North Adriatic Maritime
Incident Response System

Standard Operating Procedures

NAMIRS
North Adriatic Maritime
Incident Response System

Co-funded by
the European Union

Italian Coast Guard Headquarters – CG TS (IT)

National Institute of Oceanography
and Applied Geophysics – OGS (IT)

Adriatic Training and Research Centre for
Accidental Marine Pollution Preparedness
and Response – ATRAC (HR)

Administration of the Republic of Slovenia
for Civil Protection and Disaster Relief (SI)

Ministry of Sea, Transport and Infrastructure
of the Republic of Croatia – MSTI (HR)

Central European Initiative
Executive Secretariat – CEI

University of Ljubljana Faculty of Maritime
Studies and Transport Portorož (SI)

This document is based on the agreed but not ratified "Agreement on the Sub-Regional Contingency Plan for the Prevention of, Preparedness for and Response to Marine Pollution Incidents in the Adriatic Sea" from November 2005.
ALL DETAILS MUST BE AGREED.

North Adriatic Maritime Incident Response System

Standard Operating Procedures

NAMIRS
North Adriatic Maritime
Incident Response System

Co-funded by
the European Union

Introduction

Introduction

The North Adriatic Maritime Incident Response System (NAMIRS) adopts a holistic approach to marine pollution incident management, at sea and on shore with the scope of preventing maritime disasters and protecting from possible effects and damage in the North Adriatic Sea.
The North Adriatic Sea – a semi-closed basin where the three partner countries of this project, Croatia, Italy, and Slovenia, share a marine surface of approx. 550 sq.km – is an area of extreme importance for activities such as: coastal and maritime tourism, transport of goods and passengers, fishery, aquaculture, oil & gas, energy and communication, sand extraction, cultural heritage and protected areas.
In this context, accidental marine pollution, in particular deriving from oil-spills, is a dangerous threat with potentially devastating environmental and economic consequences. NAMIRS complements existing National Contingency Plans that are insufficient to tackle transboundary threats. Furthermore, better preparedness and a more coordinated response at a transnational level are in line with the Barcelona Convention and related Protocols.
The Standard Operating Procedures aim at identifying the relevant authorities and their respective roles in the implementation, activation and upkeeping of the NAMIRS framework for coordinated response at sea in the North Adriatic area. They define the steps to take in the event of an oil spill at sea, how to alert the NAMIRS partners, what information is necessary to plan the operations, who will be involved and how the operations should be undertaken. On shore intervention is not a matter of the present SOPs and is managed following national and local plans.

Finally, the SOPS are intended to be applied within the waters under the jurisdiction of the partner Countries, between the coast and the high seas as a measure to prevent, mitigate or eliminate the serious risks and damage to the coast or related interests, which may arise from the pollution of marine waters from hydrocarbons, following a maritime accident or events connected to such an accident, which appear likely to have serious and harmful consequences.
These SOPs could integrate the new transnational Contingency Plan elaborated in parallel with the NAMIRS project.

Content

General Framework

Competent national authorities and contact points

According to the Contingency Plan agreed and in force, hereafter 'the Plan', each Party shall designate an authority responsible for coordinating at the national level all activities related to response to pollution from ships, and in particular for the exchange of information between the Parties to the present Plan. For the purpose of the Plan such authority shall be called national Pollution Prevention Co-ordination Centre (PPCC).
The overall responsibility for the implementation of the standard operating procedures and for the activation of the Joint Response Operations (JRO) remains therefore within the national authorities of the state Parties.
The NAMIRS framework distinguishes among responsibilities that belong to a Governmental authority and those that belong to an Operational authority.

Governmental Authorities

Governmental Authority refers to the designated competent Department having the governmental responsibility for dealing with pollution at sea. The responsibilities that follow under the jurisdiction of the Governmental Authorities include (but are not limited to):

- Implementing the Plan;
- Supervising the implementation of the Plan;
- Ensuring that revisions and amendments as agreed by the Parties are properly included in the Plan;
- Ensuring the compatibility of the National Contingency Plan (NCP) with the NAMIRS framework.

Operational Authorities

Operational Authority (Prevention) refers to the designated competent Department having the responsibility for the prevention of pollution from ships. The responsibilities that follow under the jurisdiction of the Operational Authorities include (but are not limited to):

With respect to the maintenance of the Plan

- ensuring the appropriate level of preparedness with respect to: trained personnel, equipment, communication and other assets;
- liaising with other entities and authorities at the National level;
- participating in other activities and meetings as indicated in the Plan;
- keeping up to date the relevant contacts and necessary Annexes.
- responsibilities in case of marine oil pollution incidents:
- activating the Plan and notifying other Parties;

- reporting pollution incidents in accordance with the standard POLREP system;
- coordinating, at the level of each Party concerned, response operations in case of the activation of the NCP, and coordinating JRO in case of subsequent activation of the NAMIRS framework;
- coordinating, at the national level, the participation of the authorities and/or services of other Parties in JRO;
- requesting and/or rendering assistance as needed;
- coordinating the sending, receiving, using and returning, as appropriate, of personnel, equipment and other resources rendered as assistance within the framework of the Plan.

The Operational Authorities in charge of the NAMIRS framework, should be the same authorities responsible for the implementation of the National Contingency Plans.
Other crucial actors in the framework of the plan are the *National Contact Points* (see Annex 1) which are responsible for receiving reports on marine oil pollution incidents and for transmitting this information to their respective Operational Authorities and other interested parties within the country.

Assumption of the lead role

According to the Plan, the **Operational Authority** of the Country whose area of responsibility or area of interest has been affected or is likely to be affected by a marine oil pollution incident, has the duty to activate the Plan, thus taking the lead role in the operations. However, the lead role shall be transferred from one Party to another, when the major part of the pollutant has moved from the area of responsibility of the Party that has activated the Plan or initially requested assistance, to the area of responsibility of another Party that is requesting assistance.
The Lead Party shall be responsible for:

- surveillance of the pollution;
- assessment of the situation;
- forecasting the spill movement;
- reporting;
- exercising Operational Command over JRO.

National on-scene commander (NOSC) / Supreme on-scene commander (SOSC)

According to the Plan, each Operational Authority shall nominate a **National On-Scene Commander** (NOSC) who will have operational control over all response activities of the respective Party, including control over personnel (strike teams), equipment and self-contained units (vessels, aircraft).

When the Plan is activated, the NOSC of the Lead Party shall assume the role of Supreme On-Scene Commander (SOSC).
The SOSC shall have the overall responsibility for all decisions and actions taken in order to combat the pollution and to mitigate its consequences, and for the coordination of JRO. The SOSC, working in coordination with the Lead Authority, shall have Operational Command over JRO.
The NOSCs of the assisting Parties shall operate under the overall Operational Command of the SOSC, however, he/she shall retain operational control over their respective personnel, equipment and self-contained units.
In agreement with the SOSC, the NOSCs may also retain the command of response within his/her area of responsibility or area of interest.
In exercising his/her functions, the SOSC shall be assisted by a Support Team.

Support Teams

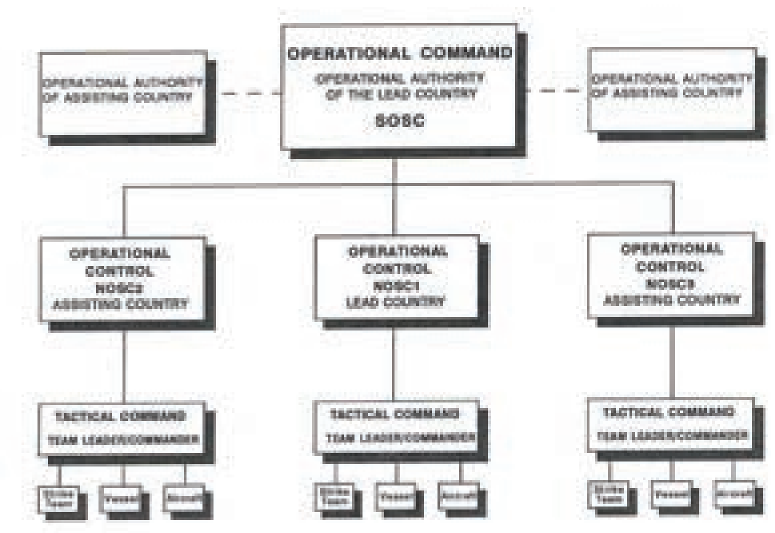
Operational Authorities of each Party shall set up their national Support Team in order to assist the National On-Scene Commander. The Support Team shall be composed ad hoc by the representatives of various relevant public authorities, national services and industry, especially the oil and shipping industries.
In case of the activation of the Plan, Support Teams shall operate from their respective national Emergency Response Centres.

Emergency Response Centres / Joint Response Centres

The Emergency Response Centre (ERC) set for the purpose of the Plan will be manned 24 hours a day, 7 days a week (24/7). Each ERC is equipped with an appropriate communications system and have the necessary facilities to be used as the operations room of the Operational Command during JRO. The contacts for the ERCs are listed in Annex 1.
In cases of the activation of the Plan, the ERC of the Lead Party shall assume the role of the Joint Emergency Response Centre (JERC). The JERC shall serve as the base of the Supreme On-Scene Commander (SOSC) and as the main communications centre for all communications related to the implementation of the Plan.

Command Structure

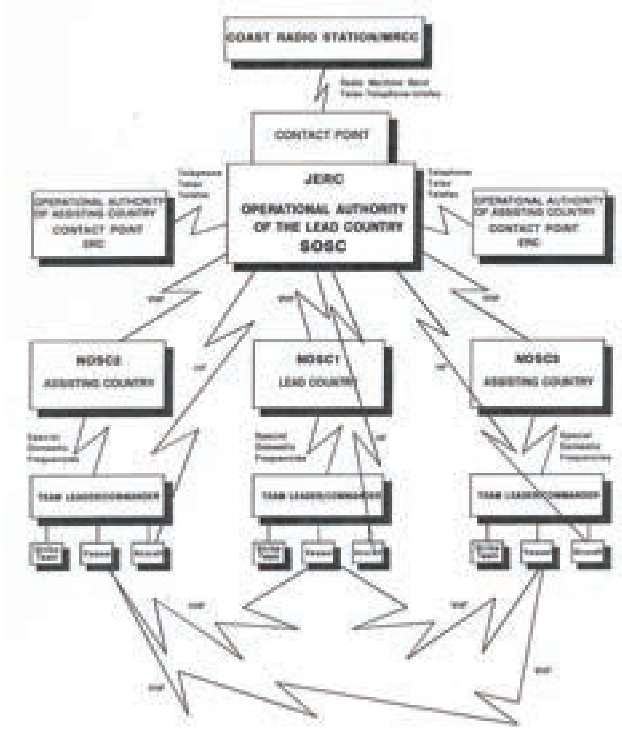
The Command Structure for JRO is shown as follows:



Liaison between the Lead Authority and the assisting Parties shall be maintained, according to the circumstances and to the type and importance of the assistance rendered, in one of the following ways:

- by direct email, telephone, telex, fax and/or radio contacts between the Lead Authority (SOSC) and Operational Authorities (NOSCs) of the assisting Parties;
- by a Liaison Officer, sent to the Lead Party by the Operational Authority of the assisting Party with a view to being integrated in the staff of the SOSC. The duty of the Liaison Officer shall be to provide the necessary information on the resources rendered as assistance and to facilitate communication with his/her respective NOSC, ERC and/or strike teams and self-contained units taking part in JRO;
- by the NOSC of the assisting Party who personally attends at the spill site and participates in the JRO.

Lines of Communication



Response Elements and Planning

Pollution response operations have been divided as follows:

- Pre-activation of the Plan
  Phase I: Evaluation
  Phase II: Notification and consultation

In the first stages, before the activation of the NAMIRS framework, the early response operations will be applied by the Country in whose area is initially located the source of the pollution or in which it is reported, according to its National/Local Contingency Plan.

- Activation of the Plan
  Phase III: Notification of activation
  Phase IV: Request for assistance
  Phase V: Joint Response Operations at sea

- Termination of Joint Response Operations and Deactivation of the plan (in this phase decision must also be made regarding the disposal of all the waste collected during phase V).

Checklists

PHASE 1.1 – RECEPTION OF A WARNING AND FIRST EVALUATION

Notification and verification of the initial information concerning a pollution incident shall be done at the national level, in accordance with the provisions of the NCP (National Contingency Plan).
The operational Authority of the Party affected by an incident, or the Party likely to be affected first, shall assess and determine, taking into consideration the severity of the incident including the place of its occurrence, the nature and quantity of the pollutant and other relevant elements, the level of response required and whether or not to activate the Plan.
Before activating the Plan, the Operational Authority of the Party concerned shall activate its NCP.

N.	WHAT	HOW
1	If the Local Operational Authority (such as Harbour Master and MRSC - MAS in Italy) of the Party whose area of responsibility or area of interest have been affected or are likely to be affected by a marine oil pollution incident, receives a warning about a possible oil spill in water, it has to proceed as follows:	
2	**Verify the reliability of the information**, in order to acquire every element useful for setting the subsequent response actions.	
3	Collect from the actor reporting on the spill every useful element to know the nature of the pollution and specifically: • geographic location of the alleged spill; • type, size and characteristics of traces of pollution detected; • possible causes of the spill and origin; • weather conditions in the area; • telephone number or a contact of the witness;	

N.	WHAT	HOW
4	Send a patrol boat or other dependent naval asset to the signaled area, to check the current situation;	
5	Check any presence of naval units in the area, Acquire the tracks of the ships that have passed through the sector reported in the last hours;	AIS or other systems-sensors used by the Operational Authority.
6	Interrogate every naval unit present in the reported area and send them to the area to check the situation;	VHF or other means of communication in use.
7	**If naval unit is assumed involved:** • Acquire all the documentation in possession relating to the vessel of interest (Ship details, shipowner, insurers, Hazmat, crew list and pax list, bunker on board and its typology, safety data sheet of the product on board). • Investigate any **damage** suffered, conditions of stability, buoyancy and seaworthiness; • Verify the presence of **people** on board; • Check if there are any **injured people** and their condition and if there are **people at sea**; • Investigate the type of cargo transported, in particular to research the **characteristics of any polluting goods** transported and the **bunker loaded** on board; If the pollution report comes from the naval unit itself, verbally warn the master immediately to adopt any useful measure for the containment and elimination of the pollution.	Acquire this information from Ship reporting System ADRI-REP, SafeSeaNet and the VTS Centre located in the area.

N.	WHAT	HOW
8	If there is a fire on board or if any danger for the human life at sea is reported, all measures should be taken to rescue people first and to extinguish the fire on board the ship, using local and national plans.	Inform the Search and Rescue authority in charge by territory. If there is fire on board and the dimensions of it require a massive intervention from the three Countries, activate the NAMIRG Group. See NAMIRG SOPs: NAMIRG_D.2.2 Handbook on SOPs.docx
9	Upon completion of the first assessment: a. Pollution excluded: return to the normal set-up; b. Ascertained pollution: continue with the next steps.	

PHASE 1.2 – EVALUATION OF THE SITUATION AND APPLICATION OF NCP

If the pollution is confirmed after the first assessment, acquire more information about the situation and apply all measures provided by the national response system.

N.	WHAT	HOW
1	Local Operational Authority has to gather more detailed information about the pollution.	
1.1	Before any other operation, consider the opportunity to create an **Exclusion Zone** around the area affected by the oil spill/incident to seclude it in order to prevent any maritime traffic around it. The same should be done for the air space above the area of the oil spill/incident, to avoid any aerial asset in the zone and to keep it clear and safe for the potential approach with a helicopter or other asset to evaluate the situation or to transfer a boarding team on board the ship.	VTS Centre or Maritime Authority has to declare the exclusion zone with proper information to the ships through VHF or other means of communication, requiring also the issuing of the appropriate Notices to Mariners (NTM) and Airmen (NOTAM) and/or specific Prohibition Ordinance/No flight zone for the area of incident.
1.2	If it is immediately clear that the oil spill has huge dimensions or it threatens to involve the territorial water of another partner Country of the NAMIRS, all gathered information must be shared as shown in Phase 2, point n. 1 with the National Contact Points of other Countries, in order to pre-alert their ERC.	See SOPs Annex 1

N.	WHAT	HOW
2	If the source of the pollution is known, acquire from the polluter every available data and characteristics about the product spilt. The chemical-physical characteristics of hydrocarbons are summarized in the relevant **safety data sheets**, which producers and carriers must possess and store in the manufacturing facilities and on board the vessel that carries them.	
2.1	If it is not possible to obtain this information, Local Operational Authority, possibly assisted by experts, has to make a **sample** of the oil to analyze it to determine its properties. Sampling techniques may differ depending on the physical state and thickness of the oil spill, so the sample should be taken by **experts** or **trained personnel**. In general, every sample made from on board a ship/patrol vessel, should be taken from the bow or, in any case, away from the exhausting system of the engine of the ship. 	A list of the best available techniques about sampling can be found in the following links. https://www.isprambiente.gov.it/files/pubblicazioni/quaderni/ricercamarina/Quadernon4Modalitdicampionamento.pdf

2.1	(see table below)	
3	Local Operational Authority has to alert experts (such as chemical consultant of the port, ISPRA / ARPA for Italy or other local-national research authorities), to request technical analysis about the material at sea according to the safety data sheet and its possible evolution in time and on any precautions to be taken during the response operations. Take into account that every oil has its own properties and its own persistence in the sea.	An updated List of contacts should be arranged in every Local/National plan.

2.1

Thickness	Method	Picture
> 1 mm	Bottle method	
> 1 mm	Teflon cone	
< 1 mm and iridescences	Schomaker sampler	
< 1 mm	Teflon sheets	

Source: ISPRA "Modalità di campionamento degli idrocarburi in mare e lungo la costa".

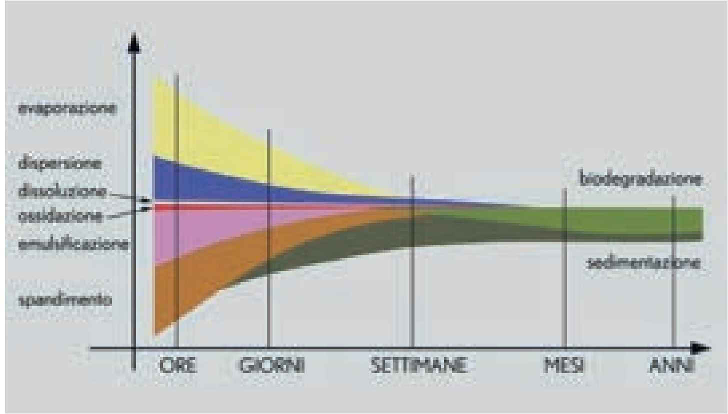
N.	WHAT	HOW
3.1	The combined effects of the various natural processes acting on spilled oil, are collectively known as 'weathering'.  *Source: ITOPF Technical Information Paper, "Fate on marine oil spills"* Factors which determine whether or not the oil is likely to persist in the marine environment have to be considered together with the implications for response operations.	A very useful collection of documents and best practices about the oil pollution could be consulted on the website of ITOPF https://www.itopf.org/knowledge-resources/documents-guides/technical-information-papers/ and ISPRA https://www.isprambiente.gov.it/it/attivita/Crisi-Emergenze-ambientali-e-Danno/area-emergenze-ambientali-in-mare/pubblicazioni.
3.2	A very useful collection of documents and best practices about the oil pollution could be consulted on the website of ITOPF https://www.itopf.org/knowledge-resources/documents-guides/technical-information-papers/ and ISPRA https://www.isprambiente.gov.it/it/attivita/Crisi-Emergenze-ambientali-e-Danno/area-emergenze-ambientali-in-mare/pubblicazioni.	

3.2

Source: ITOPF Technical Information Paper, "Fate on marine oil spills"

Weathering processes are strictly influenced by those properties, but in general terms, it can be said that the more time passes from the spill into sea, the greater the density, viscosity and persistence of the residual hydrocarbon mixture will be.

3.2

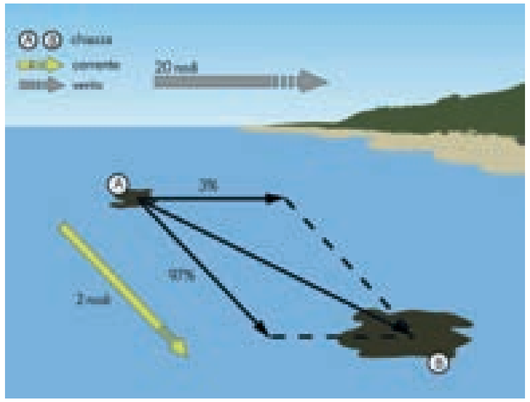


Source: ISPRA "Sversamento di idrocarburi in mare: stima delle conseguenze ambientali e valutazione delle tipologie d'intervento"

The original characteristics of hydrocarbons, together with the modifications that they undergo due to weathering, **determine the method of intervention to be implemented**. By way of example, light products, such as diesel and petrol, tend above all to evaporate and spread quickly and from an intervention point of view they rarely need a recovery action. The opposite counts for some crudes and heavy fuel oils, for which the rate of evaporation and spreading is very limited and it is therefore necessary to intervene directly for their containment and recovery.

N.	WHAT	HOW
4	Acquire information about the weather condition at the moment of the spill and an accurate forecast for the subsequent hours. As shown before, weather has a great influence on the evolution of the oil in the sea and also affects the response operation and the proper choice of the best intervention strategy. In particular, is necessary to gather information about: • Wind (direction and speed); • Surface currents (direction and speed); • Atmospheric temperature; • Water temperature; • Cloud coverage; • Sea state. Take into account that wind and current have a great influence on the direction of the oil spill. The movement of oil slicks is 3% determined by force of the wind (average value) and 100% by the strength of the currents. However, the extent of the wind's influence can vary according to the contact surface of the slick with the atmosphere, which depends on the chemical-physical characteristics of the hydrocarbons.	Official and institutional weather forecasting network (e.g. OSMER – Osservatorio Meteorologico Regionale https://www.osmer.fvg.it/home.php?ln= or Meteo Aeronautica Militare https://www.meteoam.it/it/home, or https://nodc.ogs.it/geoportal/ and https://sharemed-northadriatic-geoportal.ogs.it/ for currents) but also other public websites offer today very accurate forecast and observation (e.g. Windy, Windfinder etc.)

4



Source: ISPRA "Sversamento di idrocarburi in mare: stima delle conseguenze ambientali e valutazione delle tipologie d'intervento"

Wind Force: Beaufort Scale

DESCRIPTIVE TERM	BEAUFORT NUMBER	LIMITS OF WIND VELOCITY in knots	LIMITS OF WIND VELOCITY in m/sec	PROBABLE MEAN HEIGHT OF WAVES* in metres
Calm	0	<1	0 - 0.2	-
Light air	1	1 - 3	0.5 - 1.5	0.1
Light breeze	2	4 - 6	1.6 - 3.3	0.2
Gentle breeze	3	7 - 10	3.4 - 5.4	0.6
Moderate breeze	4	11 - 16	5.5 - 7.9	1.0
Fresh breeze	5	17 - 21	8 - 10.7	2.0
Strong breeze	6	22 - 27	10.8 - 13.8	3.0
Near gale	7	28 - 33	13.9 - 17.1	4.0
Gale	8	34 - 40	17.2 - 20.7	5.5
Strong gale	9	41 - 47	20.8 - 24.4	7.0
Storm	10	48 - 55	24.5 - 28.4	9.0
Violent storm	11	56 - 63	28.5 - 32.6	11.5
Hurricane	12	64 - +	32.7 - +	>14

Sea State: Douglas Scale

DESCRIPTIVE TERM	SEA STATE	WAVE HEIGHT
Calm (glassy)	0	0
Calm (rippled)	1	0 - 0.1
Smooth (wavelets)	2	0.1 - 0.5
Slight	3	0.5 - 1.25
Moderate	4	1.25 - 2.5
Rough	5	2.5 - 4
Very rough	6	4 - 6
High	7	6 - 9
Very high	8	9 - 14
Phenomenal	9	>14

N.	WHAT	HOW
5	Continue monitoring of the situation at sea with patrol boats and other ships potentially present in the area. It is essential to determine the distance of the slick from the coast to define the reaction time. The Master of the major Vessel of the Administration (like Coast Guard patrol boat) present in the zone of operation should be nominated On Scene Coordinator (OSC) and report the situation to the Local Operational Authority.	The designation of the OSC should be formalized using a message like the one in the SOP Annex 5.

Distance Classes	Distance from the Coast	Available time for response operations at sea
1	>50 miles	One week
2	10 to 50 miles	Some days
3	5-10miles	One day
4	<5 miles	Few hours

Source: ISPRA "Sversamento di idrocarburi in mare: stima delle conseguenze ambientali e valutazione delle tipologie d'intervento"

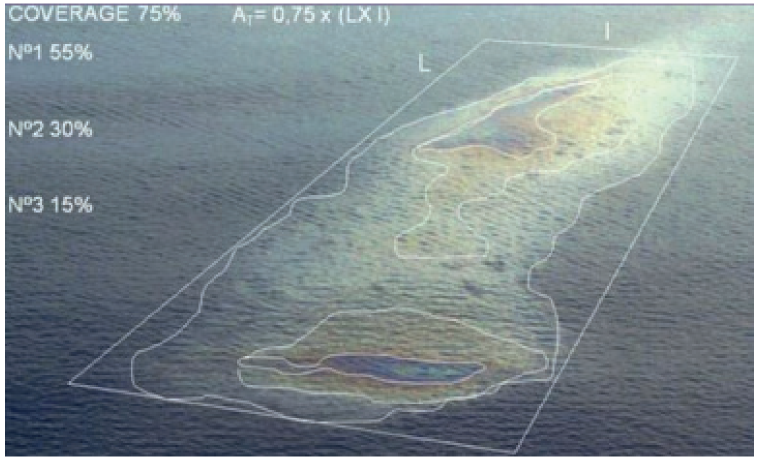
N.	WHAT	HOW
5	In case of a huge spill in the northern Adriatic Sea, a semi closed basin in which the distance from the coast is always not so high, the speed to respond is crucial.	

N.	WHAT	HOW
6	Local Operational Authority has to Ask for **aerial assets** to monitor the situation from above.	Contact the administration that has the availability of some aerial assets near the zone of the spill. Otherwise, contact the National Operational Authority to arrange aerial surveillance ASAP.
6.1	Once Aerial Assets are in the zone of operations, ask to take some picture of the surface affected by the pollution. Then, analyze those pictures in order to assess extension and thickness of the slick that are essential information to estimate the amount and the volume of the spill. The analysis of the photographs taken during the inspection is a tool basis for estimating the extent and thickness of the patches. The thickness can be estimated through the color that the stain assumes by applying the Bonn Agreement Oil Appearance Code (BAOAC), color code developed within the framework of the Agreement for cooperation in dealing with pollution of the North Sea by oil and other harmful substances (Bonn 1983), that classifies the oil slicks in the sea according to the color, function of their thick.	Specialized aerial assets (like the ATR 42 used by Italian Coast Guard) often have installed advanced remote sensing devices, such as SLAR (side looking airborne radar) and multispectral sensors, useful for evaluating the situation from above.

6.1

BAOAC – Bonn Agreement Oil Appearance Code

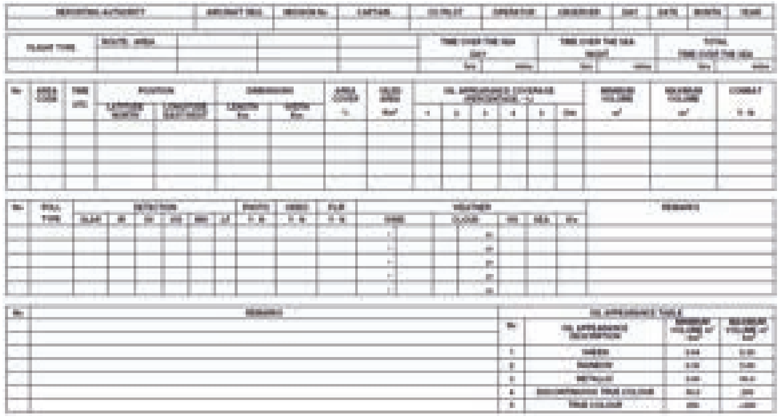
No.	Oil appearance description	Oil slick thickness [μm]	Spill volume [m3/km2]
1	Sheen	0.04 – 0.30	0.04 – 0.30
2	Rainbow	0.30 – 5.00	0.30 – 5.00
3	Metallic	5.00 – 50.00	5.00 – 50.00
4	Discontinuous true color	50.00 – 200.00	50.00 – 200.00
5	True color	> 200.00	> 200.00



N.	WHAT	HOW

6.2

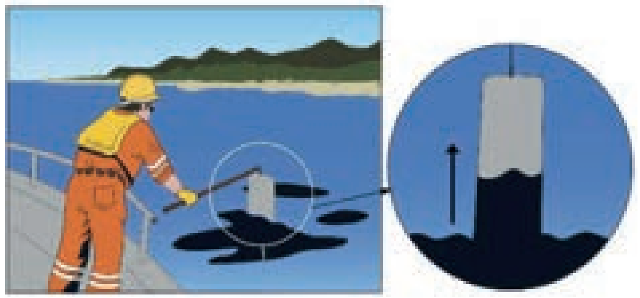
Aerial Detection Log



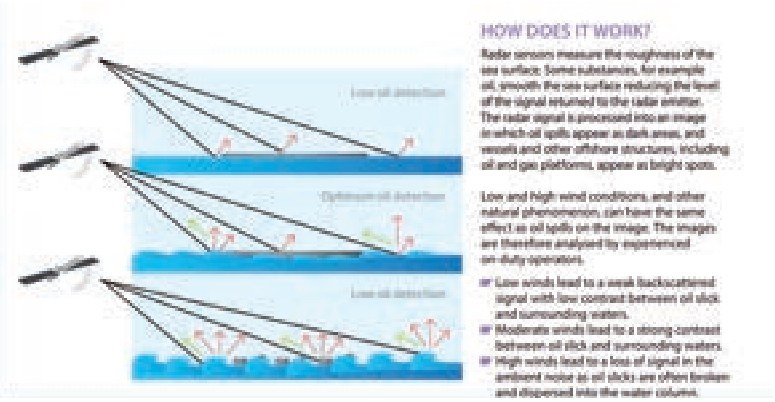
Source: University of Ljubljana – Faculty of Maritime Studies and Transport

6.3

When it is not possible to obtain aerial pictures due to the unavailability of assets or due to fog or other bad conditions, the evaluation of the thickness of the slick can also be made using the technique of the plexiglass sheet directly by the sea, applying the following formula: Thickness = volume/surface.



N.	WHAT	HOW
6.4	Aerial monitoring could be done also by satellite systems, such as **Clean Sea Net**. In particular, it is recommended to acquire SAR (synthetic aperture radar) images to determine the extension of the slick. The SAR radar elaborates a dark image resulting from the flattening of capillary waves and ripples caused by surface wind, while the surface covered by the oil slick will result flattened. So the system works if the sea is not calm.	CleanSeaNet system could be activated by National Operational Authority through the CECIS Marine platform. The affected Country could send a request for assistance to the ERCC through the CECIS Marine.



Source: EMSA website

Nevertheless, the system is not able to determine if the flattening is caused by an oil slicks or other causes (algae blooms, surface currents, calm waters etc.) so an on site evaluation is necessary.

6.4

Similar data can be obtained by coastal radar and SLAR systems.

7 On the basis on the information collected, place the contingent situation in one of the following stages:

N.	WHAT	HOW
7.1	**OPERATING SITUATIONS** **Tier 1**: mild – medium entity. Affects port, territorial sea and ZPE where it does not represent a concrete threat to coastal areas and do not represent a risk to human health and socio-economic activities and do not have large proportions and do not represent a serious risk to the environment and have no possibility to degenerate. Copable with the resources present in the area. In this case, the pollution must be treated at the Local Oil Pollution Planning level. **Tier 2**: serious entity. Ppollution or potential pollution, even of small and medium size, represents a real threat to the coast, especially if you are near areas of high intrinsic value (Marine Protected Areas, Natura 2000 network sites, fish or mussels farms -maricultures, touristic areas), islands and archipelagos. It is declared when it is not possible to intervene with only the resources of the local planning. *At this level, in Italy it is mandatory to declare the state of Local Emergency by the Maritime Authority.* At this level the pollution must be treated by the provisions of the National Contingency Plan. This is also the level in which an International – Subregional plan, such as the NAMIRS Contingency Plan should be applied, as the pollution involves the seawaters of more than one member State or for its dimensions, position, weather conditions etc., it threatens to involve the seawaters/coasts of another member state. **Tier 3**: very serious entity. This is the situation of very serious pollution for the dimensions that do not allow the situation to be addressed with local or national resources and which requires other resources. *At this level, in Italy it is mandatory to declare the state of National Emergency by the Government.*	
7.2	After the activation of local and national contingency plan, if it is clear that the Country is not able to face the situation with the available resources, or if the pollution threatens to involve the seawaters/coasts of another member state, continue with the next steps in order to activate the NAMIRS contingency plan.	The Local Operational Authority has to inform the National Operational Authority about the need for the activation of the NAMRIS plan.

PHASE 2- NOTIFICATION AND CONSULTATION

In this Phase, the NAMIRS plan is still not activated.
The Operational Authority of the Country affected by marine oil pollution severity of which surpasses the response capabilities of the Party, has to notify other Parties of its intention to activate the Plan, if in the opinion of its Operational Authority, the pollution threatens to affect or has already affected:

- the area of responsibility or the area of interest of another Party;
- the territorial sea, coasts or other related interests of the Party that activates the Plan.

In all cases outlined above, the Plan shall be activated after consulting the Operational Authorities of the other Parties.

N.	WHAT	HOW
1	Send all the data collected to other NAMIRS partners in order to share the information. Notification shall be transmitted to the Operational Authorities of the other Parties through the designated National Contact Point. National Contact Points are responsible for receiving reports on marine oil pollution incidents and for transmitting this information to their respective Operational Authorities and other interested parties within the country. On the very initial steps, the sharing of the information could be done through direct telephone calls between the National Contact Points. It is important that every communication has to be performed in English or other language commonly understood by the contact points.	The list of National Contact Points and their relevant contact details are given in SOP Annex 1.

N.	WHAT	HOW
1.1	For the exchange of information concerning pollution incidents, the Parties shall use the "pollution reporting system" (POLREP). The POLREP is divided into three parts: Part I: **POLWARN** is an initial notice (a first information or a warning) of a pollution incident. Part II: **POLLINF** is a detailed supplementary report to Part I. Part III: **POLFAC** is used for requesting assistance from other Parties and for defining operational matters related to such assistance.	
2	In the initial stage, the National Operational Authority has to properly inform other Countries about the current situation by the POLWARN message.	See SOP Annex 2 Form of POLWARN message
3	Consultations should take place at the level of the National Operational Authorities of the member Countries, after receiving the POLWARN message. At this stage the affected Country has to consult other Parties concerned clearly indicating the extent of the planned response measures and of the assistance that might be required.	Formal or informal communications between National Contact Points or Operational Authorities.

N.	WHAT	HOW
3.1	However, in case of emergency when the situation does not permit such consultations, the affected Party may activate the Plan without prior consultations.	
4	Situations in which the type and extent of the required assistance have not yet been determined, the Party who takes the decision to activate the Plan shall utilize line 53 of the POLINF part of the POLREP message to inform other Parties that the Plan has been activated.	See SOP Annex 2 Form of POLWARN message
5	Prior to activating the Plan, the Operational Authority shall alert other relevant Authorities in its own country, in accordance with the provisions of its Local and National Contingency Plans.	Convene a local Crisis Unit (Support Team) with experts and Authorities, if the Local planning provide for it (see SOPs Annex 6).
6	Activate the National On Scene Coordinator (NOCS).	

PHASE 3 – ACTIVATION OF THE PLAN – NOTIFICATION OF ACTIVATION

In this Phase, the NAMIRS plan is finally activated.
After the consultations with other Countries (or without this formality, when it is not possible to respect this step), the Operational Authority of the Country concerned may take the decision to activate the plan.
After taking the decision to activate the Plan, the Operational Authority of the Party concerned, will assume the role of **Lead Authority** (see the General Framework for further information about duties and responsibilities of the Lead Authority, NOSC, SOSC, ERC, JERC and Support Teams).

N.	WHAT	HOW
1	Lead Authority has to:	
1.1	notify the Operational Authorities of the other Parties, through their designated national Contact Points that the Plan has been activated;	The notification should be done using the POLLINF message form, specifying in line 53 that the plan has been activated.
1.2	activate its own ERC which shall assume the role of JERC;	
1.3	activate its own Support Team, composed by Administration/Experts as needed according to the actual situation;	An example of the composition of a Support Team (Crisis Unit) is given in SOP Annex 6.
1.4	designate the SOSC who shall, in liaison with the Lead Authority and his/her Support Team, formulate the strategy for dealing with the incident and evaluate the need for assistance from other Parties. The SOSC shall initiate phases IV, V and VI of the response respectively.	
	After the activation of the Plan, the SOSC have the overall responsibility for all decisions and actions taken in order to combat the pollution and to mitigate its consequences, and for the coordination of JRO. The SOSC, working in liaison with the Lead Authority, shall have Operational Command over JRO.	
2	Each National Operational Authority of the other Parties, if agrees to the activation of the plan, should alert their own:	Giving the acknowledge to the POLLINF message.
2.1	NOSC, which have to cooperate with the SOSC;	
2.2	ERC, which have to cooperate with the JERC;	
2.3	Support Teams, which have to cooperate with the SOSC/NOCS;	

PHASE 4 – REQUEST FOR ASSISTANCE

Following the activation of the Plan, the Lead Authority may request assistance from the other Parties.
The request for assistance, on the basis of the SOSC's requirements and advice, shall be sent following the activation of the Plan, by the Lead Authority to the Operational Authorities of the other Parties in accordance with the procedure outlined in POLFAC message and taking into consideration the results of previous consultations with the Operational Authorities of the other Parties.
In these cases, a good strategy to simplify the communications and the management of the subsequent Joint Response Operation (JRO), consist in designate one or more Liaison Officer, sent to the Lead Party by the Operational Authority of the assisting Party in order to be integrated in the staff of the SOCS. The duty of the Liaison Officer shall be to provide the necessary information on the resources rendered as assistance and to facilitate communication with his/her respective NOSC, ERC, Support and strike teams and self-contained units taking part in JRO.

N.	WHAT	HOW
1	The Lead Authority may require assistance in the form of:	POLFAC message form in SOP Annex 4 it shall contain a detailed description of the kind of assistance required and the purpose for which personnel, equipment, products and/or other resources will be used.
1.1	experts in various fields of oil pollution response;	e.g. ATRAC or Contact University of Ljubljana – Faculty of Maritime Studies and Transport to request the activation of the simulator "Pisces 2".
1.2	trained response personnel and, in particular, strike teams;	
1.3	specialized pollution response (pollution combating) equipment;	A list of available equipments and antipollution specialized Vessel and their characteristics is shown in Annex K of the Plan (*provided by University of Lubiana*). See SOP Annex 7. However, the Lead Authority may also choose to request equipment from EMSA via CECIS Marine platform.
1.4	specialized oil spill treatment products;	
1.5	other resources, including in particular, self-contained units such as ships and aircraft; in this step it is important to keep in mind the importance of the availability of **tankers or barges** to store the oil collected by the sea. Knowing the volume of the spill is crucial to determine the storage capacity needed to front the situation.	
2	Party receiving a request for assistance shall immediately acknowledge receipt and communicate what kind of assistance it could give, specifying the time needed for the deployment of assets and their costs.	
2.1	The Party receiving a request for assistance shall consider it and endeavor to offer its assistance to the requesting Party within the shortest possible delay, taking into consideration that it should not deplete its own national resources beyond a reasonable level of preparedness.	

N.	WHAT	HOW
2.2	Any response personnel and/or means rendered as assistance within the framework of the Plan will operate under the overall Operational Command of the SOSC and the Lead Authority. However, their respective NOSCs shall retain Operational Control over them.	
2.3	The Party receiving a request for assistance shall designate one or more **Liaison Officers** who can be sent to the Lead Country.	
3	The Lead Authority has to convene the **Support Team/Crisis Unit** composed also by Liaison Officers of assisting Countries and partners in order to manage the event and to coordinate the activities of the specialized anti-pollution units. The personnel and other resources of the assisting Parties shall operate under direct Operational Control and Tactical Command of their respective NOSCs and their unit commanders or team leaders.	
4	The SOSC with the support of the Crisis Unit has to collect every information about the oil spill and the available equipment/vessels to respond to the event.	

PHASE 5.1 – JOINT RESPONSE OPERATIONS AT SEA

According to the NAMIRS Plan, Joint Response Operations (JRO) mean all pollution response operations in which personnel, equipment, products and/or other resources, of at least two Parties to the Plan are involved.
The main objectives of Joint Response Operations (JRO) at sea are to stop the spillage of the pollutant from the source, to restrict its spreading and movement and to remove as much pollutant as possible from the sea surface before it reaches the shores or other sensitive areas of one of the Parties.
Response to a marine oil pollution incident within the area of responsibility and/or area of interest of any Party shall be conducted in accordance with the provisions of the NCP of the Party concerned/Lead Authority, under the overall Operational Command of the Lead Authority exercised through the SOSC.
Deciding on the response strategy to be applied in each particular pollution incident and the planning of specific response operations shall be the responsibility of SOSC.
The Lead Authority shall appoint an officer responsible for receiving the personnel, equipment, products and/or other resources from assisting Parties and for facilitating their participation in JRO. The responsibilities of this officer shall start at the moment of arrival into the country of resources and continue until the moment of their departure from the country. This officer shall closely collaborate with the Liaison Officer of the assisting Party.

N.	WHAT	HOW
1	Lead Authority has to call the attention of ALL SQUAD who intervene to keep a safe distance from the spill until technical instructions have been received from experts and specialist personnel or in any case if they are not equipped with suitable personal protective equipment (masks, breathing apparatus, etc.).	
2	If a ship is involved in the oil spill, and if there are the conditions to reach in safety the vessel, Lead Authority has to Activate the **Team of Experts** and arrange a mean of transport to send them on board the ship to evaluate the condition of the unit and the situation at sea.	By Helicopter or Patrol boats or other naval/aerial assets. The composition of the Team of Experts must be agreed within the participants in the NAMIRS project specifically trained for aerial operations, and must always be the same for any type of accident.

N.	WHAT	HOW
2.1	In case of huge amount of oil in proximity of the affected vessel, consider the opportunity to prefer an aerial asset instead of a naval unit to reach the ship for the evaluation. In this case, the crew of the helo must be properly briefed about the operations that must be conducted and also about: • The risks of ignition caused by the electricity generated by the rotors and conveyed by the winch, that has to be safely discharged in the sea water in a safe zone sufficiently far from the oily waters. • The eventual displacement of booms and other containment devices around the ship. In this case, the approach of the helicopter must be done trying to avoid them in order to prevent the lifting of the devices from the water and their subsequent possible damages or the leakage of oil outside the containment area.	

Picture taken during the NAMIRS Exercise

N.	WHAT	HOW
3	A Liaison Officer of the SOSC should be sent to one of the vessels involved in Rec-Oil activities to monitor the situation and report constantly to the SOSC.	
4	As stated in phase 1.2 point 5, the Master of the major Vessel of the Leading Party (like Coast Guard patrol boat) present in the zone of operation, should be nominated On Scene Coordinator (OSC) and report constantly the situation to the SOSC. It has also the duty to coordinate the activity of all the other vessel/aircrafts involved in the REC-Oil operations, according to the orders given by the SOSC. It is important that all the communications should be done in English or in a language commonly understood by the operators.	The designation of the OSC should be formalized using a message like the one in the SOP Annex 5.
5	In the event that REC-Oil operations at sea are unable to avoid the stranding of the pollutant, Joint Response Operations on shore must be activated in order to protect coastal areas and other vulnerable resources from the impact of pollutants and to remove the pollutants that have reached the coast, which will then be treated and disposed of. On shore operations will be conducted/coordinated by the competent national authorities of the affected Party using its national resources and according to the relative rules in force. If the national resources of the affected Party are not sufficient, the Party may request from another Party/other Parties to provide all possible assistance in terms of resources and specialized personnel.	

PHASE 5.2 - INTERVENTION STRATEGY

The following pages are meant to be a very simplified list of the best available techniques for the intervention on an oil spill. For a better view on the BAT, consult the ITOPF (in English) and ISPRA (in Italian) manuals at the following links
https://www.itopf.org/knowledge-resources/documents-guides/technical-information-papers/ , https://www.isprambiente.gov.it/it/pubblicazioni/quaderni/ricerca-marina/quaderni-delle-emergenze-ambientali-in-mare.

INTERVENTION TECHNIQUES

The following considerations concern, in particular, the techniques to be adopted in the event of oil pollution.
The fundamental need that arises is to want to protect everything that surrounds the area of the accident, including the coasts that may be affected by the polluting source.
It is evident that this need cannot be treated as a static situation, and therefore, in evaluating the interventions to deal with the accident, it will also be necessary to take into account a series of variables, which, by way of example, may depend on the size of the phenomenon, the speed of movement, the nature of the polluting product that characterizes it, as well as the climatic conditions.

INTERVENTION TECHNIQUES IN WATER

The water anti-pollution techniques can be substantially of two kinds: **mechanical** or **chemical**, or through the use of particular substances.
The intervention strategies that can be adopted in case of oil spills at sea are intended to prefer the containment and subsequent removal of the pollutant from the marine environment. In this perspective, priority is given strategies involving the application of various mechanical methods, such as the use of skimmers, overflow pumps or methods of oil/water separation. Subsequently, the use of products with an absorbent action can be taken into consideration and, only as extrema ratio, the use of products with a dispersing action.

