data

collection), data analysis and management tools for marine pollution assessments and cross-institutional training initiatives to improve cooperation between governmental and non-governmental stakeholders.

Proposed topics for future training curricula, outlined based on discussions, were include the following training topics as priorities:

1. **Introduction to Marine Pollution Monitoring** – regulatory frameworks and key monitoring institutions.
2. **Sampling and Analytical Techniques** – methods for assessing oil spills, eutrophication, microplastics, and chemical pollutants.
3. **Use of Modern Technologies** – integration of Earth Observation (EO), numerical modeling, and drones for pollution tracking.
4. **Data Collection and Management** – ensuring standardized data-sharing protocols between agencies.
5. **Emergency Monitoring Response** – procedures for rapid environmental assessment following pollution incidents.

The session was completed with outlining the topics suggested by the speakers for their inclusion in several thematically organized training programmes. Thus, the following topics were approached: Challenges in marine environmental monitoring, (e.g. limited integration of advanced technologies (drones, real-time sensors, modelling of the contaminants propagation)); Fragmented data collection among different institutions, leading to inefficiencies in emergency response; and Lack of dedicated training for personnel involved in marine pollution monitoring and management, particularly for non-research institutions (port authorities, civil protection agencies).

### Part 2 – Response to pollution incidents/accidents

The second part of the workshop focused and reiterate on response mechanisms to marine pollution events, highlighting case studies and best practices, included in the National Contingency Plan

The specialist from NIMRD together with Romanian Naval Authority presented the current oil spill response framework, outlining responsibilities of different agencies, and several gaps were identified in cooperation between institutions, especially when dealing with non-oil pollutants (chemical spills, floating debris).

The Case Study of Kerch Strait, the last marine pollution incident in the Black Sea was analysed as a real-world example, involving the subsequent oil spill response, thus being a base for reviewing the crisis management strategies, including media handling, community involvement, and legal accountability. Several emerging issues in Marine Pollution and Pollution risks related to offshore oil and gas operations, together with its impact (including potential contamination from military activities/northern conflict) were approached from various perspectives.

Discussion points and recommendations incorporate: the response plans appropriate for all pollution types, the necessary equipment and trained personnel for rapid response for different institutions, and the new training programs to enhance pollution response capabilities.

Findings on the National Contingency Plan, primarily focused on oil spills, were outline the limited preparedness for chemical and plastic pollution incidents, thus the training on decision-support systems (DSS) associated with certain numerical/particle tracking modelling were considered to improve predictive response capabilities. Participants reiterate the legislative gaps related to the importance of periodicity of the joint exercises to improve coordination between institutions.

**Suggestion for topics** for future training Curricula were encompassing the following:

- Crisis Management and Emergency Response Protocols – steps to take in marine pollution emergencies.
- Tracking and Clean-Up Strategies – using EO, drones, and predictive modelling for rapid assessment.
- Case Studies on Marine Pollution Accidents – learning from real-world events.
- Multi-Stakeholder Coordination – training on cooperation between navy, port authorities, environmental agencies, and NGOs, according with an upgraded national legislation.
- Public Communication and Media Handling – managing information flow during pollution incidents.

### **Part 3 - Developing a Modern Training Curriculum for Marine Pollution Preparedness and Emergency Response**

Marine pollution remains a critical environmental challenge, especially in enclosed or semi-enclosed seas like the Black Sea, where pollution from oil spills, plastic waste, eutrophication, and other contaminants has long-term ecological and economic consequences. To address these issues, it is essential to establish a modern, adaptive, and technologically advanced training curriculum that enhances preparedness and emergency response capabilities.

In this session, the expansion and modernization of marine pollution (MP) training curricula was explored aiming to ensure that universities, emergency responders, and maritime professionals are equipped with the latest knowledge, tools, and response techniques.

**Discussion on training needs for marine pollution preparedness focused** on addressing the increasing frequency and complexity of marine pollution emergencies. This urgency is driven by rising shipping traffic and oil transport in the Black Sea, as well as the escalating impacts of climate change, which intensify extreme weather events and the spread of pollution.

To effectively prepare for these challenges, training curricula must be adapted and updated to include new monitoring and assessment methods (e.g., satellite tracking, remote sensing), in a cross-disciplinary approaches, integrating marine science, environmental policy, and emergency response, for real-time decision-making simulations for pollution incidents.

The international cooperation and joint response training should ensure aligned strategies across Black Sea nations, avoiding the shortcomings seen in the Kerch Strait incident.

Key discussion points included how training can be made more accessible and practical for maritime professionals, emergency response authorities, university students, NGOs and the general public.

#### **Delineation of Modern Tools for Short Training in Marine Pollution (MP)**

Training must incorporate innovative technologies improve marine pollution preparedness, such as:

- **Decision Support Systems (DSS)** – Real-time tools for assessing pollution spread and response options.
- **Earth Observation (EO) Technologies** – Using satellites and drones for oil spill and plastic pollution detection.
- **Numerical Modeling Software** – Predicting the movement of oil spills, contaminants, and algal blooms.
- **Virtual Reality (VR) & Augmented Reality (AR)** – Simulating pollution incidents for immersive training.
- **ML/AI-Based Predictive Analytics** – Forecasting marine pollution risks and optimizing response efforts.

**Example:** Simulation Exercises: Trainees use virtual control centers to manage an oil spill in a real-world scenario, deciding response strategies based on live environmental data.

Key discussion point were contain the discussion on certain modern tools to increase the effectiveness of marine pollution training programs.

**Delineation of proposals for University Curricula Extensions** – in order to prepare the next generation, integrating marine pollution response into higher education

Maritime and environmental science faculties (ANMB, UOC and UMC) must equip students with analytical and practical response skills. Therefore, key discussion point is the integration of the marine pollution training into existing university curricula with focus on environmental impacts. Such delineated curriculum extensions may include:

- **Marine Pollution Risk Assessment** – Understanding sources, impacts, and mitigation strategies.
- **Advanced Marine Monitoring Techniques** – Learning how to use sensors, satellites, and AI for pollution tracking.
- **Legal and Policy Frameworks** – Studying international marine pollution conventions and response protocols.
- **Hands-On Emergency Response Training** – Field exercises in oil spill containment, plastic cleanup, and eutrophication mitigation.

**Example:** Course addition related to Marine Pollution Response and Crisis Management (Training program of UOC) – A module integrating case studies, hands-on response exercises, and simulation training.

## CONCLUSION OF THE CO-CREATION PROCESS IN ROMANIA

The evolving marine pollution landscape in the Black Sea requires a modern and more comprehensive training approach that includes specific elements tailored to current challenges. A modernized curriculum will equip students, professionals, and responders with cutting-edge knowledge and tools, ensuring the practical, hands-on experience through simulations and field exercises, thus strengthen cross-border cooperation for more effective pollution response, and empowering civil society and local communities to play an active role in protecting the Black Sea.

## ROMANIAN CO-CREATION WORKSHOP SUMMARY

### Key discussion points were focused on:

- marine pollution in the Black Sea, its impact on biodiversity, ecology and conservation of marine ecosystems,
- type of pollutants/sources vs. type of impact (oil pollution, eutrophication, marine noise microplastics,
- pollution monitoring and assessment,
- national Maritime/Marine pollution policy and legislation,
- analysis of intervention methods and minimization of effects: tools, EO, modeling/EWS,
- case study: accident investigations and inquiries, the human element/conducting investigations and inquiries,
- expanding training programs in different categories of marine pollution.

### Existing training needs and monitoring challenges emphasize:

- Need for modern training tools in the field of Marine pollution (e.g. Decision Support Systems/DSS in case of emergency situations (oil spills plastic pollution, eutrophication) – EO, Modeling/EWS) and integration in training exercises.
- Limitations of university curricula to general training of technical faculties/navigation.
- Need for increased frequency of field exercises and strategically planning of future actions for marine pollution response at national level.

### Stakeholder recommendations and useful suggestions were:

- ❖ Strengthen capacity building in the present training schemes with the addition of modern technologies (EO/ aerial observation/drones, EWS).
- ❖ Expand exercises focused on rapid response preparedness under the National Contingency Plan, specifically for regional conflict-related pollution, including emerging pollutants.
- ❖ Extend the university curricula on pollution impact and short courses for existing professionals.
- ❖ Organize networking exercises and public awareness campaigns on marine pollution, including its spread during extreme weather events.

### Key outcomes highlighted by participants were:

- Need to enhance the periodicity of the stakeholder engagement in exercises of marine pollution response: e.g. organization of annual-based marine pollution response exercises (which include authorities, agencies, institutions from the civil sector, or even military).
- Importance of the practical scenarios and live exercises to improve professionals' preparedness in case of emergency.
- Legal framework extension in relation to Marine Pollution
- Enhance and expand interactive modular training programs for national and institutional networking, based on established syllabus.

## 1.4. National Co-Creation workshop in Ukraine

**Place:** Odesa, State Organization "Institute Of Market And Economic & Ecological Researches of the National Academy of Sciences of Ukraine", Frantsuzkyi boulevard, 29

**Date:** 07.02.2025

**Attendance:** The co-creation workshop was attended by almost 50 participants from the Odessa, Mykolaiv, and Kherson regions of Ukraine representing key stakeholders involved in marine pollution response: State Organization "Institute Of Market And Economic & Ecological Researches of the National Academy of Sciences of Ukraine", the Black Sea Branch of the Ukrainian Ecological Academy of Sciences, Department of Ecology and Natural Resources of the Odessa Regional State Administration, Department of Environmental Management of the Administration Board of the State Enterprise "Administration of Sea Ports of Ukraine", Department of Marine Environment of the Odessa Region, State Ecological Inspectorate of the South-Western District (Mykolaiv and Odessa Regions), Ukrainian Research Institute of Medical Rehabilitation and Resort Therapy of the Ministry of Health of Ukraine, Ukrainian scientific center of Ecology of Sea (UkrSCES), Institute of Climate-Oriented Agriculture of the NAAS of Ukraine, State Institution "Institute of Marine Biology of the National Academy of Sciences of Ukraine", Kherson State Maritime Academy, Odessa I.I. Mechnikov National University, Odessa National University of Technology, Institute of Artificial Intelligence and Robotics of Odessa Polytechnic National University, National Natural Park "Kuyalnytskyi". In addition, the event was attended by guest-speakers online (partners' speeches) - Black Sea NGO Network – BSNN, Bulgaria, Greens Movement of Georgia / Friends of the Earth - GMG/FoE, Georgia, NGOs and other maritime professionals, scientists, volunteers.

**Implemented by: Institute Of Market And Economic & Ecological Researches of the National Academy of Sciences of Ukraine (IMEER – NASU) & Black Sea Branch of the Ukrainian Ecological Academy of Sciences (BSB UEAS)**

### CURRENT STATE OF TRAINING PROGRAMMES IN UKRAINE

Preliminary interviews with members of state administrations, inspections other authorities, of scientific institutions, universities, other educational establishments, environmental organizations, and public authorities revealed that most institutions are not involved actively in the development of training materials, especially on marine pollution and emergency response and pollution mitigation, ecosystems recovery.

Some issues concerning the collection of materials about the training courses on marine pollution reactions are connected with martial law restrictions in Ukraine.

Preliminary studies and interviews revealed that specialized educational programs on marine pollution and littering have been offered at Odessa State Ecological University. But now Odessa State Ecological University is disbanded, and by decision of the Ministry of Education it was merged to the Odessa National University named after Mechnikov. The period of such transformation certainly poses a threat to the continued existence of these programs.

Kherson State Maritime Academy had similar programs. The Academy had specialized simulators (including oil spills, etc.). But because of the war, the Academy was relocated, and the research and study base that the Academy had was lost.

Only at the National University "Odessa Maritime Academy" there are 2 programs that meet international standards of IMO and the EU, but they are associated with routine work on board of merchant ships, for example, the application of the Marpol 73/78 convention, etc. Therefore, these are the programs of educational disciplines "Fundamentals of Ecology" for the specialty "Marine and Inland Water Transport" and "Fundamentals of Ecology and Environmental Protection" for the specialty "River and Sea Transport". However, in the preparation of these programs, the goal was not to counteract; to prevent or to respond on the sea pollutions and littering, their appearance was facilitated by the specifics of the educational institution itself. I.e. training courses on ecology are dedicated to marine ecosystems pollutions problems because the University (Odessa Maritime Academy), is specialized in maritime transport professionals preparing.

In other higher educational institutions, there are separate educational programs in classical ecology, but in the sphere of marine ecology, in aspects of marine pollution prevention, mitigation and rapid response they are practically absent.

As for state organizations, it should be noted that all of them are engaged in training and advanced training of personnel in emergency response to natural and man-made disasters (with a certain attitude to sea pollution), but this boils down to participation in separate training programs and seminars, and this does not happen systematically. This is done in accordance with existing plans for advanced training of specialists, but these bodies do not have internal specialized developed programs to eliminate marine pollution and littering.

It is possible to highlight positively in this matter the State Enterprise "Administration of Sea Ports of Ukraine," which in the meantime had partnerships with relevant organizations from different countries, e.g. with the United Arab Emirates, which, after carrying out joint tests, donated some samples of equipment for use. Thus, SE "Administration of Sea Ports of Ukraine" has opportunities for training and advanced training of personnel due to its financial capabilities, equipment acquisition capabilities and existing partnerships. At the same time, the main protocols for responding to emergencies at sea, according to the specifics of activities, are related to the obligation to ensure the proper condition of the port water area during the transportation of different types of cargoes. The main attention in this case is paid to the risks of oil and chemical pollutions. However, other pollutants remain outside of current plans and curricula, resulting in lost time and delays in decision-making when institutions face new challenges.

At the same time, modern threats of sea pollution under the influence of military aggression impede practical activities in the field of maritime navigation and reduce the ability of scientists to carry out practical monitoring of the state of water and biota of the Black Sea in the coastal waters of Ukraine. Relevant are the issues related to both, the security risks arising in the Black Sea basin, and the direct and indirect consequences of hostilities in this regard.

The main conclusion of the preliminary analysis of the training courses in the sphere of marine ecosystems pollution is as follows: there are no comprehensive programs that would consider the existing environmental challenges of the Black Sea, including military pollution, oil emissions, microplastics, eutrophication and other threats.

