MMinE-SwEEPER

Deliverable Report

Deliverable No. 1.2.: Identified needs

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1. Introduction

The main objective of Work Package 1 (WP1) is to identify the specific needs, concerns, capabilities, and capacities of different stakeholder groups involved in the remediation of dumped marine munitions. Task 1.2 of WP1 aims to initiate dialogue and clarify stakeholders' needs, protection concerns, requirements, and limitations regarding the remediation of marine munitions. To achieve the aims of this task, a survey was conducted among a broad range of stakeholders knowledgeable about dumped marine munitions—across Europe and beyond, to initiate a dialogue on the key limitations and concerns related to the remediation of dumped munitions. The results of the survey are provided in this report, Deliverable 1.2 Identified Needs.

The stakeholders who participated in the survey are part of the Roster of Stakeholders developed under Task 1.1. The survey was conducted using a co-created questionnaire and distributed via email to persons in the Roster of Stakeholders. The questionnaires were also published on the project's communication channels, including LinkedIn, MMinE-SwEEPER newsletter and Kiel Munitions Clearance Week (KMCW) conference website.

The results of this report will serve as a baseline for further assessments to understand stakeholders' concerns related to the remediation of sea-dumped munitions. The findings from this survey, together with insights from the stakeholder workshops (World Café and Mentimeter sessions held during the Kiel Munition Clearance Week (KMCW, June 2025), the side event "No Time to Waste: Tackling Submerged Munitions in European Seas" at the United Nations Ocean Conference (UNOC; June 2025), and the BANOS Conference (April 2025), will be synthesized in Task 1.3 for Deliverable D1.3 Synthesis of Stakeholder Dialogue. This synthesis aims to capture stakeholders' needs and capacities holistically, support the co-design and joint implementation of remediation strategies, and contribute to increasing the Societal Readiness Level (SRL) for addressing sea-dumped munitions in Europe and in support of the EU Oceans Pact 2025.

This deliverable is the first of the series dedicated to the stakeholder dialogue supporting the development of MMinE-SwEEPER objective A2 Compilation of stakeholder needs.

2. Materials and Methods

2.1 Survey Area

The stakeholders represented organizations from 14 European coastal countries, bordering the Baltic, the Mediterranean, the Black Seas, and the Northeast Atlantic, as well as an organization from North America (Canada). The European organizations were based in Belgium, Denmark, Estonia, Finland, France, Germany, Italy, the Netherlands, Poland, Portugal, Sweden, Switzerland, Ukraine, and the United Kingdom.

2.3 Stakeholders Identification and Selection

The respondents for this survey were from the Roster of Stakeholders identified in Deliverable D1.1 Stakeholder community. The Roster of Stakeholders is a "living" document of entities interested in the clearance and remediation of dumped marine munitions. Most of the respondents are experts with substantial knowledge about marine-dumped munitions and the associated risks to the environment and security. Participants represented diverse disciplines and organizational sectors, including research, private industry, governance (environmental institutions, policy, security, and safety entities), and non-profit organizations (NGOs). A diverse and multi-sectoral group was selected for the survey to ensure that accurate and relevant information, based on practical experience

and technical knowledge of marine-dumped munitions, is documented to facilitate constructive dialogue and decision-making.

2.4 Survey Design

The survey was designed and administered via SurveyMonkey, a widely used online survey platform (https://www.surveymonkey.com/). A structured questionnaire was used as the data collection method for the survey to ensure the generation of qualitative data suitable for robust statistical analysis (Young, 2015). The questionnaire was developed and coordinated by HELCOM Secretariat with inputs from partners in MMinE-SwEEPER and EU co-funded projects, i.e. MUNIMAP (https://interreg-baltic.eu/project/munimap/) and MUNI-RISK (https://muni-risk.eu/) (see D1.1 Stakeholder community, for synergies within the three projects). The design and framing of the questionnaire items were based on existing literature on marine-dumped munitions and consultations with experts and researchers involved in MMinE-SwEEPER.

The questionnaire development followed an iterative process, including expert reviews within the consortium to ensure clarity, relevance and coherence of each item. It combined open-ended statements with two sets of ranking options, each using a 5-point Likert scale. The first scale range from: 1 = 'Not at all concerned', 2 = 'Slightly concerned', 3 = 'Somewhat concerned', 4 = 'Highly concerned', and 5 = 'Extremely concerned', while the second ranged from: 1 = 'Significant deterioration', 2 = 'Some deterioration', 3 = 'No effects', 4 = 'Some improvement', and 5 = 'Significant improvement'. These scales provided insights into stakeholder perceptions of the submerged munitions and the remediation actions required.

The final questionnaire for the survey comprised 18 questions (Q) structured into four thematic sections: (1) respondent's profile and expertise in marine munitions, (2) concerns related to potential effects of marine munitions on the environment, economy, security and safety, (3) specific needs, limitations and reasons to remediate marine munitions and (4) prioritization of the sites to remediate (see Appendix 1 for the full questionnaire)

2.5 Data Collection and Analysis

The questionnaire was emailed to 107 individuals listed in the Roster of Stakeholders. It was also distributed to potential respondents through the project's communication channels, LinkedIn, MMinE-SwEEPER newsletter and KMCW website, between 24 February – 31 August 2025.

To reduce stakeholder fatigue and foster synergies between MMine-SwEEPER and MUNIMAP, the questionnaire was not broadly distributed to stakeholders from governance institutions, as this group would primarily contribute to MMine-SwEEPER's WP2: Responsibilities Assessments and Decision-Making. In addition, governance stakeholders from the Baltic States overlapped with those already engaged in MUNIMAP's survey on marine munitions regulations and management responsibilities. At the close of the survey (31 August 2025), the completed questionnaires were analysed using the analytical tools embedded in SurveyMonkey, Microsoft Excel, and R-studio.

3. Results

A total of 52 participants (hereafter respondents) fully completed the questionnaire out of 81 participants. Most of the responses were received through the project's communication channels. The detailed survey results are provided in the following sections.

3.1 Profile of respondents

Most respondents were from organizations based in the Baltic Sea countries, with the largest number of respondents coming from Germany (51%), followed by Poland (12%) and Estonia (8%). In terms of their professional background, 38% worked in research, 33% in the private sector, 19% in governmental institutions and 8% in NGOs. One security entity fully completed the survey. Aquaculture and tourism-related companies did not participate in the survey. Overall, 75% of respondents worked on dumped marine munitions, often in collaboration with others, while 25% did not work directly on the topic but still reported relevant knowledge. Notably, three of these organizations collaborate with other organizations engaged in the topic.

3.2 Impacts of dumped marine munitions on the environment, economy, security and safety

The responses on the impact of dumped marine munitions were measured using a 5-point Likert scale, where 1 = 'Not at all concerned', 2 = 'Slightly concerned', 3 = 'Somewhat concerned', 4 = 'Highly concerned', and 5 = 'Extremely concerned'. Considering the overall impacts on the economy, security and safety, the respondents expressed greater concern for the Environment (3.7 ± 1.3) and the Economy (3.7 ± 1.3) than on Security (3.4 ± 1.5) (Table 1).