MECHANICAL TECHNIQUES

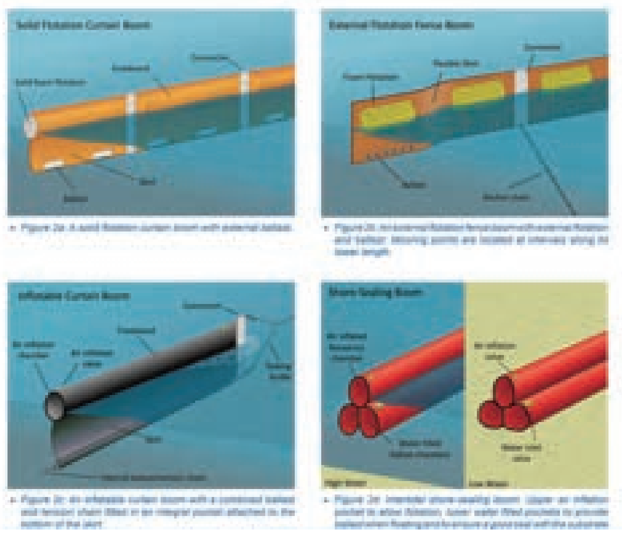
1. BOOMS

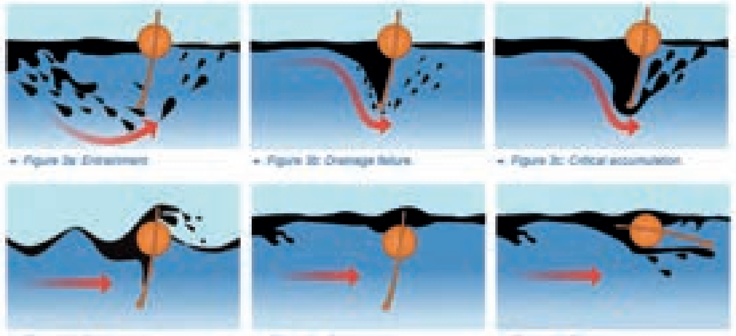
Booms come in a variety of sizes, materials and designs in order to meet the demands of these differing situations and environments. They can range from small, inexpensive, lightweight models for manual deployment in harbours, to large, expensive and robust units for offshore use, which may require the use of reels, cranes and sizeable vessels to handle them.

Booms are available in a variety of lengths with couplings to allow sections to be combined to the desired overall length. Couplings also provide towing and anchoring points. In addition to reels,a variety of ancillary equipment such as towing bridles, air blowers and anchors may be required.
The most important characteristic of a boom is its oil containment or deflection capability, determined by its behaviour in relation to water movement. All booms normally incorporate the following features to enhance this behaviour:

- freeboard to prevent or reduce splash-over;
- sub-surface skirt to prevent or reduce escape of oil under the boom;
- flotation in the form of air, foam or other buoyant material;
- longitudinal tension member (chain or wire) to withstand forces from winds, waves and currents;
- ballast to maintain the vertical aspect of the boom.

The majority of boom designs fall into two broad categories:
Curtain Booms – providing a continuous sub-surface skirt or flexible screen supported by an air or foam-filled flotation chamber usually of circular cross-section (Figures 2a and 2c).
Fence Booms – generally with a flat cross-section held vertically in the water by integral or external buoyancy, ballast and bracing struts (Figure 2b).
Shore-sealing or beach-sealing booms are also available whereby the skirt is replaced by water-filled chambers allowing the boom to settle on an exposed shoreline at low tide (Figure 2d). Fire boom is specifically constructed to withstand the high temperatures generated by burning oil and can be of either fence or curtain design with the associated abilities and limitations of these two designs in containing oil.





- Figure 3a: Entrainment
- Figure 3b: Drainage failure
- Figure 3c: Critical accumulation
- Figure 3d: Splash-over
- Figure 3e: Submergence
- Figure 3f: Planing

- Figure 3: Boom failure modes. The arrows indicate current direction. (After a diagram in Oil Spill Science and Technology, courtesy Merv Fingas)

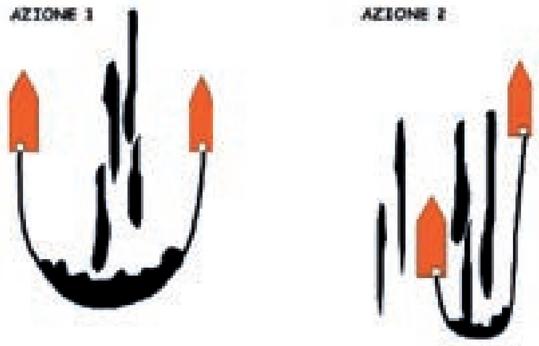
Type of Boom	Flotation Method	Storage	Wave Following Property	Moored or Towed?	Ease of Cleaning	Relative Cost	Preferred Use
Curtain Boom	Inflatable	Compact when deflated	Good	Both	Straightforward	High	Inshore or offshore
	Solid foam	Bulky	Reasonable	Moored	Easy / Straight-forward	Mid-range to Low	Sheltered inshore waters e.g. harbours
Fence Boom	External foam floats	Bulky	Poor	Moored	Difficult/Medium oil can become trapped behind external floatation or in the junctions of the chambers	Low	Sheltered waters (e.g. ports, marinas)
Shore-Sealing Boom	Inflatable upper chamber, lower chambers water filled	Compact when deflated	Good	Moored	Medium, oil can become trapped in junction of the chambers	High	Along sheltered intertidal shores (no breaking waves)

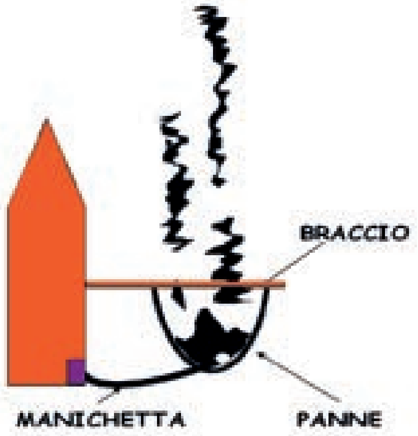
- Table 1: Characteristics of common boom types

Booms are available in a variety of lengths with couplings to allow sections to be combined to the desired overall length. Couplings also provide towing and anchoring points. In addition to reels,a variety of ancillary equipment such as towing bridles, air blowers and anchors may be required.

The most important characteristic of a boom is its oil containment or deflection capability, determined by its behaviour in relation to water movement. All booms normally incorporate the following features to enhance this behaviour:

- freeboard to prevent or reduce splash-over;
- sub-surface skirt to prevent or reduce escape of oil under the boom;
- flotation in the form of air, foam or other buoyant material;
- longitudinal tension member (chain or wire) to withstand forces from winds, waves and currents;
- ballast to maintain the vertical aspect of the boom.





The majority of boom designs fall into two broad categories:
Curtain Booms – providing a continuous sub-surface skirt or flexible screen supported by an air or foam-filled flotation chamber usually of circular cross-section (Figures 2a and 2c).
Fence Booms – generally with a flat cross-section held vertically in the water by integral or external buoyancy, ballast and bracing struts (Figure 2b).
Shore-sealing or beach-sealing booms are also available whereby the skirt is replaced by water-filled chambers allowing the boom to settle on an exposed shoreline at low tide (Figure 2d). Fire boom is specifically constructed to withstand the high temperatures generated by burning oil and can be of either fence or curtain design with the associated abilities and limitations of these two designs in containing oil.

Common uses of booms

Since the static encircling method of the areas affected by the pollution is suitable for containing and/or limiting the effects of hydrocarbon pollution, at the moment the most widely used interventions are those involving dynamic containment and recovery operations.
It allows you to move quickly within the area affected by the pollution, thus being able to adapt to changes in currents and winds; moreover, it involves a lower use of barriers.
The implementation of this concept is based on the combined use of vessels, boats, skimmers, barriers and storage units.
There are basically two possible configurations, J and U with the possibility of a third more complex but more effective V-shaped system. Nothing prevents the simultaneous use of multiple configurations 1.
Everything is better represented by the following diagrams which allow you to view the units required according to the chosen configuration.

Other uses of booms

In addition to the dynamic collection, as illustrated above, and the static containment function, however valid in certain circumstances and in the absence of other possibilities, the booms can also be used as:
1. Diversion: This application may be adopted along the coastline in situations such that there is a suitable collection site for the oil on the coast so that it can be collected by skimmers or sludge pumps or other mechanical means. It allows, with the sacrifice of a limited portion of the coast, to mechanically recover adequate quantities directly on the shoreline.
2. Protection: as a preventive measure to protect certain structures or sites of particular importance.
Attention: the barriers have some operational limitations, considering the effects of the waves (so-called Splash -over, i.e. the passage of oil above the barrier itself), wind and current (so-called Underflow, i.e. the passage of the below the barrier in the presence of strong surface currents). Therefore, when you decide to use them, it is important to identify the ones that are best suited in terms of size and strength to the meteorological characteristics of the place where they will beemployed.

2. THE SKIMMERS

Skimmers are used for the mechanical harvesting of oil from the sea surface. Their effectiveness is directly linked to certain parameters which are the thickness of the surface layer of the polluted marine area, the viscosity of the oil, its degree of emulsification, sea conditions and storage capacities.
There are different types and shapes of skimmers. They can be divided into mechanical skimmers and oleophilic skimmers. The former are based on the fluidity properties of hydrocarbons and on the difference in density between the polluting product and sea water. Fall into this category:

- weir skimmer: the weir is placed below the surface of the water so as to allow the hydrocarbons to be discharged by gravity into a recovery well from where they are pumped for storage;
- vortex skimmer: a rotor creates a whirlpool which concentrates the hydrocarbons in the center of the vortex where they are pumped for their storage.
- the oleophilic skimmers on the contrary, they are based on the principle that certain materials have a greater affinity for hydrocarbons than for water, as the name suggests. Among them there is stainless steel, aluminum, plastic materials such as polypropylene and polyurethane.

Furthermore, an important distinction is made between the different types used according to the moving surface to which the hydrocarbons adhere. We will have like this:

- disc skimmers: these are devices which bring a certain number of stainless steel or aluminum discs into contact with the hydrocarbon which tends to adhere to their surface. The discs, in turn, precisely by virtue of their rotation, tend.

Source: ITOPF Technical Information Paper, “USE OF SKIMMERS IN OIL POLLUTION RESPONSE”

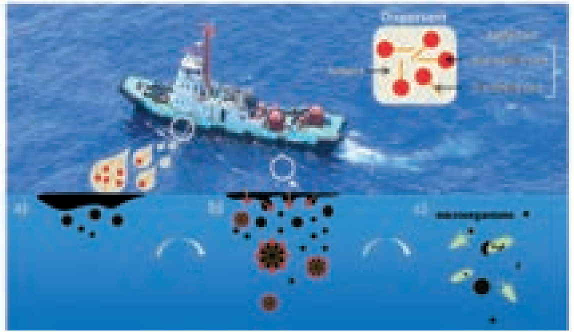
	Dependence of oil-skimming efficiency on wave height		Dependence of oil skimming on the viscosity of oil	
	Wave height [m]	Efficiency [%]	Viscosity [cP]	Efficiency [%]
Threshold	0.00	100	0	85
	0.50	100	1,000	70
	1.00	0	10,000	5
Oleophilic	0.00	100	0	10
	0.80	100	500	40
	1.30	50	1,500	90
	1.80	0	2,500	60
			5,000	20
			10,000	0
Vacuum	0.00	100	0	50
	0.60	100	2,500	60
	1.10	50	5,000	50
	1.80	25	10,000	40
	2.90	0		
Mechanical	0.00	100	0	0
	0.60	100	1,000	20
	1.30	50	5,000	40
	2.00	0	10,000	90
Belt	0.00	100	0	0
	0.60	100	1,000	10
	1.30	50	5,000	40
	2.00	0	10,000	90

Normally is used the centistokes [cSt] as the unit of viscosity. The table report the viscosity in centipoise [cP] and the conversion would be as follows: [cSt] = [cP] / specific gravity.
Source: University of Ljubljana - Faculty of Maritime Studies and Transport

CHEMICAL TECHNIQUES: DISPERSANTS AND ABSORBENTS

1. THE DISPERSANTS

Each Country has its own policy about the use of this kind of method, reported in its National Contingency Plan. In Italy, for example, the use of dispersants is permitted only and exclusively with the prior authorization of the Ministry of the Environment which will evaluate their use in terms of coast protection and marine environment safeguard.
The concept that substantiates the use of dispersants in the event of pollution is totally different from those that emerged previously. In this case, in fact, it is not a question of actively recovering the oily stain in the sea or in any case limiting its expansion but on the contrary, we try to disperse it and then rely on the self-purifying action carried out by the sea, light and wave motion which tends, over time, to degrade the stain.



Source: ITOPF Technical Information Paper, "USE OF DISPERSANTS TO TREAT OIL SPILLS"

Dispersants are compounds which have surface- active agents which tend to reduce the surface tension between the hydrocarbons and the sea water. The result to be achieved is to reduce the oily spot into very small droplets which are dispersed very rapidly in the water mass precisely due to the movement of the latter.
There are, therefore, two distinct phases: the first, in which the agent "disperses" the stain and a second in which it mixes it with a rapid decrease in the concentration of hydrocarbons within the water column which is thus brought to a minimum level.
There are different types of dispersants:

- conventional: they consist of solvents and a mixture of emulsifiers and are used pure: they generally have good compatibility with oil;
- concentrates: they are mixtures of emulsifiers, wetting agents and oxygenated solvents. These contain more active substances than the previous ones and are therefore more effective in their action.

The possibility of dispersion mainly depends on their pour point and their viscosity at sea water temperature. It is evident how the state of the sea, its temperature and salinity influence in this sense.

Dispersants should therefore only be used in the first hours of pollution, from four to about eight hours after the spill, precisely because of the high volatility of hydrocarbons. The use of dispersants on the remaining heavy (more viscous) parts, in fact, would simply cause them to sink without any dispersion effect.
The dispersant could be sprayed from vessels or from aerial assets (faster).
Their use should be limited to those of an approved type after having verified their level of toxicity on living organisms. Toxicity which, although sometimes very low, is always present and must therefore be correctly evaluated when this fight system is used.
In the light of the above, the intervention with dispersants near the coast becomes particularly delicate. In summary, it can be said that this is advisable where there are sandy, gravelly and pebbly shores where the energy of the long sea is weak or where the coasts are rocky but protected from the sea and the wind.
In fact, in these cases, where hydrocarbons can remain for a long time, the use of dispersants can help eliminate them if carried out at high tide.
On the other hand, it is **not recommended in areas particularly exposed to the sea and the wind where the same disruptive action of the agents will help to largely remove the damage caused by a possible oily stain**. The same considerations in the case of closed environments such as estuaries, coastal marshes where the water exchange is insufficient and therefore it is advisable to use means which do not further aggravate the damage caused by the hydrocarbon.
A useful instrument to know how to employ the dispersants is the "Guidelines for the use of dispersants for combating oil pollution at sea in the Mediterranean region" whose 2011 edition is published on REMPEC's Website: https://www.rempec.org/en/our-work/pollution-preparedness-and-response/response/tools/use-ofdispersants.

2. ABSORBENTS

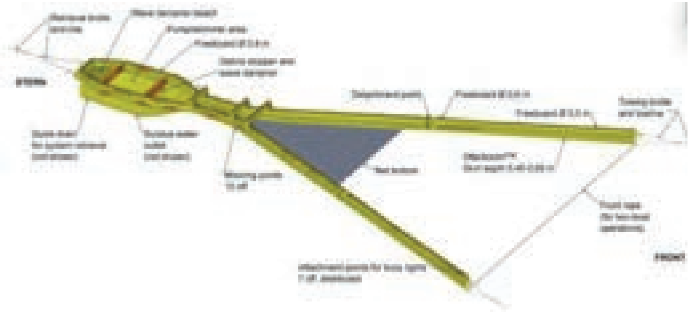
Absorbents, as the word itself suggests, absorb the oil floating on the surface of the sea and then, due to their low density, continue to float so as to allow their collection by mechanical means. They can be:

- natural products such as straw, sawdust and pumice powders;
- synthetic products such as polyurethane foam rubber and polypropylene.

They are particularly suitable in the case of small spills and where it is not possible to intervene, for technical or environmental reasons, with other mechanical collection systems.
The main properties of these products are buoyancy, selectivity, absorption capacity, consistency of agglomerates, their possibility of recycling and easy disposal.
It should be noted that, being the latter very subject to wind and current, they present the risk of being dispersed if not used correctly.

OTHER DEVICES

A modern approach to the REC-OIL operations is represented by **combined recovery system** such as the “**NOFI Current Buster**” which is a **high-speed** oil containment and recovery system, designed to be operated from a single vessel only. The system consists of an inflatable boom with an integrated oil water separator and a temporary storage tank of 40m3. It does not require continuous pumping and is to be emptied when full. NOFI Current Buster will stay out at spill site collecting oil and the vessel with tank capacity will shuttle between spill site and land with the recovered oil.
The system ensures superior clean-up capabilities in tidal, wind and wave currents due to its high Speed Through Water (STW) capability. Given its design, the hydrodynamic shape reduces the drag force and allows the system to move easier through water. Together with the optimised shape of the separator arrangement, it stabilises the movement of the liquids and the separator in the temporary storage area. The system is also capable of operating faster and more efficient than conventional oil boom configurations, by using only one vessel in conjunction with a boom vane. This provides a significant advantage as it allows the system to achieve much higher towing speeds, of up to 4.4 knots.



Source https://www.emsa.europa.eu/we-do/sustainability/pollution-response-services/equipment-assistance-service/item/4424-combined-recovery-system-nofi-current-buster-4-allmaritim.html

Pictures taken during the NAMIRS Exercise

TERMINATION OF JOINT RESPONSE OPERATIONS AND DEACTIVATION OF THE PLAN

The SOSC shall terminate JRO when, according to his/her own judgement:
i) pollution response measures have been finalized and the pollutant no longer threatens the interests of any of the Parties; or when
ii) the situation has reached a point where the response capabilities and resources of the Lead Party are sufficient for successfully finalizing the response activities.

N.	WHAT	HOW
1	After taking decision to terminate JRO, the SOSC shall immediately inform the NOSCs of the other Parties and their respective Operational Authorities of this decision and of the deactivation of the Plan.	POLLINF form message.
2	Before deactivating the Plan and leave the Crisis Unit, the SOSC and the NOCS/representatives of the Countries involved **must decide the final destination of the collected oil and the disposal of the waste generated during rec-oil activities** in the available reception facilities placed in the territory of the three Countries, according to the NCPs and in compliance with the specific environmental rules in force. In consideration of the importance and the sensitivity of the matter, it has to be treated involving the Governmental Authorities of the three Countries.	
3	Following the deactivation of the Plan, all personnel, equipment, used products and other means which were involved in JRO shall return or be returned to their respective countries of origin.	
4	The Party who requested assistance shall take the necessary measures for prompt repatriation of the personnel of the assisting Parties, although co-ordination and preparation of the necessary arrangements for their repatriation remains the responsibility of their respective Operational Authorities.	
5	The Party who requested assistance shall be responsible for returning to the country of origin, unless otherwise agreed, all equipment rendered as assistance and all unused treatment products. All equipment and other resources shall be returned clean and in the best possible working order.	
6	Operational Authorities of the Parties concerned may decide in direct contacts between them that unused treatment products remain in the country which requested assistance.	

N.	WHAT	HOW
7	Self-contained units (ships, aircraft) shall return to their country of origin using their own power. The Party who requested assistance is responsible for facilitating the formalities related to leaving its territory / territorial sea / airspace, for all units rendered as assistance.	
8	Following the termination of pollution response operations taken at both national level and within the framework of the Plan, the NOSC and/or SOSC respectively shall prepare the final report.	

Annexes

Telephone, Fax and Telex Numbers and Email Addresses of National Authorities and of their Respective National Emergency Response Centres.

Competent national authorities of each Adriatic coastal State are kindly requested to fill the table below with the relevant information concerning its country.

SOP ANNEX 1

Italia		
Access codes (dialling-out codes)	00	
Country codes (dialling-in codes)	39	
National Governmental Authority Ministry of Environment and Energetic Security – MASE	Tel	+39 06 5722 3401
	Fax	
	Email	montanaro.oliviero@mase.gov.it
National Operational Authority MASE - COIMAR	Tel	+39 06 5722 5761
	Fax	
	Email	spadoni.emanuela@mase.gov.it
Rescue Co-ordination Centre 24/7 ITMRCC – Italian Coast Guard Headquarters, Rome	Tel	+39 065923569, +390659084697
	Fax	
	Email	itmrcc@mit.gov.it
Emergency Response Centre ITMRCC – Italian Coast Guard Headquarters, Rome	Tel	+39 065923569, +390659084697
	Fax	
	Email	itmrcc@mit.gov.it

Competent National Governmental Authority	
Title (e.g. Ms, Mr, Dr., Cdr. ...)	Mr.
Name, Surname	Oliviero Montanaro
Title (position within the office)	General Director
Department (Directorate, Division)	DG – TBM
Ministry	Mase
Address 1 (street, number)	Via Cristoforo Colombo, 44
Address 2 (postal code, city/town)	00147 – Roma (RM)
Address 3 (country)	Italy
Telephone (fixed line 1)	+39 06 5722 3401
Telephone (fixed line 2)	+39 06 5722 8368
Telephone (fixed line 3)	+39 06 5722 8104
Telephone (mobile/smartphone)	+39
Fax	
Email address (official)	montanaro.oliviero@mase.gov.it
Telex (if still in use)	Teams
Working hours (winter: dates)	
Working hours (summer: dates)	

National Operational Authority	
Title (e.g. Ms, Mr, Dr., Cdr. ...)	Ms.
Name, Surname	Emanuela Spadoni
Title (position within the office)	Head of the Division 6
Department (Directorate, Division)	DG – TBM – Division 6
Ministry	Mase
Address 1 (street, number)	Via Cristoforo Colombo, 44
Address 2 (postal code, city/town)	00147 – Roma (RM)
Address 3 (country)	Italy
Telephone (fixed line 1)	+39 06 5722 5761
Telephone (fixed line 2)	+39 06 5722 3428
Telephone (fixed line 3)	+39 06 5722 8316
Telephone (mobile/smartphone)	
Fax	
Email address (official)	spadoni.emanuela@mase.gov.it
Telex (if still in use)	Teams
Working hours (winter: dates)	
Working hours (summer: dates) Annex 1	

National Contact Point (operational 24 hrs a day) Responsible for Receivingreports on Pollution Incidents	
Title (e.g. Ms, Mr, Dr., Cdr. ...)	Mr.
Name, Surname	Roberto Cresca
Title (position within the office)	Head of the Coimar
Department (Directorate, Division)	General Directorate TBM - Division 6
Ministry	Mase
Address 1 (street, number)	Via Cristoforo Colombo, 44
Address 2 (postal code, city/town)	00147 – Roma (RM)
Address 3 (country)	Italy
Telephone (fixed line)	+39 06 5722 3426
Telephone (mobile/smartphone 1)	+39 366 9615 312
Telephone (mobile/smartphone 2)	+39 331 6380 851
Telephone (mobile/smartphone 3)	+39 335 8150 659
Telephone (mobile/smartphone 4)	+39
Fax	
Email address (official)	coimar@mase.gov.it
Telex (if still in use)	Teams
Working hours (winter: dates)	24/24
Working hours (summer: dates)	

Emergency Response Centre (ERC)	
Title (e.g. Ms, Mr, Dr., Cdr. ...)	Roberto D'arrigo
Name, Surname	Captain (ITCG)
Title (position within the office)	Head of National Operating Centre and I.M.R.C.C.
Department (Directorate, Division)	Italian Coast Guard Headquarters 3RD Department Plans and Operations - Italian Maritime Rescue Coordination Centre, Conguardcost
Ministry	Ministry of Infrastructures and Transport (MIT)
Address 1 (street, number)	Viale dell'Arte, 16
Address 2 (postal code, city/town)	00144, Rome
Address 3 (country)	Italy
Telephone (fixed line 1)	+39 06 5908 4409
Telephone (fixed line 2)	+39 06 5493 7200
Telephone (fixed line 3)	
Telephone (mobile/smartphone)	
Fax	//
Email address (official)	roberto.darrigo@mit.gov.it
itmrcc@mit.gov.it	Teams
Telex (if still in use)	
Video link (videoconferencing) if available, please indicate type/model of the equipment, communication standard, ID number(s), etc.	Teams
Working hours (winter: dates)	24/24
Working hours (summer: dates) Annex 1	24/24

On-Scene Commander (NOSC)	
Title (e.g. Ms, Mr, Dr., Cdr. ...)	Appointed in case of exercises and real situations
Name, Surname	
Title (position within the office)	
Department (Directorate, Division)	
Ministry	
Address 1 (street, number)	
Address 2 (postal code, city/town)	
Address 3 (country)	
Telephone (fixed line 1)	
Telephone (fixed line 2)	
Telephone (fixed line 3)	
Telephone (mobile/smartphone)	
Fax	
Email address (official)	
Telex (if still in use)	
Working hours (winter: dates)	00-24
Working hours (summer: dates)	00-24

Telephone, Fax and Telex Numbers and Email Addresses of National Authorities and of their Respective National Emergency Response Centres.

Competent national authorities of each Adriatic coastal State are kindly requested to fill the table below with the relevant information concerning its country.

SOP ANNEX 1

Republic of Slovenia		
Access codes (dialling-out codes)	00	
Country codes (dialling-in codes)	386	
National Governmental Authority	Tel	00386 1 471 33 22
	Fax	
	Email	urszr@urszr.si
National Operational Authority	Tel	00386 1 471 33 22
	Fax	
	Email	urszr@urszr.si
Rescue Co-ordination Centre 24/7	Tel	00386 1 471 32 62
	Fax	
	Email	OperativecCORS@urszr.si
Emergency Response Centre	Tel	00386 1 471 32 62
	Fax	
	Email	OperativecCORS@urszr.si

Competent National Governmental Authority	
Title (e.g. Ms, Mr, Dr., Cdr. ...)	Mr.
Name, Surname	Leon Behin
Title (position within the office)	Director General
Department (Directorate, Division)	Administration of the Republic of Slovenia for Civil Protection
Ministry	Ministry of Defense of the Republic of Slovenia
Address 1 (street, number)	Vojkova cesta 61
Address 2 (postal code, city/town)	1000, Ljubljana
Address 3 (country)	Slovenia
Telephone (fixed line 1)	00386 1 471 33 22
Telephone (fixed line 2)	
Telephone (fixed line 3)	
Telephone (mobile/smartphone)	
Fax	
Email address (official)	urszr@urszr.si
Telex (if still in use)	
Working hours (winter: dates)	
Working hours (summer: dates)	

National Operational Authority	
Title (e.g. Ms, Mr, Dr., Cdr. ...)	Mr.
Name, Surname	Srečko Šestan
Title (position within the office)	Civil Protection Commander of the Republic of Slovenia
Department (Directorate, Division)	Administration of the Republic of Slovenia for Civil Protection and Disaster Relief
Ministry	Ministry of Defense
Address 1 (street, number)	
Address 2 (postal code, city/town)	
Address 3 (country)	
Telephone (fixed line 1)	
Telephone (fixed line 2)	
Telephone (fixed line 3)	
Telephone (mobile/smartphone)	
Fax	
Email address (official)	srecko.sestan@urszr.si
Telex (if still in use)	
Working hours (winter: dates)	
Working hours (summer: dates) Annex 1	

National Contact Point (operational 24 hrs a day) Responsible for Receiving Reports on Pollution Incidents	
Title (e.g. Ms, Mr, Dr., Cdr. ...)	Capt.
Name, Surname	Primož Bajec
Title (position within the office)	Head of MRCC Koper
Department (Directorate, Division)	Slovenian Maritime Administration, Harbour Master's Office
Ministry	Ministry of Infrastructure
Address 1 (street, number)	Kopališko nabrežje 9
Address 2 (postal code, city/town)	6000, Koper
Address 3 (country)	Slovenija
Telephone (fixed line 1)	+386 5 6632 106
Telephone (fixed line 2)	+386 5 6632 107
Telephone (fixed line 3)	+386 5 6632 108
Telephone (mobile/smartphone)	
Fax	+386 5 6632 110
Email address (official)	koper.mrcc@gov.si ; kp.promet@gov.si
Telex (if still in use)	-
Working hours (winter: dates)	24/7
Working hours (summer: dates)	24/7

Emergency Response Centre (ERC)	
Title (e.g. Ms, Mr, Dr., Cdr. ...)	
Name, Surname	
Title (position within the office)	
Department (Directorate, Division)	National Emergency 24/7 Notification Centre
Ministry	Administration of the Republic of Slovenia for Civil Protection and Disaster Relief, Ministry of Defense of the Republic of Slovenia
Address 1 (street, number)	Vojkova cesta 61
Address 2 (postal code, city/town)	
Address 3 (country)	
Telephone (fixed line 1)	+386 1 471 32 62
Telephone (fixed line 2)	
Telephone (fixed line 3)	
Telephone (mobile/smartphone)	
Fax	
Email address (official)	OperativecCORS@urszr.si
Telex (if still in use)	
Video link (videoconferencing) If available, please indicate type/model of the equipment, communication standard, ID number(s), etc.	
Working hours (winter: dates)	24/7
Working hours (summer: dates)Annex 1	24/7

National On-Scene Commander (NOSC)	
Title (e.g. Ms, Mr, Dr., Cdr. ...)	Appointed in case of exercises and real situations
Name, Surname	
Title (position within the office)	
Department (Directorate, Division)	
Ministry	
Address 1 (street, number)	
Address 2 (postal code, city/town)	
Address 3 (country)	
Telephone (fixed line 1)	
Telephone (fixed line 2)	
Telephone (fixed line 3)	
Telephone (mobile/smartphone)	
Fax	
Email address (official)	
Telex (if still in use)	
Working hours (winter: dates)	
Working hours (summer: dates)	

Telephone, Fax and Telex Numbers and Email Addresses of National Authorities and of their Respective National Emergency Response Centres.

Competent national authorities of each Adriatic coastal State are kindly requested to fill the table below with the relevant information concerning its country.

SOP ANNEX 1

Croatia		
Access codes (dialling-out codes)	+385	
Country codes (dialling-in codes)	+385	
National Governmental Authority Ministry of the Sea, Transport and Infrastructure – Maritime Safety Directorate	Tel	+385 1 6169 250
	Fax	
	Email	uprava.sigurnosti.plovidbe@pomorstvo.hr
National Operational Authority MRCC Rijeka	Tel	+385 51 195
	Fax	
	Email	mrcc@pomorstvo.hr
Rescue Co-ordination Centre 24/7 MRCC Rijeka	Tel	+385 51 195
	Fax	
	Email	mrcc@pomorstvo.hr
Emergency Response Centre	Tel	+385 51 195
	Fax	
	Email	mrcc@pomorstvo.hr

Competent National Governmental Authority	
Title (e.g. Ms, Mr, Dr., Cdr. ...)	Mr.
Name, Surname	Niko Hrdalo
Title (position within the office)	Head of the Service
Department (Directorate, Division)	Maritime Safety Directorate
Ministry	Ministry of the Sea, Transport and Infrastructure
Address 1 (street, number)	Prisavlje 14
Address 2 (postal code, city/town)	10 000, ZAGREB
Address 3 (country)	Croatia
Telephone (fixed line 1)	+385 1 6169 250
Telephone (fixed line 2)	
Telephone (fixed line 3)	
Telephone (mobile/smartphone)	
Fax	
Email address (official)	uprava.sigurnosti.plovidbe@pomorstvo.hr
Telex (if still in use)	
Working hours (winter: dates)	08:00 - 16:00
Working hours (summer: dates)	08:00 - 16:00

National Operational Authority	
Title (e.g. Ms, Mr, Dr., Cdr. ...)	Mr.
Name, Surname	Edo Šarunić
Title (position within the office)	Head of the MRCC Rijeka
Department (Directorate, Division)	Maritime Safety Directorate
Ministry	Ministry of the Sea, Transport and Infrastructure
Address 1 (street, number)	Senjsko pristanište 3
Address 2 (postal code, city/town)	51 000, Rijeka
Address 3 (country)	Croatia
Telephone (fixed line 1)	+385 51 195
Telephone (fixed line 2)	
Telephone (fixed line 3)	
Telephone (mobile/smartphone)	
Fax	
Email address (official)	mrcc@pomorstvo.hr
Telex (if still in use)	
Working hours (winter: dates)	00:00 - 24:00
Working hours (summer: dates)Annex 1	00:00 - 24:00

National Contact Point (operational 24 hrs a day) Responsible for Receiving Reports on Pollution Incidents	
Title (e.g. Ms, Mr, Dr., Cdr. ...)	
Name, Surname	
Title (position within the office)	Duty officer
Department (Directorate, Division)	Maritime Safety Directorate
Ministry	Ministry of the Sea, Transport and Infrastructure
Address 1 (street, number)	Senjsko pristanište 3
Address 2 (postal code, city/town)	51 000, Rijeka
Address 3 (country)	Croatia
Telephone (fixed line 1)	+385 51 195
Telephone (fixed line 2)	
Telephone (fixed line 3)	
Telephone (mobile/smartphone)	
Fax	
Email address (official)	mrcc@pomorstvo.hr
Telex (if still in use)	
Working hours (winter: dates)	00:00-24:00
Working hours (summer: dates)	00:00-24:00

Emergency Response Centre (ERC)	
Title (e.g. Ms, Mr, Dr., Cdr. ...)	
Name, Surname	
Title (position within the office)	Duty officer
Department (Directorate, Division)	Maritime Safety Directorate
Ministry	Ministry of the Sea, Transport and Infrastructure
Address 1 (street, number)	Senjsko pristanište 3
Address 2 (postal code, city/town)	51 000, Rijeka
Address 3 (country)	Croatia
Telephone (fixed line 1)	+385 51 195
Telephone (fixed line 2)	
Telephone (fixed line 3)	
Telephone (mobile/smartphone)	
Fax	
Email address (official)	mrcc@pomorstvo.hr
Telex (if still in use)	
Video link (videoconferencing) If available, please indicate type/model of the equipment, communication standard, ID number(s), etc.	n/a
Working hours (winter: dates)	00:00-24:00
Working hours (summer: dates)Annex 1	00:00-24:00

On-Scene Commander (NOSC)	
Title (e.g. Ms, Mr, Dr., Cdr. ...)	
Name, Surname	
Title (position within the office)	Harbour Master (in charge of the oil spill area)
Department (Directorate, Division)	Maritime Safety Directorate
Ministry	Ministry of the Sea, Transport and Infrastructure
Address 1 (street, number)	
Address 2 (postal code, city/town)	
Address 3 (country)	
Telephone (fixed line 1)	
Telephone (fixed line 2)	
Telephone (fixed line 3)	
Telephone (mobile/smartphone)	
Fax	
Email address (official)	
Telex (if still in use)	
Working hours (winter: dates)	00-24
Working hours (summer: dates)	00-24

HEADER OF THE OPERATIONAL AUTHORITY POLWARN

SOP ANNEX 2

DTG *(DAY/TIME GROUP)*____

MSG N. ____ /2023

FROM (FM) *(PARTNER REQUESTING ASSISTANCE)*
TO (TO) *TBD (NATIONAL LIST OF CONTACTS AND OTHER NAMIRS PARTNERS)*
AND, FOR KNOWLEDGE (INFO) *TBD*

PART I

1	Report the day, month and time (gmt time if possible) of the incident or, if not known, when the event became known.	
2	Report the position in latitude and longitude. In addition, it may be indicated local location (bearing and distance).	
3	Report the type of accident (e.g. collision of a tanker, i.e. " tanker collision ").	
4	Type of spill, quantity in tons of spilled product, also as installment hourly and quantity of product that could potentially end up in the sea (e.g. oil fuel spilled 100 tons and 1400 tons at risk of spilling into sea, at risk of further outflows ").	
5	Acknowledge: Use this code when you want the competent National Authority should learn about it by making the acknowledgment.	

HEADER OF THE OPERATIONAL AUTHORITY POLLINF

SOP ANNEX 3

DTG *(DAY/TIME GROUP)*____

MSG N. ____ /2023

FROM (FM) *(PARTNER REQUESTING ASSISTANCE)*
TO (TO) *TBD (NATIONAL LIST OF CONTACTS AND OTHER NAMIRS PARTNERS)*
AND, FOR KNOWLEDGE (INFO) *TBD*

PART II

40	Report the day, month and time (gmt time if possible) to which this report refers to.	
41	Indicate the location of the main pollution spots and their size in nautical miles.	
42	Indicate the characteristics of the product poured into the sea that it generated pollution (viscosity, pourpoint, specifying any type of packaging or if in bulk, etc.).	
43	Report the source and cause of the pollution, whether accidental or deliberate (e.g. from vessel due to collision).	
44	Indicate the wind direction in degrees and intensity in m/sec.	
45.	Indicate the direction in degrees and the speed in m/sec of the current.	

46	Indicate sea state and visibility.	
47	Indicate the direction in degrees in which the pollution derives and its speed in knots and decimal of a knot.	
48	Forecast of arrival at the coast with an indication of the estimated time based on a mathematical model.	
49	Indicate the person who provided the first indication of the incident. In the case of a vessel, identify it by its name, home port, flag and international callsign. Also indicate the other vessels that are present in the area at the time of the event, especially when the person who caused the pollution cannot be immediately identified.	
50	Indicate the actions taken as a result of the pollution.	
51	Indicate if photographic surveys and samplings were carried out. Also include the telex from the authority which carried out the sampling	
52	Indicate the authorities of other Countries or other organizations informed	
da 53 a 59	Available for further information such as, for example, the result of analyses, inspections, declarations made, etc.	
60	Acknowledge: Use this code when you want the competent National Authority should learn about it by making the acknowledgment.	

HEADER OF THE OPERATIONAL AUTHORITY POLFAC

SOP ANNEX 4

DTG *(DAY/TIME GROUP)*______________________________

MSG N. __________________________________ /2023

FROM (FM) *(PARTNER REQUESTING ASSISTANCE)*
TO (TO) *TBD (NATIONAL LIST OF CONTACTS AND OTHER NAMIRS PARTNERS)*
AND, FOR KNOWLEDGE (INFO) *TBD*

PART III

80	Date and time, referring to the situation described below and if it varies from the numbers 1 and/or 40	
81	Assistance required, by type and amount of assistance requested as follows: • specific equipment; • specific equipment with trained personnel; • first aid teams; • personnel with specific skills.	
82	Cost – requests for information on costs addressed to those from whom assistance is required.	
83	Preliminary arrangements for sending assistance – information concerning customs procedures, access to territorial waters, etc., in the requesting country	
84	How and where assistance should be provided – telephone and fax numbers of contact points, indications of the OSC, frequencies to be used, etc.	

85	Names of other states and organizations – to be used only if not indicated in n. 81 in the case of other requests from other States at later times.	
86	Change of command – can occur when the pollution has moved to another area, even in another country.	
87	Exchange of information - when the agreement on the change of command has been reached, all the important data pertaining to the operation underway in the incoming country must be sent.	
From 88 to 98	Free for more information and guidelines or instructions	
99	Acknowledge: Use this code when you want the competent National Authority should learn about it by making the acknowledgment.	

HEADER OF THE OPERATIONAL AUTHORITY
MESSAGE FOR DESIGNATION OF THE ON SCENE COORDINATOR (OSC)

SOP ANNEX 5

DTG *(DAY/TIME GROUP)*____________________________________

MSG N. ____ /2023

FROM (FM) (*PARTNER REQUESTING ASSISTANCE*)

TO (TO) (*OSC Zone Coordinator Designated Officer)*_________________

AND, FOR KNOWLEDGE (INFO) *TBD*

SUBJECT: ________________________ - DESIGNATION OF AREA COORDINATOR.

REFERENCE: (Local/National Contingency Plan of the concerned Country).

1. PURSUANT TO AND FOR THE EFFECTS OF THE PLAN IN REFERENCE, YOUR VESSEL IS DESIGNATED AS ON SCENE COORDINATOR IN THE AREA OF OPERATIONS RELATED TO THE POLLUTION OCCURRED IN __________________________.

2. THIS AUTHORITY WAITS FOR THE CONFIRMATION OF ASSUMPTION OF THE ASSIGNMENT.

signature

____

HEADER OF THE OPERATIONAL AUTHORITY
LOCAL CRISIS UNIT - SUPPORT TEAM

SOP ANNEX 6

AUTHORITY	CONTACTS
Maritime Authority	
Prefecture (or other governmental local structure)	
Municipality Concerned	
Fire Fighters	
Port Authority	
Local/National Environment Protection Agency	
Research Centers or Universities	
Civil Protection	
Health Authority	
Port Chemist	
Pilots	
Moorers	
Tugs	
Classification Register	
Private Societies Contractors or Concessionaire of Anti Pollution Services	
Oil Terminals	
Representatives of Industry, including, in particular, the oil and shipping industries	

LIST OF VESSELS, BOOMS, SKIMMERS AND OTHER DEVICES / FACILITIES
(Provided by the University of Lubiana)

SOP ANNEX 7

NAMIRS D2.2 Mapping of Existing resources
NAMIRS Annex K - Assets and Equipment - WORKING.docx

LIST OF SENSITIVITY AREAS
(Provided by OGS)

SOP ANNEX 8

https://www.cei.int/sites/default/files/2023-03/NAMIRS%20D2.1%20Environmental%20Risk%20Assessment%20Report.pdf

RESPONSE VESSEL JOINING MESSAGE INTRODUCTION

SOP ANNEX 9

During major spill response operations or major spill response exercises at sea, the affected State would probably request several types of assistance beyond its own spill response vessels: Oil Spill Response Vessels (OSRV) from neighbouring countries by activating Regional and Bilateral Agreements and/or by requesting oil spill response units from EMSA; or additional local, public or private units (for example private fishing vessels, private logistic vessels, etc….), named as Vessels Of Opportunity (VOOs).

In order for the coordinating maritime authority to employ all the response units in the best way possible (depends on the vessel type, equipment available, expertise available on board, extra capacities, ….), this ***Joining Message*** will give all the necessary information and detailed communication data to the Command Centre and the On-Scene Commander (OSC), for each unit working on the operation at sea.

For facilitating the communication between units and for all participating units to know each Response Vessel's capabilities and capacities, each ***Joining Message*** could be shared by the OSC with all the participating units already on scene.

This ***Joining Message*** is for operational use. It should be sent by the vessel's responsible person or authority, i.e. Designated Person Ashore (DPA)/Captain/OPS Command Center/maritime authority from State owner/Coast-Guard vessels, etc., to the Command Center of the requesting country. This is not a contractual/financial document; it should be sent after the agreement is concluded between the requesting state and the offering state/ship owner and prior to the unit's arrival on scene.

Additional detailed information on how to fill-in the ***Joining Message*** is provided below, at the end of the form.

Use the table below: don't write anything in the left column; use the right column erasing examples and just keeping the numbers to indicate your data.

	MAIN CONTACT INFORMATION	EXAMPLES
1	Name of operation - exercise/date message sent	RAMOGEPOL 2022 major Exercise / 12-10-2022
2	Ship name/operational status /IMO/MMSI	JASON / FR NAVY – RAMOGEPOL / xxxxx / xxxxx
3	Captain name / rank / tel /email	Patrick Larivière /1111 1111 1 / patricklariviere@jason.fr
4	Spill Response Operations POC on board/name/function on board	POC / Pauline Dupuis / OSR Team leader
5	POC's TEL 1/POC's TEL 2	22222222222 / -
6	POC's EMAIL	paulinedupuis@jason.fr / -
7	PERIOD/start date/end date	13-10-2022 / 20-10-2022
8	Additional info/free text	able to be integrated in WhatsApp or Signal group discussions with the MOB Phone number indicated in point 5
	VESSEL DATA	**EXAMPLES**
9	State Vessel (state owned or operated) or Vessel of Opportunity (VOO)	Vessel chartered by the FR Navy for State Action / STATE VESSEL
10	Flag state/vessel's name/type/ship owner/callsign/homeport	FRENCH / JASON / SUPPLY VESSEL / Les Abeilles / FMEE / Toulon
11	Class notation / Oil Recovery Vessel (ORV) FP> or <60°C / other	YES: Class ORV FP>60°C/ / High Sea Tug
12	HNS capability /Y/N	NO
13	DPA/full name/tel/email	DPA : M. Albert Durand / 3333333333 / a.durand@abl.fr
14	Length (m)/width (m)/draught (m)/ air draught (m) / max speed (knot)/ average speed (knot) / speed in ORO	67m. / 15.40m. / 6 m. / 20 m. / 14 kt / 12.2 knt / 1knt to 4 knt
15	Deck Crane	One deck crane: 23t for 7 m. & 8t. for 20m.
16	Bollard pull (t)	120t.
17	Oil storage capacity/heated m³/unheated m³	YES / 1 000 m3 heated / -
18	Auxiliary boat/type/engines/specific capacities	YES / 2X inflatable boats / 2X 75hp off-board engines / -
19	Chemical storage capacity/heated m³/ unheated m³	NO /- / -

20	Gas tight citadel / explosion proofed electric device / gas-alarm device / gas analysis system (type)	NO / YES /YES / NO
21	Inert gas system for storage tanks	NO
22	Additional info/free text	-
	COMMUNICATION DATA	**EXAMPLES**
23	VHF/able to guard x number of channels	YES / 4
24	AIR UHF/able to guard x number of channels	YES / 4
25	SATCOM/number	SATCOM : 4444444444
26	TETRA/ number	TETRA : -
27	Mobile phone: XXXXXXXX	Captain Mob phone: 11111111 / Bridge mobile phone: 55555555
28	Additional info/free text	-
	CREW COMPOSITION	**EXAMPLES**
29	Captain's name/number of officers/ number of other crewmembers	Patrick Larivière / 3 / 7
30	Extra expertise available on-board / number/function	Extra OSR team / 7 / 1 ORO officer team leader + 1 engineer + 5 technicians
31	Divers/number/grade	Divers / - / -
32	Medic/number/grade	Medic / - / -
33	Limitations: ship's maximal working hours per day	ability to work with spill response equipment at sea from the sunrise to the sunset
34	Additional info/free tex	2 technicians from the OSR Team are RPAS pilots too /
	RESPONSE EQUIPMENT	**EXAMPLES**
35	Sweeping-arms/name-type / length (meter) /draught (meter) / use speed / preparation's time (minutes) / limitations winds-sea (knots-Douglas scale) /additional info	YES/1 Sweeping Arm KOSEQ - portside use / 12 m. / 1 m. / 1 knt / 60 min. / max Winds :16 knts ; max Sea : 2 / -
36	Boom/name-type /length (meter) / draught (meter) / use speed / preparation's time / limitations sea-wind / additional info	YES / Booms x2 / REYCAU 600 – inflatable high-sea boom / 300 m. each / 0.8 m. / 3 knts / 40 min. / max Winds : 30 knts – max Sea : 5 / Possibility to link the two booms to have a 600 m. long boom
37	Skimmer/name-type / theoretical flow (m³/h)/ use speed / preparation's time / limitations sea-wind / additional info	YES / Skimmer 1 /LAMOR LUT 80 / 112 m3/h / 1 knt / 20 min. / max Winds : 30 knts – max Sea : 5 / - Skimmer 2 / FOILEX TDS 250 / 130 m3/h / 1.5 knts / 20 min. / max Winds : 25 knts; max Sea : 4 / -
38	Dispersant/name-type-volume on board / name-type of the spreading system /additional info	YES / 50m3 INIPOL 80 / Boat Spray / -
39	HNS capability (Y/N)	NO
40	Mobile lightening pump for oil / chemicals (Y/N)	YES / NO
41	Additional info/free text	-
	MISCELLANEOUS (other assistance & response capacities):	**EXAMPLES**
42	Firefighting / flow (m³/h) / fire-fighting foam (m³)	YES / FIFI / 2 400m3/h / YES
43	Lightering / name of cargo pump /diameter /capacity (m³/h) /additional info	YES / TK 150 FRAMO / Camelock 6 inches / 300 m3/h / ok for oils and HNS
44	RPAS on board / name-type/range (meter) / endurance (minutes) / pilots / additional info	YES / 2x quadricopter PARROT ANAFI / 1 000 m – 25 min/ 2x pilots / day flights only
45	Slick detection / name-type	–
46	Helicopter winch area / landing area	YES / NO
47	Additional accommodation space for external personnel (e.g. chemists, salvage...)	NO
48	Additional info / (any other assistance capabilities to be mentioned)	2x oil sample kit / Drifting Buoys : 3x i-SLDMB ; iridium transmission; Autonomy : 30-48Hrs

HOW TO FILL-IN the Joining Message

Use the table above : don't write anything in the left column; use the right column erasing examples and just keeping the numbers to indicate your data.