### **AIM OF THE WORKSHOP IN UKRAINE**

To design advanced training programs and curricula focused on marine pollution preparedness and emergency response in the Black Sea, addressing modern challenges such as military impacts and threats to marine ecosystems. These programs will support region-wide early warning mechanisms for monitoring both natural and man-made disasters. To engage key stakeholders to strengthen their capacity for continuous reorganization and modernization of training tools, through an interactive co-creation process, providing them the means to use modern equipment, innovative study methods, digitalization, and AI tools to ensure effective training outcomes.

### **PREPARATION PHASE**

Invitations sent to over 100 stakeholders in Odesa, Mykolaiyv, and Kherson. In addition, initial draft of the Curriculum and preliminary agenda were also sent to the stakeholders. Furthermore, personal communications were made. The focus was primarily on key stakeholders who possess a unique combination of attributes: of decision-makers involved in marine pollution response, administrations and agencies responsible for the state of the marine environment, emergency response and training for marine pollution response; research institutes and universities, training centers; associations of marine businesses, NGOs, volunteer groups. The best abilities to react on Black Sea disasters and to organize study process with cases and involving of real professionals, practitioners as trainers were preliminary demonstrated by the Administration of Sea Ports of Ukraine.

The pre-start discussion on topics for the co-creation workshop was organized with stakeholders who confirmed participation. The preliminary discussion of the Co-creation workshop topics was organized considering factors caused by pollution/litter in the Black Sea, its impact on biodiversity, ecology and conservation of marine ecosystems. A special accent was made on the resent accidents of oil-spills in the Kerch Strait, accidents of the Kahovska HPP and on military pollution impact on Black Sea ecosystems.

The most active stakeholders, previously engaged through Task 1.2 and stakeholder interviews, played a key role in the Co-creation Workshop. Two representatives from universities and scientific organizations moderated discussions: one on the impact of pollution and litter on Black Sea biodiversity and marine ecosystems (Session II), and another on expanding curricula to address various aspects of marine pollution (Session III), highlighting the active participation of stakeholders from diverse backgrounds in shaping the training approach.

The planning and preparation phase have taken about two months.

### **WORKSHOP PROCEEDINGS – A REVIEW**

The notes below cover the progress of the workshop following the agenda of the Co-creation event in Ukraine, Odesa.

1. Opening of the workshop and review of RESPONSE. The discussion focused on the new challenges to the Black Sea marine ecosystems in the training programmes. The review was organized by the teams of State Organization "Institute Of Market And Economic & Ecological Researches of the

National Academy of Sciences of Ukraine" and of the Black Sea Branch of the Ukrainian Ecological Academy of Sciences.

2. The discussion focused on environmental challenges in the Black Sea, including military pollution, oil emissions, microplastics, and eutrophication emphasizing their integration into training programs. It also included best practices for how authorities and organizations can collaborate with volunteers to ensure a rapid response to marine pollution. Emphasis was placed on the importance of appropriate training programs to enhance readiness for quick and effective action.

3. The interactive co-creation of training programs for training specialists in responding to Black Sea environmental disasters was organized. The stakeholders' opinions concerning the improving of the training courses were collected (structure, content, topics, study methods, challenges and aspects, economic and funding support, etc.).

### **Part 1 - Presentation of the RESPONSE project's national goals and objectives, along with an analysis of existing marine pollution response training programs in Ukraine**

The first part included presentations of the Response project aim, goals and the main achievements. It was organized the discussions related to monitoring of existing training programs in the sphere of forming readiness to react on marine pollution.

- *Presentation* by IMEER – NASU representative of the goals and objectives of RESPONSE at the national level focusing on building readiness for rapid response to pollution (litter) of marine ecosystems, considering modern challenges and security threats for the countries of the Black Sea basin.

The aspects of the use of the modern tools and methods in the study process were represented and discussed. It was emphasized that there is urgent necessity to improve the training programs in order to meet modern requirements to training courses and to correspond with military actions influence challenges. *State Organization* "Institute of Market and Economic & Ecological Researches of the NAS of Ukraine" now represents Southern Scientific Centre of the NAS of Ukraine and of the MES of Ukraine and coordinates, the activities of Southern Scientific Centre on Artificial Intelligence study. In this aspect it was proposed to **use AI tools in marine pollutions studying**, forecasting and mitigation. Such tools and methods are to be included in the training courses. The coordination, advisory provision for the use of **AI** in the training courses it was proposed to perform to Southern Scientific Centre on Artificial Intelligence study of the NAS of Ukraine and of the MES of Ukraine.

- *Presentation* by BSB UEAS representative of the prospects of Ukraine's chairmanship of the Common Maritime Agenda regarding the development of shipping, fishing and aquaculture in the Black Sea. The importance of incorporating the Common Maritime Agenda into RESPONSE training courses was highlighted, particularly in the context of the impact of military aggression on marine ecosystems.

- *Presentation* by a corresponding member of the NAS of Ukraine of the institutional framework for responding to pollution/litter in the Black Sea in the context of modern challenges and threats.

#### **Suggestion for topics** in the new training curriculum:

The aspects of improving of the training courses were considered in the contest of identification of sources of pollution/littering of the Black Sea according to the modern challenges of war. *Note: According to NOAA sources, approximately 1.4 billion pounds of garbage per year enters the*

world's oceans. Major components include floating consumer plastic items (including plastic bottles and caps, cigarette butts and lighters, and plastic bags), and these materials disintegrate very slowly, if at all. Other materials include metals, rubber, paper, textiles, building materials and glass. Currently, the amount of garbage in the Black Sea is 90 units per 1 km<sup>2</sup>. That is twice as many as in the Mediterranean. Unfortunately, this trend is negative, because every hour in the Black Sea with large rivers brings from 6 to 50 elements of garbage. The amount of garbage in the Black Sea is growing.

In this context, it was proposed that the training courses address the **following sources** of marine pollution:

- Municipal effluents and solid household waste (household chemicals, antibiotics, biocides, flame retardants, plasticizers, etc.)
- Industrial effluents
- Agriculture (pesticides, pharmaceuticals)
- Ports and sea transport (oil, protective coating of ships)
- Remnants of hostilities

The current legal framework in the country for the protection/preservation of natural resource potential and the prevention of pollution/clogging of the Black Sea has a long history and is formed at different levels of management. It can be considered in the following categories that are recommended to consider in the training courses:

- International documents in the field of environmental protection activities for the elimination of marine pollution/clogging
- Documents defining norms and rules of environmental activity in general in Ukraine
- Documents defining the regulation of legal relations for the conservation of water and marine resources
- Documents related to marine pollution/blockage elimination
- Documents on calculation of damage caused to the marine environment

The list of basic legal acts defining legal relations for the conservation of water and marine resources, as well as special rules for the use of water resources, their rational use and environmental protection, is quite extensive. Legal documents approximate or comply with international standards in the field of environmental pollution prevention, namely:

- International and national institutional framework for responding to Black Sea pollution/clogging
- "Convention on the Protection of the Black Sea from Pollution" (Post. VRU dated 04.02.1994 № 3939)
- "Water Code of Ukraine" (Post. VRU dated 06/06/1995 № 214/95)
- "Rules for the Protection of Inland Sea Waters and Territorial Sea from Pollution and Clogging" (Post. CMU of 29.02.1996 № 269)

- Procedure for interaction between the State Enterprise "Administration of Seaports of Ukraine" and the State Environmental Inspectorate for Ensuring Compliance with the Legislation on the Protection of NPS in the Event of Cases of Discharge by Vessels (Watercraft) of Pollutants within the Seaport Water Area (Post. CMU dated 17.07.2019 No. 670)
- "Procedure for inspection, water sampling and analysis" (Post. CMU of 21.08.2019 № 828)
- Oil Pollution Damage Calculation Methodology (Post. CMU of 26.04.2003 № 631)
- "On approval of dachshunds for calculating the amount of compensation for losses caused by enterprises, institutions, organizations and citizens of Ukraine, foreign legal entities and citizens as a result of pollution from ships, ships and other floating means of territorial and inland sea waters of Ukraine" (Post. CMU of 03.07.1995 No. 484)
- "Marine Environmental Strategy of Ukraine"(Rosp. CMU 11.10.2021 No. 1240-p)
- "On approval of dachshunds for calculating the amount of damage caused by violation of the legislation on fisheries as a result of illegal extraction (catch), destruction or damage to aquatic biological resources, as well as illegal destruction or deterioration of the habitat of aquatic biological resources" (Post. CMU of 29.09.2023 № 1042)
- Industry regulatory documents

It was also recommended to include in the training programs the regulatory acts of:

- Ministry of Transport of Ukraine:
  - "Rules for the control of ships in order to ensure the safety of navigation" (Order of 17.07.2003 № 545)
- Ministry of natural resources of Ukraine:
  - "Methodology for calculating the amount of compensation for damage caused to the state as a result of violation of legislation on the protection and rational use of water resources" (Order of 20.07.2009 № 389)
  - "Procedure for calculating the amount of compensation and payment of damages caused as a result of pollution from ships, ships and other floating means of territorial and internal sea waters of Ukraine" (Order of 16.01.2021 № 16)
  - "Methodology for determining the damage caused by pollution and/or clogging of water, unauthorized use of water resources" (Order of 21.07.2022 № 252)
  - "Methodology for determining the damage and damage caused to the territories and objects of the nature reserve fund as a result of the armed aggression of the Russian Federation" (Order of 13.10.2022 № 424)
  - "Methodology for determining the damage caused to the environment within the territorial sea, the exclusive sea (economic) zone and the internal sea waters of Ukraine in the Azov and Black Seas" (Order of 19.08.2022 №309)

The main goals and objectives defined in regulatory acts that are recommended to be considered in the training programs include:

- Prevention of degradation of marine ecosystems, in particular by minimizing marine pollution by hazardous substances, in particular oil and others.
- The introduction of administrative and economic mechanisms to reduce pollution, in accordance with the principle of "polluter pays."
- Establishing appropriate requirements for various activities, such as the construction of hydraulic structures or drilling operations, in order to prevent pollution of sea waters.
- Define procedures for detecting and responding to pollutant discharges by vessels within port waters and vessel locations.
- Control and provision of immediate response in case of contamination detection, inspection and recording of violations, as well as taking measures to preserve evidence of contamination.
- Establishing responsibility for violation of environmental legislation.

A separate group of normative legal acts is the Orders of the Ministry of Finance of Ukraine regarding the determination and calculation of the amount of damages:

- for contamination with hazardous substances, in particular oil;
- for damage to aquatic biological resources, including fishery water bodies, the continental shelf and the exclusive economic zone;
- for pollution from ships, ships and other floating means of territorial and internal sea waters of Ukraine.

Recently, Ukraine has adopted methods for assessing environmental damage to its nature reserves and exclusive economic zone in the Azov and Black Seas resulting from Russia's armed aggression. This institutional framework addresses key issues related to the protection and preservation of the marine environment, as well as the remediation of pollution in these regions. When properly implemented, it has the potential to fulfill effectively its intended objectives.

- *Presentation* by a PhD expert of best practices on stakeholder interaction, building preparedness to respond to pollution/litter of the marine environment in Ukraine and the Black Sea basin countries.

*Note: As of today, Ukraine is a party to the relevant conventions and national legislation governing legal relations and interactions in the Black Sea basin, in particular:*

- MARPOL-MARPOL/78;
- Bucharest Convention on the Protection of the Black Sea from Pollution 1992;
- Codex of merchant shipping of Ukraine;
- The Law of Ukraine "On Environmental Protection";
- The Law of Ukraine "On Seaports";
- "Maritime Strategy of Ukraine until 2030" and others.

*The procedure for interaction of stakeholders in the issue of detection and elimination of marine pollution is established by the Resolution of the Cabinet of Ministers of Ukraine No. 670 of 17.07.2019.*

At the same time, approved Oil Spill Response Plans (OSR) are available in seaport waters, which are an appropriate algorithm for the actions of institutions and organizations.

At the same time, there are certain problems in the implementation of measures to detect and eliminate pollution, in particular, the relevant seaport services have the authority to act exclusively in the waters of seaports. The Marine Emergency and Rescue Service (MARS), which was responsible for performing these actions outside the waters of ports and in the open sea more than 10 years ago, was liquidated.

A separate problematic issue is the use of single-hull tankers in the Black Sea basin for the transportation of heavy petroleum products (fuel oil). Rule 20 of Annex 1 of the Convention MARPOL-73/78 establishes that from 01.01.2011 it is prohibited to use vessels for the transport of heavy petroleum products with one hull, only two-hull vessels.

Nevertheless, the facts of exemption from the convention requirements (exclusion from the convention for a certain period) of such vessels by the Russian Federation have been established, which led to massive pollution of the marine environment with petroleum products as a result of the accident of two tankers in the Kerch area.

The most important issue is the pollution of the Black Sea because of the armed aggression of the Russian Federation towards Ukraine and the conduct of hostilities in the Black Sea. Unfortunately, taking into account the mine danger, today it is impossible to calculate the economic damage to water resources, but the "natural" harm is unlimited and requires direct legislative and, as it should, economic regulation at the level of all countries of the Black Sea basin.

**Suggestion for topics** in the new training curriculum:

- Interaction of stakeholders to enhance their readiness to respond to marine pollution and debris in Ukraine and the Black Sea Basin Countries. *Note: Stakeholders in this matter are public authorities, business entities, supervisory/control bodies, the public.*
- pollution prevention cases and protocols;
- restoration of the marine environment (including monitoring of the aquatic environment, detection of pollution, elimination of pollution, restoration of the environment with the involvement of the best scientific world practices);
- preservation of the natural environment (including state and public control, establishment of agreed standards for the use of natural resources at the state level, inevitability of punishment for damage caused to the environment);
- include methods for evaluating damage to marine ecosystems caused by armed conflicts in the training programs.
- add interactive modules to the training programs focused on best practices for responding to marine pollution resulting from armed aggression or severe violations of maritime activity regulations related to economic activities.

During the discussions, it was also recommended to amend the Bucharest Convention by adding a separate protocol that addresses the environmental impact of armed aggression cause by Russian Federation (the so-called military impact on the environment or military pollution).