Table 1. Stakeholders' level of concern

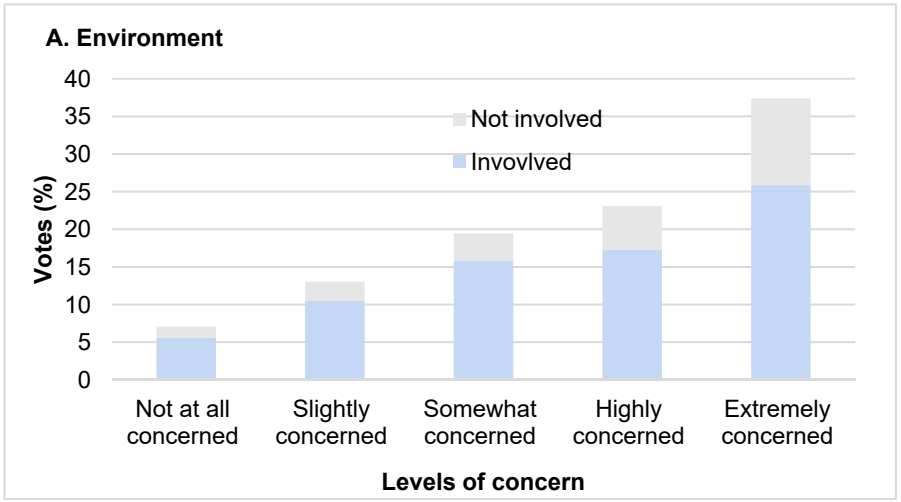
Categories	**Evaluation Aspects**	**Mean ± SD**
Environment	Marine mammals	3.5 ± 1.2
	Fish	3.9 ± 1.1
	Birds	2.9 ± 1.4
	Pelagic biota	3.5 ± 1.4
	Benthic biota	3.9 ± 1.2
	Ecosystem functions	3.7 ± 1.3
	Sediment	3.8 ± 1.3
	Water pollution	3.9 ± 1.2
	Hazards	4.1 ± 1.0
Average (Environment)		**3.7 ± 1.3**
Economy	Aquaculture activities	3.2 ± 1.3
	Maritime activities	3.6 ± 1.2
	Marine economy safety (fishing, shipping, tourism, etc)	3.9 ± 1.0
	Blue sustainable economy development	3.5 ± 1.3
	Offshore infrastructures	3.9 ± 1.0
	Seabed industry infrastructures	4.1 ± 0.9
Average (Economy)		**3.7 ± 1.2**
Security	Military	3.4 ± 1.3

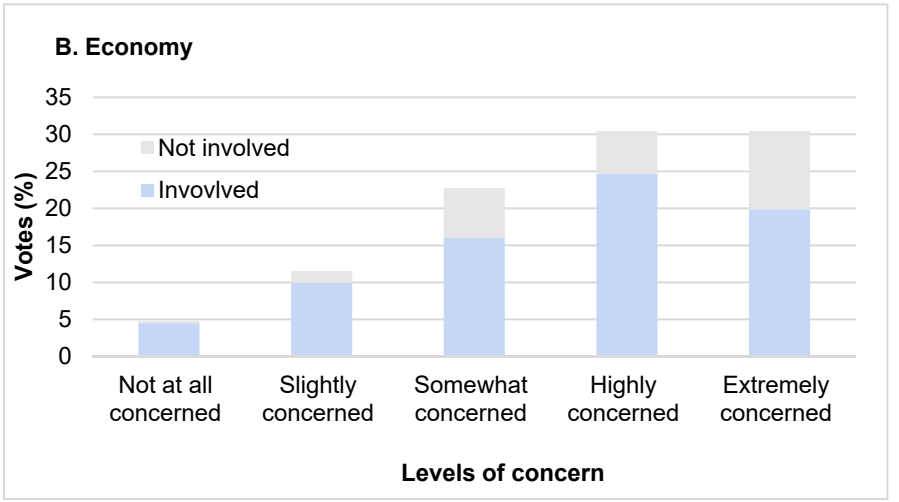
Categories	Evaluation Aspects	Mean ± SD
	Civil	3.5 ± 1.2
	Police	3.0 ± 1.2
	Occupational	3.3 ± 1.2
	Infrastructures	3.8 ± 1.1
	Terrorism	3.4 ± 1.5
Average (Security)		**3.4 ± 1.5**

Environmental concerns were highest for the release of hazardous substances (4.1 ± 1.0) into the marine environment and lowest for impacts on marine birds (2.9 ± 1.4). For the economy, respondents were most concerned about the potential damage to seabed industry infrastructure, while impacts on aquaculture activities received the lowest concern (3.2 ± 1.3). Regarding impacts on security, the highest concern was expressed for security infrastructures (3.8 ± 1.1), whereas impacts on marine police personnel were rated the lowest (3.0 ± 1.2).

The remarks of respondents who were *highly* or *extremely* concerned included, 'health hazards associated with white phosphorus on beaches', 'they pose serious environmental, security, and health risks, especially with leakage of toxic substances and the impact on marine ecosystems' and 'It is a marine pollution hazard that is hardly addressed' (Table 1s). The age and deterioration of the dumped munitions raised two contrasting concerns. Some respondents were *slightly concerned*, noting that older munitions pose a lower risk of explosion, whereas others were *highly or extremely* concerned emphasizing that ageing and corroded munitions could significantly impact the environment, compromise safety, and threaten the security of human activities and infrastructure. Additional reasons for respondents' concerns are provided in Table 1s.

Relating respondents' levels of concern to their involvement in the topic of dumped marine munitions (Q6), most expressed either extreme or high concerns about environmental, economic and security impacts, irrespective of their direct involvement in the topic (Figure 1 A—C).





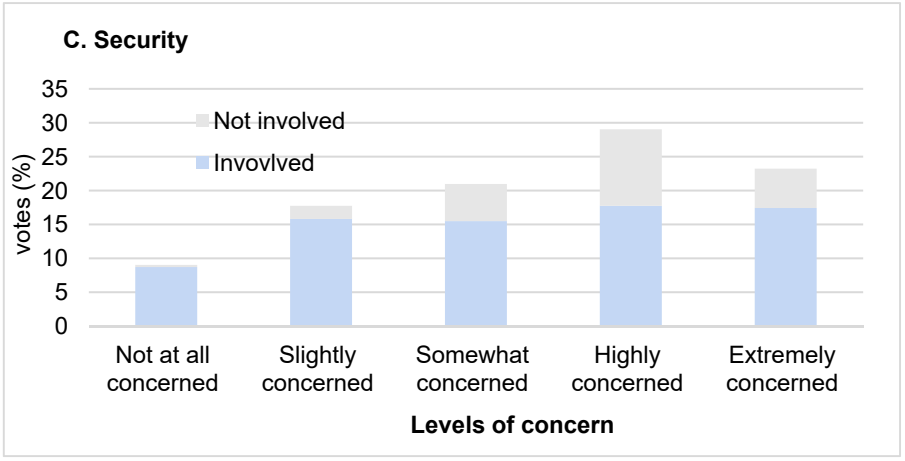


Figure 1. Levels of concern about the impact of dumped marine munitions on the A. Environment, B. Economy and C. Security in relation to the respondents' direct involvement on the topic. The light blue colour represents respondents who are directly involved, and the light tan colour represents respondents who are not directly involved.

Considering environmental impacts, most of the respondents directly involved (26%) and those not directly involved (11%) in the topic of dumped marine munitions were *extremely concerned* (Figure 1A). Regarding economic impacts, the majority of respondents directly involved in the dumped munitions (25%) were *highly concerned*, whereas most of those not directly involved (11%) were *extremely concerned* (Figure 1B). For security impacts, most of the respondents involved (18%) and not involved (11%) on the topic were *highly concerned* (Figure 1C). Detailed levels of concern for each evaluation aspect, relative to respondents' direct involvement in dumped marine munition, are presented in Table 2s.

3.3 Remediation of submerged munitions

Regarding the availability of sufficient knowledge and tools to initiate remediation actions, 62% of respondents indicated that current knowledge and tools are sufficient, while 38% disagreed. Figure 2 shows respondents' views on the availability of sufficient knowledge and tools by their organizations' country of origin.