- **MAIN CONTACT INFORMATION:**

(2) for « operational status » : please, indicate under which status the vessel is participating to the operation/exercise : under activation of a Regional Agreement, if yes which one [example : RAMOGEPOL, HELCOM, Bisacye Plan, …]; under EMSA services [in that case, just mention : « EMSA »] ; under other assistance requesting mode [example : for a local working boat which has been chartered by the maritime authority for helping with logistics at sea, just mention : «Chartered by Coastal State »]

(3) Captain: name, rank, tel and email of vessel's captain.

(4) for the Point Of Contact (POC) on board : point of contact for the response operations, it means the person with whom the OSC could discuss the operations; this POC could be the vessel captain, but not necessary. This POC could also be the second captain or the operations officer. This POC could be a member of an extra team boarding the vessel, for example a strike team leader or a spill response operations expert specifically deployed on board. Please indicate his/her Full Name and function on board.

(5) & (6): TEL & EMAIL: indicate the POC direct phone number + a second phone number if available and his/her direct email address. If the POC is the Captain, please repeat his/her phone number and email

(7), PERIOD : Indicate the period of work on scene if known / date of the vessel arrival on scene / date of leaving the operations theatre if already decided

(8) additional info: For example if the POC agrees with communication tools/applications such as WhatsApp, Signal, other, ….

- **VESSEL DATA:**

(10) "State Vessel" is a vessel that is State operated or owned, e.g., a vessel chartered for State action at sea, whereas "VOO" is a vessel (e.g., a fishing vessel or tug) specifically chartered by a Coastal State just for the duration of a specific operation

(11) & (12) for "Oil Capabilities" and "HNS capabilities*": please, indicate YES or NOT and if YES, the capabilities level. [example : "YES – ORV class FP>60oC /

Other example: "NO / NO / logistics capacities with 500m² deck and 2 cranes"]

(14) for « speed in ORO » : indicate main speed when the vessel is working on pollution recovery operations with her equipment at sea, work in progress.

(15) for "deck crane": indicate the number of cranes and capacities for each

(17) for « oil storage capacities » : indicate YES or NOT /total volume of heated storage (cubic meters) / total volume of unheated storage (cubic meters).

(18) for « auxiliary boats » on board : indicate YES or NOT, then number and type, type of engines. Add specific capacities of auxiliary boats if they have some or put « - « if they don't .

(19) for « Chemical storage capacities » : indicate YES or NOT /total volume of heated storage (cubic meters) / total volume of unheated storage (cubic meters).

(20) does the ship have a gas-tight citadel to protect personnel during operations in a contaminated atmosphere? Are the external electrical systems designed to be explosion-proof so that the ship can operate in an explosive atmosphere? Does the ship have a gas warning system that can measure toxic and / or explosive gases? Is the ship equipped with a gas analysis system in order to be able to determine gaseous hazardous substances in the atmosphere around the ship? If "yes", what type of system is it?

(21) is the ship equipped with an inert gas system to put the cargo tanks in an explosion-proof state during and after being filled with a flammable and / or explosive liquid?

(22) any additional information you might think of regarding vessel's data. Just indicate " - " if not.

- **COMMUNICATION DATA:**

(23), for VHF: indicate YES or NO if you have some or have not some VHF on board / Indicate the number of different channels you are able to guard at the same time.

(24), for UHF: indicate YES or NO if you have some or have not some UHF on board / Indicate the number of different channels you are able to guard at the same time.

(25), for SATCOM: indicate the calling number if you've got one on board, indicate "-" if you don't.

(26), for TETRA: indicate the calling number if you've got one on board, indicate "-" if you don't.

- **CREW COMPOSITION:**

(30) for "extra expertise available on board" : such extra expertise means people and functions on board in addition to the crew and could be relevant also in case such expertise can be shared during the operations if needed.

(33) The duration of deployment at sea depends, among other things, on whether the ship is operated in a 2- or 3-watch rhythm or in a 1-shift system.

- **RESPONSE EQUIPMENT:**

For each type of equipment, **"preparation's time"** means the required time to put the equipment from the secure position on deck to the working position at sea; and "wind-sea limitations" mean the limitations known from industrial specifications and real experience use for this equipment in terms of wind speed (in knots) and sea-state conditions (with the Douglas Scale). "use speed" means the vessel's speed when this equipment is at sea, work in progress.

For each type of equipment, indicate YES or NO, and detailed information as mentioned if YES. If you've got on board two or three different booms or skimmers, or several type of dispersant : indicate YES, then "skimmer 1" plus detailed information; "skimmer 2", plus detailed information; "skimmer 3" plus detailed information.

- **MISCELLANEOUS:**

(47): for "Additional accommodation" : if there is space on your board to provide accommodation for other extra people, in addition to all person you mentioned in boxes "CREW COMPOSITION".

OSC DAILY SITREP & FLEET INSTRUCTIONS INTRODUCTION

SOP ANNEX 10

Goal of this **OSC Daily SITREP & INSTRUCTIONS** is for the OSC to inform all participating captains or Strike Teams on what happened on that day and to give operational instructions for the following day. This document should be sent by the OSC (or SOSC) at least once a day.

1. Spill(s) – (Casualty)

CASUALTY (Vessel, origin of the spill, continual discharge, port of refuge …)

Fill-in here

SPILL General scope or picture of the spill (observations, drifting buoys, maps…; Results from drifting models; Some extracts or the copies of the daily POLREP/pictures from aerial survey, if relevant;)

Fill-in here /attach

2. Global Situation report – Global Strategy

Maritime authority assessment, priorities-restrictions, areas to protect

Fill-in here

Some extracts how media are reporting this operation and the work of the OSR fleet

Fill-in here

Other information from Command Center, if relevant

Fill-in here

3. Weather forecas

On site weather forecast from national Authorities / command operations center for the following days

Fill-in here

4. Aerial surveillance/support

Aerial Asset	Area	Local Time	Working channel
FR – F50 XENON CHARLIE	Wreck position	09:00 / 11:00	Channel 61 / OSRV A
ESP – CASA SASEMAR	All areas	14:00 / 16:30	Channel 74 / OSC

5. Task distribution

Distribution by the OSC of task for each Unit, for the following day.

Unit	Area	Task	Observations
OSRV A	At the wreck position (xx°xx'xx"N – xxx°xx'xx"W)	Oil recovery operations. Aerial guidance from the FR. pilots between 09:00 / 11:00 [XC]	Quickly report to the OSC if no more pollution or if black oil
OSRV B	SLICK n°3 [center at xx°xx'xx"N – xxx°xx'xx"W; 3nm in diameter)	Oil recovery operations	OSC's OSRV in the same area; tug ABC at your disposal
OSRV C	Transit to Marseille – port of call	Discharging pollutant, refueling, water / food	Previous to arrive in Marseille at 16:00 Z on the 26th of Feb

6. Shipborne RPAS restrictions*

OSRV A RPAS	Free flights under 1 500 ft	NO FLIGHT 09:00 / 11:00
OSRV B RPAS	Free flights under 1 500 ft	NO FLIGHT during aerial guidance
OSRV C RPAS	no flight	no flight

* Be aware of any specific air coordination information or instructions provided by the Command Centre/OSC

7. Additional guidance related to the operation

Health and Safety guidance; PPE	Logistics Instructions/ Information	Additional information
	for example: « Marseille would be the port of discharge, Command Center will confirm that point tomorrow afternoon	
OSRV C RPAS	no flight	no flight

8. COMPLAN and phone-mail directory

Working chanel			
SHIP to SHIP:			
SHIP to SHIP:			
OSC phone-mail directory			
Function	**Name (optional)**	**Telephone**	**Email**
For example: SOSC and OSR Team Leader on board of JASON	Pauline Dupuis	2222222222	yyyyyyyy@jason.fr
Other info, if relevant			
Fill-in here			

9. Other OSC considerations

OSC comments, overnight goals, limitations, explanations
For example: it seems slicks at the wreck position are lighter and less and less numerous. To be confirmed, but this area is probably almost cleaned and possibly no more leakages from the wreck.

10. Time of next *OSC Daily Sitrep & Fleet Instructions*

Time of next OSC Daily Sitrep & Fleet Instructions
For example: Tomorrow, the 26th of February, around 18:00

HOW TO FILL-IN

Please fill-in the blank cells next or below each of the relevant points. Where examples are available, please replace the example with your own information/free text.

DATE/TIME: always indicate the date and time the message is sent by the OSC to the captains of the vessels/Strike Teams participating to the spill recovery operations.

Usually, the DATE format would be YEAR MONTH DAY (example : 20210329), but the Command Center could decide for another format. In this case, all captains would be informed.

Usually, TIME will be indicated in local time, simple redaction, such as 18 :00 ; but the Command Center could decide for another format. In this case, all captains would be informed.

REF NUMBER: this reference number could be useful for filing/reporting ; each OSC/host country will define a numbering system for these OSC Daily SITREPS, if/as needed

Points 1 to 4 are mainly to keep all captains and crews well informed about the situation (casualty / pollution / behaviour and drifting of spill(s), last POLREP, …), the global strategy (Information from the Command Center ; priorities of the Maritime Authority; how the Media deals with these maritime operations, …), the weather forecast on the operations theatre (analysis from the Command Center and/or national competent organisation). The 4th paragraph is to inform about the aerial surveillance and support for the recovery operations (usually organised by the Command Center).

Point 5 concerns instructions / task distribution by the OSC for each vessel / strike team / unit… In that case, the 1st column of the Table 5 could indicate « UNIT » or « STRIKE TEAM » or « OSRV » or, … to be adapted by the OSC, depends on the host Country's organisation.

Point 6 concerns RPAS authorizations and/or restrictions; depending on the performed activities, aerial surveillance and Host country rules.

Paragraph 7 is to give additional guidance or information related to the operation, e.g. Health and Safety or PPE, safety zone, logistics information, MAR-ICE network if HNS incident, etc.

Point 8 will be repeated in all the OSC DAILY SITREP & INSTRUCTIONS, even though working channels don't change.

Point 9 is the place for the OSC to give his/her own considerations, analysis, comments to share with the fleet, beyond the formal distribution of tasks. The aim here is to open the possibility for captains and experts from different units to appreciate the strategic and tactic situations, maybe to open discussions, share previous experiences or share analysis. The response operations should be able to benefit from all the available expertise and experiences of the international fleet, optimising the team-work in order to be the most efficient for recovering pollution at sea.

Point 10: Here, the OSC should indicate for information the expected timeline for sending the next **OSC DAILY SITREP** (could be one per day or more SITREPs per day, depending on the host country and the OSC). This would also depend on the specific situation of the operations and could differ day by day.

DAILY REPORT MESSAGES

SOP ANNEX 11

3.VESSEL_DAILY_REPORT__FINAL.xlsx
4._OSC_FLEET_TABLE__FINAL.xlsx

Guidelines for the revision and update of the sub - regional contingency plan for the Adriatic sea

NAMIRS
North Adriatic Maritime Incident Response System

Co-funded by the European Union

University of Ljubljana Faculty of Maritime Studies and Transport Portorož (SI)

National Institute of Oceanography and Applied Geophysics – OGS (IT)

Adriatic Training and Research Centre for Accidental Marine Pollution Preparedness and Response – ATRAC (HR)

Administration of the Republic of Slovenia for Civil Protection and Disaster Relief (SI)

Ministry of Sea, Transport and Infrastructure of the Republic of Croatia – MSTI (HR)

Italian Coast Guard Headquarters – CG TS (IT)

Central European Initiative Executive Secretariat – CEI

Compiled by:

UL FPP: Valter Suban, Marko Perkovič, Peter Vidmar, Andrej Androjna, Jure Demšar, Urban Pegan

In cooperation with:

ACPDR: Rok Kamenšek, Rok Sorta, Zvezdan Božič, Milena Dobnik Jeraj
CEI: Anna Marconato, Sheila Perosa
OGS: Vinko Bandelj, Donata Canu, Stefano Querin, Fabrizio Gianni, Célia Laurent, Serena Zunino
CG TS: Giuseppe Claudio Marrone, Salvatore Amenta
ATRAC: Vedran Martinić, Anja Pilepić, Luka Erlić, Iva Alač
MSTI: Niko Hrdalo

Guidelines for the revision and update of the sub - regional contingency plan for the Adriatic sea

NAMIRS
North Adriatic Maritime Incident Response System

Co-funded by the European Union

Draft Guidelines for the revision and update of the sub-regional Adriatic contingency plan – *Abstract*

These Guidelines were developed in the framework of the activities performed within the North Adriatic Maritime Incident Response System (NAMIRS), co-financed by the European Union, through funds made available by the European Commission, the Directorate-General for European Civil Protection and the Humanitarian Aid Operations (DG ECHO).

As planned at the beginning of the project, during the application phase, the purpose of the guidelines was to present a revision to the Sub-regional Contingency Plan for the Prevention of, Preparedness for and Response to Major Marine Pollution Incidents in the Adriatic Sea from 2005 (hereinafter Sub-regional CP), which was not ratified by the governments of all the three partner countries and thus never entered into force, in order to strengthen transnational cooperation and interoperability, and ensure efficient preparedness and intervention measures in case of an oil spill occurring in the North Adriatic basin.

By integrating knowledge, tools, and available resources, Partners aim at showing the necessity for a ready-for-operations sub-regional mechanism and, with the Guidelines, provide recommendations on how to make the mechanism effective, also thanks to the elaboration of the Standard Operating Procedures (hereinafter SOPs) that are being developed within the project and will constitute the operational framework for an intervention at sea.

SOPs and Guidelines for the Revision and Update of the Sub-regional CP are the two most important outcomes of this project. They represent the elaboration of the entire set of activities performed in the past two years. While SOPs provide, as the title itself suggests, the operating procedures for response action, including the definition of the NAMIRS framework, response elements and planning, checklists, contact information of the designated competent authorities, warning, nomination, and message forms, etc., the Sub-regional CP encloses all the necessary structures to support the very existence of the Plan and its potential activation, including its purpose and objectives, scope, legal aspects, measures for the prevention of pollution from ships, the policy and responsibilities in the field of preparedness and response, response operations and planning, communication lines and reporting procedures, logistics, funding, and administration, and, last but not least, public relations.

The former Sub-regional CP was developed in accordance with the “Protocol Concerning Cooperation in Preventing Pollution from Ships and, in Cases of Emergency, Combating Pollution of the Mediterranean Sea (the Prevention and Emergency Protocol)” and the “Convention for the Protection of the Mediterranean Sea against Pollution (the Barcelona Convention)”.

The Plan of 2005 was prepared as part of the project for the development of a Sub-regional System for Preventing and Combating Major Marine Pollution Incidents affecting

or likely to affect the territorial sea, coasts, and other related interests of the Republics of Croatia, Italy, and Slovenia in the Adriatic Sea. It was prepared with technical assistance from REMPEC within the framework of the Mediterranean Action Plan (MAP).
These Guidelines were drafted by the Faculty of Maritime Studies and Transport of the University of Ljubljana (UL FPP) under the supervision of the Secretariat of the Central European Initiative (CEI) and in close cooperation with other project Partners, namely, the Administration of the Republic of Slovenia for Civil Protection and Disaster Relief (ACPDR), the Italian national Institute of oceanography and Applied Geophysics (OGS), the Italian Coast Guard Headquarters – Coast Guard Trieste (CG TS), the Croatian Adriatic Training and Research Centre for Accidental Marine Pollution Preparedness and Response (ATRAC), and the Ministry of Sea, Transport and Infrastructure of the Republic of Croatia (MSTI).
The document is a revised complete collection of suggestions for the improvement of the Sub-regional CP. It was developed with careful consideration of the evolving regional political situation, changes in national and international legislation, amendments to relevant international conventions, protocols, and agreements, the advance in both shore-based and shipboard systems and technology, the introduction of new methods and software for the performance of scientific studies, analyses, and assessments, etc.

Conclusion

NAMIRS represented a unique opportunity to develop common systems and methods for response operations as well as for making available a common set of tools for the performance of analyses, assessments, and mappings. The results presented in the deliverables have, for the first time ever, lead to common analyses and assessments for all three countries, encompassing the entire North Adriatic area and yielding uniform and comparable data, ready to be used effectively when planning an international response.

Taking into account all the preliminary work done by the Partners during the course of the project, the elaboration of the common risk assessment, coastal sensitivity mapping, and mapping of existing resources, numerous training courses, the drafting and testing of SOPs, and the analysis of the Joint NAMIRS Anti-pollution Exercise at sea of November 2023, the project Partners confirm the need to treat the North Adriatic basin as a common resource that needs specific attention and transnational coordination for its safeguard, in order to prevent and manage potential threats or accidents at sea.

Specifically, the Partners reaffirm:

- The need for a renewed and strengthened collaboration among the parties in view of a possible incident;
- The need for a ready-for-operation mechanism in view of the extreme importance and value of the area;
- The need to consider the NAMIRS recommendations for the new contingency plan for the whole Adriatic, already in the preparation phase by REMPEC.

Partners recommend that:

- SOPs are integrated as Annex V to the Plan;
- The sharing of traffic data is regular;
- The analysis of traffic data is performed as proposed within the project;
- The analysis of sensitive areas is conducted as proposed within the project;
- The mathematical models developed and used in the NAMIRS project are used;
- Joint training curricula is established, and periodic training takes place;
- Simulators (OGS, UL FPP) are used for training and the preparation of scenarios;
- A technical board for the revision of changes is nominated, and that their meetings take place not less than once a year;
- Time intervals for the conduction of risk assessments, and updating of anti-pollution resource lists and contact details are determined;
- The resource-listing fill-out forms developed by UL FPP within WP 2.2 (see Deliverable 2.2) are used;
- The format of annexes is determined (UL FPP designed the proposed format for the annexes in the project);
- Regular checks of the operability of the communication lines between authorities are conducted (communication issues during the joint exercise);
- Strong collaboration with REMPEC and EMSA is maintained, and other Adriatic-Ionic countries are liaised with in order to develop a joint plan of cooperation;
- Findings of the project are included in the new Adriatic Contingency Plan;
- Prevention phases and preliminary activities defined in the Sub-regional CP are merged into one chapter;
- Smoother communication among countries and respective operational authorities are established;
- A permanent cooperation mechanism for environmental management in the North Adriatic is established, one similar to the RamogePOL model;
- Particulars are explained in detail in the Annexes, being filled out by competent authorities.

Smjernice za reviziju i ažuriranje sub-regionalnog Plana intervencija - *Sažetak*

Ove smjernice su razvijene unutar okvira aktivnosti provedenih u Sjevernojadranskog pomorskog sustava za odgovor na nezgode (NAMIRS), sufinanciranog od strane Europske Unije, kroz fondove koje su omogućili Europska Komisija, direktorat Europske Civilne Zaštite I Operative za humanitarnu pomoć (DG ECHO).
Kao što je bilo planirano na početku projekta, tijekom faze primjene, uloga smjernica je bila predstaviti reviziju Sub-regionalnog plana intervencija za sprječavanja, pripravnost i reagiranje na slučajeve iznenadnog onečišćenja mora velikih razmjera u Jadranskom moru iz 2005. godine (u daljnjem tekstu Sub-regionalni PI), koji nije bio ratificiran od strane vlade svih triju država, te nikada nije stupio na snagu. S ciljem ojačanja međunarodne suradnje i interoperabilnosti, te osiguravanja učinkovite pripravnosti i interventnih mjera u slučaju izlijevanja nafte u Sjevernom Jadranu.
Putem integracije znanja, alata i dostupnih resursa, Partneri nastoje ukazati na potrebu za operativnim i provedivim sub-regionalnim mehanizmom, te uz korištenje Smjernica, pružaju se preporuke za stvaranje funkcionalnog mehanizma. Također, zahvaljujući elaboraciji novih Standardnih Operativnih Postupaka (u daljnjem tekste SOP-ova) koji se razvijaju unutar projekta i koji će sadržavati operativni okvir za intervencije na moru.
SOP-ovi i Smjernice za reviziju i ažuriranje sub-regionalnog Plana intervencija su dva najvažnija rezultata ovog projekta. Oni predstavljaju elaboraciju cijelog seta aktivnosti provedenih kroz posljednje dvije godine. Dok su SOP-ovi, kao što i njihovi ime predlaže, operativni postupci za reagiranje, uključujući definiciju okvira NAMIRS-a, elemente reagiranja i planiranja, popise bitnih komponenti, informacije o kontaktima zaduženih kompetentnih tijela, upozorenja, imenovanja i predložaka za prenošenje informacija, itd., Sub-regionalni PI sadržava sve strukture potrebne za potporu postojanja Plana i njegovog potencijalnog aktiviranja, uključujući njegovu svrhu i ciljeve, doseg, legalne aspekte, mjere prevencija onečišćenja sa brodova, politike i odgovornosti po pitanju pripravnosti i reagiranja, aktivnosti reagiranja i planiranje, komunikacijske kanale i procedure izvještavanja, logistiku, financiranje, administraciju i odnose s javnošću.
Prijašnja verzija Sub-regionalnog PI je bila razvijena u skladu s Protokolom za suradnju u prevenciji onečišćenja sa brodova i, u slučajevima nužde, suzbijanja onečišćenja Sredozemnog mora (Protokol prevencije i nužde) i Konvencije za zaštitu Sredozemnog mora od onečišćenja (Barcelonska konvencija). Plan je pripremljen kao dio projekta za razvoj Sub-regionalnog sustava prevencije i suzbijanja iznenadnih onečišćenja velikih razmjera koja zahvaćaju ili potencijalno zahvaćaju teritorijalna mora, obale i slične interese Republike Hrvatske, Republike Italije i Slovenije u Jadranskom moru. Plan je pripremljen uz tehničku podršku od strane REMPEC-a u okviru Sredozemnog akcijskog plana (MAP).
Smjernice je sastavio Fakultet za pomorstvo i promet Sveučilišta u Ljubljani (UL FPP) pod nadzorom Izvršnog Tajništva Srednjeeuropske Inicijative (CEI) i u bliskoj suradnji sa ostalim partnerima, poimence, Uprava Republike Slovenije za civilnu zaštitu i pomoć

u katastrofama (ACPDR), Nacionalni institut za oceanografiju i primijenjenu geofiziku (OGS), Glavna lučka uprava – Obalna straža Trst (CG TS), Jadranski edukativno-istraživački centar za reagiranja na iznenadna onečišćenja mora (ATRAC) i Ministarstvo mora, prometa i infrastrukture Republike Hrvatske (MMPI).
Ovaj dokument je revidirana potpuna zbirka prijedloga za poboljšanje Sub-regionalnog PI. Razvijen je s pažljivim razmatranjem razvijanja regionalne političke situacije, promjena u narodnim i međunarodnim legislativama, izmjena bitnih međunarodnih konvencija, protokola, sporazuma, napredaka obalnih i brodskih sustava i tehnologija, novih predstavljenih metoda i software-a za izvođenje znanstvenih istraživanja, analiza i procjena.

Zaključak

NAMIRS je predstavio jedinstvenu priliku za razvijanje zajedničkih sustava i metoda u aktivnostima reagiranja, kao i kod omogućivanja zajedničkog seta alata za provođenje analiza, procjena i mapiranja. Predstavljeni rezultati su, po prvi put ikada, doveli do zajedničkih analiza i procjena za sve tri države, te na ovaj način obuhvatili cijelo područje sjevernog Jadrana i stvorili uniformne i usporedive podatke koji su spremni za efektivno korištenje pri planiranju međunarodnog reagiranja.
Uzimajući u obzir sav rad proveden od strane projektnih partnera tijekom trajanja projekta, elaboracija analize uobičajenih rizika, mapiranje osjetljivih područja na obali, mapiranje postojećih resursa, provođenje brojnih treninga, izrađivanje koncepta i testiranje SOP-ova, te analiza NAMIRS-ove vježbe suzbijanja onečišćenja na moru, projektnim je partnerima dokazao potrebu za tretiranjem sjevernog Jadrana kao zajedničkog područja i resursa koji treba specifičnu pažnju i međunarodnu koordinaciju za održavanje sigurnosti sa ciljem prevencije i upravljanja potencijalnim prijetnjama i iznenadnim onečišćenjima mora.

Partneri su potvrdili:

- Potrebu za obnovljenom i ojačanom suradnjom među strankama uključenim u moguće incidente,
- Potrebu za operativnim i provedivim sub-regionalnim mehanizmom u pogledu ekstremne važnosti i vrijednosti ovog područja
- Potrebu za razmatranjem NAMIRS-ovih preporuka za novi Plan intervencija za cijeli Jadran, koji je već u fazama pripreme od strane REMPEC-a.

Partneri preporučuju:

- Integraciju SOP-ova kao Dodatak V Planu;
- Dijeljenje podataka o prometu;
- Analizu podataka o prometu prema preporukama iz projekta;
- Analizu osjetljivih područja prema preporukama iz projekta;
- Korištenje matematičkih modela razvijenih i korištenih u NAMIRS-u
- Stvaranje zajedničkog kurikuluma treninga i provođenje treninga u odgovarajućim vremenskim periodima;

- Simulatori (OGS, UL FPP) se koriste u treninzima i pripremama scenarija;
- Nominaciju tehničke grupe za reviziju promjena, te da se njihovi sastanci održavaju bar jednom godišnje;
- Određivanje vremenskih intervala za provođenje procjena rizika i obnovu popisa resursa i ključnih kontakata uključenih u suzbijanje onečišćenja;
- Korištenje formulara za sastavljanje popisa resursa koje je razvio UL FPP unutar WP 2.2. (Isporučevina 2.2);
- Odabir formata dodataka (UL FPP je dizajnirao preporučeni format za dodatke),
- Redovitu provjeru funkcionalnosti komunikacijskih kanala između vlasti (komunikacijske poteškoće tijekom zajedničke vježbe);
- Održavanje snažne kolaboracije između REMPEC-a i EMSA-e, te ostalih Jadransko-jonskih država kako bi se razvio zajednički plan suradnje;
- Uključivanje zaključaka iz projekta u novi jadranski Plan intervencija;
- Spajanje preventivnih faza i preliminarnih aktivnosti definiranih u Sub-regionalnom PI u jedno poglavlje;
- Uspostavljanje jednostavnije komunikacije između država i odgovarajućih operativnih vlasti;
- Uspostavljanje stalnog mehanizma suradnje za upravljanje okolišem u sjevernom Jadranu, sličnog RamogePol modelu;
- Detalji su pomno objašnjeni u Dodacima, te su precizno ispunjeni od strane kompetentnih vlasti.

Linee guida per la revisione e l'aggiornamento del piano di emergenza sub-regionale Adriatico - *Sintesi*

Le presenti Linee Guida sono state sviluppate nel quadro delle attività svolte nell'ambito del progetto NAMIRS (North Adriatic Maritime Incident Response System), attraverso un co-finanziamento messo a disposizione dalla Direzione Generale per la Protezione Civile Europea e per le operazioni di aiuto umanitario (DG ECHO).

Come previsto durante la fase di stesura del progetto, lo scopo delle linee guida era quello di proporre una revisione del Piano di emergenza subregionale del 2005 per la prevenzione, preparazione e risposta all'inquinamento marino accidentale nel Mare Adriatico (di seguito CP subregionale) - che non è mai entrato in vigore - al fine di rafforzare la cooperazione e l'interoperabilità transnazionale e garantire misure di preparazione e intervento efficaci in caso di sversamento di idrocarburi nel bacino dell'Alto Adriatico.

Avvalendosi delle competenze, degli strumenti e delle risorse disponibili nei tre Paesi, i Partner mirano a promuovere un meccanismo subregionale di pronto per l'intervento e, attraverso le Linee Guida, a fornire raccomandazioni su come renderlo efficace, anche grazie all'elaborazione delle Procedure Operative Standard (di seguito POS) del progetto, che costituiscono il quadro operativo per l'intervento in mare.

Le POS e le Linee Guida per la revisione e l'aggiornamento del CP Subregionale sono tra i risultati più importanti di questo progetto e rappresentano il punto di arrivo dell'intero insieme di attività svolte negli ultimi due anni. Mentre le POS si concentrano, come suggerisce il titolo stesso, sulle procedure operative per le attività di risposta, inclusi la definizione del quadro di riferimento NAMIRS, le modalità di pianificazione della risposta, le checklist da utilizzare in caso di intervento, le informazioni di contatto delle autorità competenti, i moduli di allarme, di nomina e la messaggistica , ecc. , il CP subregionale stabilisce le strutture necessarie a sostenere l'esistenza stessa del Piano e la sua possibile attuazione, comprese le finalità e obiettivi dello stesso: gli aspetti giuridici, le misure per la prevenzione dell'inquinamento provocato dalle navi, le politiche e le responsabilità riguardo le operazioni di preparazione, pianificazione e intervento, le procedure di comunicazione e di segnalazione, la logistica, i finanziamenti e l' amministrazione e, ultimo ma non meno importante, le pubbliche relazioni.

Il precedente CP subregionale è stato sviluppato in conformità con il "Protocollo relativo alla cooperazione nella prevenzione dell'inquinamento provocato dalle navi e, in casi di emergenza, nella lotta contro l'inquinamento del Mar Mediterraneo (Protocollo sulla prevenzione e l'emergenza)" e con la "Convenzione per la protezione del Mar Mediterraneo contro l'inquinamento (Convenzione di Barcellona)". Il Piano del 2005 è stato elaborato come parte del progetto per lo sviluppo di un sistema subregionale per la prevenzione e la lotta contro i gravi incidenti di inquinamento marino che colpiscono o potrebbero colpire il mare territoriale, le coste e altri interessi correlati delle Repubbliche di Croazia, Italia e Slovenia nel Mar Adriatico. È stato predisposto con l'assistenza tecnica di REMPEC, nel quadro del Piano d'azione per il Mediterraneo (MAP).

Le presenti linee guida sono state redatte dalla Facoltà di studi marittimi e dei trasporti dell'Università di Lubiana (UL FPP) sotto la supervisione del Segretariato dell'Iniziative Centro Europea (InCE) e in stretta collaborazione con altri partner del progetto, vale a dire l'Amministrazione della Repubblica di Slovenia per la protezione civile e i soccorsi in caso di calamità (ACPDR), l'Istituto nazionale di oceanografia e geofisica sperimentale (OGS), il Comando della Guardia costiera italiana – Guardia costiera di Trieste (CG TS), il Centro croato di formazione e ricerca per la preparazione e la risposta all'inquinamento marino accidentale (ATRAC) e il Ministero del mare, dei trasporti e della Infrastrutture della Repubblica di Croazia (MSTI).
Il documento rappresenta una raccolta di raccomandazioni e suggerimenti per il miglioramento del CP subregionale. È stato sviluppato tenendo in attenta considerazione l'evoluzione della situazione politica regionale, i cambiamenti nella legislazione nazionale e internazionale, gli emendamenti alle pertinenti convenzioni, protocolli e accordi internazionali, il progresso nei sistemi e nella tecnologia sia a terra che a bordo, l'introduzione di nuovi metodi e software per l'esecuzione di studi scientifici, analisi e valutazioni, ecc.

Conclusioni

NAMIRS ha rappresentato un'opportunità unica per sviluppare sistemi e metodi condivisi per le operazioni di risposta nell'Alto Adriatico, nonché per rendere disponibile una serie di strumenti comuni per l'esecuzione di analisi, valutazioni e mappature. I risultati presentati nei deliverable del progetto hanno portato, per la prima volta in assoluto, ad analisi congiunte per tutti e tre i paesi, abbracciando l'intera area del Nord Adriatico e producendo dati uniformi e comparabili, pronti per essere utilizzati efficacemente nella pianificazione di una risposta internazionale, in caso di incidente.
Tenendo conto, e a seguito di tutto il lavoro preliminare svolto nel corso del progetto, a partire dalla valutazione del rischio, dalla mappatura della sensibilità costiera e delle risorse esistenti, passando per numerosi corsi di formazione, per la stesura e la sperimentazione di POS e concludendo con i risultati dell'Esercitazione Congiunta Anti-inquinamento in mare del novembre 2023, i partner del progetto confermano la necessità di trattare il bacino dell'Alto Adriatico come una risorsa comune che necessita di attenzione specifica e che richiede un coordinamento transnazionale integrato per la sua salvaguardia, al fine di prevenire e gestire potenziali minacce o incidenti in mare.

Nello specifico i Partner riaffermano:

- La necessità di una rinnovata e rafforzata collaborazione tra le parti in vista di un possibile incidente;
- La necessità di un meccanismo pronto all'uso, vista l'estrema importanza e il valore dell'area;
- La necessità di considerare le raccomandazioni NAMIRS a completamento del nuovo piano di emergenza per l'intero Adriatico(già elaborato grazie al sostegno di REMPEC).

I partner raccomandano che:

- Le POS siano integrate come Allegato al Piano;
- La condivisione dei dati di traffico tra i Paesi venga effettuata regolarmente;
- L'analisi dei dati di traffico venga eseguita congiuntamente, come proposto all'interno del progetto;
- L'analisi delle aree sensibili venga condotta su base periodica come proposto all'interno del progetto;
- Vengano utilizzati i modelli matematici sviluppati e utilizzati nel progetto NAMIRS;
- Vengano stabiliti programmi di formazione congiunti e si svolgano periodicamente percorsi di formazione;
- I simulatori (OGS, UL FPP) vengano utilizzati per l'addestramento e la predisposizione di scenari;
- Sia nominato un tavolo tecnico per l'aggiornamento dei dati e che le sue riunioni si svolgano almeno una volta all'anno;
- Vengano stabilite scadenze per aggiornare la valutazione dei rischi, gli elenchi delle risorse antinquinamento disponibili e i dati di contatto;
- Vengano utilizzati i moduli di compilazione dell'elenco delle risorse sviluppati da UL FPP all'interno del WP 2.2 (vedere Deliverable 2.2);
- Venga determinato il formato degli allegati (UL FPP ha progettato il formato proposto per gli allegati nel progetto);
- Vengano effettuati controlli regolari sull'operatività delle linee di comunicazione tra le autorità dei diversi Paesi (problemi di comunicazione emersi durante l'esercizio congiunto);
- Venga mantenuta una forte collaborazione con REMPEC ed EMSA e si collabori con altri paesi adriatico-ionici per sviluppare un piano congiunto di cooperazione;
- I risultati del progetto siano inclusi nel nuovo Piano di emergenza dell'Adriatico,
- Le fasi di prevenzione e le attività preliminari definite nel CP subregionale siano accorpate in un unico capitolo;
- Venga stabilita una comunicazione più agevole tra i paesi e le rispettive autorità operative;
- Venga istituito un meccanismo di cooperazione permanente per la gestione ambientale nell'Alto Adriatico, simile al modello RamogePOL;
- I dettagli vengano definiti negli Allegati dalle autorità competenti.

Osnutek smernic za revizijo in posodobitev podregionalnega načrta ukrepov za preprečevanje večjega onesnaženja jadranskega morja - *Povzetek*

Smernice so bile oblikovane v okviru aktivnosti, ki so potekale v sklopu projekta NAMIRS (Sistem za odzivanje na pomorske incidente v severnem Jadranu). Projekt je sofinancirala Evropska unija s sredstvi, zagotovljenimi s strani Generalnega direktorata za evropsko civilno zaščito in evropske operacije humanitarne pomoči (DG ECHO) Evropske komisije. Kot je bilo načrtovano že ob začetku projekta, še v fazi prijave, naj bi Smernice predstavljale revizijo Podregionalnega načrta ukrepov za preprečevanje večjega onesnaženja jadranskega morja, za pripravljenost in odzivanje nanj (v nadaljevanju Podregionalni načrt), zasnovanega leta 2005, ki pa ni bil ratificiran s strani vlad vseh treh partnerskih držav in tako nikoli ni vstopil v veljavo. Namen posodobitve Podregionalnega načrta je okrepitev mednarodnega sodelovanja in interoperabilnosti ter zagotovitev boljše pripravljenosti in vzpostavitev učinkovitejših intervencijskih ukrepov za slučaj izlitja olja v severno-jadranskem bazenu.

Partnerji so prepoznali nujnost vzpostavitve podregionalnega mehanizma za takojšnje ukrepanje na tem območju, zato so zbrali vse znanje, orodja in sredstva, ki so jim bila na voljo, da bi v Smernicah podali priporočila za izboljšanje učinkovitosti takšnega sistema. Smernice naj bi skupaj s Standardnimi operativnimi postopki (v nadaljevanju SOP), prav tako izdelanimi tekom projekta NAMIRS, predstavljale operativni okvir za posredovanje na morju.

SOP in Smernice za revizijo Podregionalnega načrta sta najpomembnejša rezultata tega projekta. Sta nadgradnja vsega, kar je bilo ugotovljeno tekom izpeljanih dejavnosti v preteklih dveh letih. Kot namiguje že samo ime, so v SOP zbrani operativni postopki za posredovanje, vključno z opredelitvijo splošnega okvirja projekta NAMIRS, elementi za ukrepanje in načrtovanjem, seznami, kontaktnimi informacijami imenovanih pristojnih služb, obrazci za opozorila, nominacije in sporočila, itd. Podregionalni načrt pa predstavlja skupek vseh struktur potrebnih za sam obstoj načrta in njegovo morebitno aktivacijo. Načrt vsebuje opredelitev namena, ciljev in obsega, pravno podlago, in predpisuje ukrepe za preprečevanje onesnaževanja z ladij, politiko in odgovornosti na področju pripravljenosti in ukrepanja, posredovanje in načrtovanje, komunikacijske povezave in postopke poročanja, logistične in administrativne zadeve, financiranje in nenazadnje tudi odnose z javnostjo.

Prejšnji Podregionalni načrt je bil oblikovan v skladu s Protokolom o sodelovanju pri preprečevanju onesnaževanja z ladij in ob izrednih dogodkih v boju proti onesnaževanju Sredozemskega morja (Preventivni in nujni protokol) in Konvencijo o varstvu Sredozemskega morja pred onesnaževanjem (Barcelonska konvencija). Pripravljen je bil kot del projekta za razvoj Podregionalnega sistema za preprečevanje in boj proti večjemu onesnaženju Jadranskega morja, ki bi lahko vplivalo na teritorialno morje, obale in druge sorodne in-

terese republike Hrvaške, Italije in Slovenije, pod tehničnim nadzorom Regionalnega pomorskega centra za ukrepanje ob izrednih dogodkih onesnaženja Sredozemskega morja (REMPEC) v okviru Sredozemskega akcijskega načrta (MAP).
Smernice je pripravila Fakulteta za pomorstvo in promet, članica Univerze v Ljubljani (UL FPP) pod nadzorom Srednjeevropske pobude (CEI), v tesnem sodelovanju z ostalimi partnerji: Upravo RS za zaščito in reševanje (URSZR), Italijanskim nacionalnim inštitutom za oceanografijo in aplikativno geofiziko (OGS), Italijanskim generalnim poveljstvom pristaniških oblasti – Obalno stražo Trst (CG TS), hrvaškim Jadranskim izobraževalno-raziskovalnim centrom za odziv na nenadno onesnaženje morja (ATRAC) in Ministrstvom RH za morje, transport in infrastrukturo (MSTI).
Smernice predstavljajo dovršeno zbirko predlogov za izboljšanje Podregionalnega načrta. Dokument je bil oblikovan ob skrbnem upoštevanju razvijajoče se politične situacije v regiji, sprememb v nacionalni in mednarodni zakonodaji, dopolnil k relevantnim mednarodnim konvencijam, protokolom in sporazumom, napredka sistemov in tehnologije tako na ladjah kot na kopnem, uvedbo novih metod in programske opreme za izvajanje znanstveno-raziskovalnih študij, analiz in vrednotenja, itd.

Ugotovitve in predlogi

Projekt NAMIRS je predstavljal edinstveno priložnost za razvoj skupnih sistemov in metod za ukrepanje kot tudi za pridobitev skupnega nabora orodij za izvajanje analiz, vrednotenj in popisov. Slednje je prvič v zgodovini pripeljalo do skupnih rezultatov za vse tri države, z enotnimi in primerljivimi podatki za celoten severni Jadran, primernimi za učinkovito načrtovanje mednarodnega posredovanja.
Z obzirom na vse predhodno delo, ki so ga partnerji opravili med projektom, izdelavo skupne ocene tveganja, popisa ranljivih območij in popisa sredstev proti onesnaženju, številne prirejene tečaje in usposabljanja, pripravo in preizkus SOP ter analizo Skupne NAMIRS vaje proti onesnaženju na morju, se partnerji strinjajo, da se mora severno-jadranski bazen obravnavati kot skupno površino, skupni vir, ki za svojo zaščito zahteva posebno pozornost in mednarodno sodelovanje, da lahko zagotovimo ustrezne ukrepe za preprečevanje in obvladovanje morebitnih groženj ali nesreč na morju.

Partnerji se strinjajo, da obstaja:

- Glede na možnost incidenta, potreba po prenovljenem dogovoru in okrepljenem sodelovanju med deležniki,
- Glede na izjemen pomen in vrednost območja, potreba po vzpostavitvi mehanizma za takojšnje ukrepanje,
- Potreba po upoštevanju predlogov, izpeljanih tekom projekta NAMIRS, za zasnovo kriznega načrta za celotno Jadransko morje, ki je sicer že v fazi priprave s strani REMPEC.

Partnerji predlagajo, da:

- Se SOP integrirajo v Podregionalni načrt kot Aneks V,
- Je izmenjava podatkov o prometu bistvena,
- Bi morala biti analiza prometa izpeljana, kot je predlagano v projektu,
- Bi morala biti analiza ranljivih območij izvedena, kot je predlagano v projektu,
- Bi se morali uporabljati matematični modeli, razviti in uporabljeni tekom projekta,
- Se moral vzpostaviti skupni načrt usposabljanj in izvajati periodična usposabljanja,
- Bi se morali za usposabljanja in pripravo scenarijev uporabljati simulatorji (OGS, UL FPP),
- Bi se moral ustanoviti tehnični odbor, ki bi obravnaval spremembe in se sestajal najmanj enkrat letno,
- Bi se morali določiti časovni intervali za izvedbo ocen tveganja in posodabljanja seznama sredstev proti onesnaženju ter kontaktnih podatkov,
- Bi se morali za popis sredstev uporabiti obrazci za izpolnjevanje, ki jih je oblikovala UL FPP v sklopu WP 2.2,
- Bi se morala določiti oblika aneksov (UL FPP je v projektu predlagala format vsakega aneksa),
- Bi se redno moralo preverjati delovanje komunikacijskih povezav med službami (zaznane težave pri komunikaciji tekom skupne vaje),
- Bi se moralo ohranjati tesno sodelovanje z REMPEC in EMSA ter se bolje povezati z drugimi jadransko-jonskimi državami in izdelati načrt sodelovanja z njimi,
- Bi se moralo ugotovitve projekta vključiti v nov Jadranski krizni načrt,
- Bi se morale stopnje preprečevanja in predhodne dejavnosti omenjene v Podregionalnem načrtu združiti v eno poglavje,
- Bi se morala vzpostaviti boljša komunikacija med državami in njihovimi pristojnimi organi,
- Bi se moral v severnem Jadranu vzpostaviti trajen mehanizem za sodelovanje pri upravljanju z okoljem, podoben kot pri RamogePOL modelu,
- Bi se morale podrobnosti opredeliti v aneksih (glej tabelo spodaj), ki bi jih morale natančno izpolniti pristojne službe.