## **Part 2 – Incorporating in the training programs the factors contributing to pollution/litter in the Black Sea, their impact on biodiversity, ecology and the conservation of marine ecosystems**

Key topics discussed in this session as essential for inclusion in the new training curriculum:

- Pollutants/sources types and impacts (oil pollution, militarized pollution, eutrophication, marine noise, microplastics / MSFD Descriptors).
- Monitoring and assessment of pollution of marine ecosystems.
- Modern problems of marine pollution under the influence of military aggression.
- Marine pollution policy and legislation.
- Pollution Risks During Offshore Oil and Gas Operations. Oil Spill Response: Tracking/Cleanup Strategies, Including Environmental Crisis Management Strategies, Public and Media Engagement.
- Scientific and practical aspects of protecting marine waters from pollution in the context of shipping and port activities.
- Pollution management and mitigation (scientific, methodological, and practical aspects of management).
- Methods for intervention and minimization of negative impacts: tools, modeling/EWS.
- Training needs, practical examples of response, research, and response: investigation, emergency survey, human factors.

A vivid debate emerged when discussing current issues stemming from both for the security risks arising in the Black Sea basin area, as well as the direct and indirect consequences of hostilities in this regard. Modern threats of marine pollution under the influence of military aggression hinder practical activities in the field of marine navigation and reduce the ability of scientists to practically monitor the state of water and biota in the Black Sea in the coastal waters of Ukraine.

The participants of the co-creation workshop discussed the need to create a single information platform for monitoring pollution and coordinating actions in the realm of marine ecology. The concept of integrating innovative technologies into the process of training future specialists was also presented.

All the participants emphasized on issues with data collection about marine pollution during the hostilities. It was proposed to include the topic about alternative methods for data collection into the training courses. Indirect methods for such a data collection were discussed and prospects of use of innovative technical devices for pollution level monitoring in the Black Sea ecosystems were considered. E.g. it was proposed to use mobile devices on vessels in order to make permanent registration of the sea-water quality and detecting of new pollutions, registering dynamics of pollutions spreading (diffusion) that would result in improved protocols of the marine pollution response and prevention.

A suggestion was made by the representative of the Odesa State Ecological University to include in the training course the support for volunteers who are ready to assist in marine pollution mitigation and rescue operations. After a thorough discussion, it was decided that special training courses for

volunteers should be organized with the support of municipal authorities, the State Ecological Inspectorate, and other relevant stakeholders with the necessary capabilities.

### **Part 3 - Improving marine pollution response preparedness - Discussions curriculum extensions on various aspects of marine pollution**

- *Presentation* by BSB UEAS representative of an example of a proposed training curriculum (educational program) on building readiness for rapid response to pollution of marine ecosystems, in the context of modern challenges and security threats for the countries of the Black Sea basin. A list of suggestions was presented for improving the training courses curriculum according to the preliminary research of the stakeholders' needs in Ukraine (the finalized list of suggestions is provided in conclusions of this report).

- *Presentation* by IMEER – NASU representative on the topic of Enhancing Marine Research Infrastructures in Ukraine: Perspectives and Recommendations. It was highlighted the Ukraine's efforts in integrating into European marine research initiatives. The prospects and possibilities of utilizing research infrastructures to improve scientific and study processes were suggested as topics to be included in the new training courses. It was emphasized the importance of using research infrastructures (RIs) as defined by EU Regulation No. 1291/2013, underscoring their role in fostering innovation and scientific progress.

Special attention is given to Ukraine's involvement in **EMSO ERIC** and **JERICO-RI**, two key European marine observation networks. The strategic vision for a **National Research Consortium on Blue Economy (UKRMARI)** is also outlined, focusing on sustainable marine research, fisheries revitalization, offshore resource extraction, and maritime transport development.

Key Achievements:

- Engagement with EMSO and JERICO-RI representatives to discuss Ukraine's integration.
- Ongoing negotiations for a Memorandum of Understanding (MoU) between EMSO and the Institute of Market and Economic & Ecological Researches (IMEER-NASU).
- Coordination efforts to include Ukraine in the **ESFRI 2025 Roadmap**, strengthening the country's position in European research collaborations.

#### **Proposed improvements to the proposed Training Curriculum:**

After reviewing the proposed **training curriculum outline**, it is evident that while the modules comprehensively cover pollution response strategies, there is limited integration into research infrastructures as a key component. Given Ukraine's commitment to strengthening its marine research capabilities, the following recommendations are suggested for improving the curriculum:

Integration of research infrastructures in pollution monitoring:

- Introduce dedicated modules on how RIs such as JERICO-RI and EMSO ERIC contribute to marine pollution monitoring;
- Provide case studies demonstrating the use of observational platforms for real-time tracking of environmental changes;
- Include joint training sessions with European research institutions to align Ukraine's capacity with EU standards

By incorporating these elements, the training program will better reflect Ukraine's evolving role in European marine research and strengthen its ability to contribute to the sustainability and protection of the Black Sea ecosystem.

- *Presentation* by a PhD expert on the assessment of success factors and obstacles in the processes of training for operational readiness to respond to marine ecosystem pollution.

*Note: By generalizing the comparison of success factors and barriers among the countries of the Black Sea Basin involved in the RESPONSE project, namely Bulgaria, Georgia, Romania, and Ukraine, it can be concluded that there are common features in the success factors and barriers related to building capacity to respond to maritime disasters and accidents, marine pollution, and environmental management. Participation in various international initiatives and projects such as DOORS and BRIDGE related to response to maritime disasters and accidents, marine pollution and environmental management has facilitated knowledge exchange and capacity building. This cooperation allows sharing of knowledge on advanced methodologies, best practices and necessary resources to national stakeholders that can contribute to the development of effective training plans and curricula. Previous training programs and curricula have, to some extent, improved the readiness of various institutions and individuals to respond to marine pollution incidents. Regular drills and exercises have established a solid foundation of practical skills and knowledge, especially in relation to oil spillovers.*

*Prospective for a further capacity building in successful response to marine pollution, disasters and accidents in the Black Sea basin are connected with elimination of numerous barriers and obstacles for success of marine pollution mitigation and readiness to respond to maritime disasters and accidents, marine pollution. Therefore, it is essential to implement measures to further enhance the current state of affairs in this matter. One of the main opportunities includes creation of networks for data-exchange, knowledge dissemination and digitalization in order to increase training programs capacity. Improved coordination and standardization of training programs and curricula across various institutions are necessary to enhance the consistency and effectiveness of these programs through a unified approach. The solution to the problem of ensuring consistency and standardization across institutions could be achieved through the designation of a national coordination body to oversee marine pollution training programs and curricula.*

*Numerous institutions are deficient in essential resources, such as advanced equipment and sufficient funding, to conduct comprehensive training programs. Some countries need research vessel capability (as pertain to Georgia and Ukraine). Overcoming these resource limitations is crucial for enhancing training quality. Continuous revision of training materials is imperative to remain abreast of scientific and technological advancements. Prioritization should be given to the incorporation of modern tools, such as eDNA and advanced modelling systems, as well as the provision of state-of-the-art equipment and capabilities.*

*In order to increase the frequency and scope of field training and real-life simulations, and to provide participants with practical experience, it is necessary to secure additional funding from national and international sources to support training programs. Investment in advanced equipment and facilities will enhance training quality and strengthen capacity building to respond to maritime disasters and accidents, marine pollution, and environmental management.*

*The activeness and success of marine pollution mitigation and readiness trainings in Ukraine, as a country currently engaged in conflict since February 2022, depend on many factors. However, the*

main influence is caused by military actions and environmental instability in this regard. The success of preparedness, similar to other countries in the Black Sea Basin, depends on governmental support and international collaboration.

**Discussions and suggestion for topics** in the new training curriculum:

- Discussion of key areas and priorities for improving educational (training) programs.
- Presentation of modern training tools in the field of combating marine pollution in the implementation of professional activities (shipping, port activities, tourism, fishing, etc.).
- Proposals for curricula/templates for expanding the curricula of HEIs, professional organizations.
- Proposals for updating training programs taking into account the experience of emergency situations (militaristic pollution, oil spills, chemical emissions, plastic pollution, eutrophication, etc.).
- Incorporation of exercises on modeling situations for responding to marine ecosystem pollution.
- Planning joint field exercises, future actions in the field of prevention and rapid response to pollution of the Black Sea.

One of the general outcomes of the 3<sup>rd</sup> Session of the event is represented by the idea of co-created clusters of modules for education and training programs divided by focus groups, namely: 1) students; 2) representatives of controlling bodies at the state, regional or municipal level; 3) environmentally conscious population.

## **CONCLUSION OF THE CO-CREATION PROCESS IN UKRAINE - FURTHER CO-CREATION SUGGESTIONS AND DISCUSSION**

The project team and the stakeholders discussed and agreed on the following conclusions from the Co-creation workshop concerning the training courses improvement:

1. The need to create a single information platform for monitoring pollution and coordinating actions in the realm of marine ecology.
2. The concept of integrating innovative technologies into the process of training future specialists should be put into practice.
3. Incorporating field training, case studies, and the involvement of real professionals and practitioners in the training process. Additionally, the economic aspects of implementing training courses should be considered to ensure financial support for professionals and practitioners who participate as lecturers.
4. The co-creation of clusters of modules for education and training programs should be divided by focus groups, namely: 1) students; 2) representatives of controlling bodies at the state, regional or municipal level; 3) environmentally conscious population
5. The training programs should be designed especially for:
  - Universities studying process

- Rapid training courses (duration 1-2 weeks)

The training courses for universities should meet all the requirements of high education quality assurance.

6. Breakdown of the general training program into at least four sub-programs\_aimed directly at each target group of stakeholders. It was proposed to define the following types of applications:

- advanced training courses for specialists working in this industry, as well as for representatives of local governments and politicians ("decision makers")
- microcredit programs that allow a specialist from another field to gain competencies that make it possible after the successful completion to work in this field
- training courses for Universities and Scientific Institutions
- general awareness programs for the population and volunteers

7. Some modules that are dedicated to the most frequently encountered types of pollution should be extended (e.g. oil spills and disasters with chemical cargoes on the Black Sea)

8. The use of AI in modelling processes, such as forecasting pollution scenarios, should be emphasized in the training course, along with the inclusion of interactive modules on institutional support.

9. The incorporation of the public and volunteers as a key stakeholder group in the training, as many volunteers require training and knowledge on how to assist effectively authorities in disaster and pollution mitigation efforts. Their involvement has the potential to enhance greatly pollution response capabilities.

10. A clear definition of the competencies that each module of the program develops is essential, with one competency per module being considered sufficient. At the Co-creation workshop, it was stated that significant work has been done to analyze the existing training programs in this field. And the program being developed is aimed at eliminating the identified gaps in competencies that are required. With this approach, the logical sequences becomes clear: "Identified competencies that are not considered in existing programs → a list of training modules that form these competencies → an analysis of what competencies are needed for individual target groups → create training programs for these groups of stakeholders"

11. Incorporation of the module "Involvement of the population and volunteer organizations to eliminate the consequences of emergencies in coastal areas"

12. Incorporation of the module "Response to Pollution and littering caused by military actions", along with a special session titled "Pollution and littering resulting from military aggression", which will cover topics such as:

- Types and scale of pollution and blockages of the marine environment because of military aggression.
- Methods, protocols, measures to prevent and respond to pollution and littering because of military aggression.
- Features of practical measurements of impact and calculation of damage to marine ecosystems.

- Examples of responses (such as Kakhovska HPP, Kerch Strait fuel oil spill and others) and the use of training equipment and simulators in practice.

## UKRAINIAN CO-CREATION WORKSHOP SUMMARY

### Key discussion points were focused on:

- Military Pollution: Ongoing conflict raises new risks (mines, sunken military debris).
- The need to create a single information platform for monitoring pollution and coordinating actions in the realm of marine ecology

### Existing training gaps and monitoring challenges:

- Restricted access to certain coastal areas.
- Less capacity for in-situ sampling.

### Stakeholder recommendations:

- ❖ Proposals to divide training content by audience group: (1) students, (2) state/regional controlling bodies, (3) environmentally conscious citizens.
- ❖ The training programs should be designed especially for Universities studying process
- ❖ The training courses for universities should meet all the requirements of high education quality assurance
- ❖ Rapid training courses (duration 1-2 weeks)

### Key outcomes highlighted by participants:

- Single information platform for pollution monitoring,
- More field training and case studies,
- Integration of innovative technologies.
- Involvement of real professionals and practitioners to the study process, with emphasis on field training and case studies.

## 2. The Regional Co-Creation Workshops

**Place:** National Institute for marine Research and Development “Grigore Antipa” (NIMRD) at its conference hall situated at 300 Mamaia Blvd, Constanta

**Date:** 24 & 25.02.2025

**Attendance:** The co-creation workshop was attended by 43 participants (35 physical presence and 8 online) from BS Commission, AUTH (Greece), BSNN (Bulgaria), IMEER NAS and BSB of the UEAS (Ukraine), GMG/FoE (Georgia), Hidromod (Portugal), NIMRD Constanta (Romania) and different authorities representing key stakeholders from the RESPONSE perspective: Naval Academy “Mircea cel Batran”, Dobrogea-Litoral Water Basin Administration (ABADL), Romanian Agency for Saving Human Life at Sea (ARSVOM), General Association of Engineers of Romania (AGIR), Romanian Naval Authority (RNA/ANR), Chamber of Commerce, Industry and Navigation, Mare Nostrum NGO, National Company Constanta Seaports Administration (CN A.P.M.C. SA), Emergency Situation Inspectorate (MAI/ISU), Coast Guard (MAI/GC).

**Implemented by:** National Institute for marine Research and Development “Grigore Antipa” (NIMRD)

### AIM OF THE REGIONAL WORKSHOP IN ROMANIA

To synthesize conclusions from national workshops and integrate them into a coordinated transnational training framework for marine pollution preparedness and response. To foster collaboration among Black Sea countries by aligning national strategies, sharing best practices, and enhancing co-creation efforts at a regional level. To incorporate technological innovations and policy frameworks into training programs, ensuring a comprehensive and adaptive approach to marine pollution response.

### THE WORKSHOP PROGRESS – A REVIEW

Benefiting from the experience gained in the four national co-creation workshops, a regional co-creation workshop was organized at NIMRD, Constanța, Romania. The event aimed to consolidate key conclusions, recommendations, and critical insights from stakeholders in Bulgaria, Ukraine, Georgia, and Romania, ensuring a coordinated and comprehensive approach to marine pollution preparedness and response training across the Black Sea region.