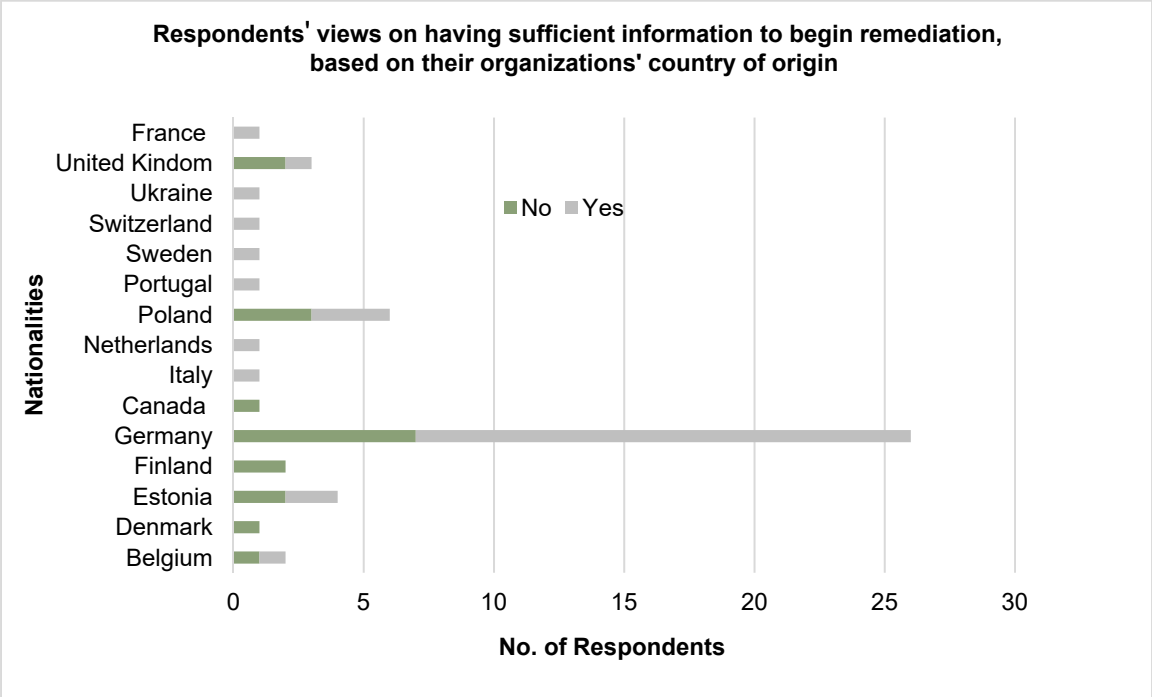


Figure 1. Views on sufficient information for remediation. The red bars indicate their disagreement with sufficient knowledge and tools to commence remediation, and the grey bars indicate agreement.

Although most respondents agreed that sufficient information exists to initiate remediation actions, there were notable regional differences depending on the country of origin of their affiliated organization. For Central European organizations, specifically Germany and Poland, which had the highest survey participation, 67% of the respondents indicated sufficient knowledge and tools exist to initiate remediation actions, while 33% disagreed. For Western and Eastern European organizations, most respondents considered the available knowledge and tools adequate to initiate remediation, except for organizations in Belgium, where responses were evenly split. Respondents for Northern European organizations in Finland and Denmark indicated that knowledge and tools were insufficient, whereas the respondent from the Swedish organization indicated that there was adequate knowledge and tools to initiate remediation actions. Outside Europe, the respondent for the Canadian-based organization indicated a lack of sufficient information. Two of the respondents for the UK organizations indicated insufficient knowledge and tools, whereas one respondent indicated that knowledge and tools are sufficient.

3.3.1 Aspects requiring further information

Based on the respondents' organizations perspectives, the aspect that was frequently identified as needing further information before remediation was 'Responsibilities, permits and bureaucracy' (56%) (Figure 3).

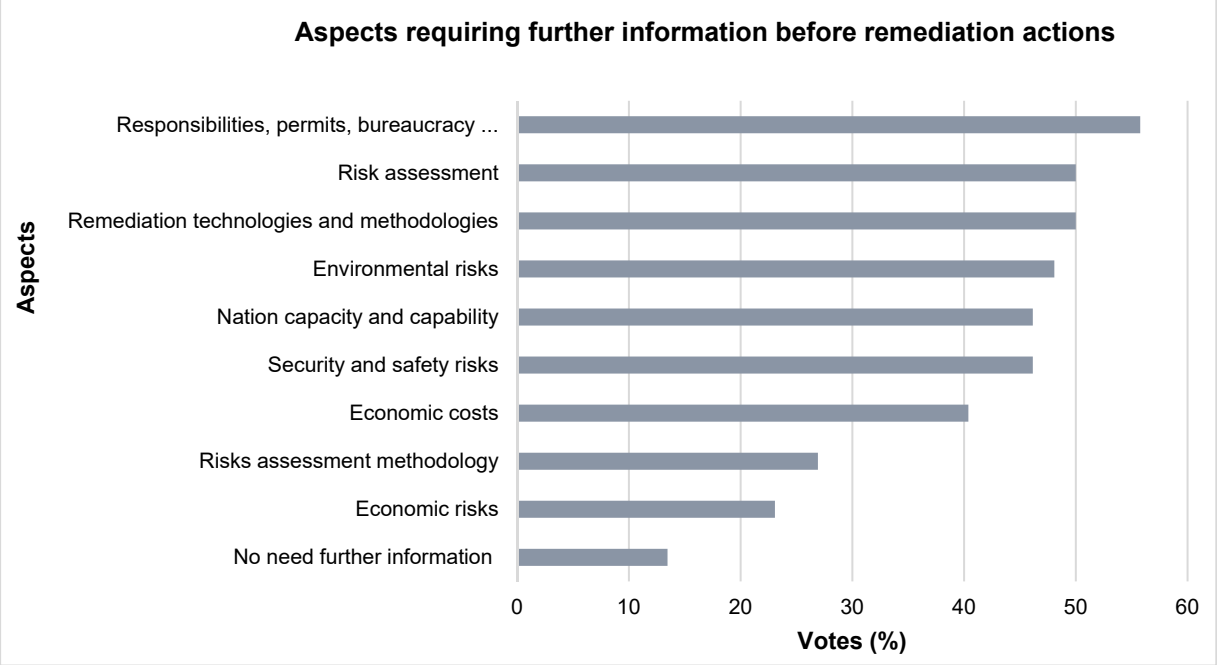


Figure 2. Distribution of the key aspects requiring further information before remediation.

This was followed by 'Risk assessment (50%)' and 'Available remediation technologies and methodologies' (50%), and 'Environmental risks' (48%).

In relation to the organizational sector, the following emerged as key aspects of focus: 1) "Responsibilities, permits, bureaucracy ...", 2) "Available remediation technologies and methodologies", "Risk assessment", 3) "Environmental risks", "Security and safety risks" and "National capacity and capability" (see Table 2).

Table 2. Stakeholder sectors and identified knowledge gaps

Sector	Order of Importance		
	1st	2nd	3rd
Governance	"Security & safety" "Environmental risks"	"Risk assessment" "National capacity & capability"	"Responsibility & bureaucracy" "Economic costs" "Available technology and methodology"
Non-profit	"Responsibilities & bureaucracy"	"National capacity & capability"	" Security & safety" "Risk assessment" " Economic costs"
Private	"Available technology & methodology"	"Responsibilities & bureaucracy"	"Security & safety " "National capacity & capability" "Environmental risks" "Economy costs"
Research	"Responsibilities & bureaucracy"	" Environmental risks" "Available technology & meth-odology"	"Risk assessment"
Security	"Risk assessment methodology" "Risk assessment" "Responsibilities & bureaucracy"	NA	NA

The organizational sector and professional background of stakeholders influenced the key aspects prioritized for further clarification before remediation actions. For example, stakeholders from the Governance sector ranked "security and safety" and "environmental risks "as the top priority, whereas stakeholders from the private sector ranked them the least (Table 2).