Content

Figures and tables

Introduction

Purpose of the guidelines

These Guidelines are developed in the framework of the activities performed within the North Adriatic Maritime Incident Response System (NAMIRS), co-financed by the European Union, through funds made available by the European Commission, the Directorate-General for European Civil Protection and the Humanitarian Aid Operations (DG ECHO).

As planned at the beginning of the project, during the application phase, the purpose of the guidelines was to present a revision to the Sub-regional Contingency Plan for the Prevention of, Preparedness for and Response to Major Marine Pollution Incidents in the Adriatic Sea from 2005 (hereinafter Sub-regional CP), which was not ratified by the governments of all three partner countries and thus never entered into force, in order to strengthen transnational cooperation and interoperability, and ensure efficient preparedness and intervention measures in case of an oil spill occurring in the North Adriatic basin.

As better explained in the following chapters, the regional context has evolved not only since 2005 but also in recent months after the NAMIRS approval. Therefore, the proposed revision takes into account not only the Sub-regional CP, but also the work done within the NAMIRS project, the new geopolitical context, recent sub-regional initiatives, and newly available technology.

By integrating knowledge, tools, and available resources, partners aim at showing the necessity for a ready-for-operations sub-regional mechanism and, with the present Guidelines, provide recommendations on how to make the mechanism effective, also thanks to the elaboration of the new Standard Operating Procedures (hereinafter SOPs) that are being developed within the project and will constitute the operational framework for an intervention at sea.

1

Evolution of the regional context since 2005

1/ Evolution of the regional context since 2005

Since the development of the Sub-regional CP, proposed in 2005, the North Adriatic Sea region has significantly changed in terms of development as well as in terms of available technology and national preparedness, Slovenia and Croatia having adopted their own national contingency plans.

Over the last decade, several regional and international mechanisms and instruments have been developed in order to strengthen the cooperation for the prevention, preparedness, and response to natural disasters. Furthermore, with Croatia joining the Schengen area in 2023, the cross-border movement of people and goods has greatly improved, facilitating cross-border operations.

Organizations such as the International Maritime Organization (IMO), the International Association of Lighthouse Authorities (IALA), the European Union (EU), the European Maritime Safety Agency (EMSA), the Regional Marine Pollution Emergency response Centre for the Mediterranean Sea (REMPEC), the Adriatic Ionian Initiative, the European Union Strategy for Adriatic-Ionian Region (EUSAIR), and the EU Civil Protection Mechanism have all developed a large set of rules, recommendations, and guidelines for a prompt response in case of maritime accidents or natural disasters at sea.

For example, the EU Civil Protection Mechanism developed a Common Emergency Communication and Information System for Maritime Incidents (CECIS Marine) for requesting and offering international assistance. CECIS Marine also has a database listing resources of all EU Mamber States and EMSA, that can be made available to any country in need following a request for assistance. EMSA capacities in the Northern Adriatic include an oil recovery vessel "Kijac", whose homeport is Rijeka, that has to be ready to intervene within 24 hours upon receiving a request for assistance, and extra anti-pollution equipment stockpiled in Ravenna, ready to be mobilized around the clock. Other EMSA contracted vessels and equipment from other stockpiles can olso be mobilized in case of need.

The latest technology available in maritime traffic monitoring and especially the obligatory use of Automatic Identification System (AIS) on merchant ships and Vessel Monitoring System (VMS) on fishing vessels are very efficient for collecting data and analyzing critical points related to maritime traffic. The Long Range Identification and Tracking (LRIT) has also been introduced, and it allows tracking ships even outside the range of VHF frequencies, the frequency band where AIS is working. New modern radars were developed primarily for the monitoring of maritime traffic, but they can be also used to detect oil spills. At the same time, the quality of satellite monitoring has significantly improved together with simulation technology, capable of simulating the behavior of oil spills with great accuracy including backtracking that allows for the detection of the source of pollution.

Over the last decade, national centers for monitoring traffic in territorial waters, the so-called Vessel Traffic Service (VTS) centers, have been upgraded in all the NAMIRS partner countries. Today, the state-of-the-art equipment allows for an immediate identification of critical situations at sea, giving the possibility to react promptly and prevent an accident. In case an accident still fails to be averted, VTS can instantly alert appropriate pollution-combating services within a country. Having done so, it should then immediately inform the VTS centers of neighboring countries about the accident and potential consequences.

Furthermore, in 2022, the Regional Marine Pollution Emergency Response Centre for the Mediterranean Sea (REMPEC) launched the first cooperation of the Competent National Authorities for the Development of the Sub-regional Marine Oil Pollution Contingency Plan between Albania, Bosnia and Herzegovina, Croatia, Italy, Montenegro, and Slovenia. Following successful meetings held in Durres, Opatija, and Rome, the countries agreed and elaborated a new Adriatic Contingency Plan, this time extended to the whole Adriatic Sea.

These Guidelines endorse the international mechanisms mentioned above and urge national authorities of the parties to utilize all the facilities already in place to the maximum possible extent in case of an emergency. However, the Guidelines recognize that the North Adriatic basin, a densely trafficked area with shallow waters, rich biodiversity, and many other peculiarities, requires special attention. In this sense, NAMIRS represents a key step towards the prevention of maritime incidents and, in case of an oil spill, a coordinated response ensuring the safeguard and protection of common areas and resources.

2

NAMIRS findings

2 / NAMIRS findings

NAMIRS is co-financed by the European Union in the framework of the EU Civil Protection Mechanism. It aims at preventing and protecting from the effects of marine disasters in the North Adriatic Sea through better preparedness and enhanced cooperation at transnational level.

The Central European Initiative – Executive Secretariat (CEI-ES) led a consortium of seven partners from Croatia, Italy, and Slovenia to elaborate these specific Guidelines for the Revision and Update of the Sub-regional Contingency Plan for the Adriatic Sea.

During the course of the project, partners engaged in several activities and training courses in order to improve preventive measures and to increase preparedness for responding to a potential oil spill in the Northern Adriatic Area. Activities were divided into work packages (WPs), each bringing significant contribution to the effectiveness of response operations and the overall elaboration of these Guidelines.

NAMIRS WP 2 – State of Art

Work package WP2 is titled “NAMIRS State of Art”. The lead beneficiary is the Administration of the Republic of Slovenia for Civil Protection and Disaster Relief (ACPDR). The ACPDR have been working on the WP2 in close cooperation with project partners, the Faculty of Maritime Studies and Transport of the University of Ljubljana (UL FPP) and the Italian National Institute of Oceanography and Applied Geophysics (OGS).

Upon realization of each segment of the WP2, findings were elaborated in three separate deliverables:

- 2.1 Environmental Risk Assessment,
- 2.2 Mapping of Existing Resources,
- 2.3 Draft Guidelines for the Revision and Update of the Sub-regional Contingency Plan for the Adriatic Sea.

Prior to NAMIRS, competent authorities of the partner countries would carry out environmental risk assessments, map anti-pollution resources, and develop, revise, and amend their contingency plans, but strictly on a national level. NAMIRS represented a unique opportunity to develop common systems and methods for response operations as well as for making available a common set of tools for the performance of such activities. The results presented in the deliverables will, for the first time ever, lead to common analyses and assessments for all three countries, encompassing the entire North Adriatic area and yielding uniform and comparable data, ready to be used effectively when planning an international response.

In the WP 2.1, experts from UL FPP and the Italian National Institute of Oceanography and Applied Geophysics (OGS) performed a maritime traffic risk assessment (collision risk assessment). To do that, they inspected all the Automatic Identification System (AIS) data for the past years and determined the expected density of maritime traffic in the overall area. Making use of the IALA Waterway Risk Assessment Program (IWRAP), they isolated the positions where incidents are most likely to occur.

As to particularly sensitive areas, the partners developed their own method for the mapping of coastal sensitivity and vulnerability. The method is based on a 1-9 sensitivity scale, taking into account geomorphological factors, protected areas, and socio-economic consequences. It is intended to identify the prioritized, most sensitive coastal areas, and aid the command in choosing proper action in case of an event.

Within the WP 2.2, UL FPP conducted a survey among the partner-countries authorities to gather information on available anti-pollution resources, namely, marine craft, aircraft, and equipment. Very importantly, the overall analysis of resources was thoroughly revised after the Joint NAMIRS Anti-pollution Exercise that took place on 20 November 2023. By the time the project is concluded, the partner countries will have had a complete and uniform mapping of assets and equipment, facilitating the command's choice of proper assets to mobilize and equipment to deploy in case of a specific incident. For the mapping, UL FPP developed specialized fill-out forms, which could prove very useful also for other countries.

As part of the WP, a feasibility study was carried out for a training centre in Slovenia. In addition, the hardware of the simulation centre for oil spills at FPP was renewed. The results of the feasibility study and the modernisation of the hardware could improve the preparation for possible oil spills and should be taken into account in these guidelines.

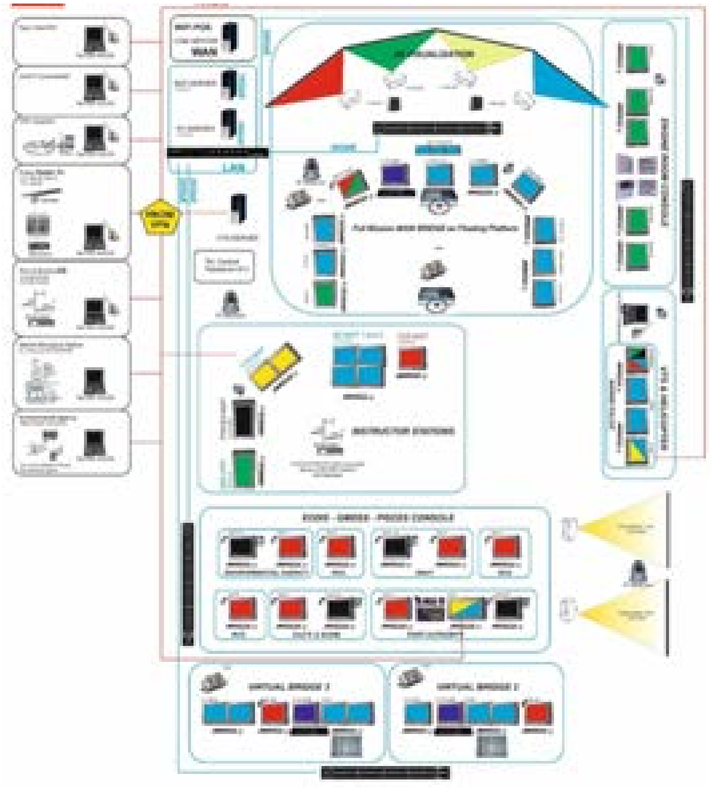


Figure 1: Scheme of the UL FPP simulation center

Figure 2: New equipment in the UL FPP simulation center

Taking into account the findings and results of the analyses and assessments conducted by NAMIRS partners, concrete suggestions for the update and revision of the Sub-regional CP are given in Chapter 3 of this report.

NAMIRS WP 3 – Training

Within the WP 3, various activities, whose main goal was improving the knowledge and skills of oil-spill responders, were conducted.

The following training courses were performed:

- Maritime English course, organized by UL FPP,
- Maritime English course, organized by the Italian Coast Guard - Trieste (CG TS),
- Tactical Pollution Response Training Using Crisis Management Oil-spill Response Simulator, organized by UL FPP,
- At-sea Response course, held in three locations (Koper, Trieste, and Rijeka), organized by the Adriatic Training and Research Centre for Accidental Marine Pollution Preparedness and Response (ATRAC),
- Shoreline Clean-up course, held in three locations (Koper, Trieste and Rijeka), organized by ATRAC,
- Familiarization with the Use of Aircraft in Oil Spills, organized by CG TS.

Taking place in the second half of the project, there was a total of 35 days of training activities. All together, 228 people attended.

One of the greatest contributions of this project to the effort is that teams have acquired new competencies and improved their spill-combating skills as well as their understanding of SOPs and the new Plan.

NAMIRS partners are recalling North Adriatic countries to continue with appropriate trainings also in the future.

NAMIRS WP 4 – SOPs and Testing

SOPs are one of the main outcomes of this project. Partners are strongly recommended to follow the procedures laid down by SOPs as well as to keep constantly revising and amending them as need be. In the future, the Plan and its annexes should be updated within a common framework composed by all the partners and lead by a body similar to the Secretariat to the existing RamogePOL Plan (Ramoge Agreement, 1976, signed by France, Italy, and Monaco).

The SOPs were developed by the Italian Coast Guard – Trieste Harbor Master's Office with the aim of offering first response operators an easy-to-consult guide providing information on how to manage a response at sea in a simple but effective way in in all its phases: from an early warning to the deployment of vessels and the commencement of anti-pollution operations, in compliance with national and local contingency plans.

The SOPs also respond to the need of establishing direct communication channels between governmental institutions and private partners operating at sea, providing pre-formatted messages and updated contact lists, and standardizing the operational structures to be put in place in case of need (crisis units, coordination, intervention teams, etc.)

The SOPs are divided into 3 parts:

- general context,
- a checklist that guides the Coordinator of Operations (Leading Country and National/Supreme On-scene Coordinators (NOSC/SOSC)) in managing the event, further divided into several operational phases,
- a collection of annexes of primary importance for managing communications and sharing information among partners.

SOPs, communication procedures, the coordination of naval units, and oil-recovering equipment were put to test at the Joint NAMIRS Anti-pollution Exercise, performed in the Gulf of Trieste on 20 November 2023. In the hypothesized scenario, a collision between an oil tanker and a vehicle carrier was simulated. The site of the collision was selected according to the risk assessment developed within the project.

Figure 3: Collision site

The exercise focused on oil-spill response capacity by using naval units from all partners and a CG TS helicopter for the boarding activity. A team of firefighters, partners to the North Adriatic Maritime Incident Response Group (NAMIRG) project, was also involved in order to check the safety of the damaged ship.

During the exercise the simulators of OGS, UL FPP, ARPA and ARSO were independently tested. The comparison of results from the different simulators will be discussed in the near future to find the best solution for forecasting in the event of oil spill.

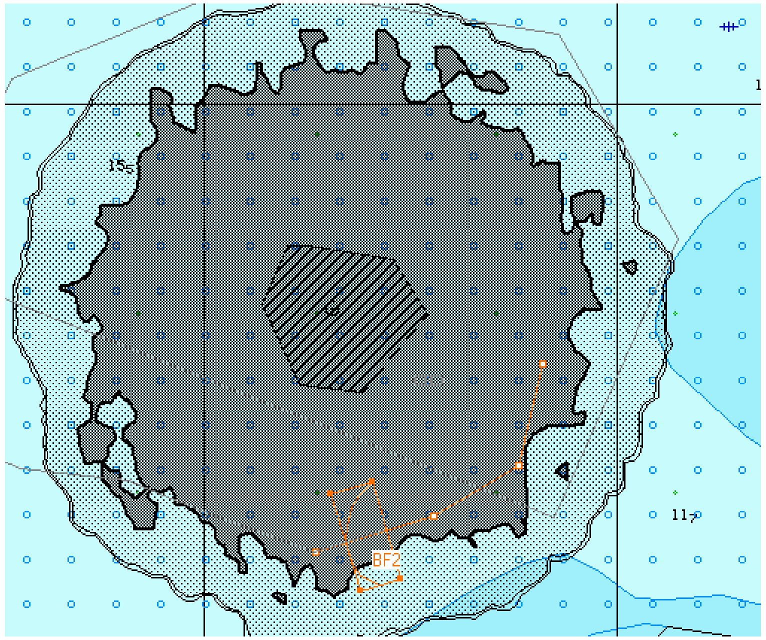


Figure 4: Simulation of the deployed boom formation

Following the conclusion of the exercise, a debriefing was carried out among the partners of the NAMIRS project, technical observers of the Italian Ministry of the Environment, the European Commission and EMSA, where deficiencies exposed during the exercise were discussed. Details on the exercise including criticalities are included in a separate report. All partners agreed on the importance of such events as well as the importance of continuous collaboration among the competent authorities.

Deficiencies were thoroughly analyzed and are now included in the SOPs, and also considered in Chapter 3.

NAMIRS WP 5 – Communication and Dissemination

WP 5 is led by the Central European Initiative (CEI). CEI drafted the project's communication and dissemination strategy and took charge of its implementation, ensuring that NAMIRS goals, scope, and results are properly conveyed and disseminated. CEI also liaised with projects that share similar goals, such as the Improving the Integrated Response to pollution Accident at sea and chemical risk in port (IRA-MAR) and regional mechanisms, such as REMPEC, which has a similar scope, in order to acquire information on the latest regional developments and ensure that the Draft Guidelines for the revision and update of the Sub-regional Contingency Plan are as thorough and comprehensive as possible.

With regard to the participation to external events, NAMIRS partners have made an effort to participate in as many external and thematic events as possible to leverage the dissemination of the project's goals and outcomes. NAMIRS partners have attended about 10 external events, several international gatherings where a variety of stakeholders took the stage. A more detailed description of the dissemination events is the object of a separate report. Noticeable is also the mediatic attention that the Joint NAMIRS Anti-pollution Exercise received, with a large number of media outlets (TV, radio, newspapers) from the three countries covering the event.

Finally, CEI took care of the professional formatting and digital printing of the main deliverables, providing the Risk Assessment with an ISBN number through the University of Ljubljana in order to make the publication available to a large public for future research and reference.

3 Recommendations for the revision of the Sub-regional CP 2005

3 / Recommendations for the revision of the Sub-regional CP 2005

The Sub-regional CP was developed in accordance with the Protocol Concerning Co-operation in Preventing Pollution from Ships and, in Cases of Emergency, Combating Pollution of the Mediterranean Sea (the Prevention and Emergency Protocol) and the Convention for the Protection of the Mediterranean Sea against Pollution (the Barcelona Convention) in 2005. The Plan was prepared as part of the project for the development of a Sub-regional System for Preventing and Combating Major Marine Pollution Incidents affecting or likely to affect the territorial sea, coasts, and other related interests of the Republics of Croatia, Italy, and Slovenia in the Adriatic Sea. It was prepared with technical assistance from REMPEC within the framework of the Mediterranean Action Plan (MAP). The Sub-regional CP constituted a valid source of information, but unfortunately, it was never adopted.

The **2005 Plan** was divided into 8 chapters and had 10 annexes. These Guidelines should be considered for its revision and update.

The main chapters of the proposed Plan were the following:

- Chapter 1: Introduction;
- Chapter 2: Prevention of pollution from ships;
- Chapter 3: Policy and responsibilities in the field of preparedness and response;
- Chapter 4: Response elements and planning;
- Chapter 5: Response operations;
- Chapter 6: Communications and reporting;
- Chapter 7: Logistics, funding, and administration;
- Chapter 8: Public information.

The 10 annexes to the Plan were:

- Annex 1: Directory of competent national authorities,
- Annex 2: Communications with REMPEC,
- Annex 3: National contingency plans (or relevant parts thereof),
- Annex 4: Directory of response personnel and inventory of response equipment, products and other means
- Annex 5: Communications system,
- Annex 6: Guidelines for reporting oil spills (aerial surveillance),
- Annex 7: POLREP pollution reporting system,
- Annex 8: Standard format for requesting assistance,
- Annex 9: Claims manual,
- Annex 10: Prevention, preparedness, and response organization flows.

UL FPP was tasked with drafting the Guidelines for the Update and Revision of the Sub-regional CP. Deliverable 2.3 is a revised complete collection of suggestions for the improvement of the Plan from all project partners. It was developed with careful consideration of the evolving regional political situation, changes in national and international legislation, amendments to relevant international conventions, protocols, and agreements, the advance in both shoreside and shipboard systems and technology, the introduction of new methods and software for the performance of scientific studies, analyses, and assessments, etc. The latter is further described in chapters 1.1 and 1.2 of the Draft Guidelines.

The amended Plan should consist of the same 8 chapters with minor to moderate modifications. However, it should be supplemented by a much larger number of annexes including much more detail. The non-exhaustive list of annexes is included in this report.

It should also be stated that significant changes to the Plan are due to the newly conducted common maritime risk assessment and coastal sensitivity mapping, the ongoing mapping of anti-pollution resources, and the recently developed SOPs.

All the technical modifications deemed necessary for the improvement, sustainability, and, ultimately, flawless operability of the Plan are included in the following chapters.

1. Introduction

1.1 Context

This chapter should be revised taking into consideration the latest technical and political situation including:

- International regulations, recommendations, and guidelines, prepared within the international and regional organizations as: IMO, IALA, EU, EMSA, REMPEC, EUSAIR;
- All three countries are now EU members and part to the Schengen area;
- Within the EU, Union Civil Protection Mechanism (UCPM), facilitates cooperation among the UCPM Member and Participating States to improve prevention, preparedness, and response to disasters;
- The request for in-kind or expert assistance through the UCPM, should be sent to the Emergency Response Coordination Centre (ERCC) via CECIS Marine,
- EMSA anti-pollution services, including satellite images, vessels and specialized equipment, located around European coastline should also be requested via CECIS Marine;
- The latest technology used in maritime traffic including shipboard equipment and shore-based monitoring systems, and the latest recommendations from different maritime organizations on how to use that equipment,
- Renewed VTS centers in all three Northern Adriatic countries with state-of-the-art equipment and trained personnel.

- Guidelines recommend that particulars should be explained in detail in the annexes to the Plan. For this purpose, an extensive set of annexes was added. A list of proposed annexes is attached at the end of the Guidelines.

1.2 Purpose and objectives

This chapter should be revised taking into consideration the above-mentioned changes.

Specific objectives of the Plan are defined as follows:

- To determine the extent of cooperation among the relevant authorities of the Parties to the Plan, in the field of prevention of marine pollution incidents;
- To determine the extent of cooperation for the implementation of the Plan in cases of emergency, between the responsible authorities, at an operational level;
- To define areas of responsibility of the Parties to the Plan;
- To divide the responsibilities and to anticipate the transfer of responsibility from one Country to another,
- To establish the principles of command and liaison, and to define the corresponding structures;
- To provide arrangements concerning the operation of ships and aircraft of one of the Parties, within the area of responsibility of the other Parties;
- To specify the type of assistance which might be provided and the conditions under which it will be provided;
- To determine in advance the financial conditions and administrative modalities related to cooperative actions in case of emergency.

In order to achieve these objectives, the Parties intend to take the following actions through the implementation of the Sub-regional Contingency Plan:

- Develop adequate activities and take appropriate measures aimed at reducing the risks of incidents or the environmental consequences thereof;
- Develop appropriate network(s) for the exchange of information concerning prevention of marine pollution incidents;
- Develop appropriate preparedness measures and effective systems for detecting and reporting pollution incidents affecting or likely to affect the areas of responsibility of the Parties;
- Promote and implement sub-regional cooperation in the fields of prevention of accidental oil pollution from ships, contingency planning, pollution control and clean-up operations;
- Implement the necessary measures to restrict spreading and to minimize the hazard posed by marine pollution incidents;
- Develop and implement a program of training courses and practical exercises for different levels of personnel involved in oil pollution prevention and combating;
- Develop procedures for increasing regional cooperation.

The new flow chart related to operational organization should be designed.

1.3 Scope and geographic coverage

This chapter should be revised and agreed among the Parties, who should establish the geographical coverage.

1.4 Definitions and abbreviations

The Partners propose that the content of this point is included in Annex A, so this point should be discarded.

2. Prevention of pollution from ships

2.1 Joint policy for the prevention of pollution from ships

The Partners recommend that this chapter is revised taking into consideration the latest rules and agreements adopted by various international organizations.

2.2 National Authorities responsible for the prevention of Pollution from ships and designation of Pollution Prevention Coordination Centres (PPCCs)

The Partners recommend that this chapter is revised taking into consideration the latest national rules and governmental organizations within each of the three countries.

2.3 Meetings of Pollution Prevention Coordination Centres

The Partners recommend that only parts of this chapter are revised. The Partners strongly suggest annual meetings to take place.

2.4 Prevention phases

The content of Point 2.4 should remain unchanged.

2.5 Preliminary activities

2.5.1 Monitoring the Sea

Point 2.5.1 should be changed completely, taking into consideration:

- Latest technology on ships and shore,
- Organization within the countries,
- Guidelines and directives of international organizations.

2.5.2 Traffic Data Collection and Traffic Analysis

The Partners recommend that this chapter is revised taking into consideration the methods recommended by IALA.

The Partners recommend that the Parties establish a common system. The traffic data analysis should be done every year by each country. The common analyses of the factors which could lead to risk of pollution by oil should be done by an authorized institution at least one month before the regular annual meeting. At the meeting, it should be defined which institution is tasked to perform next year's traffic data analyses.

The Partners recommend that more details related to the traffic survey are included in Annex T.

2.5.3 Maritime Traffic Risk Assessment

The Partners recommend that this chapter is revised taking into consideration the method developed in the project NAMIRS and taking into account international guidelines.

Based on the traffic analyses, the parties should perform a risk assessment for the territory of the agreement. The first risk assessment was done within the NAMIRS project. Parties should nominate an organization whose task it will be to update the risk assessment regularly, every year. Final acceptance of the risk assessment should be approved at the regular annual meeting. For performing the risk assessment, a common method, one of the worldwide recognized methods proposed by IALA should be used.

More details related to the traffic survey should be included in Annex U.

2.5.4 Particularly Sensitive Areas

The Partners recommend that this chapter is revised taking into consideration the method developed in the project NAMIRS and taking into account international guidelines.

The Parties should recognize the importance of designating certain zones in the area covered by the Plan, taking into consideration the implementation of Biodiversity strategy 2030 in the EUSAIR and synergies with UN/MAP as well as the Mediterranean Coast and Macro-Regional Strategies.

Due to the various types of coasts, protected areas and the different socio-economic value of the coast, the parties should carry out a Coast Vulnerability Assessment (CVA) to establish priority criteria in the case of oil spill for the territory of the agreement. A scheme on figure shown which factors must be considered. CVA would help both the SOSC and NOSCs to make correct decisions in the priority of protecting certain areas without any outside pressure.

The first CVA was performed within the NAMIRS project. The CVA should be updated regularly, at least once every 5 years, but in case of need and upon request of the parties, this time frame could be reduced (e.g., every 2 years). Final acceptance of the CVA should be approved at the regular annual meeting. To perform the CVA, a NAMIRS model should be used until appropriate new state-of-the-art worldwide recognized model appears.

A CVA of the Plan should be displayed on large-scale maps and should be used for international interventions. For a detailed CVA, each party should do it within their National Contingency Plans (NCP).

Details related to sensitivity mapping should be included in Annex J.

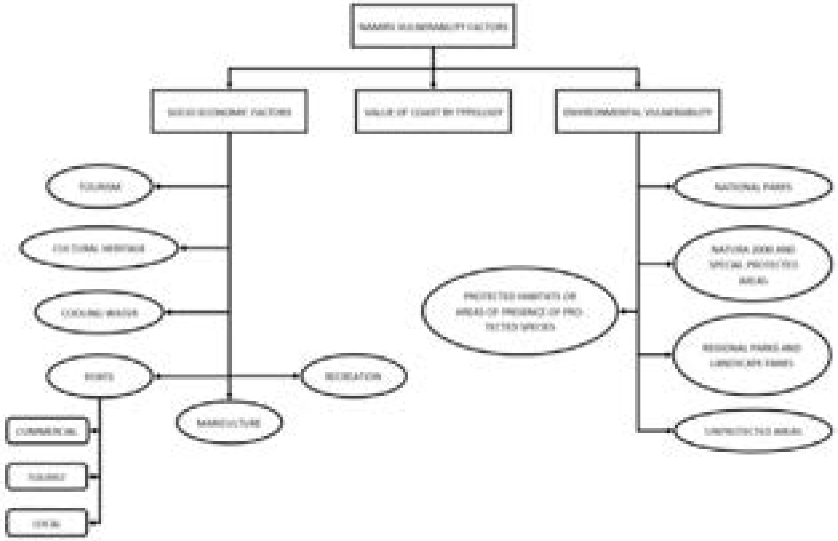


Figure 5: Schematic representation of the vulnerability factors considered in NAMIRS CVA

2.5.5 Vulnerability Mapping and Assessment

The Partners recommend that this chapter is revised taking into consideration the method developed in the project NAMIRS.

To facilitate rapid interventions of the Response Teams and decisions on priority areas to protect in case of an oil spill event, detailed information and maps on coastal vulnerability would be required for decision makers to easily and quickly consult.

Priority intervention scores of the must be categorized into four classes and visualized in GIS with different colors: very low vulnerability (1-2, green), low vulnerability (3-5, yellow), medium vulnerability (6-7, orange), high vulnerability (8-9, red) to help commanders take proper decisions.

A CVA of the Plan is on the large-scale maps and will be use for the international interventions. For a detailed CVA each party should do it within the National contingency plan (NCP). Relevant information on CVA shall be attached to the Plan in Annex J.

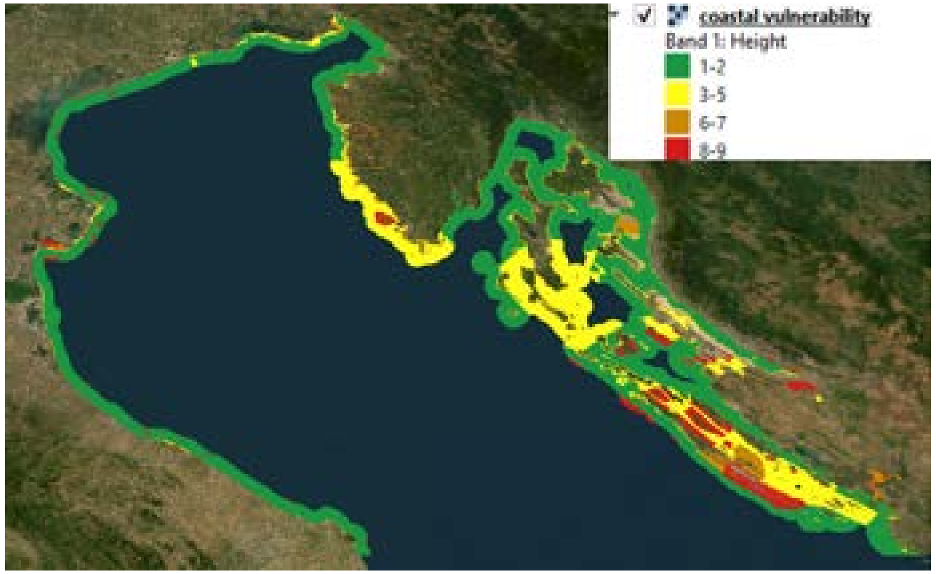


Figure 6: Intervention priorities according to CVA

2.5.6 Traffic Control Systems

The Partners recommend that this chapter is revised taking into consideration updated traffic schemes and reporting systems as well as international guidelines.

2.5.7 Facilities and Services

The Partners recommend that this chapter is revised taking into consideration the findings of the project NAMIRS, especially the suggestions on how to rectify the gaps. Furthermore, the use of CECIS Marine database for the collection of data on regional resources should be considered.

During the collection and analysis of data on available anti-pollution resources including stakeholders, services, assets, and equipment, we have detected the following gaps:

- Data on assets and equipment are incomplete (should be clearly stated in the Plan what data should be collected and exchanged);
- Assets and equipment are categorized in a non-uniform way (the Plan should clearly define which categories and particulars should be listed, in a uniform way).

Details related to assets and equipment should be included in Annex K.

2.5.8 Planning

The Partners recommend that this chapter is revised taking into consideration changes in international regulations and technology. The joint training of personnel from all Parties should be included in this part of the Plan.

Updates should be agreed at annual meetings.

2.6 Preventive measures

The Partners recommend that this chapter is revised taking into consideration changes in international regulations and technology.

3. Policy and responsibilities in the field of preparedness and response

Partners recommend that Parties express more clearly common interest in joint cooperation and organization, resource exchange, and response in the event of sea pollution or another contingency.

3.1 Joint preparedness and response policy

This part of the Plan needs only minor corrections.

3.2 Responsibilities of competent national Authorities

This part of the Plan needs only minor corrections.

3.3 Designation of national Operational Authorities responsible for the implementation of the Plan in case of emergency, and of national Operations Centres

This part of the Plan needs only minor corrections related to national terminology.

3.4 Mechanism for activating the Plan in case of emergency

This part of the Plan needs only minor corrections. The activation of the Union Civil Protection Mechanism should be reflected in the renewed Plan.

3.5 Meetings of national Operational Authorities responsible for the implementation of the Plan in case of emergency

Point 3.5 should be merged with Point 3.7. The coordination of the Partners, training, and exercises as well as other technical details and agreements at the technical level should be covered here. Meetings and exercises are recommended to take place once a year, at the same time.

3.6 Exchange of information

This part of the Plan needs to be corrected. Sections f and h should be revised (customs procedures). Communication channels or means of data exchange should be determined in more detail. Data containing personal data should be excluded (GDPR).

Section h that deals with equipment, resources, supplies, etc., to be used in disaster response should be raised to a higher level and given more weight. It is more important than all other information. Also, constituting an independent point of data exchange, it would be easier to update and amend.

3.7 Joint training and exercises

Merged with Point 3.5 (see Point 3.5).

4. Response elements and planning

The word “planning” should be deleted from the basic chapter because it can be misleading and a very broad term. The content of Chapter 4 refers only to the response of the Partners to the situation.
The chapter must define the organization of disaster response, the management of actions, lines of command and control, communication, and the ongoing planning, and adjustment of tactics and response measures.

4.1 Assumption of Lead role

This part of the Plan needs only minor corrections.

4.2 National On-Scene Commander (NOSC) / Supreme On-Scene Commander (SOSC)

Individual response units or strike teams already have their leaders and as such they need not be appointed on site. Partners should have qualified people lead major interventions, acting as NOSCs. The country leading the intervention should designate the supreme on-scene commander to whom other national commanders and team leaders shall be subordinate. This should be clearly stated in the Plan.

4.3 Emergency Response Centres / Joint Emergency Response Centre

Emergency Response Centres/Joint Response Centre. The terminology is incorrect and should be agreed. The Parties already have their national competent authorities/organizations or services for such cases. Their organization and engagement should correspond to the command-and-control structure.

4.4 Support teams

This part of the Plan needs only minor corrections.

4.5 Command structure

The organization of command in this chapter, with its three subchapters and three more subchapters of Section c, is far too demanding for the conditions in the field. The orientation should be such that the line of command and control is as straight and clear as possible without too many intermediaries. If necessary, liaison officers could assume other roles.

Details related to command structure should be included in Annex E1.

4.6 Communications arrangements

This part of the Plan needs only minor corrections. Telefax as a means of communication should be removed from the text. It would make sense to focus on maritime channels intended for this purpose.

Details related to communications should be included in Annex G.

4.7 Response planning

The title needs to be renamed because it does not reflect the content of the chapter. The chapter is about which national plans could be used in the common plan for such cases. Information from national plans is necessary for the smooth course of the intervention. This chapter could be titled Applicability of National Plans.

Details related to national plans should be included in Annex Q.

4.8 Response strategy

The terminology is incorrect and should be agreed. The content needs to be in accordance with the SOPs developed within NAMIRS. The content should basically be a description of the course of the activity, or the course and conclusion of the response to the accident.

5 Response operations

5.1 Response phases

This part of the Plan needs only minor corrections. The role of the REMPEC regional center in Malta should be defined as well as the role of the Union Civil Protection Mechanism (UCPM) and EMSA. In the Point 5.1.2, “Activation of the Plan”, it should be defined whether the Plan shall be activated only within the framework of the Plan mechanism or wider (UCPM, EMSA, REMPEC).

5.2 Spill surveillance

In “Spill Control”, the latest technologies and monitoring techniques should be defined, and the existing capacities made use of, especially in satellite observation.

The Partners recommend that details related to spill surveillance are included in Annex I.

5.3 Requests for assistance within the framework of the Plan

The same dilemma exists with the formal request for help, as the one in Point 5.1. In any case, a new request form for help should be created. This should be a mandatory part of the SOPs (Annex V), as addenda to the Plan.

5.4 Joint response operations

This part of the Plan needs only minor corrections.

5.5 Use of dispersants

This part of the Plan needs only minor corrections. For Slovenia, nothing has changed regarding dispersants.

5.6 Termination of joint response operations and deactivation of the Plan

This part of the Plan needs only minor corrections.

6. Communications and reporting

The chapter, from Point 6.1 through 6.4, needs only minor corrections. Regarding the forms that are mentioned, it should be checked whether they are still valid or not. Namely, the forms from the Barcelona Convention are defined.

The Union Civil Protection Mechanism communication procedure via CECIS Marine should be absolutely implemented if Parties agree.

6.1 Communication system

This part of the Plan needs only minor corrections.

6.2 Pollution reporting system (POLREP)

This part of the Plan needs only minor corrections.

6.3 Situation reports (SITREPs)

This part of the Plan needs only minor corrections.

6.4 Post incident reports

This part of the Plan needs only minor corrections.

6.5 Reports to and communication with REMPEC

This chapter should be redefined, considering the role and weight of this organization in the Plan. Most likely, it will be necessary to add reports and communication with the Union Civil Protection Mechanism and EMSA.

7. Logistics, funding and administration

7.1 Logistics

This part of the Plan needs only minor corrections.

7.2 Financial procedures

The Chapter refers to The Prevention and Emergency Protocol of the Barcelona Convention. It should be checked whether the document is still valid or not.

In Point 7.2 a, the guidelines should be such that the provision of assistance is free of charge. The sending country shall cover the costs of its units and equipment, except for the costs incurred during the intervention, or whatever shall be stipulated in the Plan. Everything else has proven unfeasible, based on previous experience.

In Point 7.2 c Costs, it is necessary to redefine and determine the principles of covering costs.

Details related to the reimbursement of the costs of assistance will be included in Annex F3.

7.3 Transboundary movements of response personnel, equipment, products and self-contained units

Most of the Point 7.3 should be discarded. Only restrictions due to regulations other than customs or border regulations remain.

7.4 Medical insurance and medical assistance

This part of the Plan needs only minor corrections.

7.5 Responsibility for injury and damage

The guidelines should be such that units and personnel are already insured against causing harm to a third party prior to leaving their home country.

7.6 Documentation of response operation and related costs

This part of the Plan needs only minor corrections.

8. Public information

The chapter is almost entirely fine and needs only minor corrections.

8.1 Public Relations Officer (PRO)

This part of the Plan needs only minor corrections.

8.2 Press releases

This part of the Plan needs only minor corrections.

8.3 Press conferences

This part of the Plan needs only minor corrections.

8.4 Public information through REMPEC

The content of the Point 8.4 should be redefined and also take into consideration other organizations such as the EU and the EMSA.

4

Conclusion

Taking into account the preliminary work done by the NAMIRS partners, the elaboration of the risk assessment, the numerous training courses, the drafting and testing of the SOPs, the project partners reaffirm the need to treat the North Adriatic basin as a common area, a common resource that needs specific attention and transnational coordination for its safeguard in order to prevent and manage potential threats or accidents at sea.

Specifically, the Partners reaffirm:

- The need for a renewed and strengthened collaboration among the parties in view of a possible incident;
- The need for a ready-for-operation mechanism in view of the extreme importance and value of the area;
- The need to consider the NAMIRS recommendations for the new contingency plan for the whole Adriatic, already in the preparation phase by REMPEC.

Partners recommend that:

- SOPs are integrated as Annex V to the Plan;
- The sharing of traffic data is essential;
- The analysis of traffic data is performed as proposed within the project,
- The analysis of sensitive areas is conducted as proposed within the project,
- The mathematical models developed and used in the NAMIRS project are used,
- Joint training curricula is established, and periodic training takes place,
- Simulators (OGS, UL FPP) are used for training and the preparation of scenarios;
- A technical board for the revision of changes is nominated, and that their meetings take place not less than once a year;
- Time intervals for the conduction of risk assessments, and updating of anti-pollution resource lists and contact details are determined;
- The resource-listing fill-out forms developed by UL FPP within WP 2.2 (see Deliverable 2.2) are used;
- The format of annexes is determined (UL FPP designed the proposed format for the annexes in the project);
- Regular checks of the operability of the communication lines between authorities are conducted (communication issues during the joint exercise),
- Strong collaboration with REMPEC, Union Civil Protection Mechanism, and EMSA is maintained, and other Adriatic-Ionic countries are liaised with in order to develop a joint plan of cooperation;
- Findings of the project are included in the new Adriatic Contingency Plan,
- Prevention phases and preliminary activities defined in the Sub-regional CP are merged into one chapter;
- Smoother communication among countries and respective operational authorities are established;
- A permanent cooperation mechanism for environmental management in the North Adriatic is established, one similar to the RamogePOL model,
- Particulars are explained in detail in the Annexes (see table below), being precisely filled out by competent authorities.

Annex	Content
Annex A	Definitions, and Acronyms and Abbreviations
Annex B	Alerting and Reporting Procedures
Annex C	National Contact Details
Annex D	International Contact Details
Annex E1	Command and Control
Annex E2	Staff Functions
Annex F1	List of Services and Service Availability
Annex F2	Descriptions of National Stakeholders
Annex F3	Reimbursement of Costs of Assistance
Annex G	Communications
Annex H	Legislation
Annex I	Spill Monitoring and Surveillance
Annex J	Maps of Sensitive Areas
Annex K	Assets and Equipment
Annex L	Disposal of Recovered Oil and Oily Substances
Annex M	Health and Safety
Annex N	Identification of the Polluter and the Establishment of Evidence to Court
Annex O	Information to the Public and Mass-media Relations
Annex P	Education, Training, and Exercises
Annex Q	List of Other Contingency Plans
Annex R	Salvage
Annex S	Wildlife Care
Annex T	Traffic Data Summary
Annex U	Risk Assessment
Annex V	Standard Operating Procedures
Annex Z1	Guidelines for Risk Assessment Methodology
Annex Z2	Guidelines for Oil-spill Response
Annex Z3	Oil Properties and Classification
Annex Z4	Conversion Tables and Unit Systems

Table 1: List of the proposed annexes

University *of Ljubljana*
Faculty *of Maritime Studies and Transport*

DRAFT

REPORT ON THE ANALYSIS OF EXISTING MECHANISMS, EQUIPMENT, TECHNICAL AND HUMAN RESOURCES

WP 2.2

Portorož, December 2022

Co-funded by
the European Union

Prepared by:

- Capt. VALTER SUBAN, MSc,

  E-mail: valter.suban@fpp.uni-lj.si

  Tel: 0038656767295

- MARKO PERKOVIČ, PhD,
- Prof. PETER VIDMAR, PhD; SC Member,
- JURE DEMŠAR, BSc,
- URBAN PEGAN, BSc,
- JANVIT SABADIN, MSc.

CONTENT

1. INTRODUCTION

Accidents will happen! No matter how worn out these words may sound, they should be heeded. We should always pay attention to the consequences of accidents and strive towards mitigating them as much as possible. Therefore, as individuals and up to the state level, we should always be ready to cope with an eventual accident, wherever it might occur. It is here worth recalling the proverb the friend in need is a friend indeed. However, the capability of offering help to friends depends on our own preparedness to take action. Besides that, we should be capable of informing them about an accident ourselves, and how to coordinate activities with them. Usually, it is your neighbor that will help you best.

All that also applies to accidents at sea. The Gulf of Trieste is no exception, despite the fact that sea traffic is believed to be a relatively safe branch of transport and that the International Maritime Organisation (IMO) is has made huge efforts in order to provide safe navigation and clean seas. The sea does not recognize state borderlines. It is only subordinate to the laws of nature. Therefore, a joint action of neighbors is of the utmost importance.

All the countries in the Gulf of Trieste, the Republic of Slovenia, the Republic of Italy, and the Republic of Croatia, have prepared themselves to take measures in case of accidents at sea. Thus, all the states and local communities have worked out plans of coordinated action in the case of minor accidents or disasters to a larger extent.

The first attempt to integrate resources was a project titled Rescue Simulation of a Grounded Tanker, supported by the PHARE Cross Border Cooperation funds. Within the project, several workshops were held and a study of existing resources was completed.

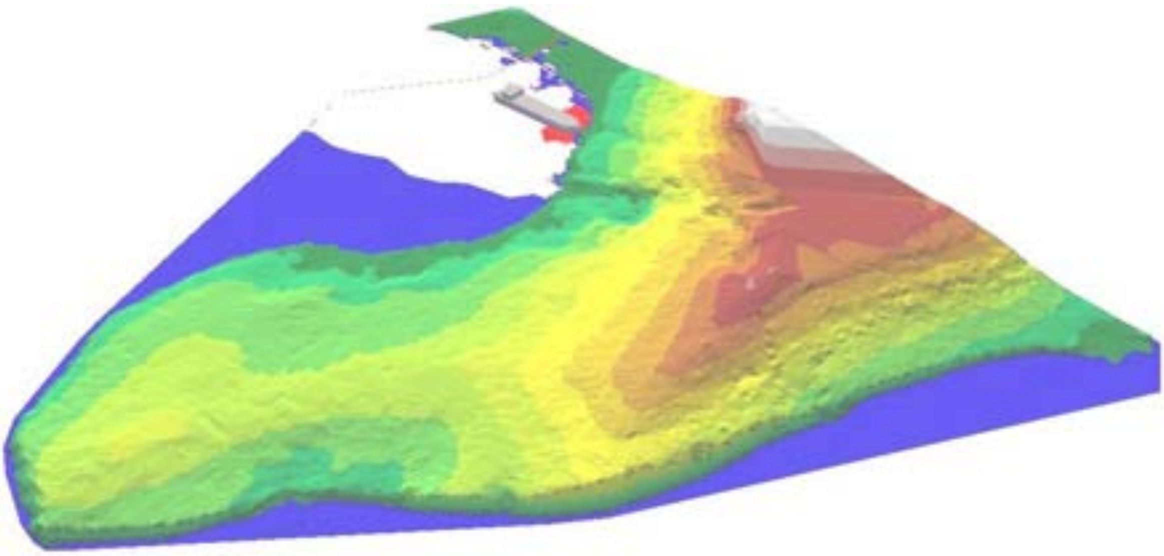


Figure 1: Simulation exercise of a stranded tanker recovery ITA-SLO 2001-2002

Ker se je že takrat čutilo potrebo po skupnem sodelovanju je bil lata 2005 izdelan Contingency plan for Norhern Adriatic, ki pa ni bil ratificiran s strani Republike Italije in zato ni zaživel v praksi in trenutno veljajo le National Contingency plans

Whereas the existing national Contingency Plans are not sufficient enough to tackle such a transboundary threat, the NAMIRS will contribute to better preparedness and a more coordinated response at a transnational level, also in line with the Barcelona Convention and related Protocols. Strengthened regional cooperation and cross-sectorial coordination will be achieved through the integration of knowledge, tools, and resources available within the NAMIRS multi-stakeholder partnership.