The workshop commenced with welcome addresses from regional authorities and the Black Sea Commission's Permanent Technical Secretariat. A comprehensive overview of the RESPONSE project was provided, highlighting its role in strengthening marine pollution preparedness and response training at a regional level while fostering transnational cooperation. A representative from the Black Sea Commission then outlined the policy framework and key challenges related to marine pollution. This was followed by presentations from RESPONSE team members, who shared findings from their national workshops, focusing on existing training programs, identified gaps, and stakeholder needs.

A key focus of the workshop was on scientific and technological advancements in marine pollution response. Experts from NIMRD presented innovations in modeling and Earth Observation for oil spill response, while a specialist in modeling and IT methodologies introduced digital training tools and decision support systems. An interactive discussion allowed stakeholders to contribute insights on refining training curricula, integrating modern technologies, and enhancing cross-agency collaboration. A set of actionable recommendations was introduced to strengthen preparedness efforts through advanced training programs tailored to stakeholders' needs and to establish a more cohesive regional strategy for marine pollution response.

The final session of the regional co-creation workshop focused on refining and finalizing the training curriculum framework for marine pollution preparedness and response. A summary of the curriculum development process was presented, highlighting the key components, learning objectives, and the integration of stakeholder insights gathered throughout the national and regional workshops. Participants engaged in discussions to provide feedback on the proposed training modules, ensuring they addressed real-world challenges and aligned with policy and operational needs. The refinement process emphasized the inclusion of innovative methodologies, digital tools, and cross-agency collaboration strategies. The session concluded with a roadmap detailing the next steps, including final refinements to the curriculum, stakeholder engagement in the upcoming phases of RESPONSE (e.g. the implementation of pilot training courses), and future initiatives aimed at enhancing training effectiveness and strengthening regional cooperation.

## KEY DISCUSSIONS AND FINDINGS ACTIVITIES

### Stakeholder Needs and Curriculum Focus Areas

During the regional co-creation workshop, stakeholders emphasized once more the need for modular, practical, and adaptable training. Therefore, the curriculum should address:

- **Pollution Sources and Impacts** – Oil spills, hazardous substances, Eutrophication marine litter.
- **Preparedness and Response Strategies** – National contingency plans, risk assessment, decision-making.
- **Technological Innovations** – Digital monitoring tools, remote sensing, modelling and AI applications/EWS.
- **Policy and Governance** – MARPOL, Bucharest Convention, EU Directives.
- **Practical Training and Exercises** – Fieldwork, case studies, real-time response simulations.

### Integration of Scientific and Digital Tools

Stakeholders emphasized the importance of incorporating innovative and cutting-edge methodologies for marine pollution monitoring, early warning, and mitigation. Key areas identified included:

- **Modeling and Earth Observation** – Leveraging real-time pollution tracking to enhance decision-making.
- **Digital Training Platforms** – Implementing online learning modules and interactive simulations to support remote training.
- **Monitoring and Early Warning Systems** – Utilizing satellite data and remote sensing technologies for real-time pollution detection and response.

## Best Practices and Collaboration Models

Throughout the regional co-creation workshop, best practices, success stories, and innovative approaches were highlighted, fostering collaboration, synergies, and networking among regional stakeholders and at the international level. Key takeaways from the discussions included:

- **Lessons from Other Black Sea Countries** – A comparative analysis of national training frameworks to identify strengths and areas for improvement.
- **Synergies with EU and Regional Projects** – Integration with projects such as Black Sea SIERRA, BS-SEOS, NEMO Tools, and DOORS to enhance training and research efforts.
- **Public-Private Partnerships** – Strengthening industry collaboration to support resource sharing and improve training programs.

## TRAINING CURRICULUM FRAMEWORK

Based on stakeholder input, the following **curriculum structure** was outlined:

- ❖ **Module 1:** Introduction to Marine Pollution (Types, Sources, Black Sea Context)
- ❖ **Module 2:** Policy and Governance (International and National Legal Frameworks)
- ❖ **Module 3:** Monitoring and Assessment (Remote Sensing, Data Access/Analysis, Data Modeling/Early Warning Systems)
- ❖ **Module 4:** Pollution Management and Response (Techniques, Risk Reduction, Cleanup Strategies)
- ❖ **Module 5:** Preparedness Planning (National Plans, Simulations, Training Exercises)
- ❖ **Module 6:** Digital Tools and Innovation (Interactive training modules on friendly webpage/IT Portals, Modeling, Decision Support Systems, ML and AI)
- ❖ **Module 7:** Community Engagement and Public Awareness (Citizen Science, Media Relations)

Each module will be **customized for different stakeholder groups**. Indicatively:

- **Decision-Makers and Emergency Responders**
- **Academia and Technical Universities Students**
- **General public and volunteers**

## REGIONAL CO-CREATION WORKSHOP OUTCOMES AND NEXT STEPS

### Key Workshop Outcomes

- **Defined Training Modules** – Drafted curriculum framework for marine pollution response.
- **Integrated Stakeholder Input** – Co-created content with decision-makers, academia, industry.
- **Strengthened Regional Cooperation** – Facilitated networking among Black Sea countries.
- **Identified Best Practices and Gaps** – Benchmarking national training approaches.
- **Established Digital Learning Pathways** – Planned integration of e-learning toolkit/IT platforms.

### Next Steps (2025-2026)

- **Finalize Curriculum Design and Training Materials** (March-May 2025).
- **Pilot Training Sessions** – Testing curriculum in selected Black Sea countries (June-Dec 2025).
- **Launch Online Learning Modules** (Early 2026).

- **Monitoring and Evaluation of Training Impact** (2026 and beyond).

## REGIONAL CO-CREATION WORKSHOP CONCLUSIONS

The regional co-creation workshop served as a crucial step in consolidating insights from the national co-creation workshops and translating them into structured, stakeholder-driven training curriculum for marine pollution preparedness and response. The event reinforced the importance of a coordinated approach among Black Sea countries, emphasizing the need for standardized yet adaptable training modules that reflect real-world challenges, technological advancements, and policy frameworks.

### Key Takeaways:

1. **Holistic Curriculum Development** – The proposed training curriculum incorporates scientific, technological, and policy-driven components, ensuring a comprehensive learning experience for various stakeholder groups, including decision-makers, emergency responders, academia, and the general public.
2. **Integration of Cutting-Edge Technologies** – The emphasis on modeling, Earth Observation, digital training tools, and AI-driven decision support systems highlights the role of technological innovation in enhancing marine pollution response strategies.
3. **Stakeholder-Driven Approach** – The co-creation process facilitated direct input from regional authorities, academia, industry, and civil society, ensuring that the curriculum aligns with practical needs and regulatory frameworks.
4. **Strengthened Regional Cooperation** – The workshop fostered collaboration and synergy among Black Sea nations, encouraging knowledge-sharing, cross-border partnerships, and alignment with EU and international initiatives.
5. **Sustainability and Implementation** – Clear next steps were outlined, including finalizing the curriculum, piloting training sessions, and integrating digital learning platforms. Long-term impact monitoring and evaluation mechanisms will ensure the training remains effective and adaptable to emerging challenges.
6. **Commitment to Continuous Development** – Stakeholders reaffirmed their engagement in ongoing curriculum development and training implementation, strengthening marine pollution response capacities in the region. As a bridge for continued collaboration, the next phase of WP2 will focus on testing, refining and deploying training modules, and ensuring long-term knowledge transfer and capacity building across Black Sea countries.

Overall, the workshop marked a significant milestone in building a robust and sustainable marine pollution preparedness and response framework, leveraging collective expertise and innovative solutions to address environmental threats in the Black Sea region.

### 3. Participant Feedback and Testimonials

A critical aspect of the national and regional co-creation workshops under the RESPONSE Project was gathering stakeholder feedback to ensure the training curriculum aligns with real-world needs and expectations. Participants provided valuable insights into the content, structure, and delivery methods of the proposed training program. Their contributions played a key role in refining the curriculum, enhancing practical learning components, and fostering regional collaboration.

The RESPONSE Project team expresses gratitude to all workshop participants, speakers, and partners for their commitment to advancing marine pollution training and response capabilities in the Black Sea region.

#### GENERAL FEEDBACK AND KEY TAKEAWAYS

In the regional workshop several organizational and relevant integrative aspects were emphasized.

##### Stakeholder Engagement and Collaboration

Participants emphasized the importance of co-designing the training curriculum through interactive discussions, ensuring that diverse perspectives were integrated into the final framework. The workshops facilitated cross-sector collaboration, allowing policymakers, scientists, emergency responders, and industry representatives to engage in meaningful dialogue.

- “The interactive nature of this workshop made it truly productive. We had real discussions, not just presentations. The exchange of ideas between different sectors—academia, government, and industry—was invaluable.” – **Representative of BSNN, Bulgaria**
- “It was a great opportunity to align our efforts across Black Sea countries. These discussions should continue beyond the workshop.” – **Representative of GMG/FoE-GE, Georgia**
- “The workshop provided a unique platform for open dialogue between policymakers, scientists, and responders. It helped us understand how different countries approach marine pollution response and training.” – **NGO Representative, Romania**
- “The interactive discussions and brainstorming sessions were excellent. They allowed us to share practical experiences and propose realistic solutions.” – **NGO Representative, Bulgaria**

##### Training Curriculum and Practicality

Participants widely appreciated the comprehensive nature of the proposed training modules, covering pollution sources, response strategies, and technological advancements. However, many emphasized the need for hands-on training, simulations, and field exercises to improve practical response skills.

- “The proposed training modules cover a broad spectrum of pollution-related challenges. However, hands-on exercises should be a greater focus, especially for emergency responders.” – **Representative of NIMRD, Romania**
- “As someone working in emergency response, I find the hands-on exercises and field training components particularly useful. This practical approach will be essential for improving response efficiency.” – **Emergency Response Officer, Georgia**
- “I particularly appreciated the session on pollution monitoring technologies. The Black Sea

needs more regional training on satellite and drone-based pollution tracking.” – **Representatives of IMEER NAS of Ukraine and BSB of the UEAS, Ukraine**

### Technology and Innovation

A significant focus of the workshops was on integrating digital tools, remote sensing, and AI-driven monitoring systems into marine pollution training. Participants highlighted the potential of these technologies to enhance real-time decision-making and improve response coordination.

- “AI-driven monitoring and Earth Observation (EO) tools must be fully integrated into the curriculum. Training responders on how to interpret satellite data will improve real-time decision-making.” – **Representative of Hidromod, Portugal**
- “Incorporating remote sensing, digital modeling, and AI-driven monitoring into the curriculum is a game-changer. It ensures that we stay up to date with technological advancements.” – **Marine Scientist, Greece**
- “The introduction of virtual simulations and online training platforms is highly valuable, especially for those who cannot always attend in-person training.” – **Consultancy Firm Expert, Portugal**
- “Digital learning platforms will allow continuous education beyond in-person workshops. This is a fantastic step towards making training accessible across all Black Sea countries.” – **University Lecturer, Georgia**

### Future Collaboration and Regional Cooperation

Participants expressed a strong interest in maintaining engagement with the project beyond the workshop phase. Many advocated for establishing a permanent training hub and strengthening regional cooperation through cross-border exercises and structured certification programs.

- “This workshop should lead to a permanent training hub for marine pollution response. A structured certification program would increase professional engagement.” – **Representative, Romanian Maritime Authority**
- “I hope this initiative will continue beyond the project timeline. Establishing a regional training network would be beneficial for long-term knowledge sharing.” – **Port Authority Official, Romania**
- “We need regular cross-border exercises to simulate pollution incidents in the Black Sea and test the effectiveness of our response strategies.” – **Port Authority Official, Romania**
- “It would be great to have more region-specific training tailored to the unique environmental and regulatory challenges of each Black Sea country.” – **University Lecturer, Georgia**

### Next Steps

Based on participant feedback, the RESPONSE Project team will:

- Refine training modules **to further integrate hands-on** exercises and real-world case studies.
- Enhance digital learning platforms to expand accessibility and ensure continuous education.
- Strengthen regional cooperation mechanisms, including a structured certification system and cross-border exercises.

- Develop a stakeholder network to facilitate long-term engagement and knowledge-sharing.
- Monitor and evaluate training impact, ensuring ongoing improvements based on participant input.

The insights gathered through national and regional workshops aim to directly shape the future implementation of training programs, reinforcing a collaborative, technology-driven, and practical approach to marine pollution preparedness in the Black Sea region.

## 4. General Conclusions from National and Regional Co-Creation Workshops

The national and regional co-creation workshops conducted under the RESPONSE Project provided valuable insights into the current state of marine pollution training, highlighting both strengths and areas for development. Participants across all workshops emphasized the need for a structured, modular training approach that integrates practical exercises, digital tools, and real-world case studies.

There was a broad consensus on the importance of transnational cooperation in tackling marine pollution, with stakeholders advocating for cross-border training initiatives, standardized response protocols, and continuous knowledge exchange. Additionally, the integration of modern technologies, such as remote sensing, AI-driven monitoring, and digital learning platforms, was identified as a key priority to enhance training effectiveness.

### Key Observations

- Technical and organizational alignment
  - Strong stakeholder engagement and knowledge-sharing throughout the workshops.
  - High agreement on the importance of harmonizing training approaches across the Black Sea region.
  - Interest in expanding digital learning tools and remote training opportunities.
  - Need for continuous engagement through follow-up initiatives and networking platforms.
- Training gaps and needs identified
  - Overemphasis on oil spill response in existing training, with limited focus on chemical spills, marine litter, eutrophication, and emerging pollutants.
  - Fragmented data collection across institutions, highlighting the need for centralized databases of pollution monitoring data.
  - Limited field exercises and hands-on training, especially for emergency responders.
  - Need to align training curricula with both national and international marine pollution frameworks (e.g., MARPOL, MSFD, Bucharest Convention).
- Technology integration
  - Increasing demand for Earth Observation (EO), AI-driven tools, and digital modeling in pollution monitoring and response.
  - Recognition of virtual simulations and e-learning platforms as essential for accessibility and continuity of training.
  - Need for enhanced laboratory capacity and modern equipment for pollutant analysis.