In addition to identified key aspects for clarification, the stakeholders requested "additional information" in relation to: 1) "The legal framework when operating in the German EEZ, as it is often unclear", 2) "long-term environmental monitoring protocols to assess the effectiveness and impacts of remediation", 3) "more detailed chemical analyses and scientific studies on this subject (marine munitions)", 4) "archival research and historical data" and 5) "funding opportunities". See Table 3s for other aspects of remediation activities where further information was required.

3.3.2 Impacts of remediation on the Environment, Economy and Security

Considering the impacts of remediating submerged munitions, overall, the respondents indicated that remediating marine munitions is more likely to improve than to deteriorate the Environment, the Economy, and Security (Table 3).

Table 3. Stakeholders' evaluation of perceived impact of remediation

Category	Evaluation Aspect	Mean ± SD
Environment	Marine ecosystem functioning	3.5 ± 1.2
	Marine fauna (e.g. noise, resuspension of hazards, etc.)	3.4 ± 1.3
	Environment (in general)	3.5 ± 1.2
Average (Environment)		**3.5 ± 1.2**
Economy	Public economy (public costs of remediation)	3.3 ± 1.2
	Blue economy development	3.6 ± 1.1
	Offshore sustainable industry development (cabling, offshore wind farms, etc.)	3.8 ± 1.1
	Aquaculture or other marine economic activity	3.4 ± 1.2
	Tourism and recreational economic activities	3.5 ± 1.3
Average (Economy)		**3.6 ± 1.2**
Security	Food security	3.6 ± 1.2
	Geopolitical security	3.4 ± 1.3
	Civil security	3.7 ± 1.1
	Military security	3.4 ± 1.3
	Ethical/well-being issues	3.9 ± 1.1
Average (security)		**3.6 ± 1.2**

However, the responses varied depending on different evaluation aspects. The average ratings on the 5-point Likert scale for Environment(Q13), Economy (Q14), and Security (Q15)[1] were 3.5 ± 1.2, 3.6 ± 1.2, and 3.6 ± 1.2, respectively (Table 3).

[1] Q15. Security and safety. Please evaluate how remediating submerged marine munitions will affect the following security and safety aspects

Table 4. Stakeholders' perception of the relative impact of remediation

Evaluation Aspects	Categories	Distribution of stakeholder responses (%)				
		1	2	3	4	5
		Significant deterioration	Some deterioration	No effects	Some improvement	Significant improvement
Environment	Marine ecosystem functioning	3.9	19.6	21.6	33.3	21.6
	Marine fauna (e.g., noise, resuspension of hazards, etc.)	7.7	19.2	21.2	26.9	25.0
	Environment in general	5.8	13.5	26.9	28.9	25.0
Economy	Public economy (public costs of remediation)	4.0	26.0	30.0	20.0	20.0
	Blue economy development	5.9	9.8	21.6	39.2	23.5
	Offshore sustainable industry development (cabling, offshore wind farms, etc.)	3.9	7.7	23.1	30.8	34.6
	Aquaculture or other marine economic activity.	7.7	13.5	28.9	28.9	21.2
	Tourism and recreational economic activities.	7.8	15.7	25.5	17.7	33.3
Security	Food security	3.9	13.7	29.4	21.6	31.4
	Geopolitical security	7.8	19.6	27.5	19.6	25.5
	Civil security	3.9	9.6	23.1	38.5	25.0
	Military security	11.5	13.5	21.2	30.8	23.1
	Ethics/well-being issues.	5.9	3.9	23.5	29.4	37.3

The highest concern about significant deterioration was observed for the military security aspect, with 11.5% (Table 4). Concerns about some deterioration were observed for the public cost of remediation, with 26%. The respondents anticipated some improvement as a consequence of remediation for the blue economy development (39.2%), civil security (38.5%) and marine ecosystem function (33.3%). Finally, respondents expected significant improvement for ethics/ well-being issues (37.3%), offshore sustainable industry development (34.6%), tourism (33.3%), and food and security (31.2%).

Additional benefits highlighted by respondents on remediation activities included long-term improvements on economic activities and ecosystem health, as well as the perceived minimal impact of remediating dump sites on offshore companies (Table 4s).

3.3.3 Need for remediation actions

Regarding the need for remediation (Q17), 98.1% of respondents agreed that remediation of dumped marine munitions is necessary (Figure 4).

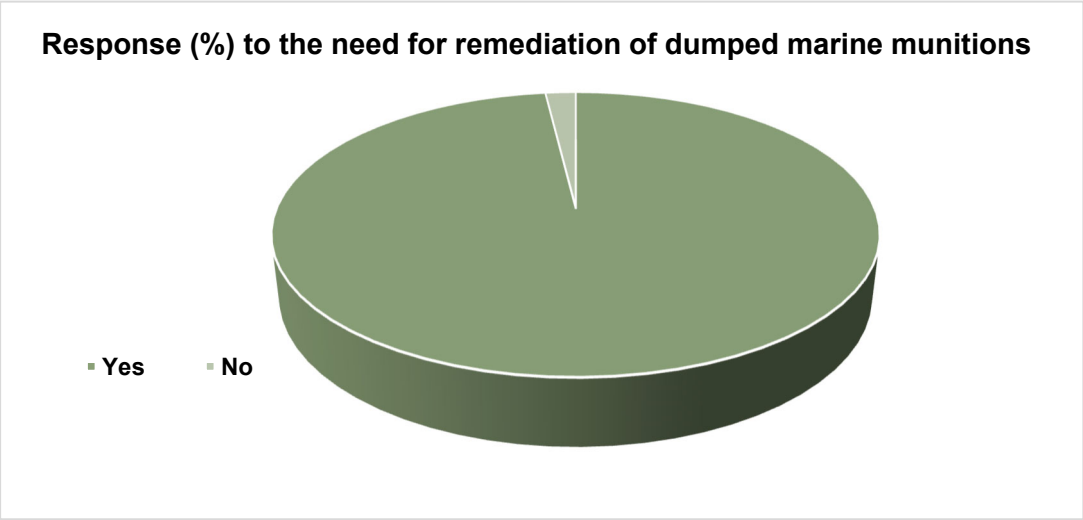


Figure 3. Percentage responses (%) to the need for remediation of dumped marine munitions.

3.3.4 Remediation approaches and methods

In terms of the remediation approaches and methods to be prioritized, 49% of the respondents indicated that remediation approaches and methods should be tailored to the specific conditions of each site and case (Figure 5).

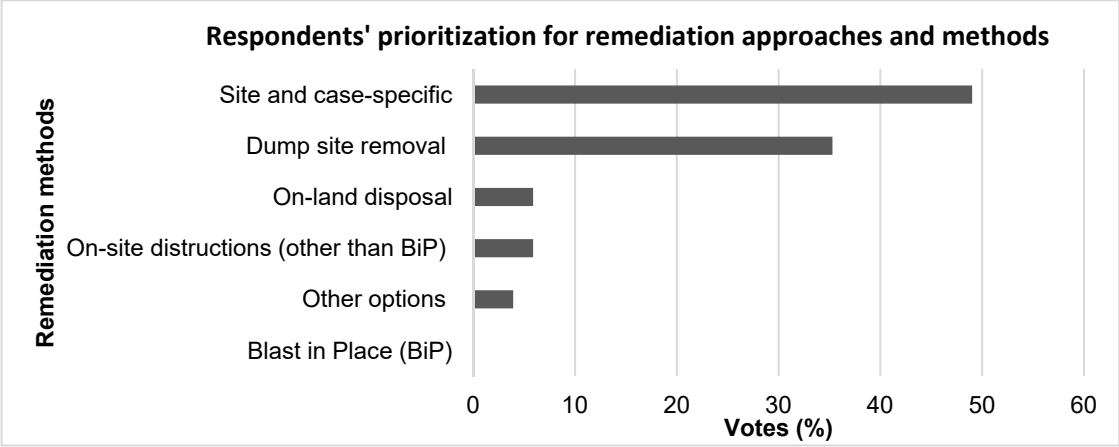


Figure 4. Distribution of respondents' preferences for prioritised remediation approaches and methods.