Vital to a contingency plan of any meaningful value is the mapping of anti-pollution resources. The task was to gather and analyze the data on all the existing resources along the entire stretch of the coastline between Ancona, Italy, and Zadar, Croatia, located in the southwest and southeast of the North Adriatic, respectively. Altogether, we had nine regions to cover: Marche, Emilia-Romagna, Veneto, and Friuli Venezia Giulia in Italy, Primorska in Slovenia, and Istarska, Primorsko-goranska, Ličko-senjska, and Zadarska in Croatia.

Following a number of initiative meetings between the partners, we started collecting data including the stakeholders involved in a potential response scenario, the relevant services available in each region, and the oil-recovery assets and equipment at the Partners' disposal.

In order to develop an efficient and sustainable contingency plan, one that would serve just as well in the present day as in the future to come, we set out to achieve the following goals:

- A uniform, complete, and detailed mapping of all resources,
- A transparent list of the existing resources annexed to the Plan,
- The assessment of the actual oil-recovering capacity in the North Adriatic,
- The analysis of national and international (cross-border) command scheme, strategy, and cooperation,
- The recognition of conspicuous deficiencies and missing resources along with other less obvious gaps,
- Possibilities and recommendations for improvement.

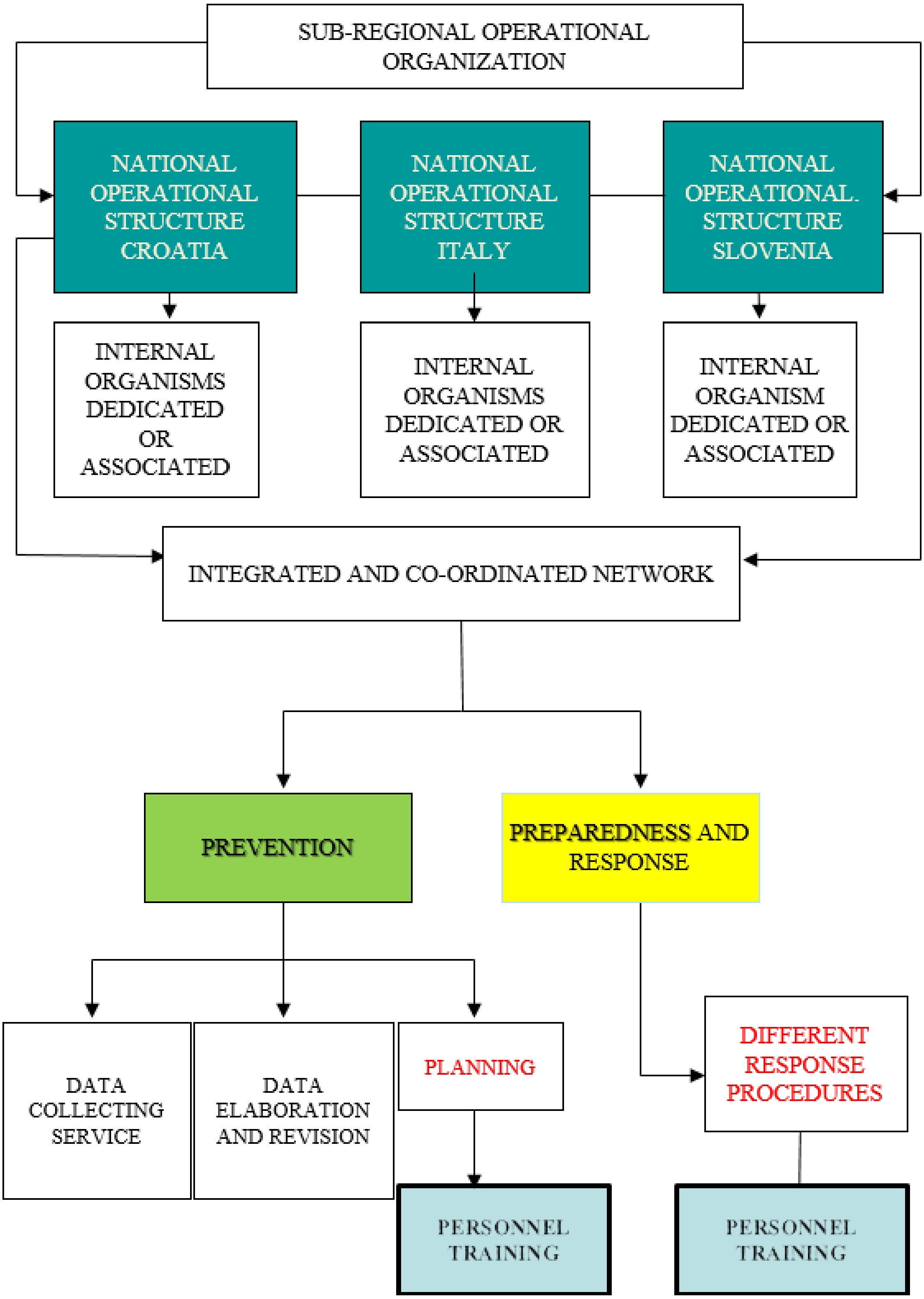


Figure 2: Flow chart of the proposed cooperation

2. CONNECTIVITY TO OTHER WORK PACKAGES

The work packages are inherently interconnected. All of them are of equal importance to developing an efficient cross-border contingency plan.

2.1. WP 2.1: Sensitivity mapping

The PP OGS, with help from other Partners, have been preparing the sensitivity maps of the Northern Adriatic. Sensitive areas will be assessed according to three criteria: the environmental, gomorfological, and socio-economic value. The most important for the decision makers in the case of an eventual oil spill will be a chart that all the forementioned factors will be incorporated into. On this chart, the priorities will be demonstrated by applying different colors to the coastline.

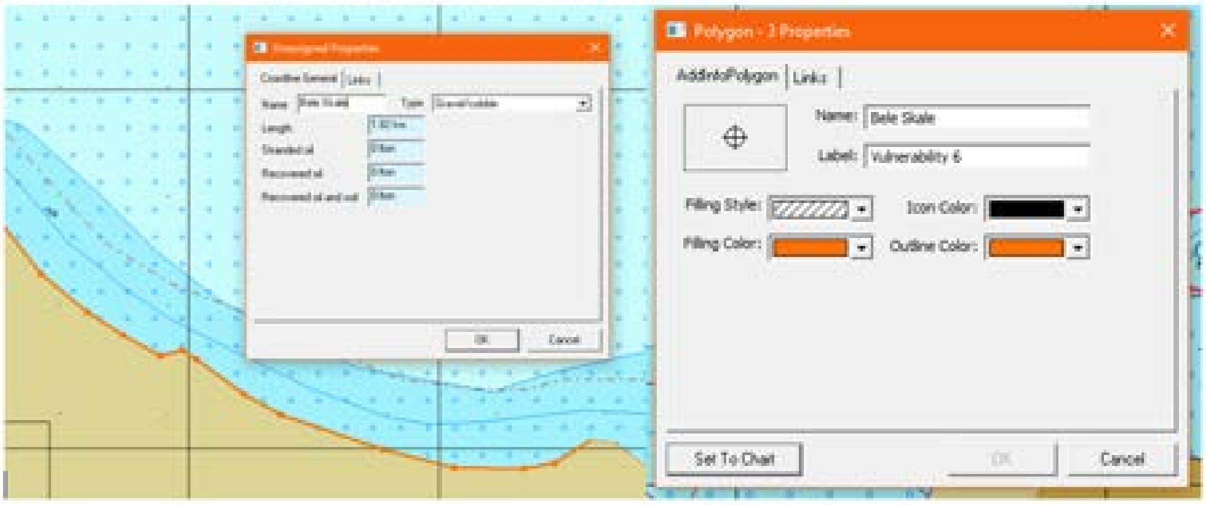


Figure 3: Beach type mapping

After the completition of sensitive mapping, the final evaluation of the coastline will be inserted into the renewed oil-spill simulator, which will provide valuable support to the commander to make the right decision on which areas to protect priorily.

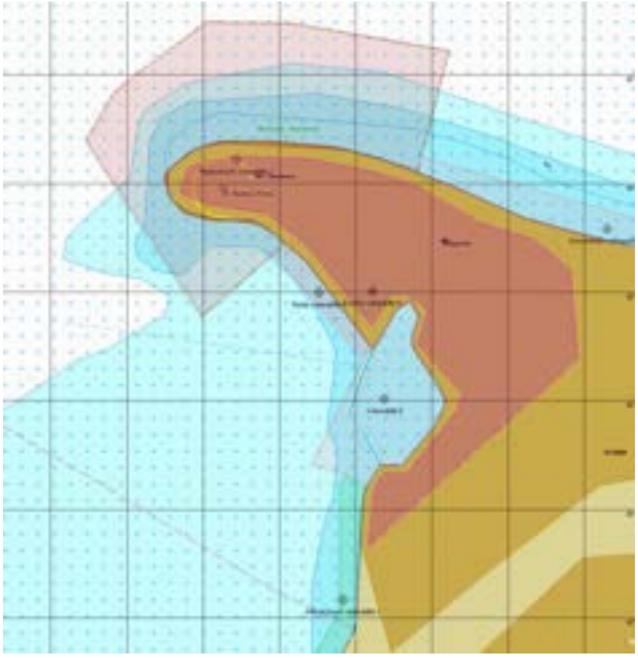


Figure 4: Fully mapped area including nature reserves, beach type, and tourist locations

For the training purposes within the WP4, the simulations done by the OGS will be rasterized and transferred to the PISCES simulator, where the results will be compared. The simulations will be optimized according to the results of the real action taking place at sea.

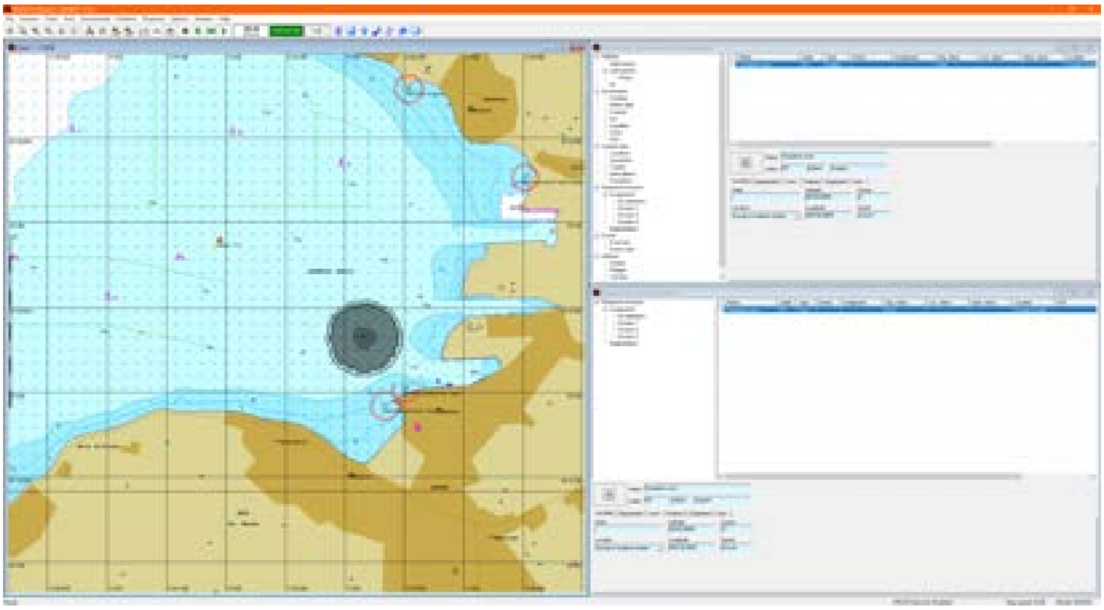


Figure 5: Display of an oil slick

2.2. WP 2.3: Guidelines for the revision and update of the sub-regional contingency plan for the Adriatic Sea

The results of the WP2.3 will be the foundation of the proposal of the Guidelines for the Revision and Update of the Sub-Regional Contingency Plan for the Adriatic Sea, which will be developed upon the completion of the WP 2.2. The data related to services and equipment will be of great significance.

2.3. WP 3: Training

Within the WP3, there are five training sessions planned, taking place on the renewed simulator, where participants from Partner coutries will receive training on the oil-spill simulators on the management level, so that they are competent in leading the operations at sea. On the PISCES simulator, exercises will be conducted using the equipment mapped within the WP 2.2. Response teams will operate in real locations and handle real environmental conditions including the wind, waves, and currents.

2.4. WP 4: Development of the SOP and practical exercises

Within the WP 4, the standard operating procedures (SOP) will be developed, based on the analysis of the resources and procedures as a result of this work package. Of course, the results of the WP 2.2 will be modified during the construction of the SOP, and, later on, during exercises and anual reviews.

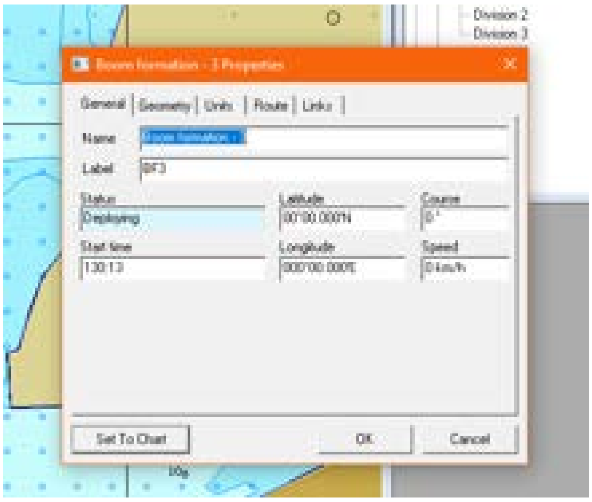


Figure 6: Setting a boom formation

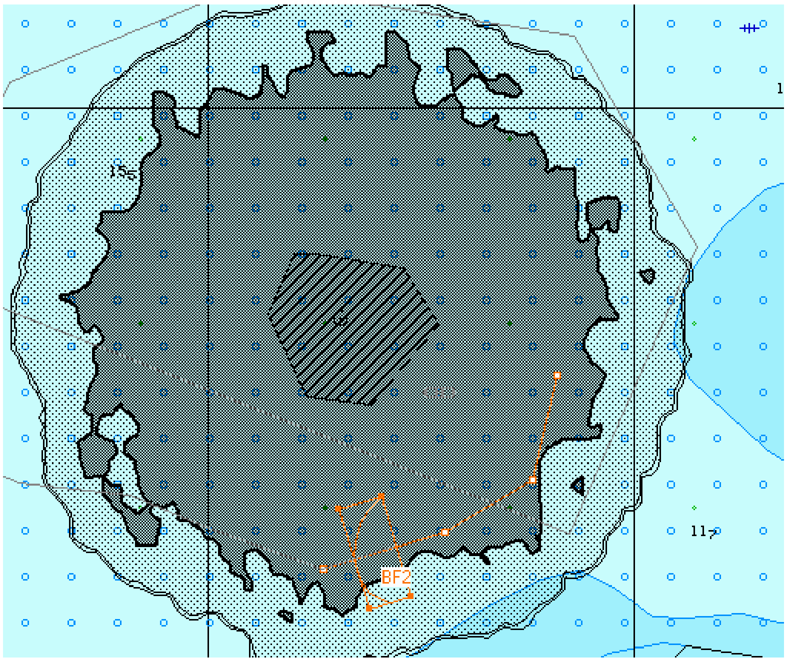


Figure 7: Deployed boom formation

3. RENEWED OIL-SPILL SIMULATOR CENTER

This chapter is very important because of the influence it has had on the other WPs within the project. So, in addition to the justification of the supplied hardware, we have also provided presentations of the features of the software and explained its significant contribution to the results of the entire project.

The Faculty of Maritime Studies and Transport of the University of Ljubljana (UL FPP) has had up-to-date simulators since the year 2000, i.e., communication, nautical, engine-room, and cargo-handling simulators. Later, those were supplemented by the purchase of the simulator called PISCES, which was a state-of-the-art oil-spill software back in the day and is still considered one of the best simulators of its kind worldwide today.

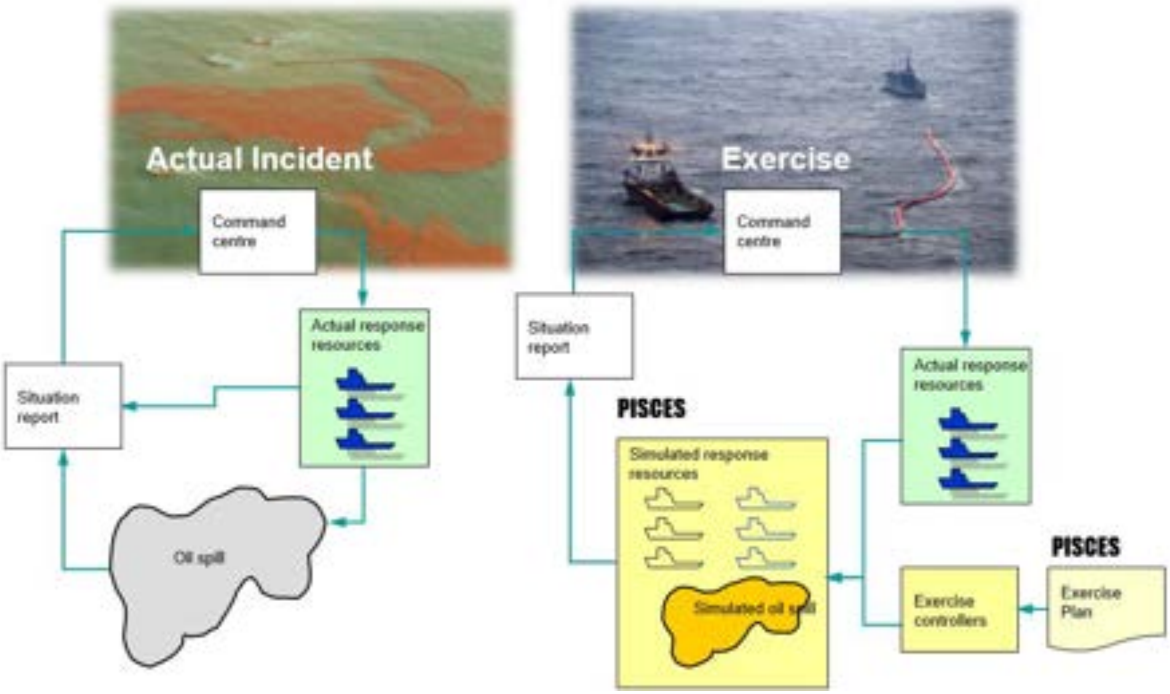


Figure 8: PISCES approach

3.1. PISCES

The PISCES II is an incident-response simulator designed for the preparing and conducting ofcommand-centre exercises and area drills. The application was developed to offer support to the exercises focusing on oil-spill response.

The PISCES II us used to establish an interactive-information environment based on the mathematical modeling of an oil spill interacting with surroundings and combat facilities. The PISCES II spill model simulates the weathering processes and the behavior of an oil slick on the water surface: transport by currents and wind, spreading, evaporation, dispersion, emulsification, variation in viscosity, burning, including interaction with booms, skimmers, and the shoreline.

The key benefits of using the PISCES are:

- The realistic crisis scenarios created for both offshore and coastal teams. The oil-spill model is affected by currents and wind. It simulates spreading, evaporation, dispersion, emulsification, viscosity variation, burning, and even the slick's visual appearance, which depends on the amount of the discharged oil and its characteristics. The computations of the oil flow distribution, affected by vessels, recovery objects, and other structures, are masterfully executed.
- A realistic equipment response is achieved by modelling the response objects (such as booms and busters) stated on the manufacturers' equipment data. Interaction with various objects is modelled, as well. For instance, inapropriate handling of booms will cause leakage.
- Realistic assessment: for determining the success of an exercise scenario, there are two factors taken into account - situational variables, like the actual sea state and its limits and currents, and the nature of the spill vis-a-vis trainees' response.
- Shared environment enables joint training of various parties involved in oil-spill-response operations, such as bridge teams, deck teams, and shore personnel.

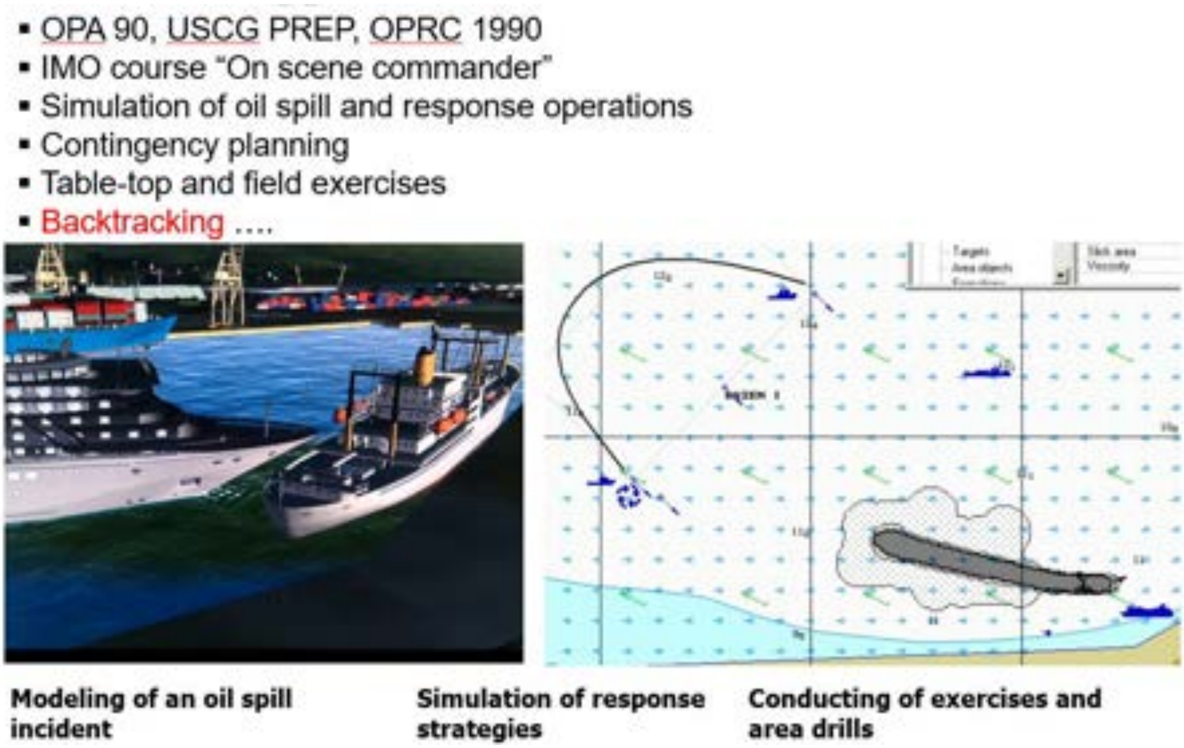


Figure 9: Description of the tasks in the PISCES

3.2. Simulation center

The PISCES and all the other simulators are part of the UL FPP integrated simulator center (see figure 5).

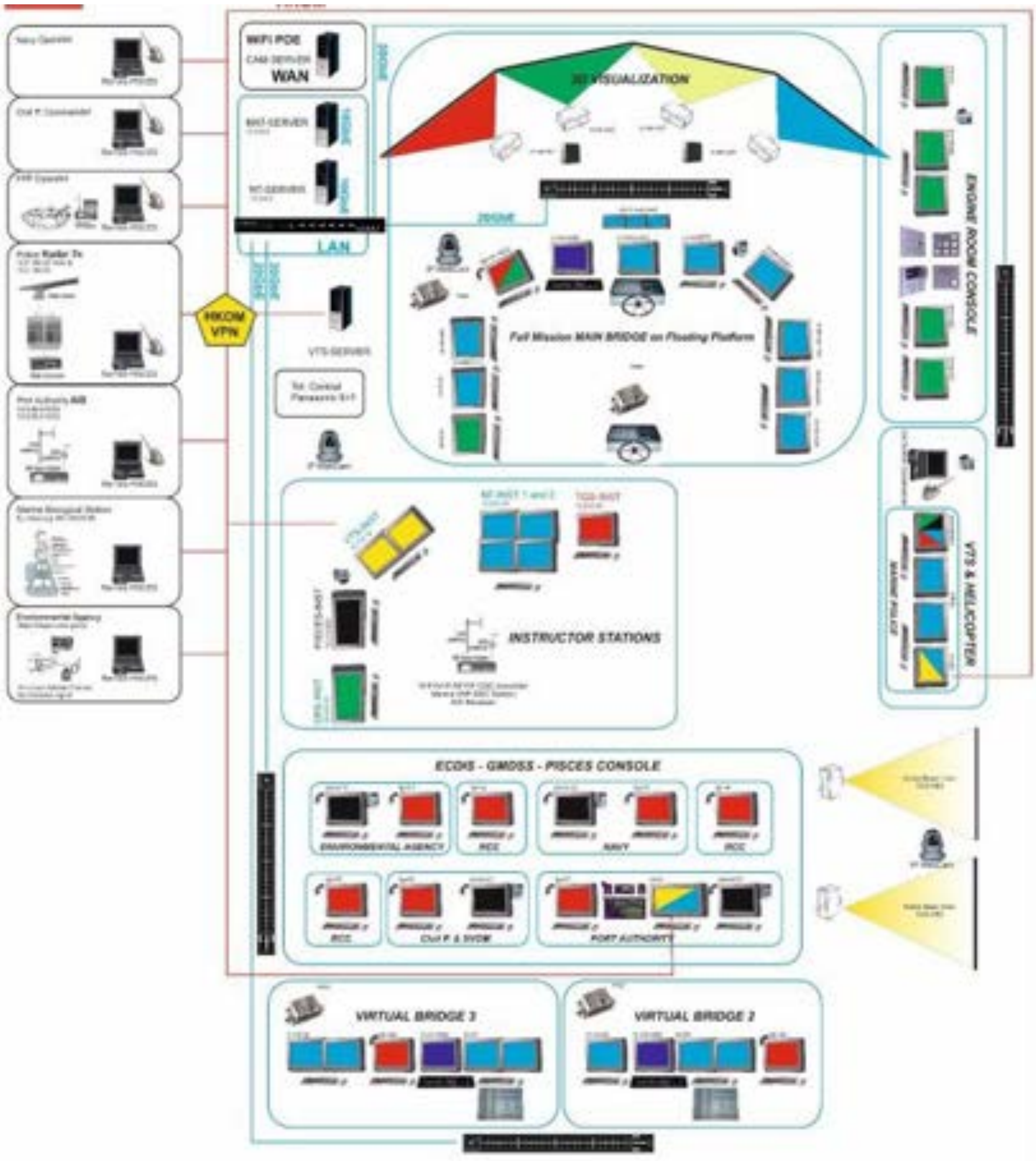


Figure 10: Scheme of the UL FPP simulation center

In combination with the nautical simulator, the PISCES enables the training of oil-spill responders in a lifelike environment, displaying the situation at sea.

Figure 11: Display of a PISCES scenario on the navigation simulator

Figure 12: Display of the oil-recovery equipment on the navigation simulator

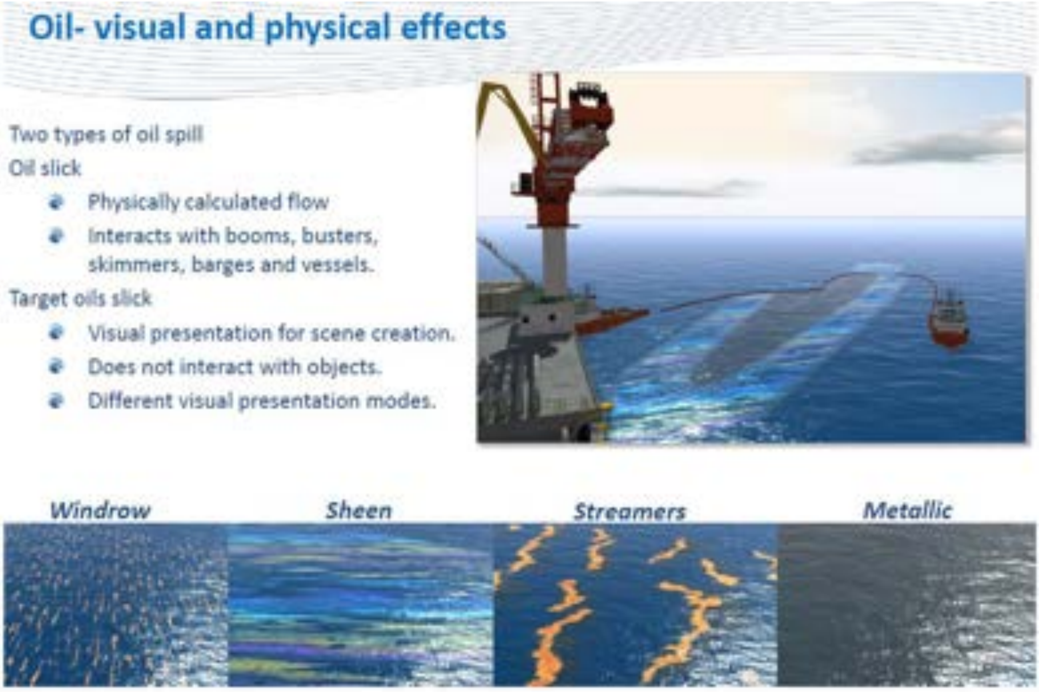


Figure 13: Display of the visual and physical effects of oil on the navigation center

3.3. New equipment

The following equipment has been supplied:

- 1 server,
- 8 workstations,
- 1 laptop,
- Supporting equipment, such as monitors, stants.

The equipment was installed during the first month after it had been received, so the appreciation of the equipment started in April 2022. Equipment was immediately made available to all the services involved in a potential intervention. All equipment is properly labeled with the logos of the project and the EU.

In the future, the new equipment will be used (in general):

- For the support to the Slovenian governmental services in the case of an accident in Slovenian waters,

- On request, for the support to the governmental services of other countries in the case of an accident,
- For the analysis of traffic and accident risk assessment, especially in the Gulf of Trieste,
- For the proffesional studies, such as oil risk assesment in the Port of Koper (other ports on request),
- For the training of professional oil-spill responders on management level,
- For the education and awareness of students,
- For the performance of research activities related to oil spills.

The following activities, related to the project NAMIRS, will take place:

- Mapping of sensitive areas within WP 2.1,
- Mapping of ports and other locations where assets would be deployed from - according to the new plan proposal (WP 2.3),
- IMO level 2 (management level) training for oil-spill responders (in total, 5 training sessions each with 8 participants within the WP 3),

Overall, the new equipment will provide support to the activities for the preparation of the SOP and exercises within the WP 4.

Figure 14: New equipment

Figure 15: Logo of the NAMIRS project

4. MAPPING OF STAKEHOLDERS, SERVICES, ASSETS, AND EQUIPMENT

In the first stage, we designed simple fill-out forms in MS Excel, based on somewhat obsolete questionnaires that other countries had been using as the recommended practice. We believed such a method would be efficient enough, especially if the received data were supplemented by the data extracted from the CECIS online database. We then sent the forms to the Partners' institutions, asking each to revert with those forms filled out. They were all requested to name and count the resources and provide general descriptions and the particulars essential to an oil-spill response. Initial uncertainties were clarified and suggestions considered via frequent online meetings and e-mail correspondence.

The initial form comprised four main tables, each intended for the mapping of the following separate resources:

- Stakeholders,
- Services,
- Assets,
- Equipment.

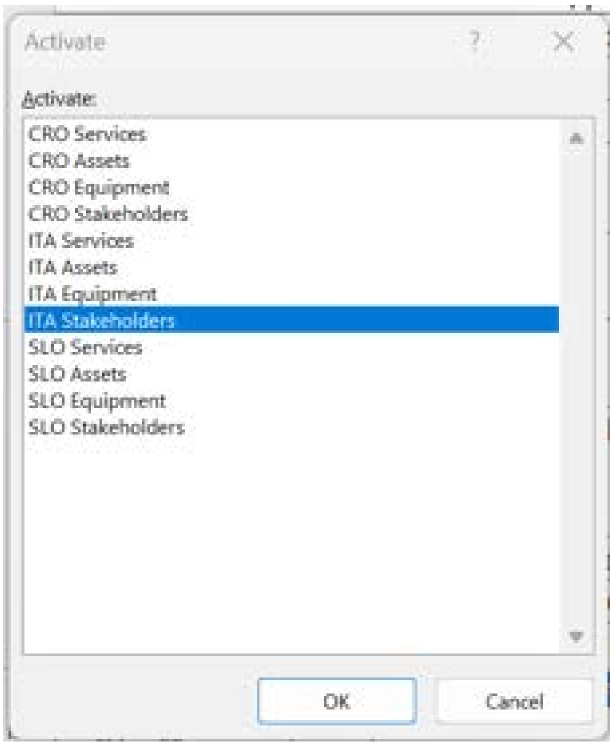


Figure 16: Spreadsheets in our MS Excel database

4.1. Stakeholders and services

4.1.1. Stakeholders

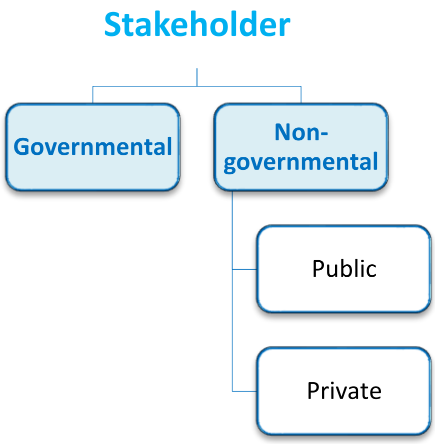


Figure 17: Division of stakeholders

We distinguished between governmental, public non-governmental, and private non-governmental stakeholders (see figure 10), each playing different roles in different stages of the response.

Table 1: Croatian stakeholders

Stakeholder				Purpose			
				[illegible]	[illegible]	[illegible]	[illegible]
Governmental	Ministry of Sea, Transport and Infrastructure	Maritime Safety Directorate	Sector for Navigation Control, Search and Rescue and Environmental Protection	✓	✓	✓	
			Sector for Inspection and Technical Standards	✓	✓	✓	
			Sector for Seafarers, Boatmasters, Ship Registers and Technical Affairs	✓	✓	✓	
		Directorate for Maritime Affairs		✓			
	Ministry of the Interior	Directorate for Border	Maritime and Airport Police Service	✓	✓		
			National Maritime Data Collection Center	✓	✓		
		Civil Protection Directorate		✓	✓	✓	
	Ministry of Defence	Croatian Coastguard		✓	✓	✓	
		Croatian Navy		✓	✓		
		Croatian Air Force		✓	✓		
	Ministry of Agriculture	Fisheries Directorate		✓	✓		
	Ministry of Physical Planning, Construction and State Assets	Institute for Spatial Development		✓			
		Directorate for Physical Planning and Permits of State Significance		✓			
	Ministry of Finance	Customs Administration		✓			
	Ministry of Culture	Directorate for the Protection of Cultural Heritage		✓			
	Ministry of Health	Directorate for primary health care, health tourism, medicines and medical products, public health and public health protection		✓		✓	
	Ministry of Foreign Affairs			✓			✓
	Agency for the Investigation of accidents in air, sea and railway traffic			✓			✓
Non-governmental	Public	Zadar County		✓	✓	✓	✓
		Istra County		✓	✓	✓	✓
		Primorsko - Goranska County		✓	✓	✓	✓
		Ličko - Senjska County		✓	✓	✓	✓
		Institute for Public Health of Zadar County		✓		✓	✓
		Institute for Public Health of Primorsko-Goranska County		✓		✓	✓
		Institute for Public Health of Ličko-Senjska Count		✓		✓	✓
		Institute for Public Health of Istra County		✓		✓	✓
		Ruđer Bošković Institute - Center for Marine Research		✓			
		Maritime Faculty in Rijeka		✓			
		National Park "Brijuni"		✓			
		National Park "Kornati"		✓			
		National Park "Paklenica"		✓			
		Nature Park "Telašćica"		✓			
		Nature Park "[illegible]"		✓			
		Nature Park "Limski Kanal"		✓			
		University of Zadar		✓			
		University of Rijeka		✓			
		County Harbour Authorities		✓	✓	✓	✓
		Harbour Authorities		✓	✓	✓	
	Private	Port of Rijeka		✓	✓	✓	
		Port of Pula		✓	✓	✓	
		Port of Zadar		✓	✓	✓	
		Port of Poreč		✓	✓	✓	
		Port of Rovinj		✓	✓	✓	
		Port of Umag/ Novigrad		✓	✓	✓	
		Port of Labin		✓	✓	✓	
		Jadranski pomorski servis		✓	✓	✓	
		Brodospas		✓	✓	✓	
		Jadrolinija		✓	✓		
		Shipyard "Viktor Lenac" Rijeka		✓			
		Shipyard "3. maj" Rijeka		✓			
		Shipyard "Dalmont" - Kraljevica		✓			
		Shipyard "Uljanik" Pula		✓			
		Forwarding agencies		✓			
		Ship agencies		✓			
		[illegible] - mariculture company		✓			
		Istra Pilot		✓			
		Croatia Pilot Rijeka		✓			
		Zadar Pilot		✓			
		LNG Croatia (Omišalj)		✓			
		INA - Croatian Oil Industry		✓			
		Dezinsekcija Rijeka		✓	✓	✓	✓
		[illegible]		✓	✓	✓	✓
		IND-EKO Rijeka		✓	✓	✓	✓
		Hidro-Interpoling Rijeka		✓	✓	✓	✓
		JANAF - Adriatic Oil Pipeline, terminal Omišalj		✓			
		Ciklon		✓	✓	✓	✓
		[illegible]		✓	✓	✓	✓
		Metis Kukuljanovo		✓	✓	✓	✓
		ACI Marina Umag		✓	✓		
		ACI Marina Rovinj		✓	✓		
		ACI Marina Pula		✓	✓		
		ACI Marina Pomer		✓	✓		
		ACI Marina Opatija		✓	✓		
		ACI Marina Cres		✓	✓		
		ACI Marina Supetarska draga		✓	✓		
		ACI Marina Rab		✓	✓		
		ACI Marina Šimuni		✓	✓		
		Marina Punat (Punat)		✓	✓		
		Marina Olive Island Ugljan (Ugljan)		✓	✓		
		Marina Veli Iž (Veli Iž)		✓	✓		
		Marina Iž		✓	✓		
		Marina Veli Rat		✓	✓		
		Marina Borik (Zadar)		✓	✓		
		Marina Zadar		✓	✓		
		Marina Dalmacija (Sukošan - Bibinje)		✓	✓		
		Marina Kornati (Biograd na moru)		✓	✓		
		Marina Šangulin (Biograd na moru)		✓	✓		

Table 2: Italian stakeholders

Stakeholder				Purpose			
				PPM	OSI	CCRA	PCD
Governmental	Ministry of Sustainable Infrastructure and Mobility	Italian Coast Guard	Harbour Master's Office	✓	✓	✓	
			National SAR organisation (IMRCC - MRSC - UCG)	✓	✓	✓	
			Vessel Traffic Service (VTS)	✓	✓	✓	
	Ministry of the Interior	Police			✓		
		Carabinieri (Gendarmes)			✓		
		Firemen		✓	✓	✓	
	Ministry of Finance	Guardia di Finanza		✓	✓		
		Customs Agency					
	Ministry of Defence	Italian Army					
		Italian Navy		✓	✓	✓	
		Italian Air Force		✓	✓		
	Ministry for the Ecological Transition (Environment)	Italian Coast Guard	RAM - Marine Environment Department	✓	✓	✓	
		ISPRA - Superior Institute for environmental protection		✓			
		General Directorate for naturalistic and marine heritage - Marine Defence Division		✓		✓	
	Ministry of Health	Local Sanitary Agency	Public Hygiene and Health Istitute				
			Animal health				
		USMAF Maritime Health Offices					
	Ministry of Foreign Affairs						
	Prime Minister Office	Civil Protection Department					
	Friuli Venezia Giulia Region	Central Directorate for Health, Social Policies and Disability					
		SORES - Regional Operative Structure for Sanitary Emergency					
		Regional Civil Protection	Operationalroom and 112 emergency number		✓	✓	
			Volunteering service	✓		✓	
		ARPA - Regional Environmental protection Agency		✓	✓	✓	
Non-governmental	Public	IN OGS - national institute for Oceanography and experimental geophysics		✓	✓	✓	
		Protected sea area MIRAMARE		✓	✓	✓	
		Padova University - CERT Cetacean Emergency Response Team					
		IZSVe Istituto Zooprofilattico Sperimentale delle Venezie					
		Port System Authority of the eastern adriatic sea (Trieste and Monfalcone ports)			✓	✓	
		Chamber of Commerce				✓	
		Municipalities					
	Private	Tripmare - Vessel Towing Services		✓	✓	✓	
		Mooring company			✓		
		Pilotage Corporation of Trieste			✓		
		Castalia consorzio stabile		✓	✓	✓	
		Crismani Ecologia		✓	✓	✓	
		Ocean		✓	✓	✓	
		Sub Sea Loperfido				✓	
		Gaia Logistica				✓	
		SIOT – TALON				✓	
		Seastock				✓	
		Mariculture Companies					
		Docks dealers and terminal operators					
		Bathing facilities					
		Small port and Marina dealers					
		Fishing companies					
		Terrestrial wildlife recovery center					
		WWF and others similar institutions					

Table 3: Slovenian stakeholders

Stakeholder				Purpose			
				PPM	OSI	CCRA	PCD
Governmental	Ministry of Infrastructure	Slovenian Maritime Administration (URSP)	Harbour Master's Office			✓	✓
			Rescue Coordination Center (RCC)		✓	✓	
			Vessel Traffic Service (VTS)	✓	✓	✓	
			Safety of Coastal Sea Division (SVOM)	✓	✓	✓	
			Maritime Inspection Division				✓
			Maritime Documents and General Affairs Division				
		SL. Marine and Railway Accident and Incident Investigation Unit					✓
		Directorate of Aviation and Maritime Transport			✓		✓
	Ministry of the Interior	Police	Fleet of the Maritime Police	✓		✓	
			Crime Detection and Investigation				✓
			Operations and Communications Center - OKC 113		✓		
	Ministry of Defence	Fleet of the 430. Naval Division of the Navy of the Republic of Slovenia		✓		✓	
		Administration of the Republic of Slovenia for Civil Protection and Disaster Relief		✓	✓	✓	✓
		Operations and Communications Center – ReC 112			✓		
		Inspectorate of the Republic of Slovenia for Protection against Natural and Other Disasters					✓
	Ministry of Agriculture, Forestry and Food	Inspectorate for Agriculture, Forestry, Hunting and Fisheries	Hunting and Fisheries Inspection Service	✓		✓	✓
	Ministry of the Environment and Spatial Planning	Slovenian Environment Agency		✓	✓	✓	✓
		HSP Drava		✓		✓	✓
		Slovenian Water Agency		✓		✓	✓
	Ministry of Finance	Financial Administration of the Republic of Slovenia	Customs Department Koper				✓
			Port of Koper Border Control Department				✓
	Ministry of Culture	Institute for the Protection of Cultural Heritage of Slovenia				✓	✓
	Ministry of Health	National Institute of Public Health			✓	✓	✓
	Ministry of Foreign Affairs	Directorate for International Law and Protection of Interests			✓	✓	✓
Non-governmental	Public	Institute of the Republic of Slovenia for Nature Conservation		✓		✓	✓
		Municipalities		✓		✓	✓
		Debeli Rtič Landscape Park		✓		✓	✓
		Strunjan Landscape Park		✓		✓	✓
		Sečovlje Salina Nature Park		✓		✓	✓
		Škocjanski Zatok Nature Reserve		✓		✓	✓
		Marine Biology Station Piran		✓		✓	✓
		University of Ljubljana	Faculty of Maritime Studies and Transport (UL FPP)	✓		✓	✓
			Other faculties				✓
		University of Primorska					✓
		Electro and Maritime School Portorož (SEPŠ)					✓
		Science and Research Center Koper					✓
		Morigenos, Slovenian Marine Mammal Society		✓		✓	✓
		DOPPS, BirdLife Slovenia		✓		✓	✓
		Maritime Museum Piran					✓
		Other Research and Educational Institutions					✓
	Private	Port of Koper, d.d., Environmental Protection Unit				✓	
		KOPP, d.o.o., Pilotage Service				✓	
		Adria Tow, d.o.o., Vessel Towing Services				✓	
		Ship Agencies					✓
		Forwarding Agencies					✓
		Fishing companies				✓	✓
		Mariculture Companies					
		Marinas				✓	✓

Additionally, the stakeholders were sorted according to the type of their engagement/purpose in an oil-spill contingency, which was divided into additional four sub-categories:

- Prevention, preparedness, and monitoring (PPM),
- Detection and alerting (DA),
- Cleaning and cleaning-related activities (CCRA),
- Post-cleaning operations (PCO).