## Suggestions for Improvement

- Enhance practical training and field exercises
  - Expand hands-on drills and real-time pollution response simulations.
  - Develop multi-agency and cross-border emergency exercises.
  - Improve access to specialized response equipment and laboratory facilities.
- Develop localized and modular training programs
  - Adapt training modules to national regulatory frameworks and environmental challenges.
  - Establish tailored programs for different target audiences (students, professionals, authorities).
  - Strengthen collaboration with universities to integrate marine pollution courses into academic programs.
- Increase use of case studies and best practices
  - Incorporate real-world incidents (e.g., Kerch Strait oil spill) into training.
  - Develop scenario-based learning materials for pollution response planning.
- Leverage digital and remote learning tools
  - Develop an online training portal with interactive content and virtual exercises.
  - Use AI and satellite-based monitoring for real-time data analysis in training.
  - Provide blended learning opportunities combining in-person and remote training.

## Next Steps

- Refine Training Modules – Incorporate stakeholder feedback to finalize the curriculum and ensure relevance to real-world needs.
- Develop Digital Learning Tools – Establish an online training Digital Toolkit with interactive and remote learning capabilities.
- Pilot Training Sessions – Test and refine training programs in the Black Sea partner countries before full-scale implementation.
- Expand Practical Training Components – Enhance the stakeholders' capacity towards increasing the frequency and complexity of field exercises and simulations.
- Strengthen Regional Collaboration – Provide material to support the organization of joint workshops, cross-border drills, and policy alignment initiatives to improve cooperation in marine pollution response.

By considering these recommendations, the RESPONSE Project aims to establish an advanced training framework in the next phases, which will support stakeholder capacity building at regional scale and enhance marine pollution preparedness and response across the Black Sea region.

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## ACKNOWLEDGMENT

The RESPONSE Project team extends gratitude to all participants, experts, and stakeholders for their valuable contributions and commitment to strengthening marine pollution preparedness and rapid response capacity in the Black Sea region.

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## Appendix 1 – The proposed training curriculum at national co-creation workshops

### MODULE 1. MARINE POLLUTION IN CONTEXT: CAUSES AND EFFECTS

**1.1 Overview of marine pollution types** – (General introduction: What is marine pollution – the most common marine pollution types in the BSB)

**1.2 Oil pollution** (sources/ impacts/ etc.)

**1.3 Contaminants** (Heavy metals, Nutrients, Pesticides, Radioactive contamination) (sources/ impacts/ etc.)

**1.4 Marine Litter** (sources/ impacts/ etc.)

**1.5 Eutrophication** (sources/ impacts/ etc.)

**1.6 Pollution from armed conflicts** (sources/ impacts/ etc.)

**1.7 Ballast water** (sources/ impacts/ etc.)

**1.8 Other types of pollution** (e.g. atmospheric)

**1.9 Economic impact of marine pollution – an environmental aspect**

### MODULE 2. LEGISLATION AND GOVERNANCE

**2.1 International Legal Framework** (e.g. MARPOL, London Convention/ “London Protocol”, UNCLOS, Basel Convention, OPRC International Convention for the Preventing, Combating and Compensation of Marine Pollution, Bunkers Convention etc.)

**2.2 EU Legislation** (e.g. MSFD, WFD, Bathing Water Directive, Port Reception Facilities Directive, Integrated Maritime Policy etc.)

**2.3 Regional agreements** (e.g. Bucharest Convention, Protocol on Protection of the Black Sea Marine Environment against Pollution from Land Based Sources, Emergency Protocol, Dumping Protocol, Black Sea Emergency Plan to the Emergency Protocol, Strategic Action Plan for the Environmental Protection and Rehabilitation of the Black Sea, Danube River Protection Convention)

**2.4 National Legislation** (it will be adjusted based on country)

**2.5 International bodies** (e.g. International Maritime Organisation (IMO), European Maritime Safety Agency (EMSA))

**2.6 Regional bodies of the BSB**

**2.7 National/Local bodies** (e.g. National maritime agencies/bodies, other national bodies involved with marine pollution - it will be adjusted based on country)

**2.8 Other organizations and societies involved in control marine pollution** (e.g. salvors, Classification societies, environmental NGOs)

### MODULE 3. MARINE POLLUTION PREPAREDNESS

*Note: This module can be expanded to cover either specific or various types of marine pollution*

### **3.1 Introduction to National Plan and incident management (this will be adjusted based on country)**

– identification of gaps

**3.2 Examples of international protocols** (e.g. International Convention on Oil Pollution **Preparedness, Response and Co-operation** (OPRC 90), Protocol on Preparedness, Response and Co-operation to Pollution Incidents by Hazardous and Noxious Substances 2000 (OPRC-HNS Protocol))

**3.3 Designing an effective plan - key points**

**3.4 Key operational staff - Define roles and assign responsibilities**

**3.5 Overview of equipment - Identify and organize**

**3.6 Practicalities of different types of marine pollution – Preparedness** (including the various hazards to responders and safety aspects to consider)

**3.7 Prepare training sessions for key operational staff and responders – key elements**

**3.8 Prepare field exercises-training/ scenarios/ use of equipment**

**3.9 Assessment of operational staff preparedness**

## **MODULE 4 PREPAREDNESS STRATEGIES**

**4.1 Risk assessments for vulnerable areas**

**4.2 Contingency planning**

**4.3 Training and capacity building**

**4.4 Community awareness programs**

**4.5 Activate early warning systems.**

## **MODULE 5. MARINE POLLUTION RESPONSE**

*Note: This module can be expanded to cover either specific or various types of marine pollution.*

**5.1 Overview of response strategies** (International examples)

**5.2 Methods of intervention and minimisation of effects**

**5.3 How to create an efficient contingency planning** (importance, use, key points)

**5.4 Practicalities of different types of marine pollution – how to act on site** (including the various hazards to responders and safety aspects to consider)

**5.5 Organize the resources safely and efficiently at a contaminated site** (e.g. oil pollution)

**5.6 Practices on fully utilise the resources available on a site effectively**

**5.7 Monitoring and reporting – overview of new technologies -sampling and analysis tools and techniques** (e.g. GIS geographic information systems, remote sensing etc.)

**5.8 Waste management and safe disposal**

**5.9 Assessment of response plan efficiency**

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## **5.10 New technologies for marine pollution response training – the use of Virtual Reality**

### **5.11 Managing The Media - media interactions and ongoing relations**

### **5.12 Design Training Programs for Civilian Response to Marine Pollution Incidents**

### **5.13 Port reception facilities**

### **5.14 Sustainable shipping practices**

## **MODULE 6. MONITORING – NEW TECHNOLOGIES**

### **6.1 Techniques in pollution monitoring: Sampling, remote sensing, and in situ measurements**

### **6.2 Analytical methods for detecting pollutants (e.g., chromatography)**

### **6.3 Data analysis and mapping of pollution hotspots**

### **6.4 New technologies in marine pollution monitoring (e.g. UAVs, satellite images, remote sensing, real-time monitoring, AI, machine learning)**

### **6.5 Engaging citizens – the power of crowdsourcing**

### **6.6 Case studies on monitoring programs (e.g., UNEP, NOAA, EU Marine Strategy Framework Directive, National, regional)**

### **6.7 Sampling Scenarios**

## **MODULE 7. RESPONSE TO WILDLIFE IN NEED (DUE TO MARINE POLLUTION INCIDENT)**

### **7.1 Overview of the wildlife mostly affected by marine pollution incidents**

### **7.2 Effects of different types of marine pollution on wildlife**

### **7.3 Safety protocols for working in wildlife environments affected by marine pollution incidents**

### **7.4 Response preparedness for wildlife affected by marine pollution incident (e.g. oiled wildlife)**

### **7.5 Key Processes for wildlife affected by marine pollution incident**

### **7.6 Integrating wildlife in need Response with the other functional areas of an incident management team**

### **7.7 Key 'inputs' required commencing and maintaining wildlife in need response (e.g. consumables & feed stock, human resources, equipment, etc.)**

### **7.8 Species-Specific cleanup techniques: Marine mammals, birds etc.**

### **7.9 Occupational health and safety considerations for wildlife in need**

## **MODULE 8. ECOSYSTEMS IN DISTRESS**

### **8.1 Overview of ecosystems vulnerable to marine pollution**

### **8.2 Ecological impacts of the different marine pollution types (Impact on marine ecosystems and biodiversity, Bioaccumulation and biomagnification)**

### 8.3 Preparedness and Response actions in case of specific ecosystems

#### 8.4 Ecosystem services and marine pollution incidents

#### 8.5 Impacts on human health

**8.6. Socioeconomic Effects** (fisheries and aquaculture, Tourism and recreation, coastal community livelihood)

#### 8.7 Case studies overview

## MODULE 9. MITIGATION TECHNIQUES

### 9.1 Oil spill containment and recovery

### 9.2 Use of dispersants and booms

### 9.3 Clean-up operations for plastics and debris

### 9.4 Bioremediation methods

## MODULE 10. TECHNOLOGICAL INNOVATIONS

### 10.1 Satellite and drone monitoring

### 10.2 Ocean-cleaning devices

### 10.3 Green shipping technology

### 10.4 Bioremediation: Using microorganisms to degrade oil.

### 10.5 Real-time sensors for detecting pollution.

#### **SPECIAL SESSION: VESSELS IN DISTRESS**

- Types of Ship Casualties (e.g., capsizing and listing, collision, contact, fire or explosion, hull failure, etc.)
- Impacts on ecosystems and biodiversity
- In need of assistance: The Role of Places of Refuge
- Ship recycling with safety
- Examples of selected incidents in the BSB – facts and assessments

#### **SPECIAL SESSION: OIL POLLUTION AND OFFSHORE ACTIVITIES**

- Basics of Oil Pollution
- Pollution Risks in Offshore Oil and Gas Activities
- National Legal Frameworks for Oil Pollution
- Oil Spill Response Strategies

### **SPECIAL SESSION: BALLAST WATER AND OTHER MARINE POLLUTANTS**

- Environmental Risks Associated with Ballast Water Usage
- Anti-Fouling Systems and Their Environmental Impact
- Addressing Chemical Pollution in Maritime Operations
- Managing Sewage, Garbage, and Other Waste, Including Disposal Practices
- Sustainable Practices for Ship Scrapping and Recycling

### **SPECIAL SESSION: AIR POLLUTION AND GREENHOUSE GAS EMISSIONS**

- Air Pollution Challenges in the Shipping Industry
- Regulatory and Voluntary Initiatives for Emission Control
- Advanced Abatement Technologies for SO<sub>x</sub>, NO<sub>x</sub>, PM, and Other Pollutants
- Issues and Opportunities in Addressing Maritime Emissions

*Note: The special session could be adapted each time to the interests of the stakeholder group or the country.*

## Appendix 2 – The training curricula as adjusted during the national co-creation workshops

### BULGARIA - CURRICULUM OUTLINE

Stakeholder target groups:

- 1) decision makers, representatives of administrations and institutions, especially people participating in civil defence units and teams, emergency response teams, businesses involved in training activities, local communities, volunteers, NGOs, media etc. – interested in short 1 to 1.5 day courses, problem oriented training, use of the project online platform and tools; and
- 2) representatives of education institutions and academia, university students, distance learning students, other maritime professionals - interested in extracurricular programmes and studies, use of combinations of modules, use of the online platform and tools of the project.

Modules suggested by the RESPONSE team have been discussed and elaboration will continue in the future with individual communication with participants.

#### Module 1. Introduction to Pollution

- Definition pollution
- Overview of marine ecosystems and their vulnerability to pollution
- Overview of human impacts on pollution
- Black Sea characteristics and relation to pollution
- Historical background of pollution and regional / national trends

#### Module 2 Black Sea geography and characteristics, influence on pollution

- Black Sea geography, hydrography, unique characteristics, currents
- Black Sea biodiversity and nature resources
- Overview of marine ecosystems and their vulnerability to pollution

#### Module 3. Types and Sources of Pollution, pollution in the Black Sea Basin (BSB)

- Marine pollution sources and impacts on the Black Sea ecosystems and their services
- Overview of marine pollution types – general introduction and the most common marine pollution types in the BSB
- Eutrophication (nutrient sources/ impacts/ etc.)
- Oil pollution (sources/ impacts/ etc.)
- Harmful and noxious substances, contaminants (heavy metals, pesticides, radioactive contamination) (sources/ impacts/ etc.)
- Invasive species - ballast waters, other (sources/ impacts/ etc)
- Marine litter (sources/ impacts/ etc.)
- Pollution from armed conflicts (sources/ impacts/ etc.)
- Other types of pollution (e.g. atmospheric depositions, persistent chemicals etc.)

- Economic impact of marine pollution – environmental aspects, etc.