The most suitable method identified was removal of the munitions from the dump sites (35%), followed by on-land disposal and on-site destruction other than BiP (6%) (Figure 5). None of the respondents opted for Blast in Place

(BiP) as an appropriate remediation method. Two "other" methods indicated were “prevent stripping equipment” for mines and the "use of platforms for destroying munitions" (see comments in Table 5s).

For the final question, Q18, the respondents were queried regarding the criteria that should be considered for prioritization of sites for potential remediation, see Figure 6 below.

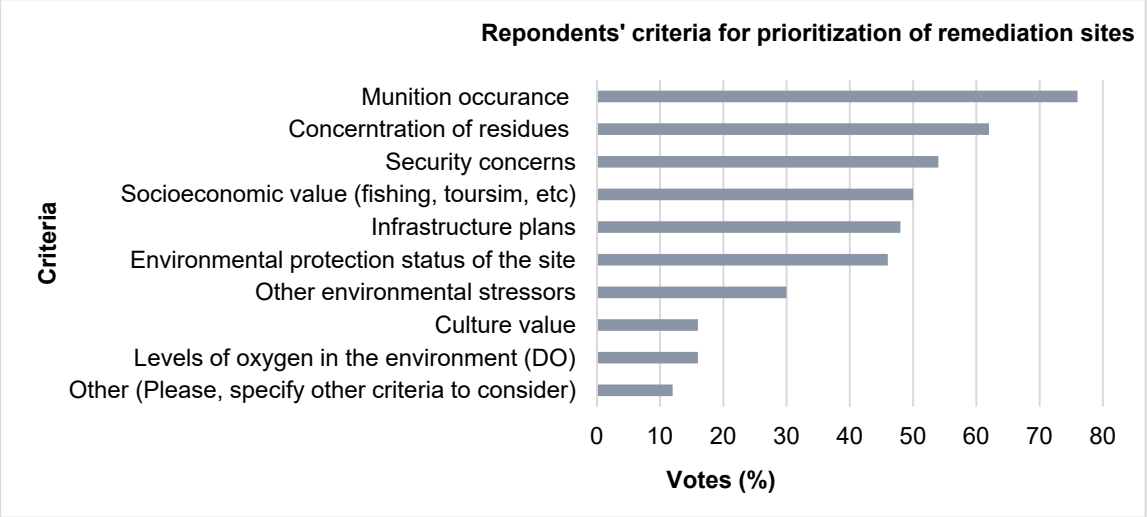


Figure 5. Percentage contribution of each criterion for prioritizing remediation sites.

The majority of the respondents (76%) indicated that munition occurrence should be prioritized followed by concentration of residues (62%) and security concerns (54%).

4. Discussion

This report reflects the specific needs and concerns of different stakeholder groups regarding the remediation of marine munitions in Europe based on the presented survey. The survey provided broad insights into stakeholder concerns about the potential environmental, economic, and security impacts of dumped marine munitions, as well as their specific needs and priorities for site remediation. Stakeholders expressed stronger concerns about the environmental and human security risks of dumping marine munitions, while also highlighting the need for enhanced knowledge about remediation methods.

The relatively high participation from Central European organizations, especially Germany, may be due to a relatively higher level of concern and expertise in the dumped marine munition topic. Germany is an early mover and has demonstrated greater political commitment to remediation of dumped munitions (Greinert et al., 2024; Pechmann & Hinkel, 2025).

While stakeholders indicated that the risks of explosions and material corrosion from munitions pose significant threats to the environment, economy and security, the survey also revealed deeper challenges associated with remediation. Critical among these is an apparent lack of appropriate remediation methods, as well as limited information and understanding of the broader impacts of dumped munitions. These gaps likely explain why 'risk assessment' emerged as one of the most prominent information needs identified by the respondents before remediation. Further, the respondents highlighted the need for additional information on the responsible institutes, available technologies and methodologies, environmental risks, security and safety, and the country's capacity to initiate remediation activities.

A critical concern is the scarcity and confidentiality of the records of dumping activities, accessing this information, among others, can be challenging (Barbosa et al., 2023; Sanderson et al., 2017). Underscoring the importance of sharing this information as also highlighted in the Palanga commitments from 2023.

The top three criteria for remediation of dumped marine munitions were the following (1) munition occurrence, (2) concentration of residues, and (3) security concerns. These priorities suggest that stakeholders are most concerned about areas where munitions are most prevalent, where chemical contamination is highest, and where there are potential threats to human and environmental security. These prioritization criteria are similar to studies by Bełdowski et al. (2020) and Barbosa et al. (2023), who emphasized the need for site-specific and targeted remediation activities. Future surveys could be enhanced by increasing the representation from NGOs, governance, and security institutions, as well as respondents from the fisheries and aquaculture, and tourism sectors.

5. Conclusions

The main objective of Work Package 1 (WP1) is to identify the specific needs, concerns, capabilities, and capacities of different stakeholder groups involved in the remediation of dumped marine munitions.

Task 1.2 of WP1 aims to initiate dialogue and clarify stakeholders' needs, protection concerns, requirements, and limitations regarding the remediation of marine munitions and to report the findings of this in this present Deliverable 1.2 (*Identified Needs*). In this regard, this deliverable is the first step for compiling the stakeholder needs (objective A2, see Table 1.s. of Deliverable 1.1. Stakeholder Community).

To achieve the aims of this task, a survey was conducted among a broad range of stakeholders knowledgeable about dumped marine munitions across Europe and beyond to initiate a dialogue on the key limitations and concerns related to the remediation of dumped munitions; see above. This deliverable thus reflects the concerns,

needs, and requirements of stakeholders regarding the impact and remediation of dumped marine munitions in European seas. The key findings and conclusions align in general with those of the ICF (2022) report on underwater unexploded munitions and the needs and responses expressed by the stakeholders in the report, based on a significantly higher number of respondents than the ICF (2022) report. We identified the following six primary conclusions based on the work:

- The primary concerns and needs were expressed in three thematic areas in ranked order: (1) **environment**, (2) **economy,** and (3) **security and safety**.

- We document a collection of **knowledge, practices, and identified gaps** at this point in time (2025), serving as an initial step to guide further investigation, support decision-making, and foster collaboration among stakeholders on the remediation of dumped marine munitions – this will be elaborated on further in WP2.

- The report highlights **strong stakeholder commitment to remediating dumped munitions**, with site selection and prioritization driven by: 1) the presence of munitions, 2) the concentration of residues, and 3) associated economic and security risks.

- While the majority of respondents suggest that the knowledge and tools to initiate remediation actions exist, perceptions varied by the geographic location of the respondents' organization. These **regional disparities** underscore the need for more targeted knowledge sharing, capacity building, and collaboration to ensure remediation actions are implemented effectively across the different geographical regions in Europe.

- Moreover, there are no stand-alone or uniform regulations or requirements, such as environmental impact assessments (EIAs) regarding dumped marine munitions or the remediation of these in Europe. Hence, there is a **need to develop more explicit guidance on operational responsibilities, robust methodological standards, and enhanced risk assessments** to ensure that remediation is conducted in ways that are not detrimental to the environment, economy, and security and safety – which will be further explored in WP2.

- In conclusion, the **EU Oceans Pact** (**Priority 5**: to ensure safe and secure seas) proposes the development of a comprehensive Unexploded ordnance (UXO) strategy to remove unexploded ordnance from European waters, starting in the Baltic and North Seas. The development of this **strategy should provide the necessary policy and regulatory frameworks** to support efforts to better understand the impact of dumped marine munitions and identify sustainable, environmentally sound ways to manage and remediate them, in support of the blue economy and the critical interest in maritime matters.