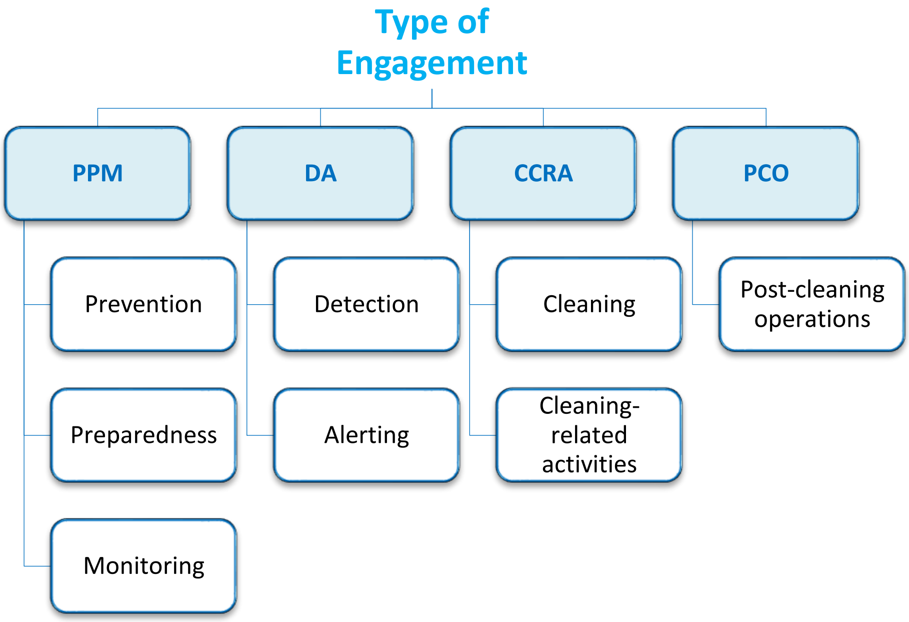


Figure 18: Types of engagement

4.1.2. Services

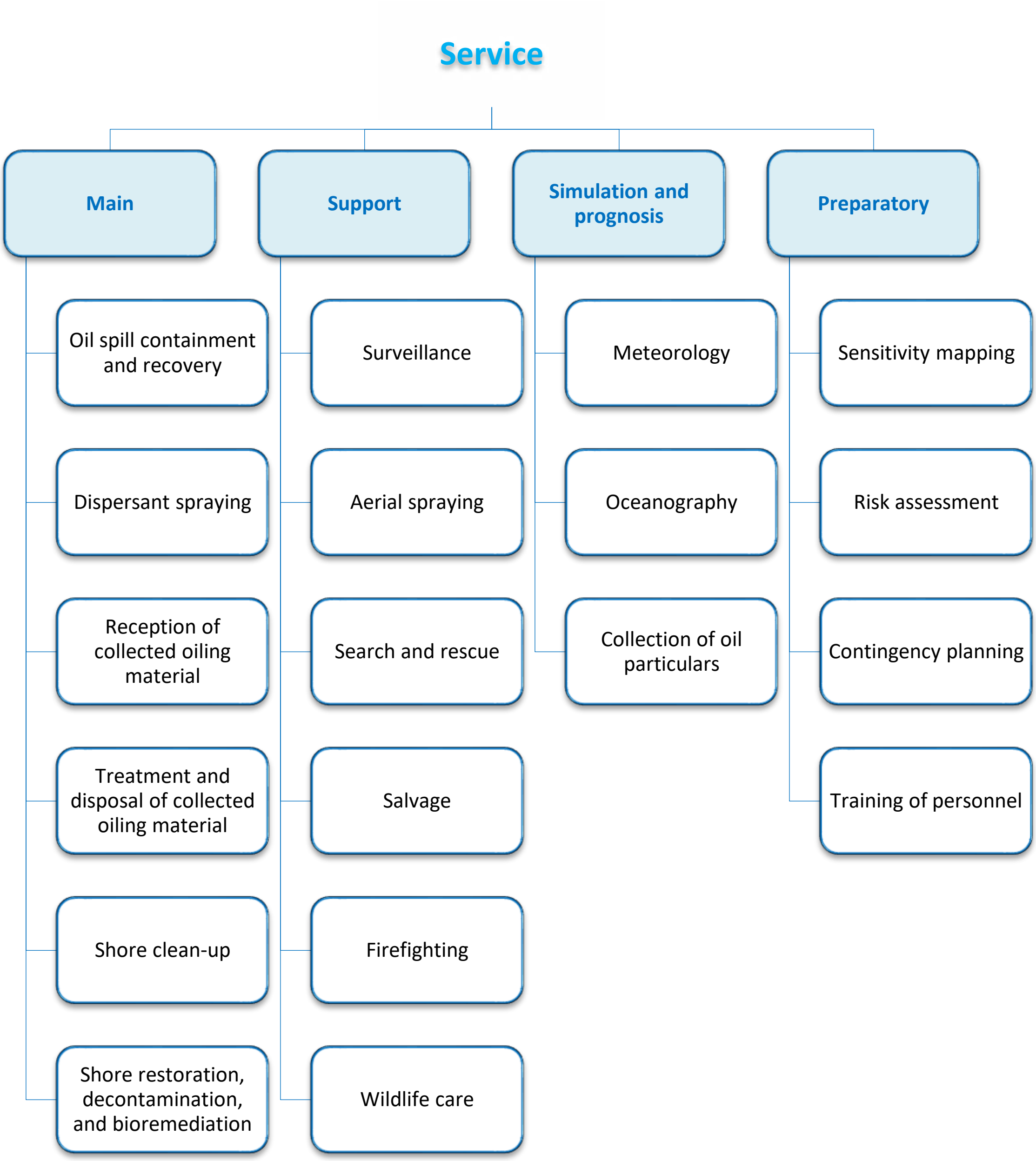


Figure 19: Anti-pollution services

The next step was to ascertain the availability of necessary services in Partners' regions including the main and support services, simulation and prognosis, and the preparatory services.

Table 4: Availability of the services in Italy

Service		Availability
		Friuli Venezia Giulia
Main	Oil spill containment and recovery	✓
	Dispersant spraying	✓
	Reception of collected oiling material	
	Treatment and disposal of collected oiling material	
	Shore clean-up	Not yet
	Shore restoration, decontamination and bioremediation	
Support	Surveillance	✓
	Aerial spraying	
	Search and rescue	✓
	Salvage	✓
	Firefighting	✓
	Wildlife care	✓
Simulation & Prognosis	Meteorology	✓
	Oceanography	✓
	Collection of oil particulars	✓
Preparatory	Sensitivity mapping	Not yet
	Risk assessment	Not yet
	Contingency planning	✓
	Training of personnel	✓

Table 5: Availability of the services in Croatia

Service		Availability			
		Istarska	Primorsko - goranska	Ličko - senjska	Zadarska
Main	Oil spill containment and recovery	✓	✓	✓	✓
	Dispersant spraying	✓	✓	✓	✓
	Reception of collected oiling material		✓		
	Treatment and disposal of collected oiling material		✓		
	Shore clean-up	✓	✓	✓	✓
	Shore restoration, decontamination and bioremediation		✓		
Support	Surveillance	✓	✓	✓	✓
	Aerial spraying				
	Search and rescue	✓	✓	✓	✓
	Salvage	✓	✓	✓	✓
	Firefighting	✓	✓	✓	✓
	Wildlife care	✓	✓	✓	✓
Simulation & Prognosis	Meteorology	✓	✓	✓	✓
	Oceanography	✓	✓	✓	✓
	Collection of oil particulars	✓	✓	✓	✓
Preparatory	Sensitivity mapping	✓	✓	✓	✓
	Risk assessment	✓	✓	✓	✓
	Contingency planning	✓	✓	✓	✓
	Training of personnel				

Table 6: Availability of the services in Slovenia

Service		Availability
Main	Oil spill containment and recovery	✓
	Dispersant spraying	
	Reception of collected oiling material	✓
	Treatment and disposal of collected oiling material	
	Shore clean-up	✓
	Shore restoration, decontamination and bioremediation	✓
Support	Surveillance	✓
	Aerial spraying	
	Search and rescue	✓
	Salvage	✓
	Firefighting	✓
	Wildlife care	✓
Simulation & Prognosis	Meteorology	✓
	Oceanography	✓
	Collection of oil particulars	✓
Preparatory	Sensitivity mapping	✓
	Risk assessment	✓
	Contingency planning	✓
	Training of personnel	✓

4.2. Assets and eqipment

The remaining two parts, concerning assets and equipment, called for a more detailed approach, taking into account their type of engagement, quantities, capacities, as well as their locations and mobilization times.

4.2.1. Assets

Groups of assets on the form:

- Marine craft,
- Aircraft,
- Storage facilities,
- Treatment facilities.

Table 7: Italian assets

Asset		Quantity	Capacity	Purpose PRM	SM	CORA	PCD	UN LOCODE	Mobilisation Time	Additional info
Marine craft	Anti-pollution vessel	10		✓	✓	✓		ITPRO/ITMMR	2-5 Max immediate	[illegible]
	Fire fighting vessel	2		✓	✓					
	Survey vessel	45		✓	✓	✓				
	Multi purpose vessel									
	Tug	24		✓	✓	✓		ITPRO/ITMMR		
	Response vessel									
	Rescue boat	4								
Aircraft	Airplane									
	Helicopter	5		✓	✓			[illegible]	30 min Max	
	Drone									
Storage facilities	Barge	6				✓		ITTRS		Usable to recover liquids
	Flexible/portable container									
	Tank	1	3,000.0			✓		ITTRS		Barge tanks (shore tanks are not available)
	Vehicle									
Treatment facilities	TF for oily water	2				✓		ITTRS		[illegible]
	TF for absorbents									
	TF for contaminated personal protective wear and equipment									

Table 8: Croatian assets

Asset		Quantity	Capacity	Purpose PRM	SM	CORA	PCD	UN LOCODE	Mobilisation Time	Additional Info
Marine craft	Anti pollution vessel	15		✓	✓	✓	✓	HRRJK/HRPUY/HRZAD		[illegible]
	Fire fighting vessel	4				✓	✓	HRRJK/HRPUY/HRZAD		
	Survey vessel	1				✓		[illegible]		
	Multi purpose vessel									
	Tug	8						HRRJK/HRPUY/HRZAD		
	Response vessel	1			✓	✓		HRRJK		
	Rescue boat	4						[illegible]		
Aircraft	Airplane	1		✓	✓			Zadar Airport		
	Helicopter	1		✓	✓			Zadar Airport		
	Drone									
Storage facilities	Barge	4	[illegible]			✓	✓			
	Flexible/portable container / Tank	[illegible]	[illegible]			✓	✓	HRRJK/HRZAD		
	Vehicle	[illegible]						HRRJK/HRPUY/HRZAD		
Treatment facilities	TF for oily water	1	2,000.0					HRRJK		
	TF for absorbents									
	TF for contaminated personal protective wear and equipment									

Table 9: Slovenian assets

Asset		Quantity	Capacity	Purpose PRM	SM	CORA	PCD	UN LOCODE	Mobilisation Time	[illegible] Quantity	Capacity	[illegible] Quantity	Capacity	Port of Koper Quantity	Capacity
Marine craft	Anti pollution vessel	1	0.0			✓	✓	SIKOP				[illegible]		[illegible]	
	Fire fighting vessel	1	0.0			✓		SIKOP						[illegible]	
	Survey vessel	0	0.0												
	Multi purpose vessel	0	0.0												
	Tugboat	5	0.0			✓	✓	SIKOP		5					
	Response vessel	14	0.0			✓	✓	SIKOP		[illegible]		[illegible]		[illegible]	
	Rescue boat	0	0.0												
	Defence vessel	2	0.0			✓		SIKOP		2					
Aircraft	Airplane	2	0.0	✓	✓	✓		[illegible]		2					
	Helicopter	0	0.0												
	Drone	0	0.0												
Storage facilities	Barge	0	0.0												
	Flexible/portable container	2	25,000.0			✓	✓	SIKOP		2	25,000.0	[illegible]	0.0		
	Tank	28	136.0			✓	✓	SIKOP						28	136.0
	Garbage container	184	[illegible]			✓	✓	SIKOP						184	[illegible]
	Vehicle	15	50.0			✓	✓	SIKOP						15	50.0
Treatment facilities	TF for oily water	0	0.0												
	TF for absorbents	0	0.0												
	TF for contaminated personal protective wear and equipment	0	0.0												

4.2.2. Equipment

General types of equipment were split into the following categories:

- Equipment for cargo transfer from damaged vessels,
- Oil-containment equipment,
- Oil-recovery equipment,
- Dredges for contaminated sediments,
- Dispersant-distribution equipment,
- Treatment and disposal equipment,
- Beach-cleaning, decontamination, and restoration equipment,

- Special equipment,
- Non-specialized resources.

Table 10: Croatian equipment

Place of Equipment			Quantity	Capacity	UN LOCODE	Mobilization Time
Cargo transfer from damaged vessels (if ship equipment is non-operational)		Hose		150.0	HRRJK	
		Pump	11/7		HRRJK/HRZAD	
		Fender				
		Inert gas generator				
Oil containment		Boom [m]	24	20,500.0	HRRJK/HRPUY/HRZAD	
Oil recovery		Skimmer	41		HRRJK/HRPUY/HRZAD	
Dredges for contaminated sediments		Mechanical	12	360.0	HRRJK	
		Hydraulic	1	480.0	HRRJK	
		Pneumatic				
Dispersant distribution	Dispersants	Bioremediation agent [l/l]		500.0/15.00	HRRJK /HRPUY	
		Absorbent [l]/[kg]		3,000.0/200.0	HRRJK /HRPUY	
		Emulsion breaker [l]/[l]/[l]		200.0/ 160.0/ 160.0	HRRJK/HRPUY/HRZAD	
		Cleaning agent [l]/[l]/[l]		2,515.0/520.0/180.0	HRRJK/HRPUY/HRZAD	
		Other chemical agent [kg]/[l]/[kg]		980.0/1,200.0/350.0	HRRJK/HRPUY/HRZAD	
	Dispersant spraying	Vessel-mounted system				
		Portable system				
		Aerial system				
Treatment and disposal		Mobile treatment plant	8		HRRJK	
		Fixed treatment plant [m3]	1	730.0	HRRJK	
Beach cleaning, decontamination and restoration		Beach cleaner	24		HRRJK	
		Pressure cleaner	16		HRRJK	
		Vacuum system	7/1	85/6	HRRJK/HRZAD	
Special equipment		Power pack ?				
		Transfer pump	23	638.0	HRRJK	
		Other (please state)				
Non-specialized resources		Hand tools	Full stock of PPE, tools, and bags in each County storage			
		Plastic bags				
		Mobile lab				
		Meters and samplers				
		Other				

Table 11: Italian equipment

Place of Equipment			Quantity	Capacity	UN LOCODE	Mobilization Time
Cargo transfer from damaged vessels (if ship equipment is non-operational)		Hose				
		Pump [m3/h]	13	150.0	ITTRS	1 h - 6 h
		Fender				
		Inert gas generator				
Oil containment		Offshore boom [m]		7,300.0	ITTRS	
		Coastal boom [m]		3,300.0	ITTRS & other in FVG	1 h - 4 h
		Fireboom				
		Absorbent booms [m]		4,700.0	ITTRS & other in FVG	1 h - 4 h
Oil recovery		Skimmer [m3/h]	31	1,300.0	ITTRS	1 h - 4 h
Dredges for contaminated sediments		Mechanical				
		Hydraulic				
		Pneumatic				
Dispersant distribution	Dispersants	Bioremediation agent				
		Absorbent				
		Emulsion breaker				
		Cleaning agent [l]		7,300.0	ITTRS	1 h - 4 h
		Other chemical agent				
	Dispersant spraying	Vessel-mounted system	10			
		Portable system				
		Aerial system				
Treatment and disposal		Mobile treatment plant	2		ITTRS	
		Fixed treatment plant				
Beach cleaning, decontamination and restoration		Beach cleaner				
		Pressure cleaner				
		Vacuum system				
Special equipment		Power pack [kW]	3	108.0		
		Transfer pump				
		Other (please state)				
Non-specialized resources		Hand tools				
		Plastic bags				
		Mobile lab				
		Meters and samplers				
		Other				

Table 12: Slovenian equipment

Piece of Equipment			Quantity	Capacity [m3/h] [m3] [m]	UN LOCODE	Mobilisation Time	URSZR		SVOM		LK	
							Quantity	Capacity	Quantity	Capacity	Quantity	Capacity
Cargo transfer from damaged vessels (if ship equipment is non-operational)		Hose	0	0.0								
		Pump	0	0.0								
		Fender	0	0.0								
		Inert gas generator	0	0.0								
Oil containment		Offshore boom [m]	0	5,840.0	SIKOP			5,250.0		590.0		
		Coastal boom [m]	0	6,302.0	SIKOP			971.0				5,327.0
		Fireboom	0	0.0								
		HNS boom [m]	0	750.0	SIKOP			750.0				
		Air blower	5	0.0	SIKOP		5					
		Reel	21	0.0	SIKOP		21					
		Generator	3	0.0	SIKOP		3					
		Anchor set	18	0.0	SIKOP		18					
Oil recovery		Skimmer [m3/h]	8	225.0	SIKOP		1	50.0	4		3	175.0
Dredges for contaminated sediments		Mechanical	0	0.0								
		Hydraulic	0	0.0								
		Pneumatic	0	0.0								
Dispersant distribution	Dispersants	Bioremediation agent	0	0.0								
		Absorbent [kg]	0	1,143.6	SIKOP							1,143.6
		Emulsion breaker	0	0.0								
		Cleaning agent [l]	2	32.0	SIKOP						2	32.0
		Other chemical agent	0	0.0								
	Dispersant spraying	Vessel-mounted system	0	0.0								
		Portable system [m3]	3	0.6	SIKOP						3	0.6
		Aerial system	0	0.0								
Treatment and disposal		Mobile treatment plant	0	0.0								
		Fixed treatment plant	0	0.0								
Beach cleaning, decontamination and restoration		Beach cleaner	0	0.0								
		Pressure cleaner	1	0.0	SIKOP						1	
		Vacuum system	1	0.0	SIKOP		1					
Special equipment		Power pack	5	0.0	SIKOP		2		1		2	
		Transfer pump	6	0.0	SIKOP				3		3	
		Other (please state)	0	0.0								
Non-specialized resources		Hand tools	0	0.0								
		Plastic bags	0	0.0								
		Mobile lab	0	0.0								
		Meters and samplers	0	0.0								
		Other	0	0.0								
Firefighting		Foam [m3]	0	4.1	SIKOP			3.4				0.7

4.3. CECIS resource list

CECIS or Common Emergency Communication and Information System is a joint European database created to establish the interconnection between National Authorities (civil protection services) and the Emergency Response Coordination Center (ERCC) with responsibility to protect citizens from natural and technological hazards. Through CECIS, operational information can be exchanged in a secure and reliable way, as needed for the effective implementation of the mechanism.

We had a team work on extracting every detail from each listing on the CECIS website related to the Partners' anti-pollution resources, one by one, and compare them to what we already had. The assets and equipment in the database fell under similar categories to the ones that had already been included in our list.

Figure 20: Chart of the CECIS resource loacations

All the locations of equipment storage facilities, marine craft homeports, and airports from the CECIS were put on a chart (see figure 13). The locations in the North-Adriatic area are colored yellow. We have kept the entire chart for two reasons. Number one, even though a vessel setting sail or an airplane taking off from a location outside the NAMIRS area, it might still arrive at the site sooner than one starting from within the area. For instance, suppose it comes to a spill in the south part of the North Adriatic, and the northerly wind is advancing the slick towards the imaginary borderline extending from Ancona to Zadar, a vessel from, say, Giulianova or Šibenik will evidently reach it much faster than one coming from Koper. The other reason is, the chart might prove useful in future endeavors, especially if the project were to be expanded across the whole Adriatic.

Table 13: CECIS listings for Croatia

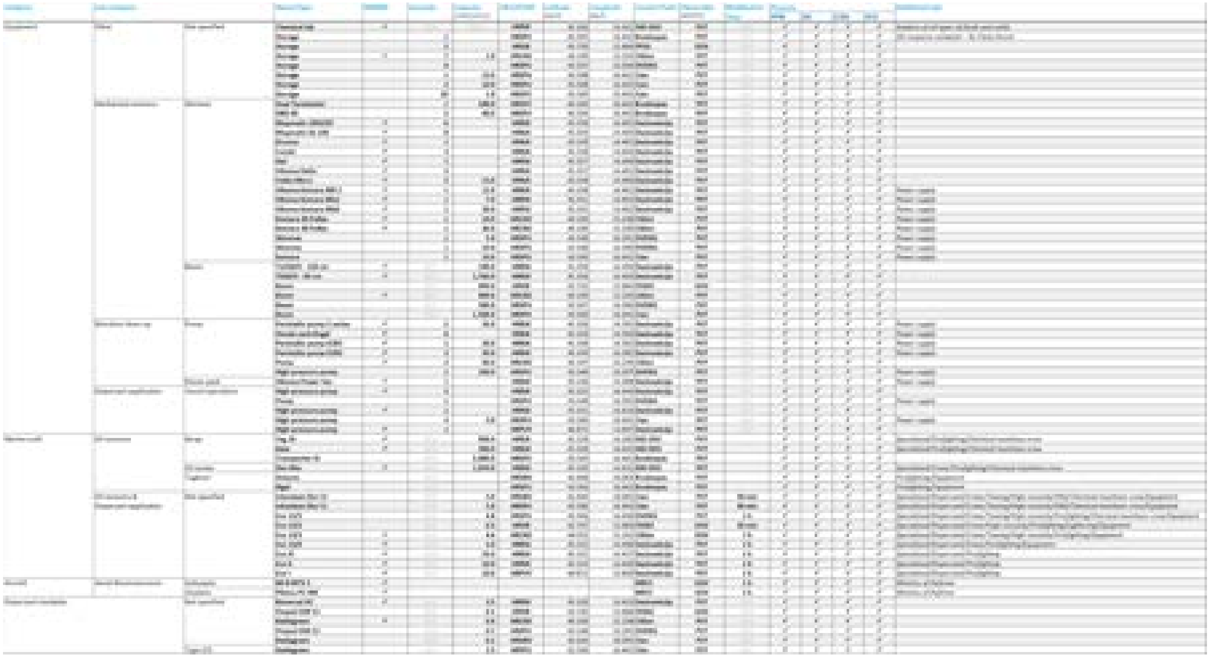
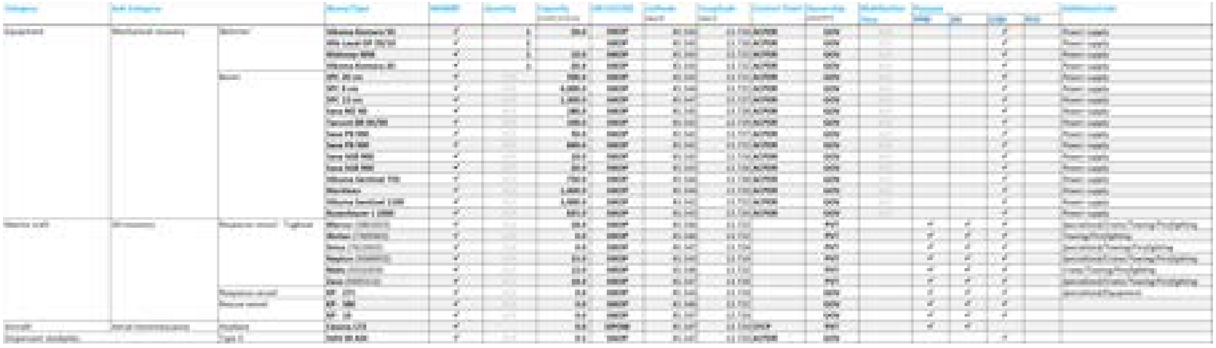


Table 14: CECIS listings for Italy

[illegible]

Table 15: CECIS listings for Slovenia



4.4. EMSA resource list

European Maritime Safety Agency ensures a high, unified, and efficient safety and security level in the maritime world, as well as strives towards better prevention of, and response to potential oil or HNS pollution from ships. The organization also greatly contributes to the overall effectiveness of the maritime transport by facilitating the establishment of the European Maritime Transport Space without Barriers. The EMSA mission is to become the European center for a safe and sustainable maritime sector.

The European Maritime Safety Agency (EMSA) manages a storage facility in Ravenna, Italy, were they keep the anti-pollution equipment intended for use in the North Adriatic. We contacted the EMSA by e-mail and asked for a list of all the equipment stored in Ravenna, including the particulars of the contracted oil-tanker Kijac, whose homeport is Rijeka, Croatia. We received links to the websites where the information is available:

https://emsa.europa.eu/we-do/sustainability/pollution-response-services/equipment-assistance-service.html.

4.5. Analysis of the mapping of resources

Having examined the completed forms that had been submitted, we can say that the attempt has brought partial success. Unfortunately so, but not unexpectedly at all. The list provided by the EMSA, however, is exemplary. If our mapping looks anything like that when the project is through, we will be on the right track.

Regarding stakeholders and services, the mapping has been carried out satisfactorily. We do figure that there is still room for minor improvements, which are being addressed at this very moment.

On the other hand, the data that we have managed to gather from all the Partners on assets and equipment will simply not suffice, not at this point, anyway. Most likely owing to poorly designed fill-out forms, the data are, for the most part, incomplete, deficient, non-uniform, and ambiguous, not at all delivering a clear picture of resources. Much less a complete one. Surprisingly, the data that we have obtained from the CECIS turned out not to be a significant contribution to the list, either.

Generally, two types of issues were found. One the one hand, we have data on different resources listed for each country, when they should obviously be on the same since the very same types of anti-pollution resources are in question. The latter suggests that the lists are incomplete. On the other hand, those resources that actually do match in type are described in different ways, stating different particulars. And that indicates that the lists are in lack of detail, having been filled out by personnel with limited insight or not with enough effort. To make that clearer, for instance, an Italian listing might read that they have booms including storage reels and air blowers, and a Croatian listing might read that they have five hundred meters of booms categorized as either coastal or offshore. The discrepancy is obvious. Furthermore, the number of empty cells in particular tables sort of implied that the forms we had drawn up in the beginning were too complicated.

Examples of the most conspicuous deficiencies and discrepancies that we have detected are shown and explained in the charts and paragraphs below. There are comparisons between the data extracted from the CECIS and the data provided by the Partners for skimmers, booms, marine craft, and aircraft.

4.5.1. Skimmers

The differences in number of skimmers from to the CECIS database and our list can be clearly seen in figure 14. Also, just as important as the number of skimmers is their type, their nominal oil-recovery rates and, last but not least, their power supply. Neither are specified in several listings. Depending to the viscosity of oil and environmental conditions, such as wave height, different types of skimmers would be the preferred option. Moreover, if there is debris at the site, some skimmers will be of little to no help due to pieces of debris restricting the flow.

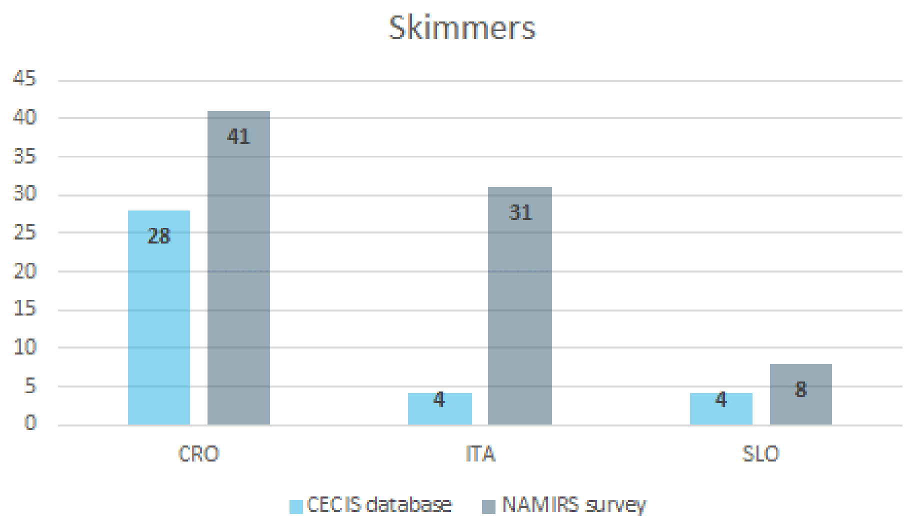


Figure 21: Comparison - number of skimmers per country

4.5.2. Booms

Inspecting the total lengths of booms extracted from the CECIS (see figure 15) and given that the Slovenian coastline is by far the shortest, there has got to be something wrong. Additionally, knowing only the lengths is meaningless without including the boom's type and basic design. There are standard, HNS, fire-resistant, and sorbent booms. According to their shape, freeboard, and floatation element, not every boom is suitable for every situation. Another important factor to be considered is the compatibility among types. Most of that information seems to have been left out on both lists.

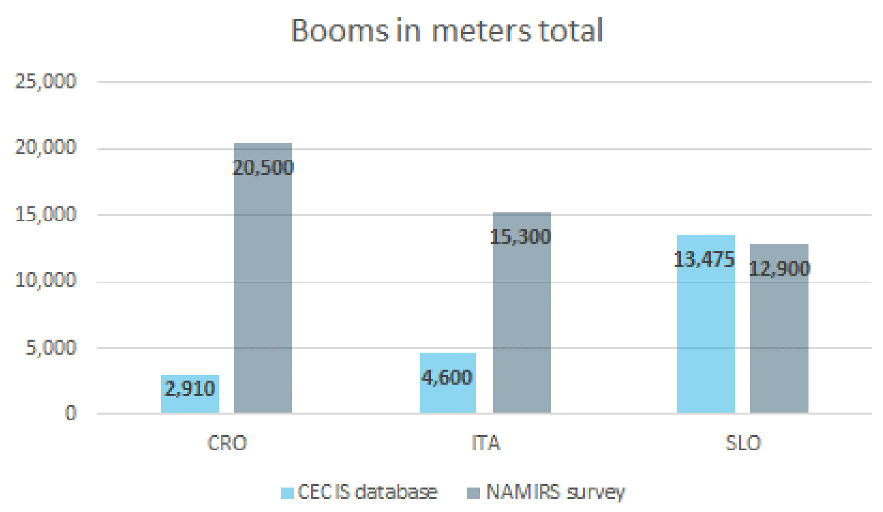


Figure 22: Comparison - total length of booms per country

4.5.3. Marine craft

Both lists offer a limited amount of information about the available marine craft, also missing some information critical to choosing a particular vessel to mobilize in a particular situation. Vessel types are mixed up. Their navigational area and endurance (coastal or offshore) are left out in many cases. The list does not include details on the shipboard anti-pollution equipment. What is their service speed? What is the number of additional personnel that could embark? What about contact points? At the moment, our database lacks quite a lot of necessary details about marine craft and that will have to be rectified in the following months.

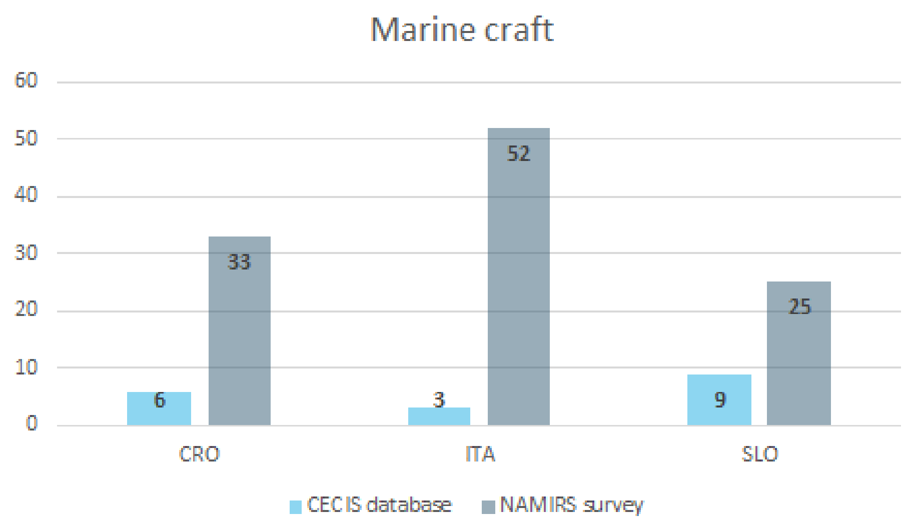


Figure 23: Comparison - number of marine craft per country

4.5.4. Aircraft

We believe that a lot of aircraft have been neglected to enter into the CECIS. We know for a fact that Italy has many at their disposal, but there is not a single aircraft listing on the website. Those aircraft that can be found on the lists are, again, not described at all.

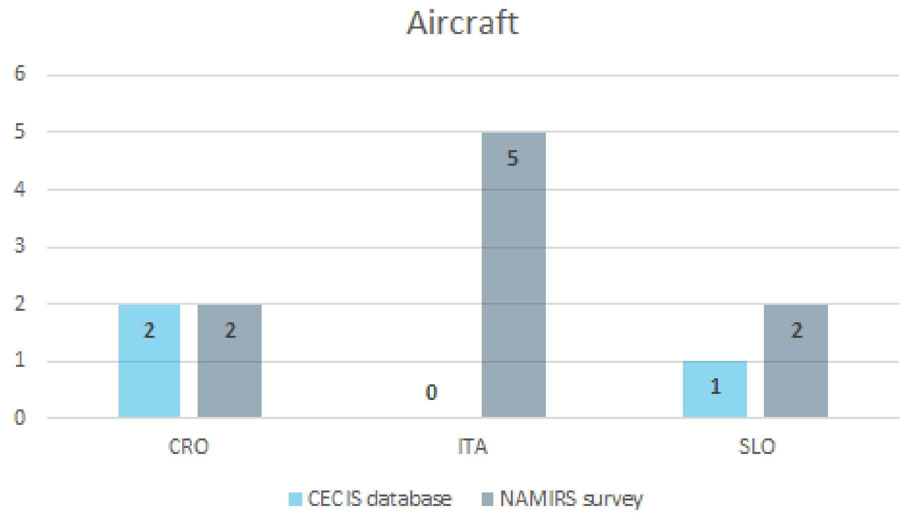


Figure 24: Comparison - number of aircraft per country

There are many other assets we are certain that should be listed, such as storage facilities, quantities and capacities of shore tanks, floating tanks, barges, power pack, transfer pumps, etc.

All things considered, we needed to start over and find a more efficient way of performing the mapping. Initial difficulties are always anticipated to some extent. However, careful consideration and analysis of what might have been approached the wrong way can eventually lead to improvements, which can ultimately be turned to one's advantage.

4.6. Way forward

After careful consideration, we believe to have found a more sistematic way of collecting data. We have designed new forms. Moreover, we wish to take the accessibility of the resources and thus the facilitation of organizing an intervention to a higher level. We have taken the initial steps towards developing an app where the available resources will be displayed against their locations on a chart of the North Adriatic.

4.6.1. New forms

Recently, we have come up with new, amended forms, having taken into consideration the factors we believed to be of greatest significance to a swift and successful oil-spill response. An imminent threat to human life and the environment needs to be addressed immediately upon detection. In a real emergency, one cannot afford to waste time. With every minute, more oil is discharged into the sea and the amount of the mixture of oil and water that needs to be recovered, stored, and treated increases due through emulsification. Hence, the forms should include only the essential information that the first responders require to mobilize the most suitable resources and take action.

We have introduced three separate forms, one for marine craft, one for aircraft, and one for equipment. Including drop-down lists and thorough instructions for guidance, they are all designed in a way that allows the user to enter data with very little freedom of choice, which will contribute to detailed descriptions of only the targeted information and result in a compact, uniform, and focused design and structure of the entire list. Also, we came up with the idea of adding a box to the marine craft and aircrafts forms where the user will be requested to drop off an image of the asset. No matter how corny it may sound, a picture is worth a thousand words. A lot can be read from a picture in a single glance, which is definitely an advantage when one is in a rush and under pressure. Moreover, several resource categories, those irrelevant to a Tier-3, cross-border response, have been excluded from the forms, because we figured that those had only been creating confusion and redundance.

Having seen the first examples of the completed forms, we are confident that we have taken the right path. We intend to reform those into annexes and add them to the Plan. When the implementation of the SOP takes place, the responsibilities for updating and modifications will be assigned and maximum time intervals between updates will be determined.

4.6.1.1. Annex I: Marine craft

Annex I (working title) will include all the Partners' Tier-3 vessels and EMSA's M/T Kijac.

There are five groups of requested entries on the marine craft listing form:

- General data,
- Homeport,
- Particulars,
- Capacities,
- Shipboard equipment.

General data include the vessel's name, type and category, its picture, and the necessary details for contact and communication. Next, there are homeport details and the vessel's particulars along with the service speed, endurance in nautical miles, and the number of additional personnel, which is very important when boarding extras or passengers. Besides the storage and dispersant capacity in the fourth group, we have added additional services: firefighting, lightering, and the handling of high-viscosity oil and HNS (hazardous and noxious substances). In the final group, the user will be requested to list all the shipboard equipment. In order to avoid any duplication of data, together with the equipment listing form, we have emphasized in the instructions that only the vessel-mounted equipment and the stand-by equipment permanently stored on board must be entered.

MARINE VESSEL Listing Form NAMIRS

DATE OF ENTRY/MODIFICATION: 08/12/2022

GENERAL

NAME	ZEUS

IMO	9395513
CALL SIGN	S5EK9
VHF DSC [MMSI] ✓	278301000
TYPE	Tug
CATEGORY	Offshore
MOBILIZATION TIME [min]	60

OWNERSHIP	Private
OPERATOR CONTACT [company]	Adria Tow, d.o.o.
[phone No.]	0038656656318
[email address]	adria.tow@adria-tow.si

HOME PORT

CITY/PORT	Koper	LATITUDE [degrees]	45.548 N
UN/LOCODE	SIKOP	LONGITUDE [degrees]	013.730 E

PARTICULARS

LENGTH OVERALL [meters]	34.50	SERVICE SPEED [knots]	10
BEAM [meters]	11.60	ENDURANCE [nautical miles]	1,500
DRAFT [meters]	6.70	NO. OF CREW	4
POSSIBILITY OF BOARDING ADDITIONAL PERSONNEL	✓	NO. OF ADD. PERSONNEL	8

CAPACITY

STORAGE [cubic meters] ☐		CRANE ✓	1
DISPERSANT [liters] ☐		TOWING [metric tons] ✓	74
FIREFIGHTING ✓	LIGHTERING ☐	HIGH VISCOSITY ☐	HNS ☐

SHIPBOARD EQUIPMENT

EQUIPMENT	UNIT	CAPACITY
FIRE PUMP KVAERNER	[cubic meters per hour]	1,500
FIRE PUMP KVAERNER	[cubic meters per hour]	1,200
REMOTE CONTROLLED MONITOR WATER/FOAM	[cubic meters per hour]	100
SELF PROTECTECTING CURTAIN SPRAY SISTEM	[cubic meters per hour]	300
ALTERNATOR	[kilowatts]	306
ALTERNATOR	[kilowatts]	306
HARBOUR ALTERNATOR	[kilowatts]	195
ME-DRIVEN HYDRAULIC PUMP DRIVING ALTERNATOR	[kilowatts]	300

Figure 25: Marine craft listing example – tug "ZEUS"

4.6.1.2. Annex II: Aircraft

Annex II (working title) will be a list of all the aircraft, both fixed-wing and helicopters.

The aircraft listing form is very similar to the marine craft listing forms. There is only one different entry in the first two groups – instead of the IMO number, specific to marine vessels, there is the tail number, which is the number an airplane is identified by. The particulars include the minimum takeoff and landing distances. The water storage capacity for firefighting and the dispersant storage capacity, in case there is a spraying system on board, are complemented by additional services: firefighting, search and rescue for helicopters, and whether or not the aircraft is amphibious and whether or not it has the possibility of water scooping. The last group of data is entirely different from the one in Annex I. It is related to reconnaissance aircraft for the detection of oil slicks. The performance of remote-sensing equipment depends on the fraction of the spilled oil and its viscosity, the thickness of the oil slick, and the environmental conditions, such as waves, cloud coverage, or the reflection of sunbeams.

There are six different systems for oil slick detection:

- SLAR (side-looking airborne radar),
- SAR (synthetic aperture radar),
- IR (infrared scanner),
- UV (ultraviolet scanner),
- MWR (microwave radiometer),
- LSF (laser fluorosensor).

AIRCRAFT Listing Form | NAMIRS

DATE OF ENTRY/MODIFICATION: 09/12/2022

GENERAL

NAME	ZLIN 526F

TAIL NO.	S5-DBO
CALL SIGN	S5DBO
VHF DSC [MMSI] ☐	
TYPE	Fixed-wing
CATEGORY	Surveillance
MOBILIZATION TIME [min]	60

OWNERSHIP	Private
OPERATOR CONTACT [company]	AK OLCP
[phone No.]	0038651300755
[email address]	info@akolcp.com

HOME AIRPORT

CITY/AIRPORT	Portorož	LATITUDE [degrees]	45.514 N
UN/LOCODE	SIPOW	LONGITUDE [degrees]	013.591 E

PARTICULARS

SERVICE SPEED [knots]	112	ENDURANCE [hours]	4
FLIGHT HOURS [hours per year]	20	TAKEOFF DISTANCE [meters]	220
NO. OF CREW	2	LANDING DISTANCE [meters]	135

CAPACITY

STORAGE [cubic meters] ☐		DISPERSANT [liters] ☐	
FIREFIGHTING ☐	SAR ☐	AMPHIBIOUS ☐	WATER SCOOPING ☐

REMOTE SENSING EQUIPMENT

SLAR ☐	SAR ☐	IR ☐	UV ☐	MWR ☐	LFS ☐

Figure 26: Aircraft listing example - reconnaissance plane "ZLIN 526F"

4.6.1.3. Annex III: Equipment

Annex III (working title) will be a collection of equipment, and storage and treatment facilities. The listing form for equipment was the most demanding to design. There are a lot of different pieces of anti-pollution equipment, and each comes with its own set of specific details. We had to be really careful considering the ratio of quantity and detail to simplicity, transparency, and user-friendliness. One form is intended for each resource location (see figure 20).

We have decided to map the following equipment and facilities:

- Skimmers (category, type, power source, recovery rate, pump characteristics),
- Booms (category, type, design, length, corresponding equipment),
- Transfer pumps (type, capacity, maximum viscosity)
- Power packs (power source, output, number of connections),
- Storage (barges, floating tanks, mobile containers, tanker trucks),
- Treatment (mobile treatment plants, fixed treatment plants),
- Dispersant (amount, number of spraying systems),
- Other.

EQUIPMENT Listing Form NAMIRS

DATE OF ENTRY/MODIFICATION

Click or tap to enter a date.

LOCATION

CITY/PORT		UN/LOCODE	
LATITUDE (deg N)		LONGITUDE (deg E)	

SKIMMERS

NO. OF SKIMMERS			
NAME		POWER	Choose an item.
CATEGORY	Choose an item.	RECOVERY RATE (m3/h)	
TYPE	Choose an item.		
PUMP	Choose an item.	PUMP CAPACITY (m3/h)	
PUMP TYPE	Choose an item.	MAX VISCOCITY (cSt)	

BOOMS

NAME				FLOATATION ELEMENT		Choose an item.	
CATEGORY		Choose an item.		TOTAL LENGTH (m)			
TYPE		Choose an item.		FREEBOARD (m)			
DESIGN		Choose an item.		DRAFT (m)			
REELS	☐	AIR BLOWER	☐	ANCHORING SET	☐	COMPATIBLE	☐

TRANSFER PUMPS

NO. OF PUMPS			
NAME		CAPACITY (m3/h)	
TYPE	Choose an item.	MAX VISCOCITY (cSt)	

POWER PACKS

NO. OF POWER PACKS			
NAME		OUTPUT (kW)	
POWER	Choose an item.	NO. OF CONNECTIONS	

Figure 27: Equipment listing empty form - page 1/2

EQUIPMENT Listing Form NAMIRS

STORAGE

BARGES

NAME		LENGTH OVERALL (m)	
OWNERSHIP	Choose an item.	BEAM (m)	
CAPACITY (m3)		DRAFT (m)	

FLOATING TANKS

NO. OF FLOATING TANKS		TOTAL CAPACITY (m3)	

MOBILE CONTAINERS

NO. OF MOBILE CONTAINERS		TOTAL CAPACITY (m3)	

SHORE TANKS

NO. OF SHORE TANKS		TOTAL CAPACITY (m3)	

TANKER TRUCKS

NO. OF TANKER TRUCKS		TOTAL CAPACITY (m3)	

TREATMENT

MOBILE TREATMENT PLANTS

NO. OF MOBILE TPs		TOTAL CAPACITY (m3/h)	

FIXED TREATMENT PLANTS

NO. OF FIXED TPs		TOTAL CAPACITY (m3/h)	

DISPERSANT

AMOUNT OF DISPERSANT (l)		NO. OF SPRAYING SYSTEMS	

OTHER

Figure 28: Equipment listing empty form - page 2/2

4.6.2. PISCES

Once the mapping of resources is complete, assets and equipment will be imported to the PISCES. Real quantites and real characteristics will be considered. The latter will contribute to extremely accurate exercise scenarios, resembling real situations where the actual oil-recovering capacity and competency will be put to test.