#### **Module 4. Impacts of marine pollution on Ecosystems and Human Health**

- Ecological impacts on marine organisms and ecosystems, BSB aspects
- Bioaccumulation and biomagnification in marine food webs
- Human health risks associated with seafood contamination and water quality
- Socioeconomic impacts: Fisheries, tourism, coastal communities

#### **Module 5: Legislation and Governance in the BSB**

- International legal framework (e.g. MARPOL, London Convention / "London Protocol", UNCLOS, Basel Convention, OPRC International Convention for the Preventing, Combating and Compensation of Marine Pollution, Bunkers Convention etc.) – national and regional aspects
- EU Legislation and policy framework (e.g. MSFD, WFD, Bathing Waters Directive, Port Reception Facilities Directive, Integrated Maritime Policy etc.), CMA for the BS
- Regional agreements (e.g. Bucharest Convention, Protocol on Protection of the Black Sea Marine Environment against Pollution from Land Based Sources, Emergency Protocol, Dumping Protocol, Black Sea Emergency Plan for Oil Pollution to the Emergency Protocol, Strategic Action Plan for the Environmental Protection and Rehabilitation of the Black Sea 2009, Danube River Protection Convention)
- National legislation – basic legal framework for Bulgaria as transposed from EU directives
- International bodies (e.g. International Maritime Organisation (IMO), European Maritime Safety Agency (EMSA), etc.
- Regional bodies of the BSB - BSC, BSEC, ICBSS think tank, CPMR at EU, through its Balkan and Black Sea Commission (BBSC)
- National/Local bodies (e.g. National maritime agencies/bodies, other national bodies involved with marine pollution – environment agencies, maritime administrations involved in monitoring and emergency response and preparedness in Bulgaria)
- Other organizations and societies involved in control marine pollution (e.g. salvors, Classification societies, environmental NGOs)

#### **Module 6. Monitoring and Assessment of Pollution**

- Techniques in pollution monitoring: Sampling, remote sensing, and in situ measurements
- Analytical methods for detecting pollutants (e.g., chromatography, etc.)
- Data analysis and mapping of pollution hotspots
- Case studies on monitoring programs (e.g., UNEP, NOAA, EU Marine Strategy Framework Directive, National, regional) – BS Commission and monitoring programmes and projects with EU and UNEP support
- National monitoring programmes as part of Marine Strategy of Bulgaria, Romania under EU MSFD

#### **Module 7. Pollution Management and Mitigation**

- Pollution prevention strategies if applicable
- Remediation and cleanup techniques if applicable

- Engineering solutions for wastewater treatment and coastal pollution control if applicable
- Technologies in oil spill response if applicable
- Reducing plastic waste: Policy, recycling, and alternative materials if applicable

### **Module 8 Marine Pollution Preparedness**

- Introduction to National Plans for emergency response and management of incidents in Bulgaria, regional plans (oil pollution, marine litter) – identification of gaps, issues, funding sources
- Existing national system for emergency response in the Bulgarian marine response area – monitoring, distress calls, start and coordination of operations
- Examples of international protocols (e.g. International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC 90), Protocol on Preparedness, Response and Co-operation to Pollution Incidents by Hazardous and Noxious Substances 2000 (OPRC-HNS Protocol)
- Designing an effective plan - key points, types of pollution to address
- Key operational staff role - Define roles and assign responsibilities
- Overview of equipment - Identify and organize
- Practicalities of different types of marine pollution – Preparedness (including the various hazards to responders and safety aspects to consider)
- Prepare training sessions for key operational staff and responders – key elements
- Prepare field exercises-training/ scenarios/ use of equipment – national naval exercise, training at sea exercise
- Assessment of operational staff preparedness – training, equipment, sources to support the system

### **Module 9 Preparedness Strategies**

- Risk assessments for vulnerable areas – (BS designated by Marpol)
- Contingency planning
- Training and capacity building
- Community awareness programs
- Activate early warning systems (ref. Module 8)

### **Module 10. Marine Pollution Response**

- Overview of response strategies (International examples)
- Methods of intervention and minimisation of effects
- How to create an efficient contingency planning (importance, use, key points)
- Practicalities of different types of marine pollution – how to act on site (including the various hazards to responders and safety aspects to consider)
- Organize the resources safely and efficiently at a contaminated site (e.g. oil pollution) – described in National Plan for emergency response to oil pollution in the Black Sea, also in the regional plan
- Practices on fully utilise the resources available on a site effectively
- Monitoring and reporting – overview of new technologies -sampling and analysis tools and techniques (e.g. GIS geographic information systems, remote sensing etc.)

- Waste management and safe disposal
- Assessment of response plan efficiency
- New technologies for marine pollution response training – the use of Virtual Reality
- Managing the Media - media interactions and ongoing relations
- Design Training Programs for Civilian Response to Marine Pollution Incidents
- Port reception facilities – in Bulgaria, in other Danube and BSB countries
- Sustainable shipping practices – Marpol, reporting of vessels, lists of polluters

### **Module 11. Monitoring – New technologies**

- Techniques in pollution monitoring: Sampling, remote sensing, and in situ measurements
- Analytical methods for detecting pollutants (e.g., chromatography,....)
- Data analysis and mapping of pollution hotspots
- New technologies in marine pollution monitoring (e.g. UAVs, satellite images, remote sensing, real-time monitoring, AI, machine learning)
- Engaging citizens – the power of crowdsourcing
- Case studies on monitoring programs (e.g., UNEP, NOAA, EU Marine Strategy Framework Directive, National, regional)
- Sampling Scenarios

### **Module 12. Response to wildlife in need (due to marine pollution incident)**

- Overview of the wildlife mostly affected by marine pollution incidents
- Effects of different types of marine pollution on wildlife
- Safety protocols for working in wildlife environments affected by marine pollution incidents
- Response preparedness for wildlife affected by marine pollution incident (e.g. oiled wildlife)
- Key Processes for wildlife affected by marine pollution incident
- Integrating wildlife in need Response with the other functional areas of an incident management team
- Key 'inputs' required commencing and maintaining wildlife in need response (e.g. consumables & feed stock, human resources, equipment, etc)
- Species-Specific cleanup techniques: Marine mammals, birds etc.
- Occupational health and safety considerations for wildlife in need

### **Module 13. Ecosystems in distress**

- Overview of ecosystems vulnerable to marine pollution
- Ecological impacts of the different marine pollution types (Impact on marine ecosystems and biodiversity, Bioaccumulation and biomagnification)
- Preparedness and Response actions in case of specific ecosystems
- Ecosystem services and marine pollution incidents
- Impacts on human health
- Socioeconomic Effects (Fisheries and aquaculture, Tourism and recreation, Coastal community livelihood)
- Case studies overview – examples from the Black Sea

### **Module 14. Mitigation Techniques**

- Oil spill containment and recovery
- Use of dispersants and booms
- Clean-up operations for plastics and debris
- Bioremediation methods

### **Module 15. Technological Innovations**

- Satellite and drone monitoring
- Ocean-cleaning devices
- Green shipping technology, green ports
- Bioremediation: Using microorganisms to degrade oil.
- Real-time sensors for detecting pollution – availability, functioning and providing data for common platform.

### **Module 16. Emerging Issues in Marine Pollution**

- Climate change and pollution: Synergies and combined impacts
- Innovations in marine pollution control and green technologies
- Public awareness and the role of citizen science in pollution monitoring

### **Module 17. Fieldwork and Practical Applications**

- Field sampling techniques and data collection
- Lab-based analysis of pollutants
- Site visits to wastewater treatment plants, coastal cleanups, and monitoring stations
- Development of pollution monitoring and response plans for local coastal areas
- Remote sensing/EO, modelling/etc.

### **Module 18. Communication and Public Outreach**

- Communicating scientific information to the public
- Engaging with communities on marine pollution prevention
- Developing educational materials and campaigns on marine pollution awareness

### **Special sessions**

#### **Session 1. Vessels in distress**

- Types of ship casualties (e.g., capsizing and listing, collision, contact, fire or explosion, hull failure, etc.)
- Impacts on ecosystems and biodiversity
- In need of assistance: the role of places of refuge
- Ship recycling with safety
- Examples of selected incidents in the BSB – facts and assessments – Kerch incidents of oil pollution 2007 and 2024, Vera Su incident on Bulgarian coast 2021

#### **Session 2. Oil Pollution and Offshore Activities**

- Basics of oil pollution

- Pollution risks in offshore oil and gas activities
- National legal frameworks for oil pollution
- Oil spill response strategies

### **Session 3. Ballast Water and Other Marine Pollutants**

- Environmental risks associated with ballast water usage
- Anti-fouling systems and their environmental impact
- Addressing chemical pollution in maritime operations
- Managing sewage, garbage, and other waste, including disposal practices
- Sustainable practices for ship scrapping and recycling

### **Session 3. Air Pollution and Greenhouse Gas Emissions**

- Air pollution challenges in the shipping industry
- Regulatory and voluntary initiatives for emission control
- Advanced abatement technologies for SO<sub>x</sub>, NO<sub>x</sub>, PM, and other pollutants
- Issues and opportunities in addressing maritime emissions

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## GEORGIA - CURRICULUM OUTLINE

Stakeholder target groups: Decision-making/Operational stakeholders.

The modules proposed by the RESPONSE team were reviewed and discussed by stakeholders during the co-creation process of the advanced training curricula. Their feedback is incorporated as comments in *italics*.

### **Module 1. Pollution in Context: Causes and Effects**

*Comment: It would be good if this module were to include a separate sub-chapter on pollution linked to climate change, or pollution caused by climate change - Sources of Pollution Linked to Climate Change.*

**1.1 Overview of marine pollution types** – (General introduction: What is marine pollution – the most common marine pollution types in the BSB)

**1.2 Oil pollution** (sources/ impacts/ etc.)

**1.3 Contaminants** (Heavy metals, Nutrients, Pesticides, Radioactive contamination) (sources/ impacts/ etc.)

**1.4 Marine Litter** (sources/ impacts/ etc.)

*Comment: It may be beneficial to include a discussion on coastal pollution within this chapter or consider dedicating a separate chapter to the topic.*

**1.5 Eutrophication** (sources/ impacts/ etc.)

**1.6 Pollution from armed conflicts** (sources/ impacts/ etc.)

**1.7 Ballast water** (sources/ impacts/ etc.)

**1.8 Other types of pollution** (e.g. atmospheric pollution by the ozone depleting substances, microbiological and chemical substances)

*Comment: Pollution related to underwater noise and light pollution, largely driven by recreational and tourism activities could also be included.*

**1.9 Physical pollution** (vibration, sound impact)

**1.10 Marine and ocean acidification**

**1.11 Economic impact of marine pollution – an Environmental Aspect**

### **Module 2. Legislation and Governance**

*Comment: A chapter could also be prepared on modern approaches to marine environmental management, e.g. the Source-to-sea approach.*

**2.1 International Legal Framework** (e.g. MARPOL, London Convention/ “London Protocol”, UNCLOS, Basel Convention, OPRC International Convention for the Preventing, Combating and Compensation of Marine Pollution, Bunkers Convention etc.)

*Comment: The International Convention for the Control and Management of Ships' Ballast Water and Sediments should also be included.*

**2.2 EU Legislation** (e.g. MSFD, WFD, Bathing Water Directive, Port Reception Facilities Directive, Integrated Maritime Policy etc.)

**2.3 Regional agreements** (e.g. Bucharest Convention, Protocol on Protection of the Black Sea Marine Environment against Pollution from Land Based Sources, Emergency Protocol, Dumping Protocol, Black Sea Emergency Plan to the Emergency Protocol, Strategic Action Plan for the Environmental Protection and Rehabilitation of the Black Sea, Danube River Protection Convention)

**2.4 National Legislation** (it will be adjusted based on country)

**2.5 International bodies** (e.g. International Maritime Organisation (IMO), European Maritime Safety Agency (EMSA))

**2.6 Regional bodies of the BSB**

**2.7 National/Local bodies** (e.g. National maritime agencies/bodies, other national bodies involved with marine pollution - it will be adjusted based on country)

**2.8 Other organizations and societies involved in marine pollution control** (e.g. salvors, classification societies, environmental NGOs)

*Comment: The thematic Climate Change and Marine Governance could also be included.*

**2.9 Training packages on Marine Spatial Planning (MSP), Integrated Coastal Zone Management (ICZM), and Integrated River Basin Management (IRBM)**

### **Module 3. Marine Pollution Preparedness**

**3.1 Introduction to National Plan and incident management (this will be adjusted based on country) – identification of gaps**

**3.2 Examples of international protocols** (e.g. International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC 90), Protocol on Preparedness, Response and Co-operation to Pollution Incidents by Hazardous and Noxious Substances 2000 (OPRC-HNS Protocol))

**3.3 Designing an Effective plan - key points**

*Comment: The plan is developed as follows:*

*Legislative Acts According to:*

1. Georgia Law, Civil Security About" (27.06. 2018 Year.);
2. Georgia Government 2015 Year 24 September No. 508 Resolution, Civil Security National Plan Approval About";
3. Georgia Government 2022 Year 10 June No. 309 Resolution "State Fire department Supervision And Vital Of importance Objects Supervision Implementation Rule Approval About";
4. Georgia Government 2015 Year 23 July No. 370 Resolution "Fire department Security Rules And Conditions About Technical Regulations Approval About";
5. Georgia Government 2017 Year 6 October No. 452 Resolution "Emergency Management Plan Preparation Rules Development About";
6. Georgia Government 2017 Year 6 October No. 453 Resolution "Emergency Situation Risk Management Plan Preparation Rules Development About";
7. Georgia Government 2018 Year 27 November No. 577 Resolution "Civil Security Field Volunteers Statute Approval About";
8. Georgia Government 2020 Year 23 September No. 590 Resolution "Incident And Emergency Situation Classification Rule Approval About";
9. Georgia Government 2021 Year 4 February No. 48 Resolution "Municipality Security Passport Development Rule Approval About".

**3.4 Key operational staff - Define roles and assign responsibilities**

### **3.5 Overview of equipment - Identify and organize**

**3.6 Practicalities of different types of marine pollution – Preparedness** (including the various hazards to responders and safety aspects to consider)

**3.7 Prepare training sessions for key operational staff and responders – key elements**

**3.8 Prepare field exercises-training/ scenarios/ use of equipment**

**3.9 Assessment of operational staff preparedness**

## **Module 4. Preparedness Strategies**

**4.1 Risk assessments for vulnerable areas**

**4.2 Contingency planning (Emergency Management Plan Development is to be written)**

*Comment: The plan should be developed as follows: Legislative Acts According to:*

1. Georgia Law, Civil Security About" (27.06. 2018 Year.);
2. Georgia Government 2015 Year 24 September No. 508 Resolution, Civil Security National Plan Approval About";
3. Georgia Government 2022 Year 10 June No. 309 Resolution "State Fire department Supervision And Vital Of importance Objects Supervision Implementation Rule Approval About";
4. Georgia Government 2014 Year 14 January No. 51 Resolution Technical Regulations - Civil Security Engineering - Technical Events "Approval About";
5. Georgia Government 2010 Year 4 June No. 154 Resolution "Security Declaration Submission Rule About Instructions Approval About";
6. Georgia Government 2015 Year 23 July No. 370 Resolution "Fire department Security Rules And Conditions About Technical Regulations Approval About";
7. Georgia Government 2017 Year 6 October No. 45 2Resolution "Emergency Management Plan Preparation Rules Development About";
8. Georgia Government 2017 Year 6 October No. 453 Resolution "Emergency Situation Risk Management Plan Preparation Rules Development About";
9. Georgia Government 2018 Year 27 November No. 577 Resolution "Civil Security Field Volunteers Statute Approval About";
10. Georgia Government 2020 Year 23 September No. 590 Resolution "Incident And Emergency Situation Classification Rule Approval About";
11. Georgia Government 2021 Year4 February No. 48 Resolution "Municipality Security Passport Development Rule Approval About".

**4.3 Training and capacity building**

**4.4 Community awareness programs** (such as International Black Sea Day activities; Valentine Day Ocean Literacy initiative 'Love the Ocean: Love the Black Sea' (sources: DOORS project/ EuroGOOS, etc.)