The findings in this deliverable have also contributed to two scientific papers: one to *J. Marine Pollution Bulletin (in press)* and one to *J. Marine Policy (submitted)*.

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Appendices

Appendix 1. Questionnaire.

General knowledge and concerns on undertaking remediation actions on submerged marine munitions in Europe.

KNOWLEDGE AND PERSPECTIVES ON REMEDIATING SUBMERGED MARINE MUNITIONS IN EUROPEAN WATERS.

Chemical and unexploded ordnance are polluting our seas. It is estimated that more than 1.6 million tons lie on the North and Baltic seabed, a large part delivered dumped after the Second World War. Leaks from old conventional munitions and active chemical warfare threaten the safety (toxicity) and security (injuries) of marine ecosystems, living organisms, and human health. These threats may increase with time due to the advancing corrosion state of the ammunition. In addition, explosion risks endanger offshore infrastructures and hinder the development of a sustainable blue economy and recreational marine activities.

To minimize above mentioned negative impacts of marine munitions it is urgent to initiate remediation actions. However, munitions management and remediation activities are complex, and they are not exempt of security, environmental, and economic risks that might be carefully assessed.

This questionnaire aims to identify the needs, protection concerns, requirements, and limitations that different public and private sectors of the society might have regarding the management and remediation strategies for marine munitions.

The most pressing issues highlighted in this questionnaire will be further discussed in the following workshops.

This questionnaire is anonymous. The data will be aggregated and used in statistics outcomes for MMinE-SwEEPER, MUNI-RISK, and MUNIMAP EU-co-funded sister projects.

Thank you for participating in our survey. Your feedback is important to enhance safety and security in our waters!

General knowledge and concerns on undertaking remediation actions on submerged marine munitions in Europe.

I. RESPONDENT BACKGROUND

Please indicate the origin, name (optional) and sector of the institution you represent when responding this questionnaire. This information will help us assess perspectives on marine munitions from different sectors and locations in Europe.

* 1. Country of your organization

Other (please specify)

2. Name of your institution (optional)

* 3. Sector of activity

Other (please specify)

Private

General knowledge and concerns on undertaking remediation actions on submerged marine munitions in Europe.

* 4 Do you know anything about munitions in the sea?

- ◯ Yes
- ◯ No

* 5. Do you work on the topic of submerged and dumped marine munitions?

- ◯ Yes
- ◯ No

(If yes) Please, indicate your operational territorial area (country, sea region etc)

* 6. Are you collaborating with other institutions on the topic?

- ◯ Yes
- ◯ No

(If yes) Please, indicate the name of the organization (optional)

General knowledge and concerns on undertaking remediation actions on submerged marine munitions in Europe.

II. CONCERNS ABOUT MUNITIONS IN THE SEA

The following questions will help us assess the needs and potential concerns from different sectors of activities that munitions in the sea potentially cause on the environment, on the blue economy development, and on security.

* 7. Are you concerned about munitions in the sea? (scale from "not at all=1" to "extremely concerned=5")

1 2 3 4 5

Why? (please, specify)

* 8. Environment. What is your level of concern regarding how submerged marine munitions may affect on the following environmental aspects. (Scale from "Not at all concerned=1" to "Extremely concerned=5", based on whether you believe the effects range from "No effect" to "High effect" respectively)

	1	2	3	4	5
Marine mammals	◯	◯	◯	◯	◯
Fish	◯	◯	◯	◯	◯
Birds	◯	◯	◯	◯	◯
Pelagic biota	◯	◯	◯	◯	◯
Benthic biota	◯	◯	◯	◯	◯
Ecosystem functions	◯	◯	◯	◯	◯
Sediment	◯	◯	◯	◯	◯
Water pollution	◯	◯	◯	◯	◯
Hazards	◯	◯	◯	◯	◯

Other environmental concern (please specify)

* 9. Economy. What is your level of concern regarding the potential economic impacts of munitions in the sea. (Scale from "Not at all concerned=1" to "Extremely concerned=5", based on whether you believe the effects range from "No effect" to "High effect" respectively)

	1	2	3	4	5
Aquaculture activities	○	○	○	○	○
Maritime activities	○	○	○	○	○
Marine economy safety (fishing, shipping, tourism, etc)	○	○	○	○	○
Blue sustainable economy development	○	○	○	○	○
Offshore infrastructures	○	○	○	○	○
Seabed industry infrastructures	○	○	○	○	○

Other concern on economic impacts of munitions in the sea (please specify)

* 10. Security. Please evaluate how concerned you are about the effects of submerged marine munitions on the following security aspects.(Scale from "Not at all concerned=1" to "Extremely concerned=5", based on whether you believe the effects range from "No effect" to "High effect" respectively)

	1	2	3	4	5
Military	○	○	○	○	○
Civil	○	○	○	○	○
Police	○	○	○	○	○
Occupational	○	○	○	○	○
Infrastructures	○	○	○	○	○
Terrorism	○	○	○	○	○

Other security concern (please specify)

General knowledge and concerns on undertaking remediation actions on submerged marine munitions in Europe.

III. CONCERNS ABOUT REMEDIATING SUBMERGED MARINE MUNITIONS

The following questions will help us assess the most pressing points to remediate, listening to different perspectives depending on the respondent sector of activity.

* 11. From your perspective, are the available knowledge and existing tools (e.g. scientific knowledge on methodology, environmental risks, regulations, technology, etc) sufficient to initiate remediation actions?

* 12. Information needs. From your organization's perspective, which of the following aspects require further information before taking remediation actions? (please select one or multiple options)

- [ ] Available remediation technologies and methodologies
- [ ] Environmental risks
- [ ] Risk assessment
- [ ] Risks assessment methodology
- [ ] Security and safety risks
- [ ] Economic risks
- [ ] Economic costs
- [ ] Nation capacity and capability
- [ ] Responsibilities, permits, bureaucracy ...
- [ ] No need further information to start remediating
- [ ] Other aspects that need further information (please, specify)

* 13. Environment. Please evaluate how remediating submerged marine munitions may affect the following marine environmental aspects. (Scale from 1 to 5, where "Significant deterioration=1", "No effects= 3", "Significant improvement=5")

	1	2	3	4	5
Marine ecosystem functioning	○	○	○	○	○
Marine fauna (e.g. noise, resuspension of hazards, etc)	○	○	○	○	○
Environment (in general)	○	○	○	○	○

Other environmental aspects (please specify)

* 14. Economy. Please evaluate how remediating submerged marine munitions will affect the following sea-based economic aspects. (Scale from 1 to 5, where "Significant deterioration=1", "No effects= 3", "Significant improvement =5")

	1	2	3	4	5
Public economy (public costs of remediation)	◯	◯	◯	◯	◯
Blue economy development	◯	◯	◯	◯	◯
Offshore sustainable industry development (cabling, offshore wind farms, etc)	◯	◯	◯	◯	◯
Aquaculture or other marine economic activity	◯	◯	◯	◯	◯
Tourism and recreational economic activities	◯	◯	◯	◯	◯

Other economic aspects (please specify)

* 15. Security and safety. Please evaluate how remediating submerged marine munitions will affect the following security and safety aspects. (Scale from 1 to 5, where "Significant deterioration=5", "No effects= 3", "Significant improvement =5")

	1	2	3	4	5
Food security	◯	◯	◯	◯	◯
Geopolitical security	◯	◯	◯	◯	◯
Civil security	◯	◯	◯	◯	◯
Military security	◯	◯	◯	◯	◯
Ethic/wellbeing issues	◯	◯	◯	◯	◯

Other security aspects (please specify)

* 16. Please evaluate how concerned you are on how remediation activities might affect the following environmental, economical and security aspects.(Scale from "Not at all concerned=1" to "Extremely concerned=5", based on whether you believe the effects range from "No effect" to "High effect" respectively)

	1	2	3	4	5
Marine fauna and flora (e.g. noise, resuspension of hazardous, etc)	○	○	○	○	○
Ecosystem functioning	○	○	○	○	○
Efficiency of current technology	○	○	○	○	○
Efficiency of current remediation methodology	○	○	○	○	○
Remediation costs	○	○	○	○	○
Safety and security risks of remediation actions	○	○	○	○	○
Current regulations and legal requirements	○	○	○	○	○
Current international collaboration in remediation actions	○	○	○	○	○
Geopolitical situation	○	○	○	○	○
Coordination between different authorities in same state	○	○	○	○	○
Regional/national capability and capacity to remediate	○	○	○	○	○

Other concern related to remediation actions (please specify)

* 17. Shall remediation actions be undertaken?