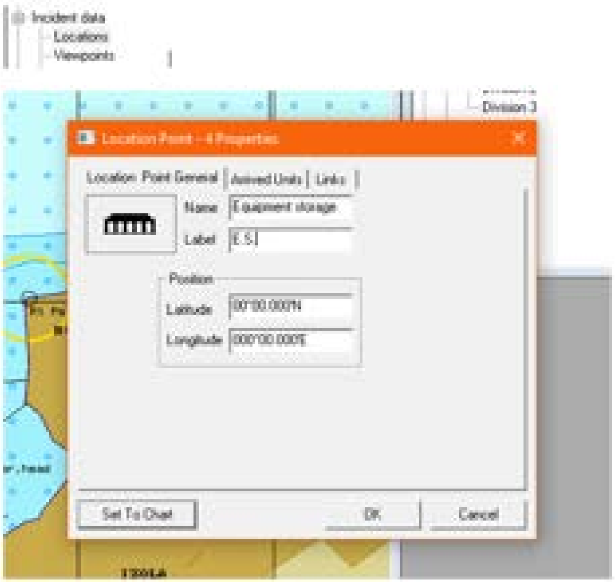


Figure 29: Setting a location point - equipment storage

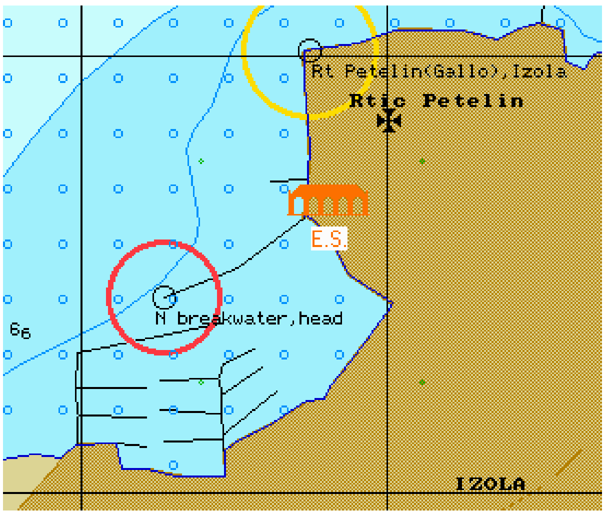


Figure 30: Equipment storage icon on location

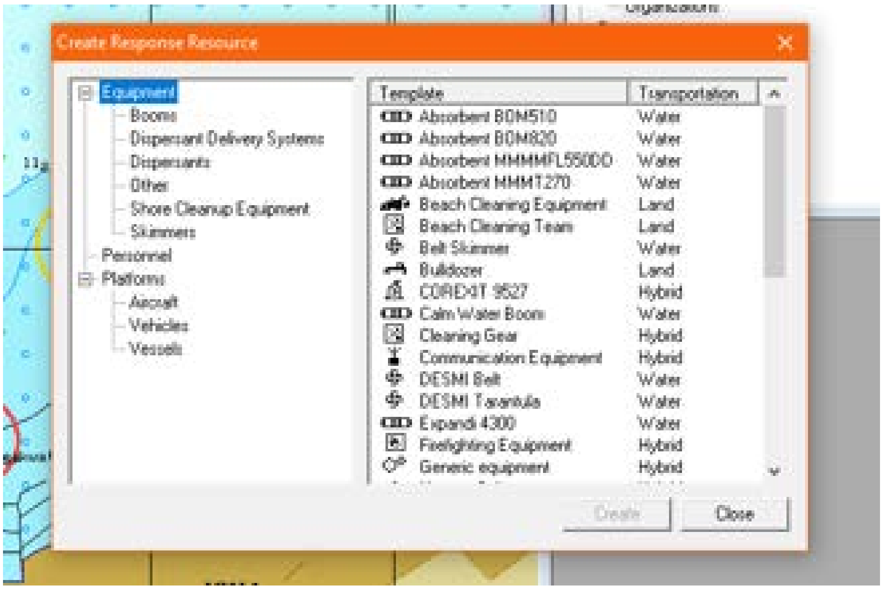


Figure 31: Creating response resources

4.6.3. App

We are striving towards developing an app displaying locations of all the assets and equipment on an interactive chart of the North Adriatic. Selecting a location, the app will show all the resources correspondent to that location (only the essential information, details will be available in the annexes to the contingency plan). All the features and details are yet to be discussed upon delivery of the SOP and during the upcoming seminars, workshops, and exercises.

In our opinion, the app should be kept separate from complicated professional software, such as spill simulators or wind/current predictors. Such programs require expert operators, which are not always at hand. The app should be average-user-friendly and run on an easily accessible platform, so as to facilitate the organization of the first response for everyone involved and thus reduce the time of mobilization. We suggest integrating it into an open map platform, such as QGIS, Google Earth, or Google maps, and protecting with a password to ensure that access is denied to unauthorized personnel.

5. FEASIBILITY STUDY

5.1. General

The Administration of the Republic of Slovenia for Civil Protection and Disaster Relief (ACPDR) is the institution responsible for emergency interventions on national territory. In scope of the project NAMIRS, the ACPDR would be expanding its territory of operation to the international waters of the North Adriatic, shared by the Republic of Italy and the Republic of Croatia.

If the ACPDR wishes to operate properly, making quick and efficient interventions, they need properly trained personnel. In the coursge of the training of personnel, the ACPDR encountered a problem in the area of diver training. The intervention procedures and on depths equal to 25 meters or deeper were not up to the standard because we do not have a professional training center for divers. Should a tanker, loaded with crude oil or any other kind of derivative, sink in the area of the ACPDR operational territory or in the NAMIRS Northern Adriatic area, the oil on board would have to to be pumped out of the tanks with the help of a trained team of divers and oil clean-up service personnel.

For that purpose, the ACPDR would like to have a training center established. Generally, there is a lack of such facilities in the area covered by the NAMIRS. Besides professional divers, a potential user of the training center could be anyone in need of that kind of training, even foreigners, from Partner countries or other countries from the Adriatic and Central Europe. According to the data currently known to us, the only centers of such nature are located in Padua, Italy, and in Poland.

Figure 32: Conceptual exterior of training center

The centre would be located in the Municipality of Izola, which is located in the hearth of Slovenska Istra in the macro region of Obalno-Kraška. The region can be found in the western part of the Republic of Slovenia in the land of Primorska.

Figure 33: Macro location of the training center

The Municipality of Izola encompasses many small settlements around its centre in the coastal town of Izola from which the municipality got its name from. The diver training centre proposed in this document would be located in the north-western part of Izola called Ruda, on land southern of the main road junction which connects Izola with Koper and the national highway.

Figure 34: Micro location of the training center

The construction would be funded partially by the state budget of the Republic of Slovenia, and partially by the European Union's funds for protection and disaster relief, or from other EU-budget resources. A partial amount could also be provided by the Municipality of Izola from its municipal fund.

Apart from the deep-diving training, the center could also hold shallow-water-diving training sessions. The latter would enable diving personnel from the countries participating in the NAMIRS to obtain additional training for activities happening in the waters of the Bay of Trieste, or in the area due north of the imaginary line between Savudrija and Grado, where depths are less than 25 meters.

Based on the needs described above, the concept and the architectural design of the center was created, which is presented in the feasibility study. Besides the deep-diving training, the pool would be used for the performance of exercises for oil-pollution interventions at sea, as well.

The feasibility study also delivers a raw estimation of the center's operation-procedure costs, based on the expected number of potential employees, and all other associated costs.

5.2. Description of the diving center

The center would comprise the following units (in different locations but functioning as one center):

- Izola fire station,
- Regional station for the rescue unit of lifeguards including divers,
- Storage space for rescue equipment (approximately 600 square meters of warehouse grounds for booms and other equipment with direct access to the sea and a loading lift, or as close to the sea as possible),
- Macro-regional pool for deep-water training of divers and rescuers, and rescue at sea (passenger and cargo ships).

Figure 35: Floor plan of the building (outside view)

Center units can be centralized or decentralized in the area of Izola (within a radius of 500 meters) depending on the access requirements, and other sports facilities and space requirements.

The center should include the following amenities, as proposed by Capt. Rok Sorta:

- A deepwater pool with an extended stepped section at the shallower part and tunnels at different depths,
- A multipurpose pool,
- A connection between the deepwater pool and the multipurpose pool (optional),
- A small pool with low-temperature water,
- A swimming-pool engine room and storages for various props and equipment,
- Diver rescue unit's own premises and storage,
- A first-aid room fitted a decompression chamber,
- Classrooms, one of them connected to the working balcony of the multipurpose pool by steps,

- Changing rooms, toilets, a laundry, and an equipment-drying room,
- Shops and a bar (optional: with underwater windows to the pool),
- A reception office and a control room,
- An outdoor balcony, a green roof covered with solar cells and possibly small windmills for generating electricity (optional),
- Hotel rooms or apartments (optional).

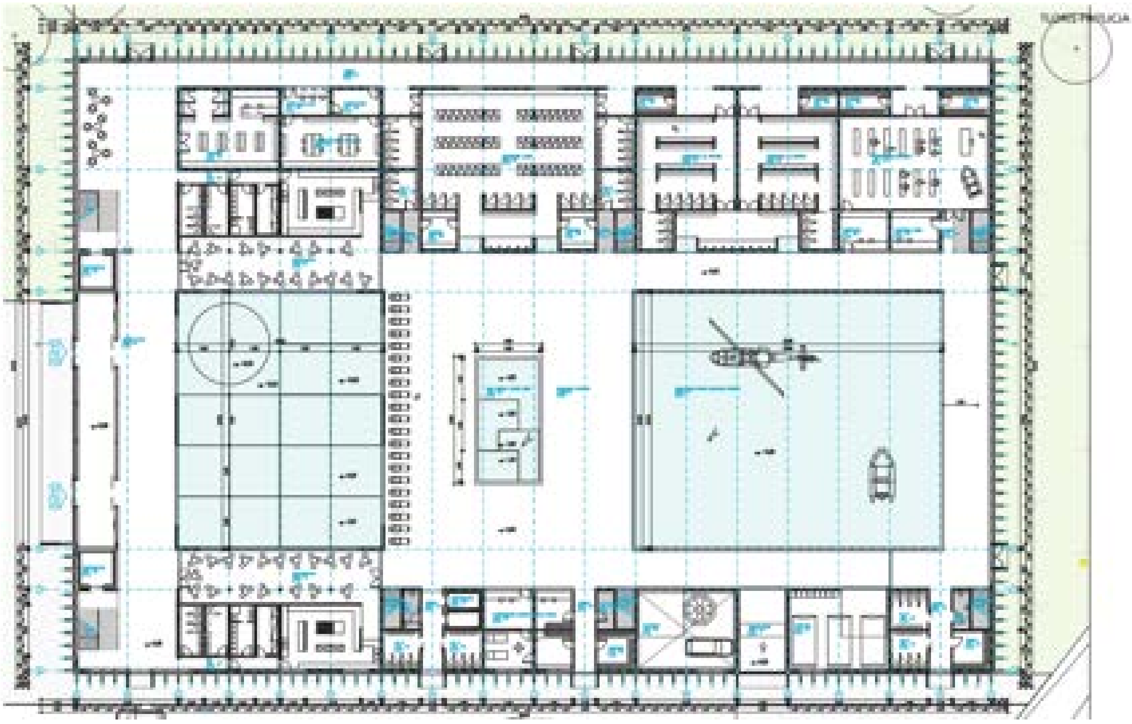


Figure 36: Ground floor of the training center

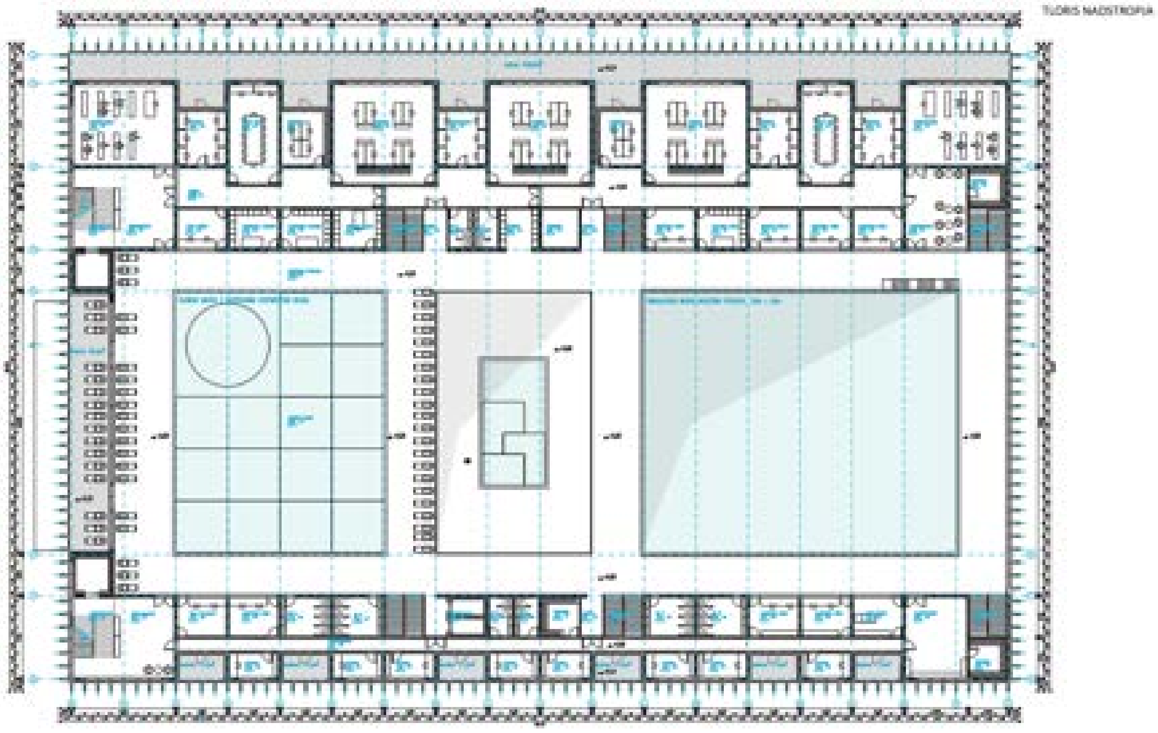


Figure 37: First floor of the training center

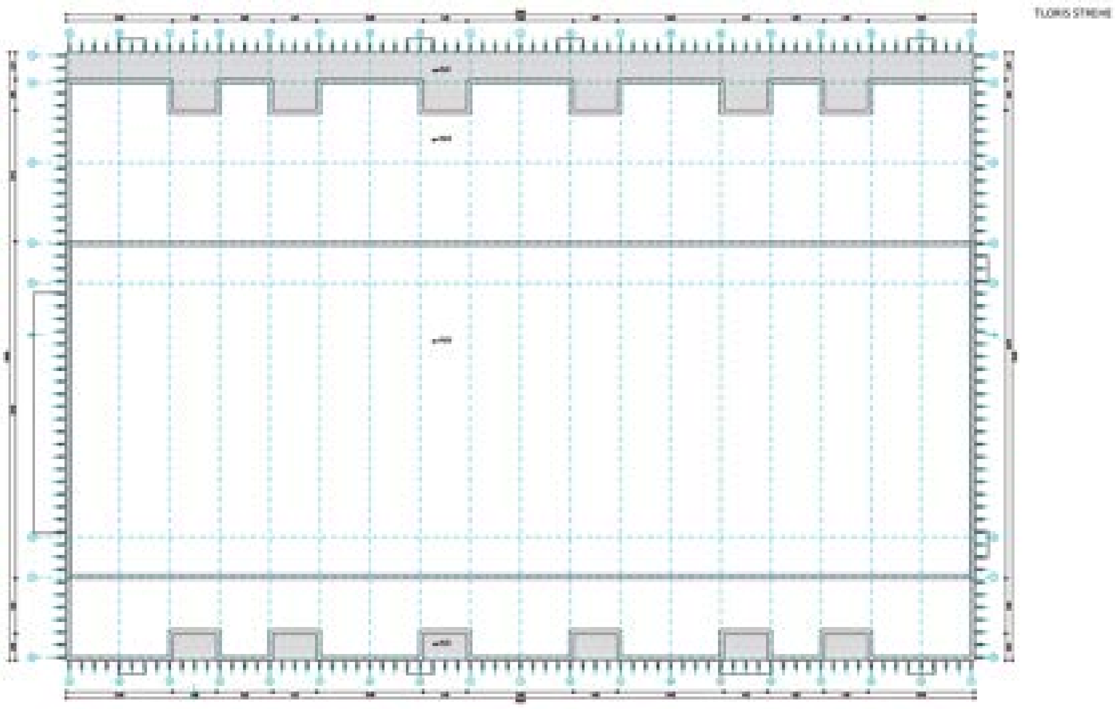


Figure 38: Side view of the training center A-A

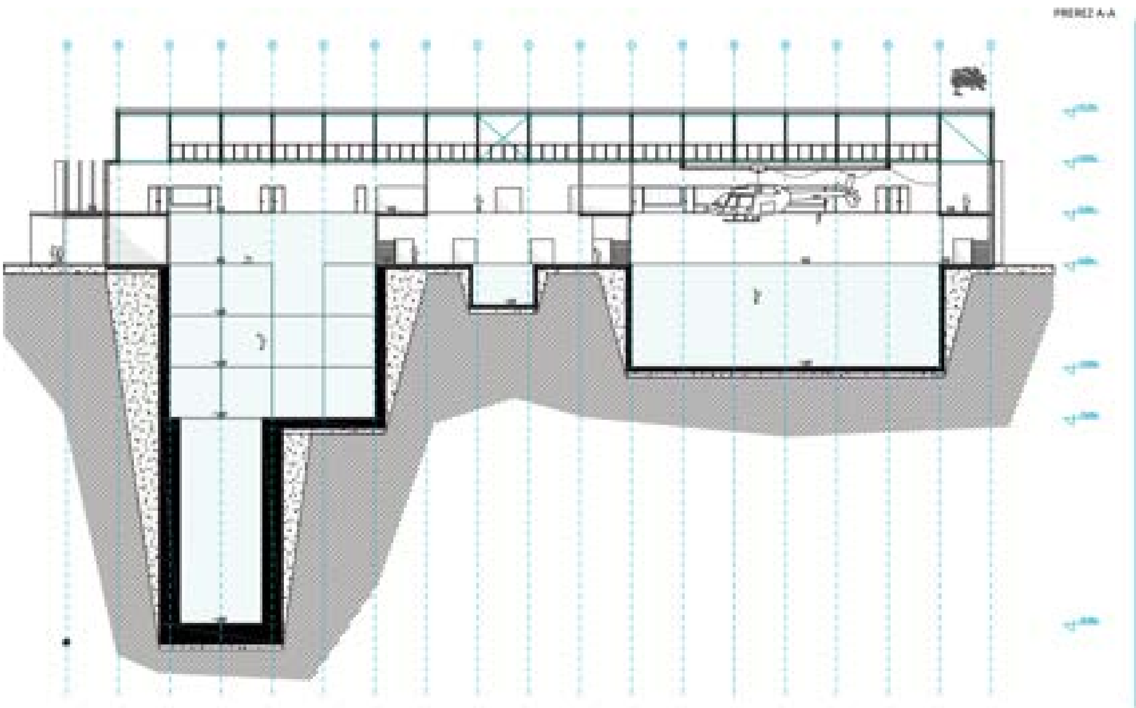
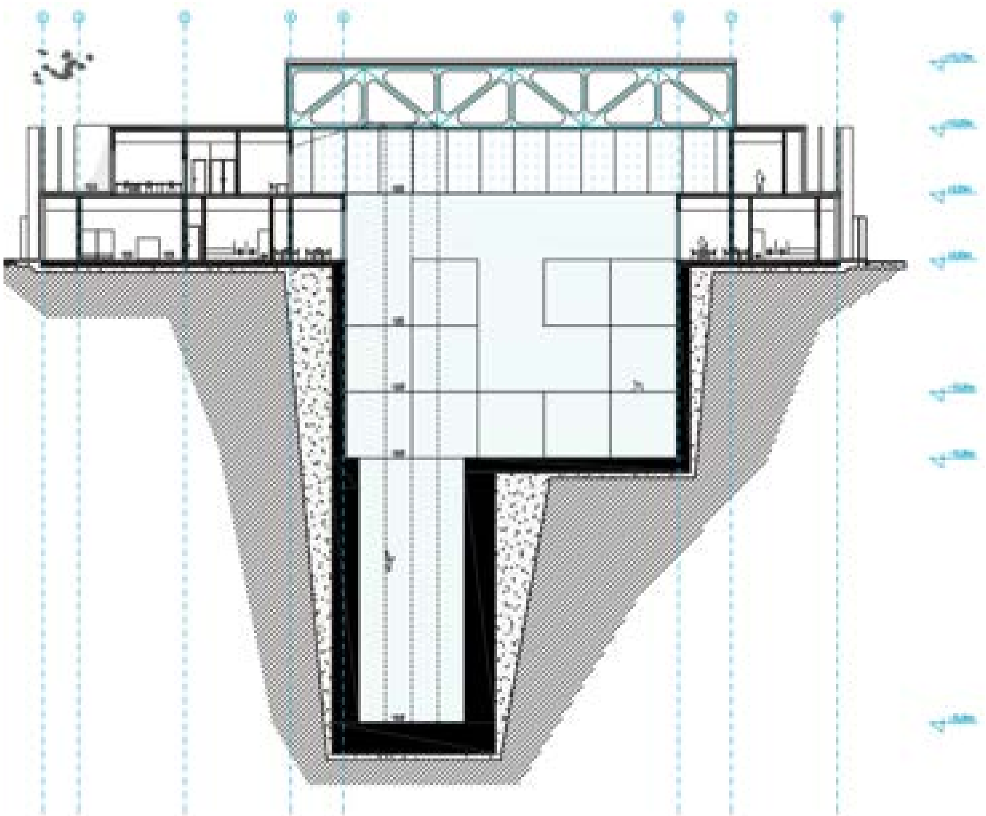


Figure 39: Side view of the training center B-B

PREREZ B-B



5.3. Goals and the purpose of the diving center

The basic goal of the center, common to any state-of-the-art facility, is to enable all users, amateurs and professionals, as well as military personnel, to undergo different training courses in the water, set in a safe and controllable environment.

However, if broader goals were considered during planning and construction, too, the pool could in fact become a multipurpose facility for various activities, such as:

5.3.1. Diving activities

The pool would be suitable for both beginner and advanced level training courses, and tests related to snorkelling and scuba diving in a variety of situations and conditions. In addition to that, the pool would be used for exercises and training for professional divers.

5.3.2. Training of seafarers

Seafarers are required to complete theoretical education and training for the rescue, assistance, and survival at sea. Practical exercises must enable a realistic but safe simulation of a wide spectrum of rescue and survival techniques at sea. This pool would allow a range of exercises and training in the sea for skippers, sailors, and others in all weather conditions.

5.3.3. Research activities

Owing to the distinctive properties of pools and their specific functions, certain research activities could be taking place there, such as oceanographic studies, physics studies, rescue and survival techniques, various measurements, ship stability, propulsion, manouevering, performance studies, naval architecture, hull design and water resistance, studies of wave and wind loads on structures, wave patterns, etc. The center would also be a suitable facility for the performance of various tests of the impact ow water on equipment and materials. When it comes to science, the options are endless.

5.3.4. Activities of other services related to the sea and use of the sea

Not only seafarers, but also lifeguards, civil-protection teams, harbour masters, first-aid teams, army units, police, firefighters, helicopter pilots (e.g., helicopter overturning, winch rescue from water, etc.) would be encouraged to use the premises to perform their own statutory exercises, training, and exams.

5.3.5. Other technical activities

The pool could also serve as the environment for accurate pollution simulations with real oil without any risk of causing harm to the outside world, testing of recovery methods and procedures, as well as training for the use of underwater equipment and devices, such as underwater drones, ROUV, etc.

5.3.6. Extracurricular and afternoon activities

Various clubs and courses could also be organized in the swimming pools (especially in the multi-purpose pools), such as safe jumping into the water, swimming lessons, synchronized swimming, basics of sailing, various diving courses and training (freediving, scuba diving, night diving, apnea), courses in water rescue and survival, demonstrations of activities related to the sea for pre-school and primary school children, water recreations for amatuers, sports training, sports competitions, and last but not least, fun activities, such as pool parties, underwater weddings, etc.

5.3.7. Tourist activities

All the additional features of the training center including shops and an open bar would also promote touristic activities and attract companies by hosting teambuildings or demonstrations.

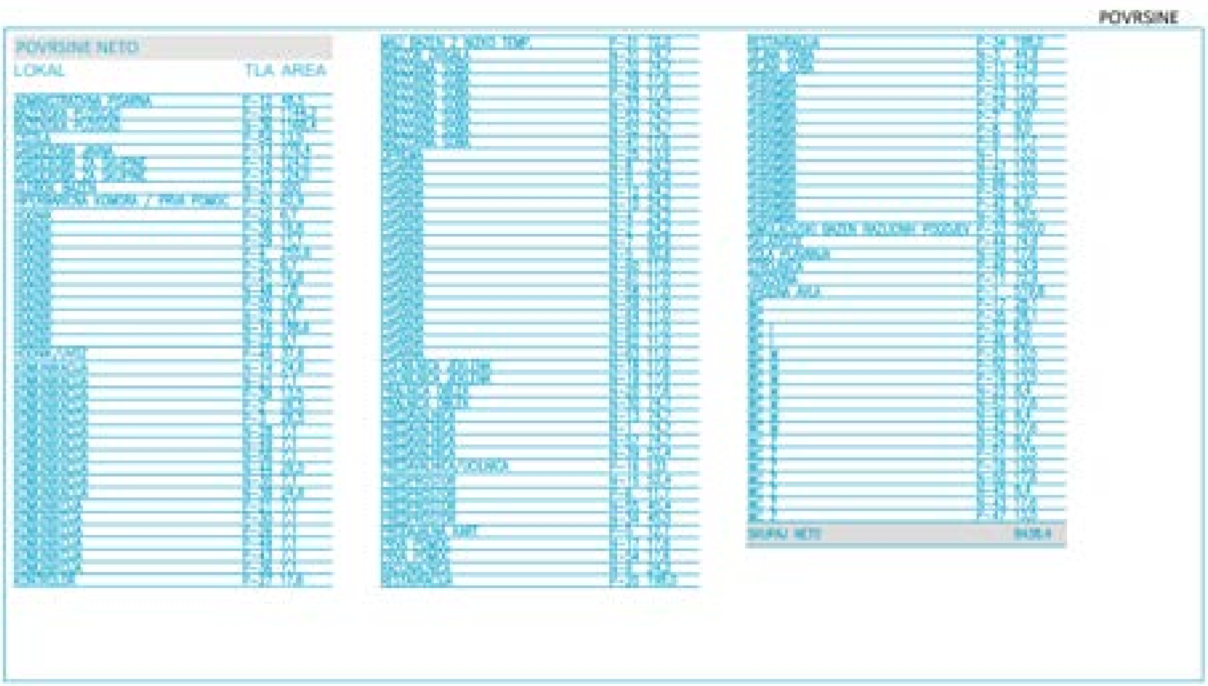


Figure 40: Functional areas in the training center

5.4. Multipurpose pool description

- Dimensions overall: 25 meters by 30 meters,
- On one longer side of the pool, balconies, mounted on a wall at 4.5-meter, 5-meter, and 9-meter heights, will be used for descent and abandon-ship exercises,
- In one corner above the pool, a hanging balcony, 5 meters long and 2 meters wide, will be connected to an external staircase from the pool,
- A 5-meter long part of the wall will be enclosed and fitted doors at 2-meter, 4-meter, 6-meter, and 8-meter heights above the surface.
- There will be a balcony for spectators on the opposite longer side at a height of 5 meters with an open-storage space underneath,
- On one shorter side, a jumping tower will be assembled with jumping boards at heights of 1 meter, 3 meters, 5 meters, 7.5 meters, and 10m meters,
- On the opposite shorter side, there will be a seafety net hanged at the end of the pool (for safety during exercises),
- The prescribed depth below the diving boards is 5 meters and a step at a depth of 4 meters,
- A 4-meter wide mobile underwater platform for exercises at a depth of 1.2 meters,
- Partition in the middle of the pool (optional).

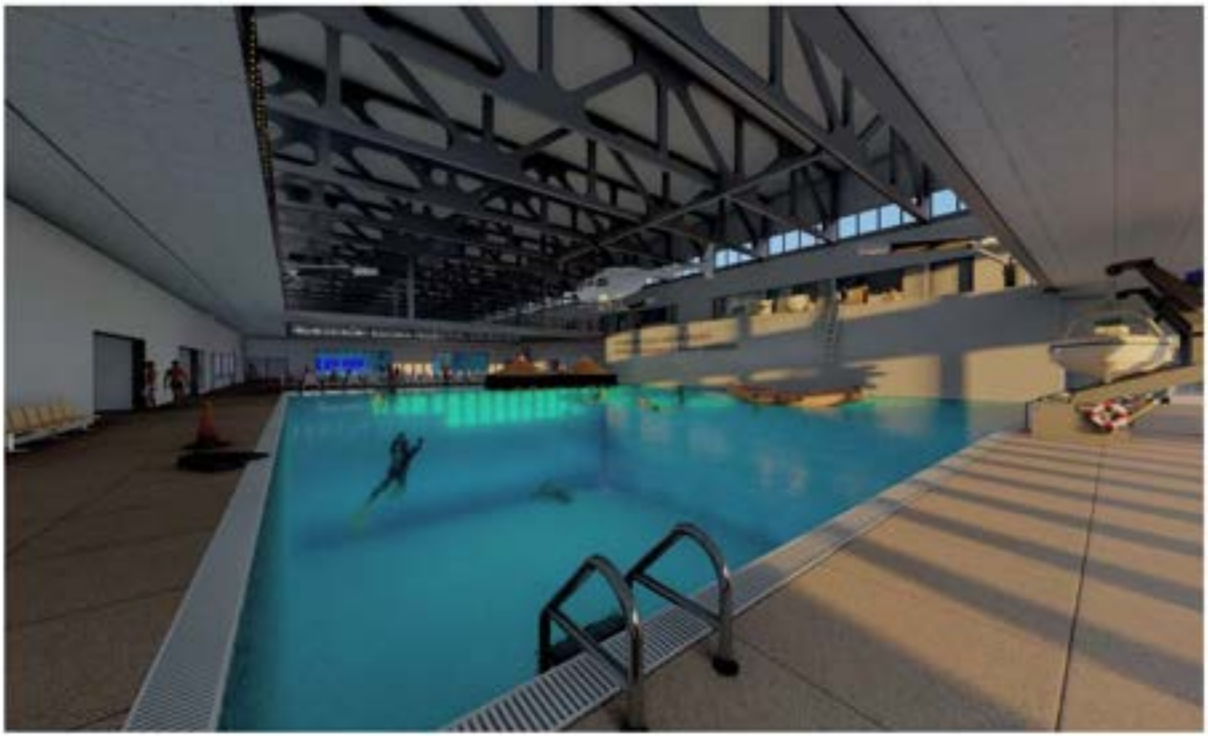


Figure 41: Multipurpose pool

In addition to the general requirements for pools, stronger filtration and an engine room, the multipurpose pool would also have:

- A system for the generation of artificial waves and currents,
- A lighting system, underwater reflectors and cameras,
- Increased lighting (reflectors) of the room,
- A system for complete and partial darkening of the room,
- A water sprinkling system for the simulation of work during rainfall,
- A wind simulation system (fans),
- A strong sound system for the simulation of noise and ship announcement during exercises,
- A control balcony with a control cabin and video surveillance of the pool (safety, analysis of exercises, training, etc.),
- A mobile lift above the pool for simulations of rescue by helicopter, lifting of persons from the sea, etc.),

- Underwater windows at the bottom and certain depths for the observation and supervision of exercises,
- A lift above the working wall for lowering the raft and other objects into the water,
- A powerful ventilation system, also capable of performing simulations, such as working in smoke,
- An underwater lighting and sound system,
- Balconies for installing evacuation systems in vessels on the high wall (the MES systems),
- markings, stickers, and emergency lighting according to the IMO standards.

5.5. Low-temperature small pool description

- Dimensions overall: 12 meters by 6 meters,
- Stepped depths of 1.2 meters, 2 meters, 3 meters, and 4 meters,
- Temperature of 10 degrees Celsius with the possibility of regulating the temperature,
- The possibility of darkening the room,
- Pool lighting,
- Various underwater obstacles - spaces under the pool steps,
- Extremely powerful water filtration,
- A ladder to the bottom of the pool,
- Drains (rinks) at different depths on one side of the pool,
- Windows at different depths on one side of the pool,
- A smaller revolving lift at the edge of the pool.

Figure 42: Cold-water pool

5.6. Deep-water pool description

- Dimensions overall: 20 meters by 25 meters,
- A tunnel 6 meters wide in the deepest part,
- A depth of 45 meters in the deepest part of the pool (another option is a depth of 20 to 25 meters),

Figure 43: An example of a layout of a similar concept

Source:

http://divemagazine.co.uk/skills/8470-deep-poo,https://www.youtube.com/watch?v=HkflOAvLGUI

- Extended step parts at different shallow depths,
- Underwater windows and an underwater observation tunnel,
- Tunnels at different depths,

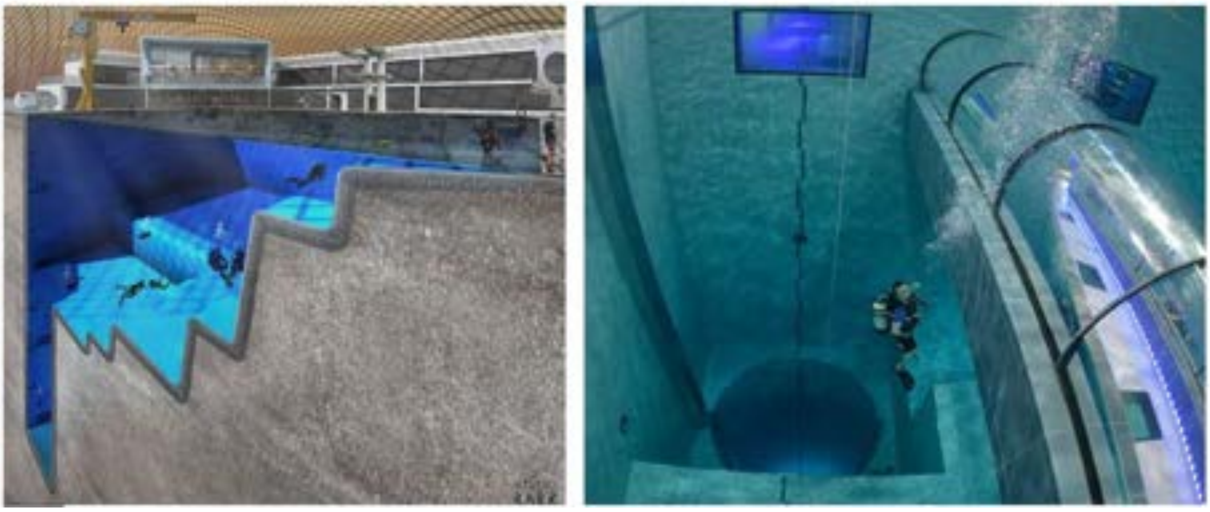


Figure 44: An example of gradual stepped depths and an observation tunnel

Sources:

https://pros-blog.padi.com/blue-abyss-aims-to-build-worlds-largest-and-deepest-research-training-and-development-pool/,

https://www.spotmydive.com/en/top-10/what-are-the-deepest-swimming-pool-in-the-world/

- A connection to a multipurpose pool with a door/hatch (optional,)
- An elevator above the pool,
- Depth marking.

Figure 45: Deep-water pool

6. GAPS

During the collection and analysis of data on available anti-pollution resources including stakeholders, services, assets, and equipment, we have detected the following gaps:

- Data on assets and equipment are incomplete (not all resources are actually listed),
- Assets and equipment are categorized in a non-uniform way (the same assets and pieces of equipment are put under different categories in different listings),
- Different particulars of the same assets and pieces of equipment are stated in different listings,
- The essential particulars to organizing a proper intervention are either not properly listed or not listed at all (missing types, categories, dimensions, capacities, mobilization times, contact points, etc.).

For a more detailed analysis and explanations of the significance of the detected gaps to the cause, see chapter 4.5.

In order to be able to deliver a realistic assessment of the joint recovering capacity and proceed with the development of the contingency plan effectively, these gaps will have to be eliminated. The recommended solutions that we have managed to prepare are presented in the conclusion (see chapter 7).

7. CONCLUSIONS AND SUGGESTIONS

Regarding stakeholders and services, the mapping has been carried out satisfactorily. We do figure that there is still room for minor improvements, but those are being addressed at this very moment.

We have found some obstacles collecting data on available resources. Each of the Partner countries are using their own system for the evidentation of assets and equipment. Most likely, for Tier-1 and Tier-2 interventions that is not even an issue. But, should it come to a larger, Tier-3 cross-border pollution, demanding international effort and precise coordination, that will not be enough.

These are our suggestions for improvement and eliminations of the detected gaps:

- A unified data display system should be used. Our proposal is to place separate databases for each resource location on an open map, such as QGIS, Google Earth, or Google Maps. The The database could be accessed by the password.
- We are not entirely sure who to entrust with the management of the server. The access should be strictly controlled.
- Unified sistematic forms should be used for the mapping of resources providing the necessary particulars and information. See the suggested forms in chapter 4.6.1.
- Common descriptions of assets and equipment should be supplemented by their images.
- We should nominate a permanent technical comittee who will be required to take regular meetings, probably annually, meetings, and have the responsibility to discuss modifications, updates, and improvements for the future.

In our opinion, the overall quantity of assets and equipment in the North Adriatic is sufficient. However, we could not claim with certainty that the same applies to particular locations. The availability of an adequate amount of resources in some locations remains questionable. Sufficient anti-pollution resources are especially important in the Gulf of Trieste and the Gulf of Kvarner, where every minute of delay could result in severe damage to the diverse environment of the area.

The feasibility study for the training center for the governmental service needs is the first step towards better preparedness. At this point, the next steps to take are further studies related to investment plans, spatial planning, geological surveys, eventual modification.

The center will, indeed, not limit their access only to Slovenian users but will also be available to the neighboring countries, promoting cross-border cooperation and enhancing joint efforts for the training of emergency response teams through a common approach.

The renewed oil-spill training simulator has never worked better and faster. The new hardware also allows smoother communication with the navigational simulator NT-PRO, where the visualization of either simulated or real situations is not only possible but incredible.

We strongly recommend that the Partners make use of these advantages, and:

- Share sugestions related to the planned training workshops within the WP 3. In training sessions, we will be using the evidented equipment so as to make scenarios as realistic as possible and test our actual preparedness.
- Use the renewed simulator for the planned excercises within the WP 4.

The simulator could also be used for promotional activities, for instance, live or online demonstrations, videopromotions, pictures for the media, etc.

8. LIST OF FIGURES

9. LIST OF TABLES

10. LIST OF ABBREVIATIONS

ACPDR:	Administration for Civil Protection and Disaster Relief
AOR:	Areas of responsibility
BC:	Beach Commander
CCRA:	Cleaning and cleaning-related activities
CECIS:	Common Emergency Communication and Information System
COLREG:	Convention on the International Regulations for Preventing Collisions at Sea
CP:	Contingency Plan
CRCPH:	Coastal Region Civil Protection Headquarters
DA:	Detection and alerting
DO:	Duty Officer
EA:	Environmental Agency
ELMU:	Ecological Laboratory Mobile Unit
EMSA:	The European Maritime Safety Agency
EPA:	Environment Protection Agency
ENCRS:	The Emergency Notification Centre of the Republic of Slovenia
ERNC:	The Emergency Regional Notification Centre
HNS:	Hazardous and noxious substances
HNS protocol:	Protocol on preparedness, response and co-operation to pollution incidents by hazardous and noxious substances
HO:	Acting Head of Operations
IMDG code:	International Maritime Dangerous Goods Code
IMO:	International Maritime Organisation
IR:	Infrared scanner

LFS:	Laser fluoro-sensors
MARPOL 73/78:	International Convention for the Prevention of Pollution from ships, 1973 as amended by the Protocol of 1978
MI:	Ministry of Interior
MOD:	Ministry of Defence
MOI:	Ministry of Infrastructure
MOSP:	Ministry of Environment and Spatial Planning
MRCC:	Maritime Rescue Co-ordination Centre
MWR:	Microwave radiometer
NAMIRS:	North Adriatic Maritime Incident Response System
NOSC:	National On Scene Commander
OPRC convention:	Oil Pollution, Preparedness, Response and Co-operation convention, 1990
OSC:	On Scene Commander
PAU:	Police Administration Unit
PCO :	Post-cleaning operations
PISCES:	Potential Incident Simulation Control and Evaluation Software
POLREP:	Pollution Report
PP:	Project Partner
PPM:	Prevention, preparedness and monitoring
RC:	Response Commander
RCPC:	Regional Civil Protection Commander
ROUV:	Remotely operated underwater vehicle
SAF:	Slovenian Armed Forces
SAR:	Search and rescue

SAR:	Synthetic aperture radar
SLAR:	Side-looking airborne radar
SMD:	Slovenian Maritime Directorate
SOLAS:	International Convention for the Safety of Life at Sea
SOP:	Standard Operating Procedures
SOSC:	Supreme On Scene Commander
SVOM:	Sea Shore Maritime Administration
UV:	Ultraviolet scanner
WMC:	Watrer Management Company Drava
WP:	Work package

D2.1

Report on Environmental Risk Assessment

NAMIRS
North Adriatic Maritime
Incident Response System

Co-funded by
the European Union

National Institute of Oceanography
and Applied Geophysics – OGS (IT)

University of Ljubljana Faculty of Maritime
Studies and Transport Portorož (SI)

Adriatic Training and Research Centre for
Accidental Marine Pollution Preparedness
and Response – ATRAC (HR)

Administration of the Republic of Slovenia
for Civil Protection and Disaster Relief (SI)

Report on Environmental Risk Assessment
D.2.1

Authors: Vinko Bandelj, Fabrizio Gianni, Donata Canu, Célia Laurent,
Stefano Querin, Serena Zunino (OGS), Valter Suban, Urban Pegan,
Marko Perkovič, Blaž Luin (UL-FPP), Vedran Martinić, Anja Pilepić (ATRAC)
Publisher: Central European Initiative (CEI), University of Ljubljana,
Faculty of Maritime Studies and Transport (UL-FPP)

Year of publication: 2024
Print run: printed digitally
Co-funded by the European Union

Risk Assessment finalised on February 28th, 2023.

D2.1

Report on Environmental Risk Assessment

NAMIRS
North Adriatic Maritime
Incident Response System

Co-funded by
the European Union

1

Introduction

1 / Introduction

This report describes the activities carried out in the framework of the Activity 2.1 – Environmental Risk Assessment of NAMIRS. According to the project proposal, the goals and scopes of the Activity were to perform an Environmental Risk Assessment. The report showcases a methodology to conduct the oil spill risk assessment by integrating different tools such as the identification of particularly sensitive areas and the assessment of their vulnerability, the statistical and expert-based analysis of the ship traffics and oil spill probability, and a numerical oil spill model statistically assessing the oil spill hazard. The vulnerability assessment was done through stakeholder involvement following a participatory approach, as detailed in the report in order to assign scores (weights) to the different receptors. Through the assessment model developed, environmental damages in case of ship accidents (collision/sinking/grounding) are studied, taking especially into account the impact of oil-spill in marine sensitive areas and their secondary but relevant impact on the economy, and on the life of people living on the shore. The results of Activity 2.1. will help in contingency planning which is the main outcome expected from NAMIRS.

The activity was led by OGS, coordinated by URSZR in the wider context of NAMIRS WP2, and saw the active collaboration of the University of Ljubljana (UL-FPP) for most activities, and of ATRAC for the organization of the stakeholders' workshop in Croatia.

Figure 1: Schematic representation of Activity 2.1, its division in 4 tasks, and the related specific subtasks. The logos of the partners indicate the main responsibility for each Task or subtask, but all three partners actively collaborated during the whole Activity 2.1.

For operative purposes, activity 2.1 was subdivided into four tasks (Fig. 1):

1. Risk of Accidents
2. Oil Spill Simulations
3. Vulnerability of coastal and Sea Areas in the Northern Adriatic Sea
4. Risk Assessment

The four tasks are devoted to the definition of the hazard (Task 1), exposition (Task 2), and vulnerability (Task 3) of the area of interest, while the risk assessment is computed in Task 4 is the risk, as a function of hazard, exposition, and vulnerability, is computed.
The organization of the report is as follows: Section 2 is devoted to the description of the activities of UL-FPP for the analysis of the risk of accidents in the Northern Adriatic Sea (Task 1); Section 3 to the description of the activities of OGS regarding oil spill simulations (Task 2); Section 4 to the description of the activities regarding the stakeholders involvement, i.e. to the preparation of the questionnaires and to the activities regarding the stakeholders' workshops on behalf of UL-FPP, ATRAC and OGS; Section 5 to the vulnerability mapping and assessing in the coastal areas of the Northern Adriatic Sea; Section 6 to the description of the activities for the computation of the final risk index and the production of the relative mappings; Section 7 brings some general final remarks and suggestions for possible future developments of the work.

2

Traffic data analysis and hazard estimation

2 / Traffic data analysis and hazard estimation

The Faculty of Maritime Studies of the University of Ljubljana, as a partner in the NAMIRS project, was commissioned to study maritime traffic in the northern Adriatic from the point of view of the risk of maritime accidents resulting from the significant oil release (Task 1 of Activity 2.1).

2.1 Introduction

The aim of the Section is to examine the nautical risks, focusing on potential accidents occurring during the vessel en-route to and from one of the major ports in the northern Adriatic Sea. The risk assessment is carried out for actual traffic conditions and comparative simulations, including traffic separation systems. The focus of the risk assessment is on commercial vessels, but fishing and recreational vessels are also considered to some extent.