**4.5 Activate early warning systems**

**4.5 Activate early warning systems**

## **Module 5. Marine Pollution Response**

**5.1 Overview of response strategies** (International examples)

**5.2 Methods of intervention and minimisation of effects**

### **5.3 How to create an efficient contingency planning** (importance, use, key points)

### **5.4 Practicalities of different types of marine pollution – how to act on site** (including the various hazards to responders and safety aspects to consider)

*Comment: The plan is being developed for the next legislative session. The plan developed in accordance with the plan will be submitted to the relevant department of the Emergency Management Service for approval.*

1. Georgia Government 2017 Year 6 October No. 452 Resolution "Emergency Management Plan Preparation Rules Development About";

2. Georgia Government 2017 Year 6 October No. 453 Resolution "Emergency Situation Risk Management Plan Preparation Rules Development About";

3. Georgia Government 2018 Year 27 November No. 577 Resolution "Civil Security Field Volunteers Statute Approval About";

4. Georgia Government 2020 Year 23 September No. 590 Resolution "Incident And Emergency Situation Classification Rule Approval About";

### **5.5 Organize the resources safely and efficiently at a contaminated site** (e.g. oil pollution)

### **5.6 Practices on fully utilising the resources available on a site effectively**

### **5.7 Monitoring and reporting – overview of new technologies -sampling and analysis tools and techniques** (e.g. GIS geographic information systems, remote sensing etc.)

### **5.8 Waste management and safe disposal**

### **5.9 Assessment of response plan efficiency**

### **5.10 New technologies for marine pollution response training – the use of Virtual Reality**

### **5.11 Managing the Media - media interactions and ongoing relations**

### **5.12 Design Training Programs for Civilian Response to Marine Pollution Incidents**

### **5.13 Port reception facilities**

### **5.14 Sustainable shipping practices**

### **5.15 Bathing water monitoring & beach award schemes** (e.g. MEDCOAST Blue Flag training, ZEWSGES project package)

### **5.16 Combined beach litter cleanups and monitoring training**

## **Module 6. Monitoring – New Technologies**

### **6.1 Techniques in pollution monitoring: Sampling, remote sensing, and *in situ* measurements**

### **6.2 Analytical methods for detecting pollutants** (e.g., chromatography, spectroscopy)

### **6.3 Data analysis and mapping of pollution hotspots**

### **6.4 New technologies in marine pollution monitoring** (e.g., UAVs, satellite images, remote sensing, real-time monitoring, AI, machine learning)

### **6.5 Engaging citizens – the power of crowdsourcing**

### **6.6 Case studies on monitoring programs** (e.g., UNEP, NOAA, EU Marine Strategy Framework Directive, National, Regional)

## 6.7 Sampling Scenarios

**6.8 Training package for the Black Sea System of Systems (Black Sea SoS) portal applications and use** (source: H2020 DOORS project)

**6.9 Enhance monitoring capacity in Coastal & Marine Protected Areas**

**6.10 eDNA Training (introductory & data processing, including with AI)** (source: H2020 BRIDGE project)

## Module 7. Response to Wildlife in Need (Due to Marine Pollution Incident)

**7.1 Overview of the wildlife mostly affected by marine pollution incidents**

**7.2 Effects of different types of marine pollution on wildlife**

**7.3 Safety protocols for working in wildlife environments affected by marine pollution incidents**

**7.4 Response preparedness for wildlife affected by marine pollution incidents** (e.g., oiled wildlife)

**7.5 Key processes for wildlife affected by marine pollution incidents**

**7.6 Integrating wildlife in need response with the other functional areas of an incident management team**

**7.7 Key 'inputs' required for commencing and maintaining wildlife in need response** (e.g., consumables & feed stock, human resources, equipment, etc.)

**7.8 Species-specific cleanup techniques: Marine mammals, birds, etc.**

**7.9 Occupational health and safety considerations for wildlife in need**

## Module 8. Ecosystems in Distress

**8.1 Overview of ecosystems vulnerable to marine pollution**

**8.2 Ecological impacts of the different marine pollution types** (Impact on marine ecosystems and biodiversity, Bioaccumulation and biomagnification)

**8.3 Preparedness and Response actions in case of specific ecosystems**

**8.4 Ecosystem services and marine pollution incidents**

**8.5 Impacts on human health**

**8.6 Socioeconomic Effects** (Fisheries and aquaculture, Tourism and recreation, Coastal community livelihood)

**8.7 Case studies overview**

**8.8 Marine and coastal Nature-based Solutions (NBS)** (e.g. H2020 Connecting Nature NbS impact assessment tool applied marine and coastal spatial planning SEA; WB Blueing the Black Sea NbS portal and guidelines – e.g. wastewater management with constructed wetlands in the coastal zones; restoring/rewetting drained wetlands, etc.)

## Module 9. Mitigation Techniques

*Comment: In addition, there should be a separate module on Adaptation Techniques, for example: Restoration of coastal ecosystems, climate-resilient infrastructure, adaptation policies and governance. If it were related to pollution, it would depend on how much scientific literature is available on this specific topic.)*

### 9.1 Oil spill containment and recovery

### 9.2 Use of dispersants and booms

### 9.3 Clean-up operations for plastics and debris

### 9.4 Bioremediation methods

## Module 10. Technological Innovations

### 10.1 Satellite and drone monitoring

### 10.2 Ocean-cleaning devices

### 10.3 Green shipping technology

### 10.4 Bioremediation: Using microorganisms to degrade oil

### 10.5 Real-time sensors for detecting pollution

To add to curriculum a separate recommended session:

## Module 11. Investigating marine pollution impact from areas within administrative boundaries of the Kolkheti National Park:

**Paliastomi Lake, adjacent World Natural Heritage status peatlands, dunes, river Rioni, by studying biodiversity impacts and identifying respective risks, also elaborating methodologies to combat such impacts.**

### Special session: vessels in distress

- Types of Ship Casualties (e.g., capsizing and listing, collision, contact, fire or explosion, hull failure, etc.)
- Impacts on ecosystems and biodiversity
- In need of assistance: The Role of Places of Refuge
- Ship recycling with safety
- Examples of selected incidents in the BSB – facts and assessments

### Special session: Oil Pollution and Offshore Activities

- Basics of Oil Pollution
- Pollution Risks in Offshore Oil and Gas Activities
- National Legal Frameworks for Oil Pollution
- Oil Spill Response Strategies

**Special session: Air Pollution and Greenhouse Gas Emissions**

- Air Pollution Challenges in the Shipping Industry
- Regulatory and Voluntary Initiatives for Emission Control
- Advanced Abatement Technologies for SO<sub>x</sub>, NO<sub>x</sub>, PM, and Other Pollutants
- Issues and Opportunities in Addressing Maritime Emissions

**Special session: Ballast Water and Other Marine Pollutants**

- Environmental Risks Associated with Ballast Water Usage
- Anti-Fouling Systems and Their Environmental Impact
- Addressing Chemical Pollution in Maritime Operations
- Managing Sewage, Garbage, and Other Waste, Including Disposal Practices
- Sustainable Practices for Ship Scrapping and Recycling

## ROMANIA - CURRICULUM OUTLINE

Stakeholder target groups:

1) government and regulatory bodies: Representatives from environmental administrations, inspectorates, and institutions, as well as decision-makers and emergency response teams, who require practical training utilizing online platforms and problem-based learning to enhance rapid response capabilities to marine pollution.

2) educational and research institutions: Scientists, educators, students (both full-time and distance learning), and other maritime professionals, who are interested in extracurricular programs, modular training, and online project tools.

3) community and civil society: Training organizations, local communities, volunteers, NGOs, and media outlets, in order to improve their understanding related to marine pollution.

The co-creation workshop in Romania resulted in the proposal of two curriculum outlines, one for short training course on rapid response in case of oil pollution and one for a longer training program on building institutional capacity for Black Sea pollution/litter preparedness & response training.

### SHORT TRAINING ON RAPID RESPONSE IN CASE OF OIL POLLUTION

#### Module 1. Introduction to Marine Pollution

- Definition of marine pollution
- Overview of marine ecosystems and their vulnerability to pollution
- Overview of human impacts on pollution
- Black Sea characteristics and relation to pollution
- Historical background of pollution and regional / national trends

#### Module 2. Black Sea geography and characteristics, influence on pollution

- Black Sea geography, hydrography, unique characteristics, wave regime, mesoscale and sub-mesoscale currents
- Black Sea biodiversity and nature resources
- Overview of marine ecosystems and their vulnerability to pollution

#### Module 3. Oil pollution (sources/ impacts/ methods of intervention)

- Harmful hydrocarbon /oil derivatives contaminants (sources/ impacts/ etc.)
- Accidents on sea/ Vessels in distress - Types of ship casualties (e.g., capsizing and listing, collision, contact, fire or explosion, hull failure)
- Marine ecosystems' impact (inshore/offshore)
- Type of interventions (inshore/offshore)
- Economic impact of marine pollution – environmental aspects on the Romanian coast/maritime space

#### Module 4. Physic-chemical properties and accidental oil spills' behavior

- Oil components (oil type and associated properties)
- Oil propagation and dispersion on sea water masses

- Modeling tools available for general use

### **Module 5. Methods of intervention**

- National Contingency Plan (national legislation and BS legal framework)
- Type of intervention and equipment used
- Specific intervention on different shores/marine environment - NEBA
- Coastal specificity of the Romanian shore/marine areas

### **Module 6. Particularities of supervised interventions in the marine depollution**

- Technologies on intervention, marine env. Factors, efficiency and productivity of different tools
- Techniques in pollution monitoring: Sampling, marine forecast, remote sensing, and in situ measurements
- Analytical methods for detecting pollutants (e.g., chromatography, etc.)
- Data analysis and mapping of pollution hotspots
- Case studies on monitoring programs (e.g., UNEP, NOAA, EU Marine Strategy Framework Directive, National, regional) – BS Commission and monitoring programmes and projects with EU and UNEP support
- National monitoring programmes as part of EU MSFD implementation

### **Module 7. Rapid Response in case of emergency (due to Oil Pollution)**

- Overview of response strategies (International examples)
- Methods of rapid intervention and minimisation of effects (EWS/NEBA)
- Practicalities of different types of marine pollution – how to act on site (including the various hazards to responders and safety aspects)
- Resources organization for best efficiently for an oil contaminated site – list of institutions/ tools described in National Plans for emergency response to oil pollution in the western Black Sea
- Practices on fully utilizing the resources available on a site effectively
- Monitoring and continuous reporting – overview of new technologies -sampling and analysis tools and techniques (e.g. GIS geographic information systems, remote sensing etc.)
- Assessment of response plan efficiency
- New technologies for marine pollution response training – the use of Virtual Reality/new monitoring technologies
- Managing the Media - media interactions and ongoing public relations
- Design Training Programs for Civilian Response to Marine Pollution Incidents
- Port reception facilities – in Danube, transitional and southern sectors of Romanian shore – including trans-boundaries areas with BS countries

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## LONG-TERM TRAINING ON BUILDING INSTITUTIONAL CAPACITY FOR BLACK SEA POLLUTION/LITTER PREPAREDNESS & RESPONSE

### Module 1. Introduction: Key Research Issues in Marine Ecosystem Pollution

- Understanding marine pollution: definitions and impacts on ecosystems
- Overview of anthropogenic pollution in the marine environment
- Historical context of pollution and current regional/national trends: MP monitoring

### Module 2. Types, Sources, and Impacts of Marine Pollution: A Black Sea Basin/MFSD Implementation Perspective

- Identifying Types of Marine Pollution: General Overview and Black Sea Basin Definition of Descriptors

#### Specific Pollutants:

- Harmful and Toxic Substances (Hydrocarbons, Heavy Metals, Pesticides, Contamination): D8/D9: Contaminants - Sources and Impacts

#### Biological and Physical Pollution:

- Invasive Species (Ballast Water, etc.): D2 - Sources and Impacts
- Marine Litter: D10 - Sources and Impacts

### Module 3. Environmental Pollution Monitoring and Assessment

#### Marine Pollution Monitoring Techniques:

- Sampling procedure and measurements procedure for pollution monitoring
- Remote Sensing: Sentinel-2, Sentinel-3 (ESA Copernicus), MODIS, Landsat; Detectable Parameters: Chlorophyll-a (eutrophication indicator), Suspended Particulate Matter (SPM), Sea surface temperature, Oil spills (via synthetic aperture radar - SAR);
- Modeling and Data Integration - DSS/Decision Support Systems (Hydrodynamic models, Oil spill models, Water quality models – EWS/Earl Warning Systems); GIS integration for spatial analysis – Case studies/MP Scenarios

#### Analytical and Data Processing:

- Analytical Methods for Pollutant Detection (Chromatography, etc.)

#### Monitoring Programs:

- Case Studies: International (EU MSFD) and National Monitoring Initiatives
- National Monitoring Program under the EU Marine Strategy Framework Directive (its stages of implementation in Romania)

### Module 4. Legislation and Governance in the BSB

- International legal framework vs National legislation – national and regional aspects
- EU Legislation and policy framework (e.g. EU directives: MSFD, etc.)

- Regional agreements: International vs regional vs national/local bodies (involved in monitoring and emergency response and preparedness)
- Other organizations and civil society organizations, involved in marine pollution control & public awareness.

### **Module 5. Pollution Management and Mitigation**

- Pollution prevention strategies for specific types of pollutants (MSFD's POM)
- Remediation and cleanup techniques for specific types of pollutants
- Engineering solutions for specific types of pollutants, including wastewater treatment and plastic waste collection & recycling

### **Module 6. Marine Pollution Preparedness**

- Introduction to National Contingency Plan for emergency response and management of incidents in Romania, regional plans (oil pollution – identification of gaps, issues, funding sources)
- Existing DSS for emergency response in Romania – start and coordination of operations
- Key points, types of pollution to address, Key operational staff role (legal framework: institutional roles and assign responsibilities)
- Overview of equipment – specific intervention technologies, practicalities on different types of marine pollution, preparedness for various hazards/key operational staff and responders for field exercises-training/scenarios analysis
- Assessment on stage of operational staff preparedness – required training, equipment, access to EWS/early warning systems designed as DSS/decision support systems/networking in case of emergency/rapid response, Coastal Community awareness.