(If yes) Please specify which remediation actions must be undertaken.

- ◯ Blast in place (BiP)
- ◯ Removal
- ◯ On the site (other than BiP)
- ◯ On land
- ◯ None of the above
- ◯ Action to be undertaken depends on the site and case
- ◯ Other actions or comments on remediation actions (please specify)

* 18. In your opinion, what are the criteria that need to be addressed in order to allow prioritization of sites for potential remediation?

- ☐ Munition occurrence
- ☐ Concentration of residues
- ☐ Environmental protection status of the site
- ☐ Levels of oxygen in the environment (DO)
- ☐ Other environmental stressors
- ☐ Security concerns
- ☐ Infrastructure plans
- ☐ Socioeconomic value (fishing, toursim, etc)
- ☐ Culture value
- ☐ Other (Please, specify other criteria to consider)

General knowledge and concerns on undertaking remediation actions on submerged marine munitions in Europe.

Finally, we would like to thank you in advance for completing this questionnaire.

The main points raised in this questionnaire will be further discussed in more detail in a workshop at Kiel Munitions Clearance Week (18-20 June), where you are very welcome to meet us in person, and others stakeholders and experts on managing marine munitions!

If you wish to continue this dialogue with us, please do not hesitate to contact us at mmine-sweeper@geomar.de

Appendix 2: Concerns of the Presence of Munitions in the Sea

Table 1s. Reported arguments of the different concerns related to the presence of munitions in the sea. The number of selected levels of concerns reported brackets.

Level of concerns (times selected)	Recorded arguments of selected level of concern
Not at all concerned (1)	• Does not affect our business
Slightly concerned (3)	• Munition is not very dangerous, as there has been a lot of corroding and the munition is not very harmful, except for chemical weapons and Hg containing devices.
Somewhat concerned (9)	• Dropped almost 80 years ago in salty water. • Our main concern are the UXOs on wrecks, especially those that are PPWs. • The gravest danger comes from incompetent analytics, and almost clueless threat assessment approaches as well as lack of funds • Because it's a risk for human and environmental health
Highly concerned (22)	• Another unknown risks for the environment and human activities • Combination of the 3 unique factors: tonnage of marine munition, pollutants (like TNT) are as a "pure material" in the sea (not like other pollutants diluted), safety problems (explosive) and still challenging remediation • Munitions pose a hazard to the safety of marine operations (e.g. jack-up vessels). • Toxic compounds and "provision" of energetic material to any interested party • leakage • The current status of munition is about to corrode in the near future and will cause a high risk for environmental safety • Economic and personal damage • Security • toxicity of explosives, health hazards of white phosphorus findings at beaches • Source of contamination; Risk of explosion or detonation • the nature, the amounts, the corrosion state and the limited knowledge by the public due to lack of proper communication • Because they pose serious environmental, security, and health risks, especially with leakage of toxic substances and the impact on marine ecosystems. • This is a marine pollution hazard that is hardly addressed. • safety, pollution • Baltic Sea is in the centre of geopolitical tensions. The uncertainty is persistent, and the asymmetric threats are increasing. • Negative impacts on the marine ecosphere • As an offshore wind developer, munitions pose a big risk if not removed from the sea-bottom.
Extremely concerned (17)	• Environmental disaster • worldwide problem, no general activities in clearance • Marine diversity, marine ecology, human food safety • I have to take care about war remains for more than 40 years! • Detonations kill animals, destroy habitat, chemicals leaking into the marine environment • Hazards of corroding Munitions of all kinds • dangerous • Future management of our natural resources, our environment, developing industries • They are a serious public safety threat, possibly toxic threat, and impede economic development • Explosives will get more sensitive. They have to be disposed. • Munitions in the sea threaten marine life, human health, and offshore infrastructure. Corrosion leads to toxic leaks affecting ecosystems and seafood safety. Unexploded ordnance hampers maritime activities and blue economy. These risks are growing and require urgent action, including regular environmental monitoring. Addressing this issue is also important for implementing Ukraine's Marine Strategy and fulfilling EU environmental obligations. • due to environmental and marine safety risks/reasons • Environmental Safety

Table 2s. Stakeholders' perception of the relative impact of remediation activities on the environment, the economy and security in relation to their direct involvement in the topic

Evaluation aspects	Categories	Direct involvement on the topic of dumped munitions	Distribution of stakeholder responses (%)				
			1	2	3	4	5
			Not at all Concerned	Slightly concerned	Somewhat Concerned	Highly Concerned	Extremely Concerned
Environment	Marine mammals	Involved	5,8	11,5	21,2	17,3	19,2
		Not Involved	0,0	5,8	1,9	7,7	9,6
	Fish	Involved	1,9	9,6	5,8	28,8	28,8
		Not Involved	0,0	3,8	7,7	1,9	11,5
	Birds	Involved	17,3	13,5	19,2	9,6	15,4
		Not Involved	3,8	7,7	1,9	1,9	5,8
	Benthic biota	Involved	1,9	9,6	11,5	21,2	30,8
		Not Involved	3,8	0,0	1,9	5,8	13,5
	Ecosystem functions	Involved	3,8	13,5	19,2	11,5	26,9
		Not Involved	1,9	0,0	3,8	9,6	9,6
	Sediment	Involved	7,7	9,6	11,5	19,2	30,8
		Not Involved	0,0	1,9	1,9	7,7	13,5
	Water pollution	Involved	3,8	5,8	17,3	21,2	26,9
		Not Involved	0,0	1,9	5,8	1,9	15,4
	Hazards	Involved	0,0	3,8	19,2	19,2	32,7
		Not Involved	1,9	0,0	1,9	7,7	13,5
Economy	Aquaculture activities	Involved	7,7	19,2	21,2	13,5	13,5
		Not involved	1,9	3,8	5,8	5,8	7,7
	Maritime activities	Involved	7,7	9,6	9,6	28,8	19,2
		Not involved	0,0	1,9	11,5	3,8	7,7
		Involved	1,9	5,8	15,4	28,8	23,1

	Marine economy safety (fishing, shipping, tourism, etc)	Not involved	0,0	1,9	5,8	9,6	7,7
	Blue sustainable economy development	Involved	9,6	9,6	17,3	21,2	17,3
		Not involved	0,0	1,9	7,7	5,8	9,6
	Offshore infrastructures	Involved	0,0	9,6	17,3	25,0	23,1
		Not involved	0,0	0,0	5,8	5,8	13,5
	Seabed industry infrastructures	Involved	0,0	5,8	15,4	30,8	23,1
		Not involved	0,0	0,0	3,8	3,8	17,3
Security	Military	Involved	7,7	19,2	9,6	15,4	23,1
		Not involved	0,0	5,8	5,8	9,6	3,8
	Civil	Involved	5,8	17,3	15,4	21,2	15,4
		Not involved	0,0	0,0	3,8	11,5	9,6
	Police	Involved	9,6	25,0	21,2	11,5	7,7
		Not involved	0,0	1,9	7,7	11,5	3,8
	Occupational	Involved	5,9	19,6	23,5	13,7	11,8
		Not involved	0,0	0,0	7,8	9,8	7,8
	Infrastructures	Involved	3,9	9,8	15,7	23,5	23,5
		Not involved	0,0	0,0	3,9	15,7	3,9
	Terrorism	Involved	19,2	3,8	7,7	21,2	23,1
		Not involved	1,9	3,8	3,8	9,6	5,8

Appendix 3: Additional Information for Remediation

Table 3s. List of other aspects that need further information before starting remediation. Indications at "Q12. Information needs. From your organization's perspective. which of the following aspects require further information before taking remediation actions? (please select one or multiple options)".

Responses:

- The legal framework when operating in the German EEZ is often unclear as Bund and Länder are in disagreement who is responsible.
- There is of course an need for communication regarding risks if remediation measures are planned in a certain region. but this is more a task. then an objective of research.
- Much more detailed information. chemical analyses and scientific work is needed on this subject. and also on the subject of the dangerous decomposing and increased sensitivity of historical military explosives. a full bilateral study should be ordained. with the findings correlated & disseminated within the EOD community!!
- Environmental risk DURING remediation
- start anyway. research further information on the fly
- Scientific knowledge on munition-related transformations and fate including biological uptake and effects on biota
- International law
- Archival research. history
- Almost all programmes omit thorough determination of property changes of munition constituents. Many parties involved avoid any such activity because they lack even basic competence.
- Long-term environmental monitoring protocols to assess the effectiveness and impacts of remediation. Best practices from other countries that have started remediation. especially regarding chemical munitions. Coordination mechanisms between national and international stakeholders for joint actions in transboundary areas
- Funding
- Continue with toxicological (environment and human) risk data collection

Appendix 4: Other Considerations for Remediation Activities

Table 4s. List of *other aspects* to consider that may be affected by remediation activities. Responses recorded in questions Q16. Q17. and Q18 referring to environmental economic and security aspects, respectively.

Responses:

Other environmental aspects (please specify)

- The removal of hard grounds will strongly affect ecosystem function on a local to regional scale
- Spread of TNT particles from BiP
- Some UXO may detonate on the slightest provocation. DMM usually can be handled safely if in competent hands.
- Water quality improvement over time due to removal of toxic sources. Restoration of safe conditions for fisheries and aquaculture. Reduced risks for marine protected areas (MPAs) and vulnerable species.

Other economic aspects (please specify)

- defence industry as main player in clearance
- If the question is about remediation of dump sites. there will be very limited impact to the offshore industry as wind farm and cables avoid dump sites and mostly deal with singular. randomly distributed UXO
- public economy benefits in the long run compared to "no action". offshore windfarms are not sustainable. it is a large-scale industry

Other security aspects (please specify)

- 1990s. only the Mark 5. Mark 12 and Mark 17 were in service use. The Mark 17 appears to have been withdrawn from service sometime in the mid to late 1990s. Britain has not manufactured mines for some years. probably since the 1950s. In 1982. a modernization program was announced for about 1.500 mines. some of them dating back to World War II. In 1984 it was reported that the entire program might have to be abandoned as inspection showed that the TNT or RDF fillings had crystallized. causing at least two mines to explode prematurely. The solution was to X-ray each mine and discard those that showed cracks or crystallization. As of 1994. only Mark 12 mines had been modernized. mainly by adding the British Aerospace microprocessor sensor and processing unit (SAP) described above.
- DMM can be utilized by state/non-state actors to enact terrorism or initiate warlike actions.

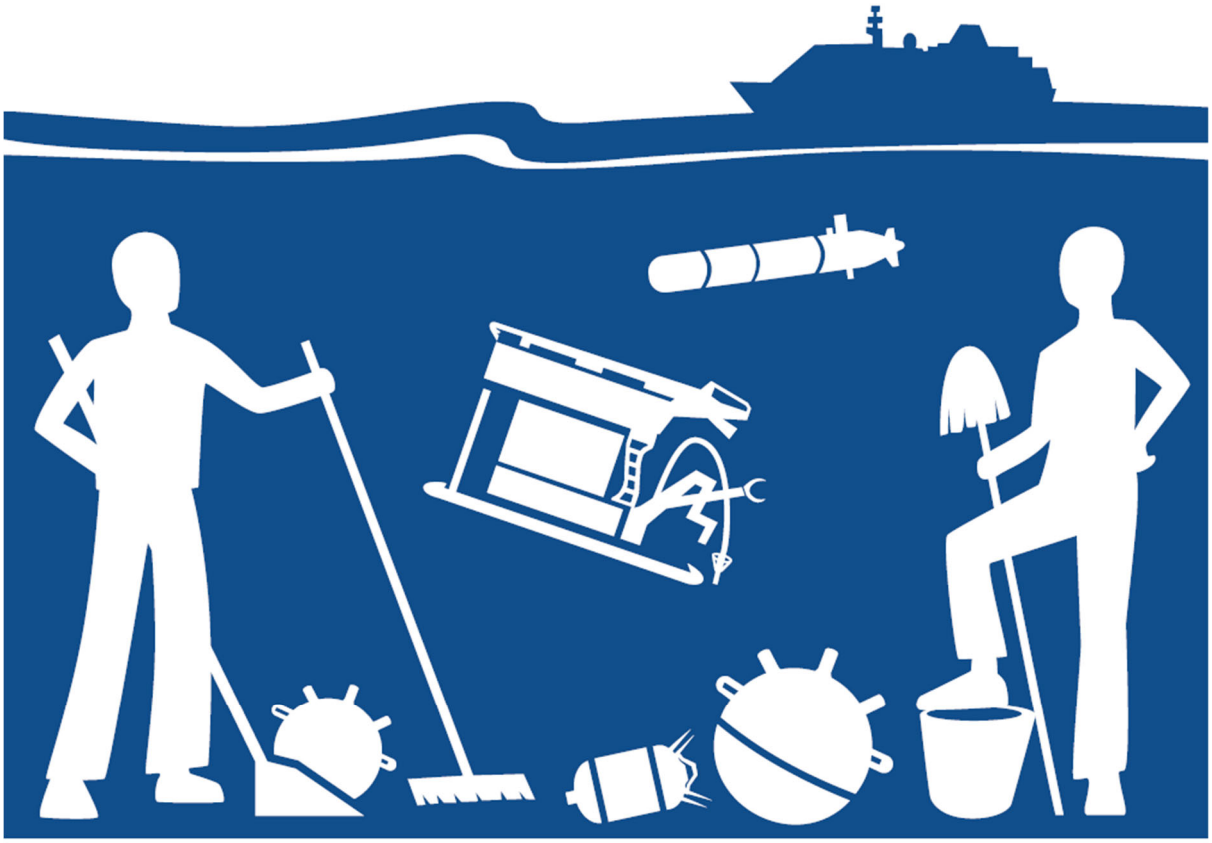
Appendix 5: Methods for Remediation

Table 5s. List of "other methods" to do remediation (Q17)

Responses:

PREVENT STRIPING EQUIPMENT (PSE) Various device of PSE (BOOBY TRAPS) has been used by the Germans to preserve the security of their Mine assemblies. Normal firing is by the closing of the electrical circuit. But there are PSE firing systems that will not require the use of a battery. A mechanical PSE used in the LMA & LMB Mines. Uses a spring-loaded firing pin onto a detonator and booster charge and needs no battery power to Fire the Mine. The BRITISH A MkI & A MkII influence units have sea batteries fitted as a PSE.

There is NO single solution, and each site and item demands specific lines of treatment. Destruction at sea (Platforms) is mandatory.



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