### **Module 7. Marine Pollution Response**

- Overview of response strategies (International examples)
- Methods of intervention - NEBA/Environmental Benefit Analysis /process of minimization of impacts
- Monitoring of MP/oil pollution – overview of new monitoring technologies -sampling and analysis tools and techniques (e.g. GIS/GPS drifters, UAVs, EO/remote sensing, modeling, AI, machine learning, etc.)
- Assessment of response plan efficiency in case of Marine Pollution Incidents /New technologies for marine pollution response efficiency – the use of Virtual Reality, EWS/ DSS for data/scenarios analysis, mapping of pollution hotspots according with marine species-Specific cleanup techniques for various marine habitats/ecosystem particularities (NEBA/env case based on a net environmental benefit analysis).

### **Module 8. Western BS Marine and Coastal Ecosystems in distress**

- Overview of ecosystems vulnerable to marine pollution
- Ecological impacts of the different marine pollution types (Impact on marine ecosystems and biodiversity, Bioaccumulation and biomagnification)
- Preparedness and Response actions in case of specific ecosystems

- Impacts on human health/socioeconomic impact (Fisheries and aquaculture, Tourism and recreation, Coastal community livelihood)
- Case studies overview – examples from the Black Sea

### **Module 9. Intervention Techniques in case of accidental Oil Pollution**

- Oil spills containment and recovery
- Use of dispersants and booms
- Clean-up operations and cleaning devices
- Bioremediation methods for oil degradation
- New Technologies for oil spill monitoring (EO/Satellite and UAV monitoring)
- Real-time sensors for detecting oil pollution – drifters availability, functioning and providing data for common monitoring platforms.

### **Module 10. Emerging Issues in Marine Pollution**

- Climate change and pollution: Synergies and combined impacts
- Innovations in marine pollution control and green technologies
- Public awareness and the role of citizen science in marine pollution preparedness (MP monitoring and mitigation activities) and rapid response

### **Module 11. Design of Fieldwork and Practical Applications**

- Field sampling techniques and in situ data collection
- Lab-based analysis of pollutants
- Emergency services data access
- Development of pollution monitoring and response plans for specific coastal areas (Short range remote sensing techniques vs EO & modelling/EWS)
- Communication and Public Awareness – international and regional case studies
- Engaging professionals vs coastal communities on marine pollution prevention
- Designs questionnaire for public basic awareness on marine pollution

## UKRAINE - CURRICULUM OUTLINE

Stakeholder target groups:

- 1) representatives of administrations, inspectorates, institutions, decision-makers in the field of environmental protection, civil defense, emergency response teams, involved in problem-based learning, interested in using online platforms and other training tools for rapid response to pollution of marine ecosystems;
- 2) scientists, representatives of educational institutions, students of higher education institutions, full-time and distance learning, other professionals in the maritime sector - interested in extracurricular programs and training, the use of combinations of modules, the use of online platforms and project tools;
- 3) other training organizations, local communities, volunteers, NGOs, media, etc. – interested in short 1-1.5-day courses, problem-based learning, use of online platforms and other training tools for responding to pollution of marine ecosystems.

The modules proposed by the RESPONSE team have been previously discussed, but their development will continue in the future during individual communication with participants.

### **Module 1. Introduction to the issues of research into pollution of marine ecosystems**

- Identification of contaminants
- Overview of marine ecosystems and their vulnerability to pollution
- Overview of anthropogenic human impact and pollution on the marine environment
- Historical background on pollution and regional/national trends

### **Module 2. Geography and characteristics of the Black Sea, pollution and its impact on marine ecosystems**

- Overview of marine ecosystems and their vulnerability to pollution
- Geography of the Black Sea, hydrography, unique characteristics, currents
- Black Sea biodiversity and natural resources
- Characteristics of the Black Sea and the connection with pollution

### **Module 3. Types and sources of pollution, the impact of pollution on the state of the ecosystems of the Black Sea Basin (BSB)**

- Sources of marine pollution, their impact on Black Sea ecosystems and the quality of ecosystem services
- Overview of types of marine pollution – general introduction and the most common types of marine pollution, particularly in the BSB
- Eutrophication: sources of occurrence and impact on the state of marine ecosystems
- Oil pollution: sources, risks, impacts, consequences
- Harmful and toxic substances, pollutants (heavy metals, pesticides, radioactive contamination) (sources/impacts/etc.)
- Invasive species - ballast water, other (sources/impacts/etc.)
- Marine litter (sources/impacts/etc.)
- Pollution due to armed conflicts (sources/impacts/consequences, etc.)

- Other types of pollution (e.g., atmospheric precipitation, persistent chemicals, etc.)
- Consequences of marine pollution: ecological, economic, social and other aspects.

#### **Module 4. Impact of marine pollution on ecosystems and human health**

- Environmental impact on marine organisms and ecosystems, features for BSB
- Bioaccumulation and biological increase in pollutant concentrations in marine food chains
- Human health risks associated with seafood contamination and water quality
- Ecosystem services and marine pollution incidents
- Impact on human health
- Socio-economic consequences (fisheries and aquaculture, tourism and recreation, coastal community livelihoods)

#### **Module 5: Legislation and management systems that contribute to combating pollution in the BSB**

- International legal framework (e.g. MARPOL, London Convention/London Protocol, United Nations Convention on the Law of the Sea (UNCLOS), Basel Convention, International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC), Bunker Convention, etc.) – national and regional specificities of application
- EU legislation and policy framework (e.g. MSFD, WFD, Bathing Water Directive, Port Reception Facilities Directive, Integrated Maritime Policy, etc.), The Common Maritime Agenda (CMA) for the Black Sea
- Regional agreements (e.g. Bucharest Convention, Protocol for the Protection of the Black Sea Environment against Pollution from Land-based Sources, Protocol on Emergency Situations, Protocol on Dumping of Wastes, Black Sea Oil Pollution Contingency Plan under the Protocol on Emergency Situations, Strategic Action Plan for the Protection and Restoration of the Black Sea Environment, Danube River Protection Convention)
- National legislation is the main legal framework for Ukraine in accordance with EU directives
- International bodies (e.g. International Maritime Organization (IMO), European Maritime Safety Agency (EMSA), etc.).
- Regional bodies of the BSB - BSC, BSEC, ICBSS think tank, CPMR in EU through the Balkan and Black Sea Commission (BBSC)
- National/local bodies (e.g. National maritime agencies, other national bodies related to marine pollution – environmental protection agencies, maritime administrations involved in monitoring and responding to emergencies and building preparedness for responding to marine pollution in Ukraine)
- Other organizations and societies involved in marine pollution control (e.g., rescuers, environmental NGOs)

#### **Module 6. Pollution Monitoring and Assessment**

- Pollution monitoring methods: sampling, remote sensing and in-situ measurements
- Analytical methods for detecting contaminants (e.g. chromatography, etc.)
- Data analysis and mapping of pollution hotspots
- Case studies of monitoring programmes (e.g. UNEP, NOAA, EU Marine Strategy Framework Directive, national, regional) – BS Commission, monitoring programmes and projects supported by the EU and UNEP

- National monitoring programs as part of the strategic course for the development of the maritime complex of Ukraine, in the context of the EU MSFD

### **Module 7. Pollution Management and Mitigation**

- Pollution prevention strategies and measures
- Methods for restoring and cleaning marine ecosystems
- Engineering solutions for wastewater treatment and coastal pollution control
- Oil spill response technologies and solutions
- Reducing plastic waste: policy, recycling and alternative materials

### **Module 8. Preparedness to respond to marine pollution challenges: operational and tactical aspects**

- Introduction to national emergency response and incident management plans, regional plans (oil pollution, marine litter) – identification of gaps, problems, funding sources
- The existing national emergency response system in the Ukrainian maritime response zone – monitoring, distress signals, initiation and coordination of operations
- Examples of international protocols (e.g. International Convention on Oil Pollution Preparedness, Response and Cooperation (OPRC 90), Protocol on Preparedness, Response and Co-operation to Pollution Incidents by Hazardous and Noxious Substances 2000 (OPRC-HNS Protocol)
- Developing an effective response plan to the challenges of marine pollution - types of pollution, key issues that need to be addressed
- Key operational staff role - Define roles and assign responsibilities
- Review of equipment for responding to marine pollution challenges - definition and organization
- Practical aspects of different types of marine pollution – Preparedness (including different hazards for response services and safety aspects to consider)
- Prepare training sessions for key operational staff and responders – key elements
- Prepare field exercises-training/ scenarios/ use of equipment – national naval exercise, training at sea exercise
- Assessment of operational staff readiness – training, equipment, system support sources

### **Module 9. Marine Pollution Risk Assessment and Planning of Early Warning Systems**

- Risk assessment for vulnerable areas – (BS defined by Marpol)
- Contingency planning
- Training and capacity building
- Community raising awareness programs
- Activation of the early warning system
- Practicalities of responding to different types of marine pollution – how to act on site (including the different hazards for response services and safety aspects to consider)
- Methods of intervention in critical situations and minimization of the consequences of marine pollution

### **Module 10. Strategic aspects of building preparedness to respond to the challenges of marine pollution**

- Overview of strategies for responding to marine pollution challenges (international examples)
- Effective emergency planning (importance, use, key points)
- Strategic planning and organization of the application of effective resources and measures in contaminated areas (e.g. in the case of oil pollution), in accordance with the Black Sea oil pollution emergency response plans at the national level and at the level of the Black Sea Basin countries
- Planning practices for the effective use of material, information and other resources
- Monitoring and reporting – review of new technologies – sampling and analysis tools and methods (e.g. geographic information systems GIS, remote sensing, etc.)
- Waste management and safe disposal
- Assessing the effectiveness of the response plan
- New technologies for preparing for marine pollution response – using virtual reality
- Strategic media engagement management – media engagement and ongoing relationships
- Development of training programs for civilian response to marine pollution incidents
- Port reception facilities – in Ukraine, in other BSB and Danube countries
- Sustainable shipping practices – Marpol, ship reporting, pollutant lists

### **Module 11. Monitoring and prospects for the application of new technologies**

- Pollution monitoring methods: sampling, remote sensing and in-situ measurements
- Analytical methods for detecting contaminants (e.g. chromatography, etc.)
- Data analysis and mapping of pollution hotspots
- New technologies for monitoring marine pollution (e.g. UAVs, satellite imagery, remote sensing, real-time monitoring, application of AI, including machine learning)
- Citizen engagement – the power of crowdsourcing
- Case studies of monitoring programs (e.g. UNEP, NOAA, EU Marine Strategy Framework Directive, national, regional regulations)
- Scenarios and rules for forming representative samples

### **Module 12. Responding to Marine Pollution Incidents: Wildlife Conservation**

- A look at the wildlife most affected by marine pollution incidents (including militarized pollution)
- The impact of different types of marine pollution on wildlife
- Safety protocols for working in wildlife environments affected by marine pollution
- Preparedness to respond to and preserve marine wildlife affected by a marine pollution incident (e.g., oil, chemical, military, etc.)
- Key processes and response protocols used for wildlife affected by a marine pollution incident
- Formation of integrated marine pollution response systems, in accordance with the needs of wildlife. Functional areas of marine incident management
- Key "inputs" required to conserve and support wildlife (e.g., supplies and feed, human resources, equipment, etc.)
- Specific cleaning methods: bacteriological preparations, marine mammals, birds, etc.

- Safety, health and working conditions measures when responding to marine pollution incidents in the context of wildlife conservation

### **Module 13. Ecosystems and marine pollution incidents**

- Overview of ecosystems vulnerable to marine pollution
- Impact of different types of marine pollution on marine ecosystems
- Preparedness and response actions for specific ecosystems
- Overview of practical examples of responding to pollution of certain ecosystems – examples from the Black Sea

### **Module 14. Methods for mitigating the consequences of marine pollution (using the example of petrochemical, military impact, plastic pollution)**

- Oil spill containment and recovery (use of dispersants and booms)
- Mitigating the effects of marine pollution and littering due to military influence
- Plastic and garbage cleanup operations
- Bioremediation methods

### **Module 15. Technological Innovations**

- Organization of permanent monitoring and pollution prevention systems. Satellite and unmanned monitoring
- Marine environment cleaning devices
- Green shipping technologies, green ports
- Bioremediation: Using microorganisms to degrade oil.
- Real-time sensors for detecting pollution – availability, functioning and providing data for common platform.

### **Module 16. Modern challenges and responses to marine pollution**

- Climate change and pollution: synergy and combined impact
- Ecological, economic and social challenges of the impact of military conflicts on the Black Sea ecosystem
- Public awareness and the role of science in research and rapid response to pollution

### **Module 17. Fieldwork and practical application of marine pollution response measures**

- Field sampling and data collection methods
- Laboratory analysis of pollutants
- Investigation of treatment plants, coastal treatment plants and monitoring stations
- Development of pollution monitoring and response plans in the context of local coastal development
- Peculiarities of conducting research on the marine environment under martial law
- Remote probing/ Remote sensing of the Earth (EO), modeling / etc.

### **Module 18. Communication and Public Relations**

- Bringing scientific information to the public

- Interaction with communities to prevent marine pollution
- Development of educational materials and campaigns to raise awareness about marine pollution

## Special sessions

### Session 1. Vessels in distress

- Types of ship accidents (e.g. capsizing and listing, collision, contact, fire or explosion, hull damage, etc.)
- Impact on ecosystems and biodiversity
- The need for help: the role of places of refuge
- Safe ship recycling
- Examples of selected incidents in the BSB – facts and assessments – tanker wrecks, etc.

### Session 2. Pollution and littering due to military aggression

- Types and extent of pollution and littering of the marine environment as a result of military aggression
- Methods, protocols, measures for preventing and responding to pollution and contamination resulting from military aggression
- Features of practical measurements of impact and calculation of damage to marine ecosystems
- Examples of responses (Kakhovska HPP and others) and practice of using training equipment and simulators

### Session 3. Oil pollution and marine activities

- Oil Pollution Basics
- Pollution risks during offshore oil and gas production
- National legal framework for oil pollution
- Oil spill response strategies

### Session 4. Ballast water and other marine pollutants (invasive species, etc.)

- Environmental risks associated with the use of ballast water
- Anti-fouling systems, invasive species and their impact on the environment
- Addressing chemical pollution during maritime operations
- Management of wastewater, garbage and other waste, including disposal methods
- Environmentally friendly methods of ship recycling and utilization

### Session 5. Air pollution and greenhouse gas emissions

- Air pollution problems in the shipping industry
- Regulatory and voluntary initiatives to control emissions
- Advanced technologies to reduce emissions of SO<sub>x</sub>, NO<sub>x</sub>, particulate matter (PM) and other pollutants
- Challenges and opportunities in addressing marine emissions