Marine casualty risk assessment is one of the bases for implementing measures to reduce the number of marine casualties, but also one of the bases for improving the overall risk management of such casualties. This includes the analysis and design of the response measures available in the region, which measures and how they should be improved in order to achieve a balanced and satisfactory response to disasters, thus reducing the consequences in terms of human lives, environmental pollution and economic damage.

Neither Italian, Slovenian nor Croatian legislation do prescribe approaches or methods for assessing the risk of accidents at sea. Based on the international scientific and technical literature, the recommendations of the International Maritime Organization (IMO) and of the European Maritime Safety Agency (EMSA), and the Emergency Response Centre for Marine Pollution in the Mediterranean (REMPEC) combination of qualitative and quantitative approaches were applied. This is particularly important in order to obtain the most realistic assessment possible, given the local situation, as in some parts of the risk assessment it is practically impossible to give a quantitative assessment based on the local situation, simply because there are no statistics or relevant events (e.g. the assessment of the probability of a major spill of hazardous substances on the water cannot be based on the frequency of events in our area, as this has not yet happened).

The collision and stranding frequency calculations are based on historical event statistics and near misses. These are based on vessel movement data via AIS. The consequences of accidents are described in qualitative terms. The identification of risk sources includes the screening of all hazardous substances on board ships in transit that could be released into the environment and thus cause adverse effects.

2.2 AIS data

Near offshore traffic and coastal traffic along with confined waters traffic can be easily monitored using shore AIS base stations. The system, called AIS (Automatic Identification System), is primarily for ships. It allows a vessel to detect another vessel in time, even in poor visibility when radar is unable to indicate all hazards in the water, and to obtain the necessary information about the sighted vessel without establishing a radio link. Maritime industry stakeholders built the AIS with the goal of improving maritime safety, security, and their assessment. The AIS was launched as a joint effort of the International Maritime organization (IMO), the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA), the International Telecommunication Union (ITU), and the International Electrotechnical Commission (IEC). Originally, AIS was introduced on certain types of International Convention for Safety of Life at Sea (SOLAS) ships to assist the Officer of the Watch (OOW) in making decisions in the event of a collision. Naturally, the AIS system was immediately used in Vessel Traffic Service (VTS) systems for vessel traffic control. Officially, AIS was first recognized in 1998 by a resolution of the International Maritime Organization (IMO) adopted at the 69th session of the Maritime Safety Committee (MSC). The AIS device is capable of transmitting information to vessels and coastal authorities automatically, with the required accuracy and using only the designated radio frequencies. AIS operates in the VHF frequency band. It has been assigned two channels: AIS 1 (161.975 MHz - marine band channel 87B) and AIS 2 (162.025 MHz - marine band channel 88B). The nominal reporting intervals for data transmission vary from 2 seconds to 6 minutes and depends on the type of AIS station, the group of messages, the navigational status, the speed and the course change of ships (Burmeister et al., 2014). Slower ships send kinematic data every 10 seconds, medium speed ships every 6 seconds, high speed ships every two seconds. If the ship changes heading, the transmission intensity increases by a factor of 3 (for slower and medium speed ships). Table 1 shows the transmission intensity of static and dynamic information for Class A and B and for Single and Dual Channel Transceivers. AIS Transponders can receive all transmission information from both AIS channels simultaneously and combine the information from both channels into a single data stream. The standards of transmission, types, the format of messages and symbols, make it simple for users to identify, monitor, and track targets detected by AIS.

AIS Class A Transponder - Ships Dynamic Conditions	Dual Channel	Single Channel
Ship at anchor or moored	3 min	6 min
SOG 0-14 knots	10 sec	20 sec
SOG 0-14 knots and changing	3.3 sec	6.6 sec
SOG 14-23 knots	6 sec	12 sec
SOG 14-23 knots and changing course	2 sec	4 sec
SOG >23 knots	2 sec	4 sec
Ship Static Information	6 min	12 min
AIS Class B Transponder - Ships Dynamic Conditions	**Dual Channel**	**Single Channel**
SOG <2 knots	3 min	6 min
SOG >2 knots	30 sec	1 min
SOG		
Ship Static Information	6 min	12 min

Table 1: Transmission period of dynamic data (IALA, 2016).

The AIS system must be capable of processing at least 2000 messages per minute when used as a ship reporting system. The technical characteristics of AIS, such as variable transmission power, operating frequencies, modulation and antenna systems, are specified in the ITU (International Telecommunication Union) standards. The envisaged capacity of 4500 telegrams per minute is assumed to be sufficient for unrestricted ship-to-ship (2S) and even ship-to-shore (4S) use, with a typical range of 20 nautical miles (NM) between ships and up to 40 NM between ship and shore. The theoretical range of the system is given by the following equation:

$$d_{min}=2.5(\sqrt{(height_{TXant}[m]\,)}+\sqrt{(height_{RX\,ant}\,[m]\,)})=range\,[Nm]$$

The main AIS receiving antenna in Slovenia is located on Slavnik, while in Croatia (for the northern Adriatic Sea) it is located on Učka. Both antennas are on excellent locations, so there is also good monitoring of shipping traffic. For example, a VHF antenna at 1030 metres receiving data from a large merchant vessel with a VHF antenna at 49 metres has a range of 100 NM:

$$2.5(\sqrt{1026}+\sqrt{49}) \approx 100Nm$$

Today's applications of AIS data have shifted from use for collision avoidance, identification, and tracking to monitoring shipping routes, maritime traffic trends, risk analysis, marine accident investigations, near-miss investigations, search and rescue operations, waterway planning, management and maintenance using AtoNs (Aid to Navigation), traffic simulation, and forecasting, fisheries monitoring, environmental monitoring, prevention of illegal activities at sea.

Fig. 2 shows the current ship status in the Northern Adriatic, while Fig. 3 shows yearly based traffic density. This information is available from the MarinTraffic provider, which collects AIS data on a voluntary basis.

Figure 2: Example of the vessel position on 07.09.2022 at 08:25 in the study area. (Source: MarineTraffic)

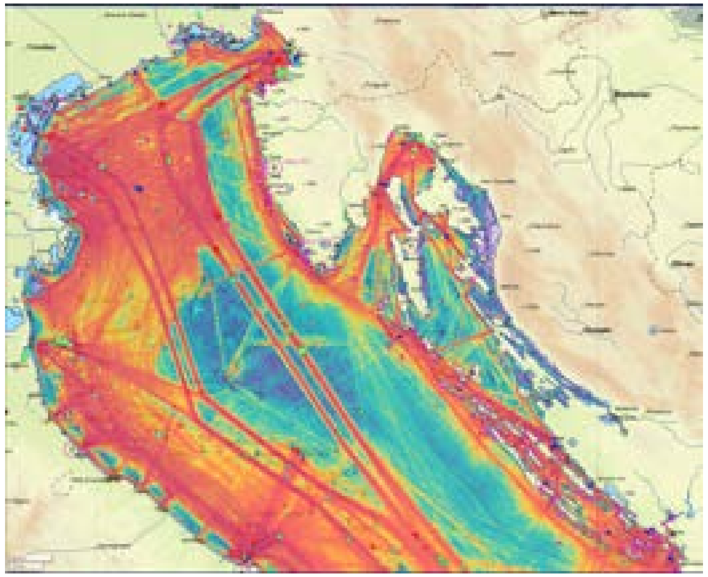


Figure 3: All ships traffic density in 2020-2021 in the study area. (Source: MarineTraffic)

The Slovenian Maritime Administration integrates AIS from the following sources:

1. AIS BS SLAVNIK - MMSI 002780201
Latitude= 45°32.028947' –> 45.53381578°
Longitude= 13°58.517946' –>13.97529910°
MSL= 1025.68m

2. AIS BS IZOLA - MMSI 002780202
Latitude= 45°32.669470'
Longitude= 13°41.204462'
MSL= 135.88m
MSL_{GPS} = 135.88+44.477=180.357m

3. AIS BS KOPER - MMSI 002780203 (MSL=54.387 m)

4. AIS BS POORTOROŽ - MMSI 002780204
(Installed by UL FPP and shared with the MarineTraffic system)

5. MARES stream - display of AIS data extracted from the national AIS systems of the Mediterranean countries. The main service provided by the AIS server is the collection and transmission of AIS data in real time and its storage in databases.
The AIS storage is done with the commercial software of Transas/Wartsila "TranDB", which writes the data into a MS SQL database, where due to the amount of data the messages are recorded in a separate table for each message type and each day:

Table 2: AIS messages grouped.

Name of the table
dbo.part_(YYYY-MM-DD hh:mm)_MsgPos
dbo.part_(YYYY-MM-DD hh:mm)_MsgPos2
dbo.part_(YYYY-MM-DD hh:mm)_Msg5
dbo.part_(YYYY-MM-DD hh:mm)_MsgOther1
dbo.part_(YYYY-MM-DD hh:mm)_MsgOther2
dbo.part_(YYYY-MM-DD hh:mm)_MsgNonAIS

Table 3: explanations of the abbreviations in Table 2.

YYYY	Year
MM	Month
DD	Day
Hh	Clock
mm	Minute
msg	Message
Other	Other messages

Up to 250 million AIS messages are recorded monthly only for the Northern Adriatic area. Commercial devices do not allow the export of large amounts of data from AIS without disrupting the ongoing AIS recording. Therefore, we set up a parallel offline server on the UL-FPP with identical (commercial) software and synchronized the databases with those available on the UL-FPP. To export data from a specific area and time period, we used a Python 3.6 script that uses the pymssql library and writes the desired data to CSV files for further processing. When exporting, the geographic coordinates must also be recalculated since they are not in the standard notation.

The data is exported to a separate file for each month, as this makes the most sense given the number of records.

For further processing, we used the Pandas tool for Python to import the data. This allows to quickly filter the data by various criteria once it is loaded into memory. To process the large amount of AIS data, we developed three batch processing programs. During the pre-processing, only data limited to the desired geographical area is extracted, the original SQL database record is exported as a csv file for a time period of two months. The files were read using the Pandas library for Python. As the ship trajectories are given at different sampling rates, depending on the ship speed and navigation status (Table 1), all trajectories were resampled to a period of 10 s. This simplified or speeded up the calculation steps.

When no information about a ship was available for more than 120 s, it was assumed to be stationary. The resampling was performed by linear interpolation of velocities and positions between known points.

In addition to the pre-processing of the input data, a grid was defined for the calculation by setting the longitude and latitude step.

Fig. 4 shows vessel density due to all traffic in 2019 in the northern part of the Northern Adriatic Sea. The largest number of messages (maximum 13,105,332 messages) is in the ports and terminals marked in purple (e.g., the Rovigo LNG terminal).

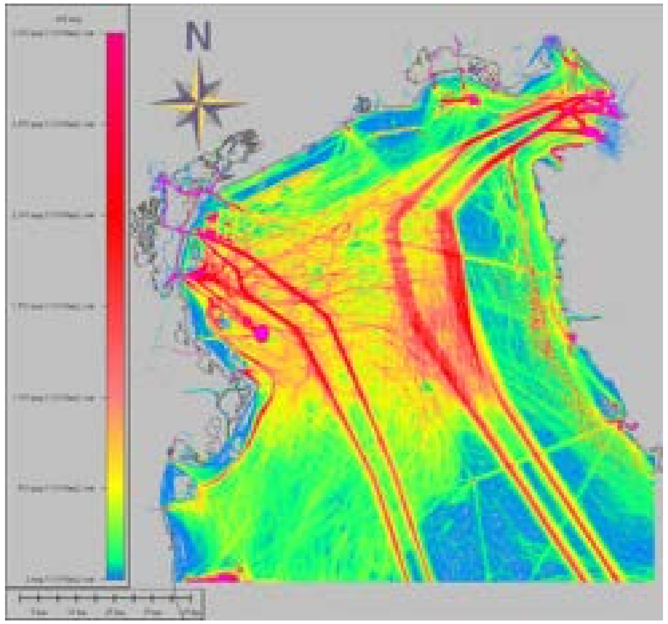


Figure 4: High resolution traffic density chart in 2019, main routes, ports are terminals are clearly identified.

2.3 Traffic data – spatial distribution analysis

The shipping densities are discussed in more detail below. First, ships are classified into size classes, small ships less than 50 meters in length, which includes all fishing boats, pleasure crafts and service vessels, then up to 150 meters, which includes mainly coaster ships, ships up to 230 meters, and ships up to 300 meters in length, and ships larger than 300 meters, which includes mainly container ships. For all these size classes, density maps are then produced for the distribution of average ship size, number of ships, occupancy time of ships and speed distribution.

Fig. 5 showing the distribution of average ship lengths within the 50-meter class clearly identifies the positions of the larger service ships close to 50 meters in length i.e., the red lines connecting the offshore platforms. Fig. 6 shows the distribution of ships (number of ships in each cell) in a class within 50 meters of the ship's length. The highest density of small vessels is in the coastal zone on the Croatian side, while Italian fishing boats sail all the way to the border zone. Fig. 7 shows the distribution of occupancy time (in seconds) in each cell, for ships less than 50 meters in length. This figure accurately depicts the locations of fishing boats, especially the stationary locations along the Istrian coast. In addition to the obstacles in the way shown in the previous figures, shipping speeds are also important. Fig. 8 shows the distribution of these, which are highest on service vessel courses, up to 15 knots on average.

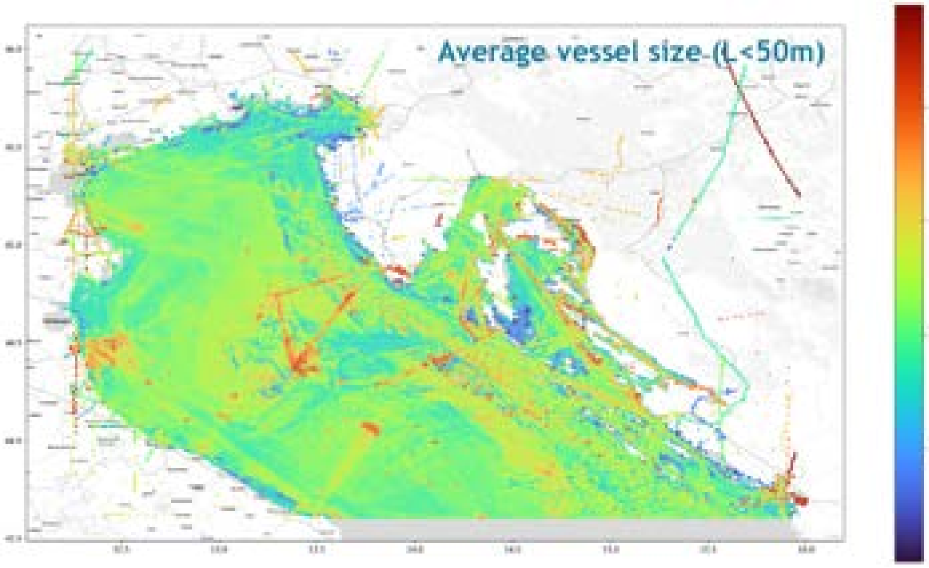


Figure 5: Average vessel size distribution (L<50m)

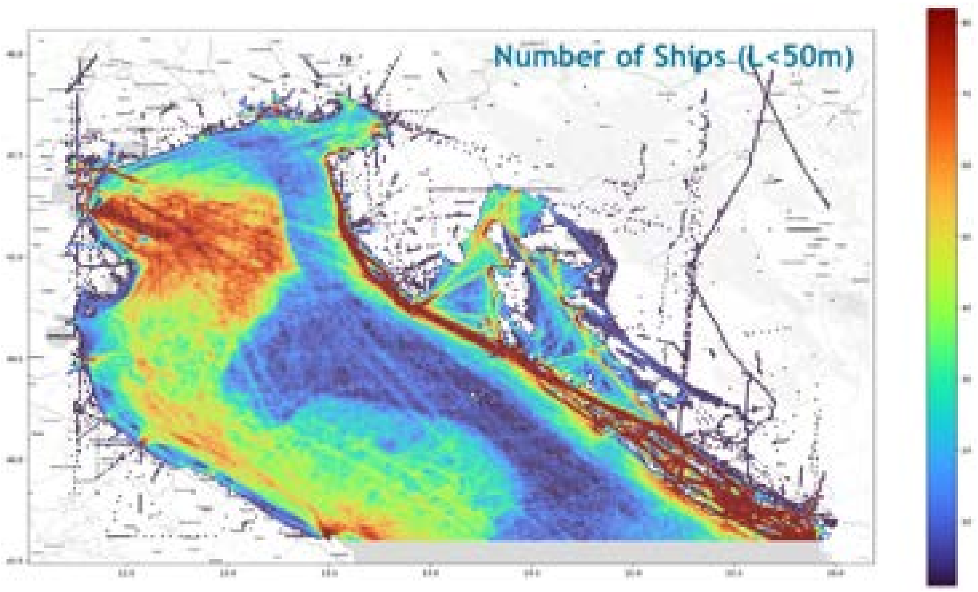


Figure 6: Ships position distribution (L<50m).

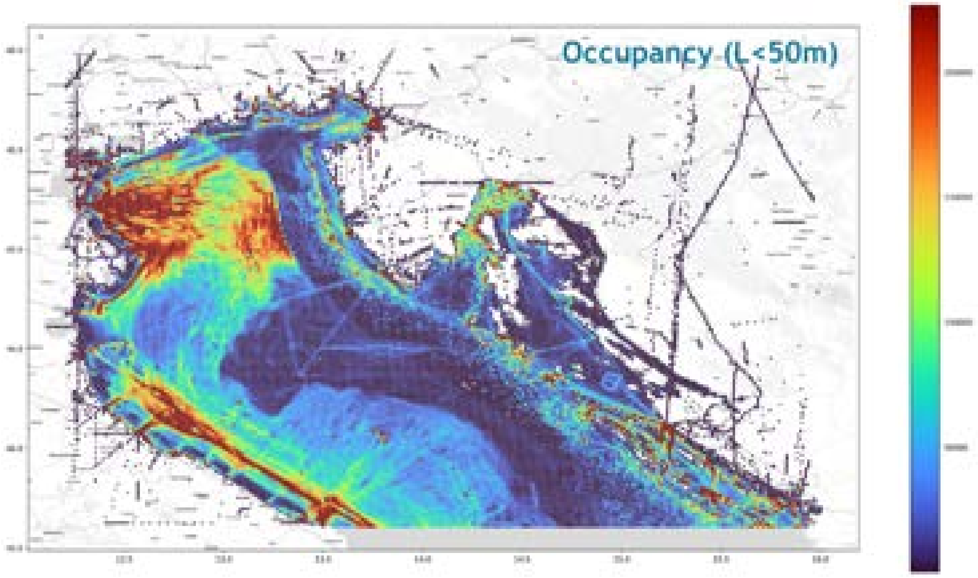


Figure 7: Temporal distribution (L<50m).

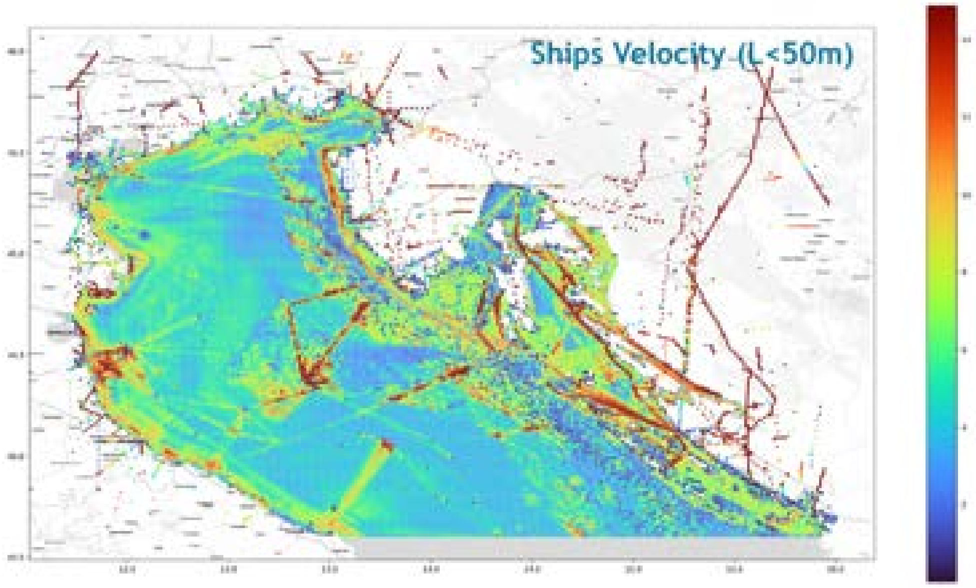


Figure 8: Ship velocity distribution (L<50m)

In the class of ships up to 150 meters in length, the distribution of ship average length is almost equally spread over the whole area except for the part dedicated to the offshore industry (Fig. 9). The figure gives a slight indication of the main traffic flows.

The distribution of vessels (number of vessels in each cell) in a class within 50 and 150 meters of length is shown Fig. 10. The highest density of coastal vessels is in the main lanes leading to major regional ports.

At first glance, the temporal distribution for this class of vessels (Fig. 11) looks like the positional distribution, but a closer look clearly shows anchorages that could obstruct ships as they navigate or be a potential location for collisions between ships.

The distribution of ship speeds also evidences the anchorages (Fig. 12), but also the courses of the larger offshore supply vessels. Furthermore, the figure shows that smaller merchant ships move on average steam at less than 15 knots.

As in the previous length class, the distribution of the average length of vessels in the 150 to 230 meter class is not evenly spread over the whole area. Fig. 13 gives a better indication of the main traffic flows.

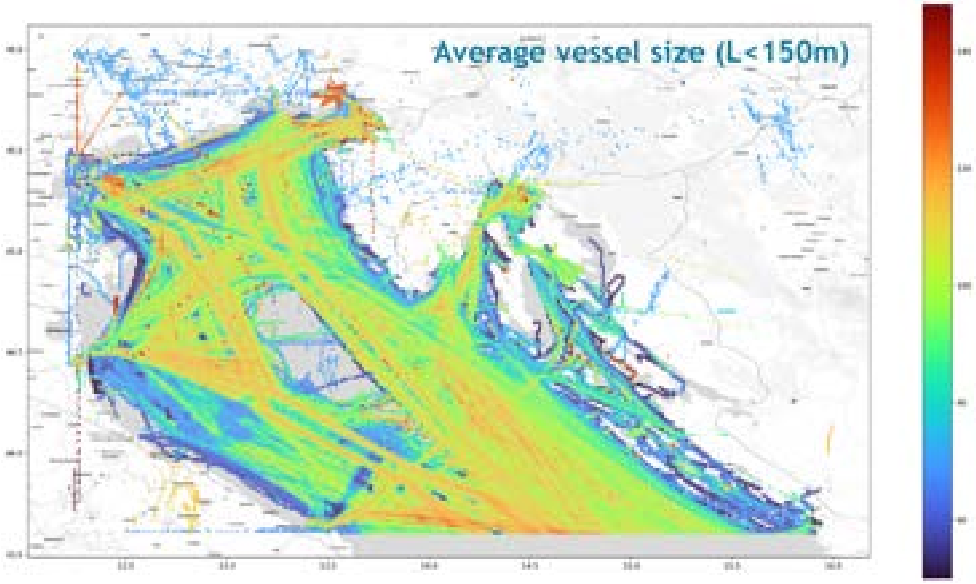


Figure 9: Average vessel size distribution (50<L<150m).

Figure 10: Ships position distribution (50<L<150m).

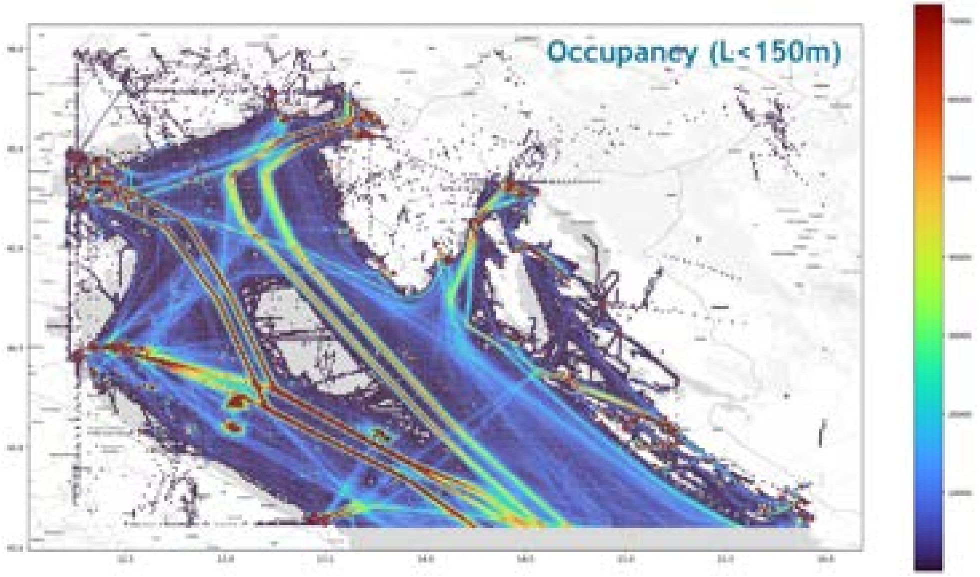


Figure 11: Temporal distribution (50<L<150m).

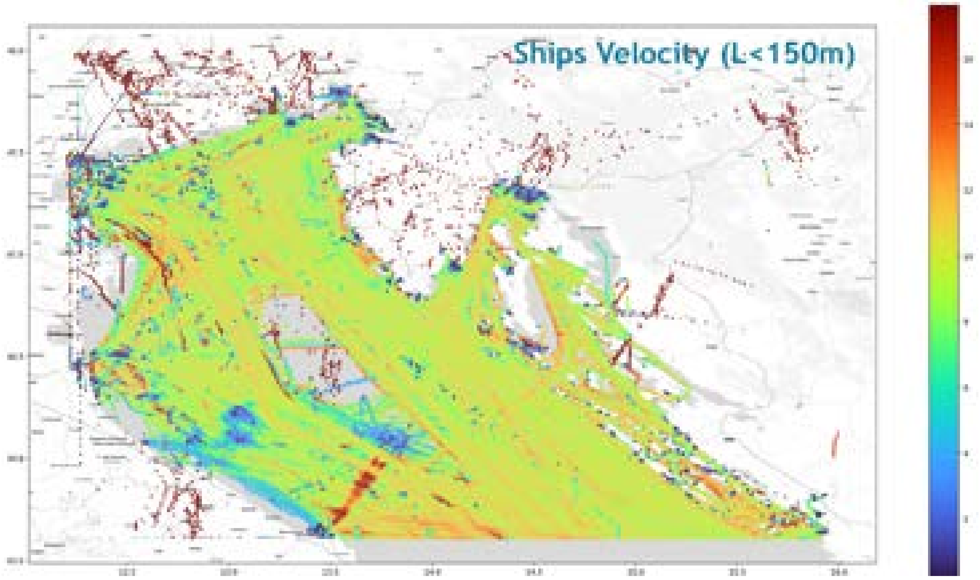


Figure 12: Ship velocity distribution (50>L<150m).

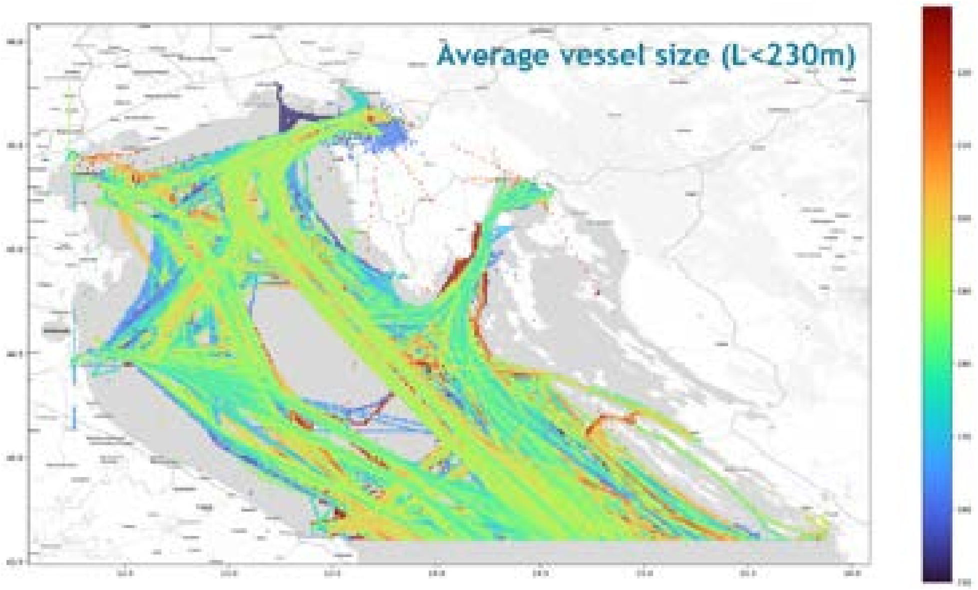


Figure 13: Average vessel size distribution (150<L<230m).

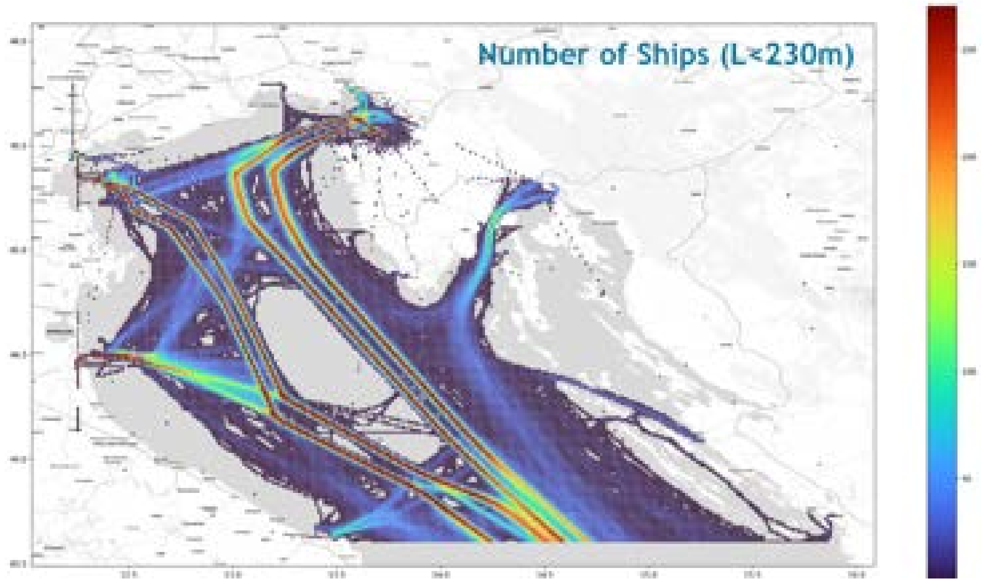


Figure 14: Ships position distribution (150<L<230m).

The distribution of ship positions in this length class shows more clearly the shipping lanes in relation to the previous class, and it is also clear that there are more ships, with the number of ships in each cell reaching up to 270 ships (Fig. 14). The distribution of the occupancy of the individual cells in the 150-230 meter class is indeed illustrative of the fairways (Fig. 15), there are no more visible anchorages of larger superyachts in this class. The locations of the main ports can be clearly seen. In this class, the speed distribution chart also shows shipping lanes where the speed of the ships is slightly higher compared to ships in the previous class (Fig. 16): on the fairway, average speeds reach 17 knots.

The distribution of average ship lengths in the 230 to 300 meter class occupies a much smaller area, with occupied cells concentrated around waterways and ports (Fig. 17). It is interesting to note that in this class the average length of the ships calling Venice is slightly greater than that of the ships calling Koper, Trieste and Monfalcone, mainly due to the cruisers.

The distribution of the number of ships (Fig. 18) shows that traffic to the Gulf of Trieste is significantly higher than traffic to Venice. The spatial distribution of ships is, of course, similar to the distribution of average ships lengths.

The occupancy of each cell is concentrated around traffic lanes, anchorages, and harbours (Fig. 19). This spatial distribution is also consistent with the other distributions in this class.

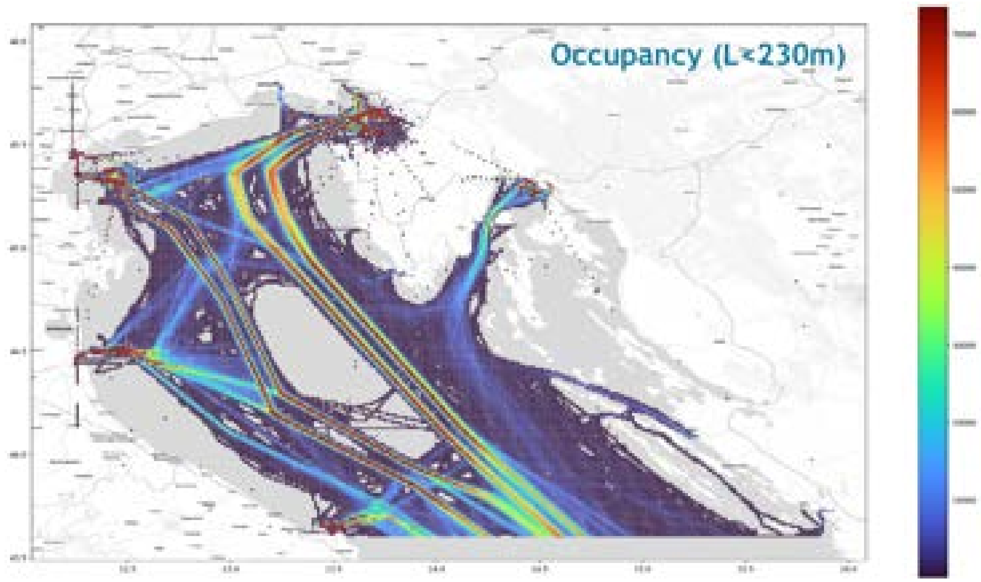


Figure 15: Temporal distribution (150<L<230m).

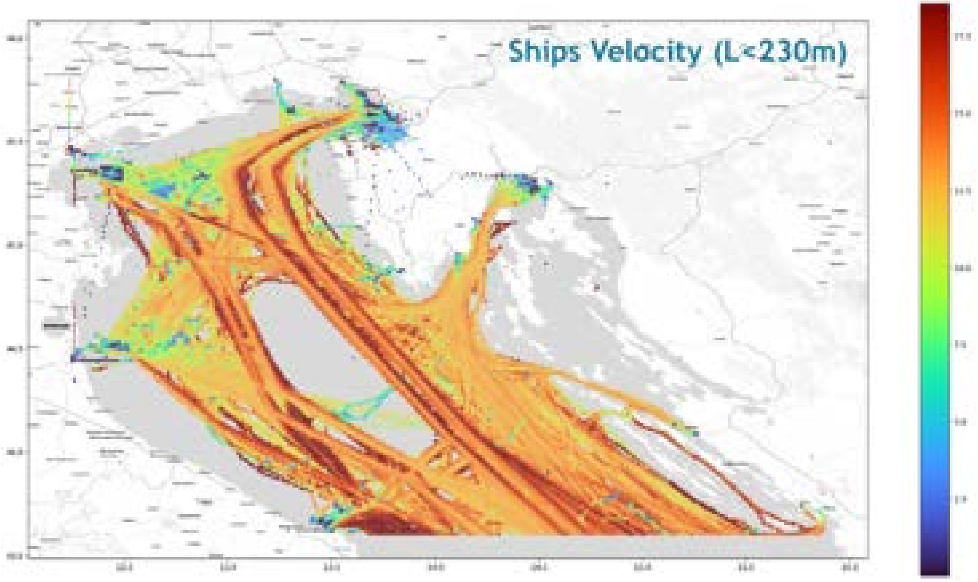


Figure 16: Ship velocity distribution (150<L<230m).

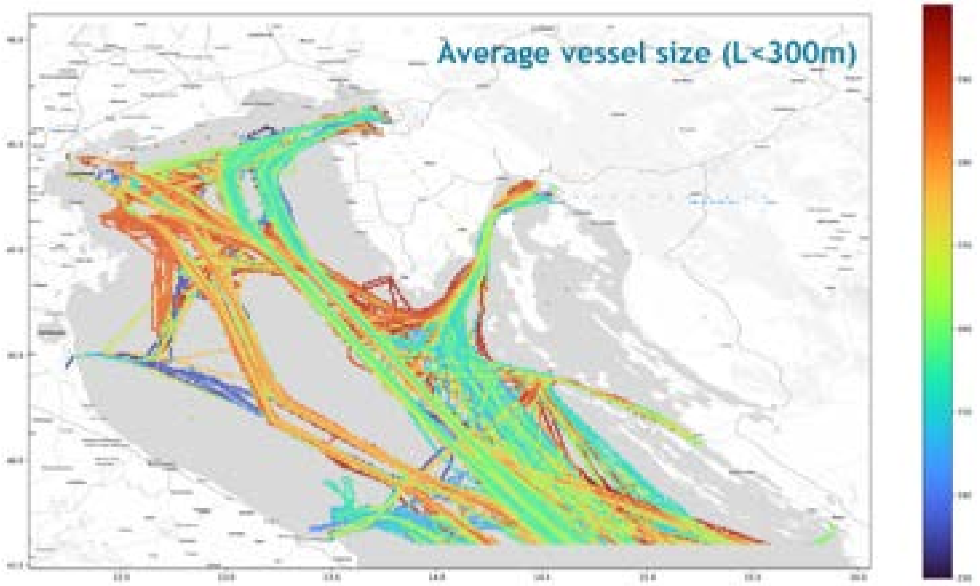


Figure 17: Average vessel size distribution (230<L<300m).

Larger vessels do also have slightly higher speed (Fig. 20), which in the event of a collision means a higher energy of penetration of the ship's plating and a higher probability of fuel or cargo release.

The biggest ships in the region, i.e., those exceeding 300 m, are the container ships - the motherships that regularly operate the liner service, Koper, Trieste, Rijeka (Fig. 21). There is also a share of ships that calls Venice, mainly cruisers (Fig. 22). The spatial distribution of occupancy per cell provides similar information than the distributions of the other relevant quantities (Fig. 23). However, the occupancy is lower than that of other classes of vessels because there are fewer of them, and they are much faster (Fig. 24). In the event of a collision, the energy released is enormous, and if any ship collides with a large container ship, the amount of bunker fuel that can be spilled is significant.

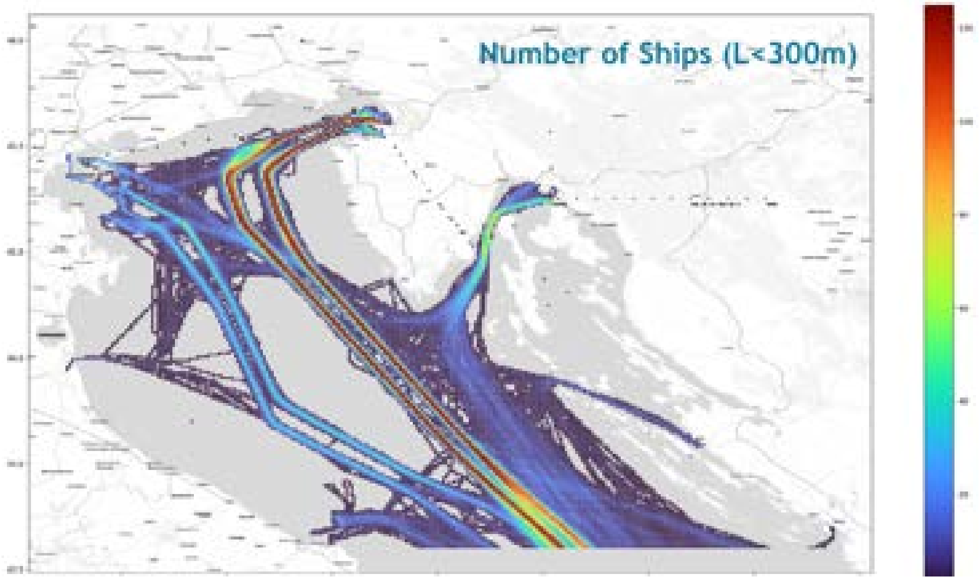


Figure 18: Ships position distribution (230<L<300m).

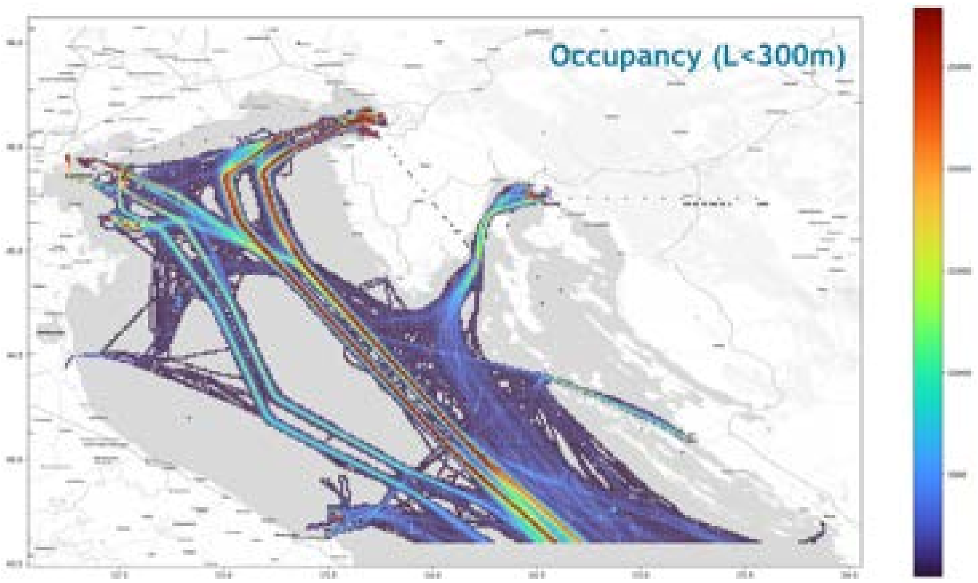


Figure 19: Temporal distribution (230<L<300m).

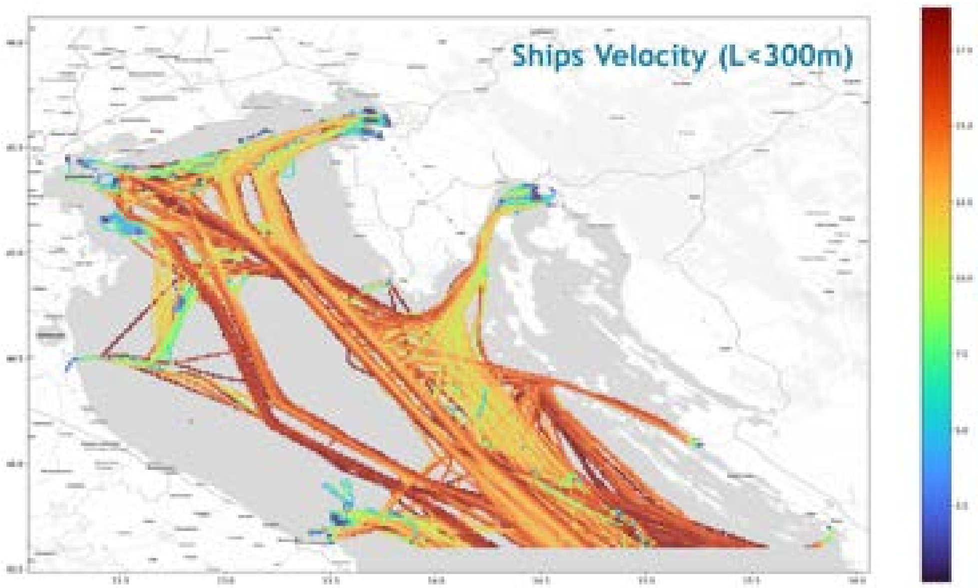


Figure 20: Ship velocity distribution (230<L<300m).

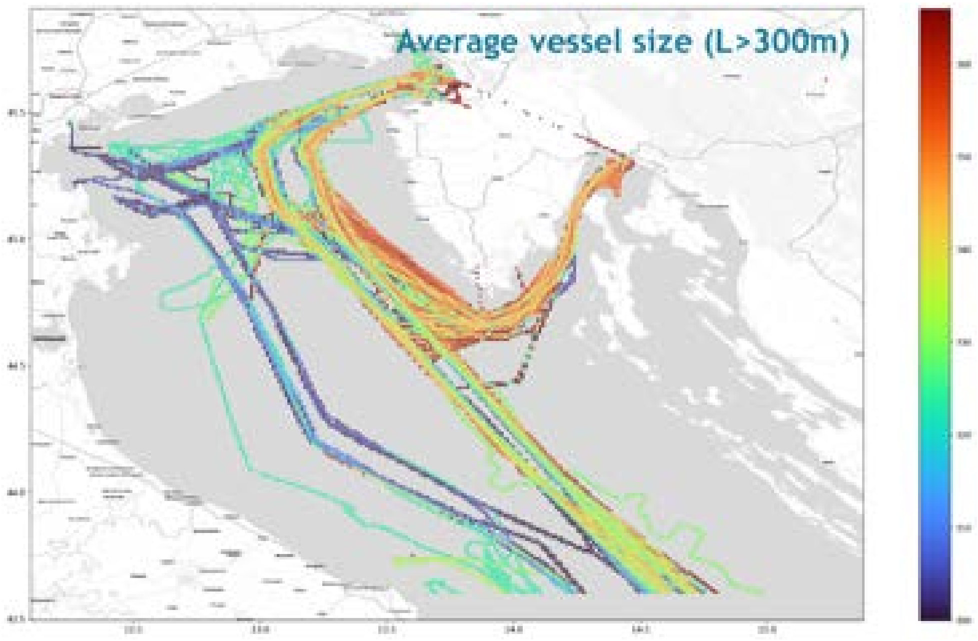


Figure 21: Average vessel size distribution (L>300m).

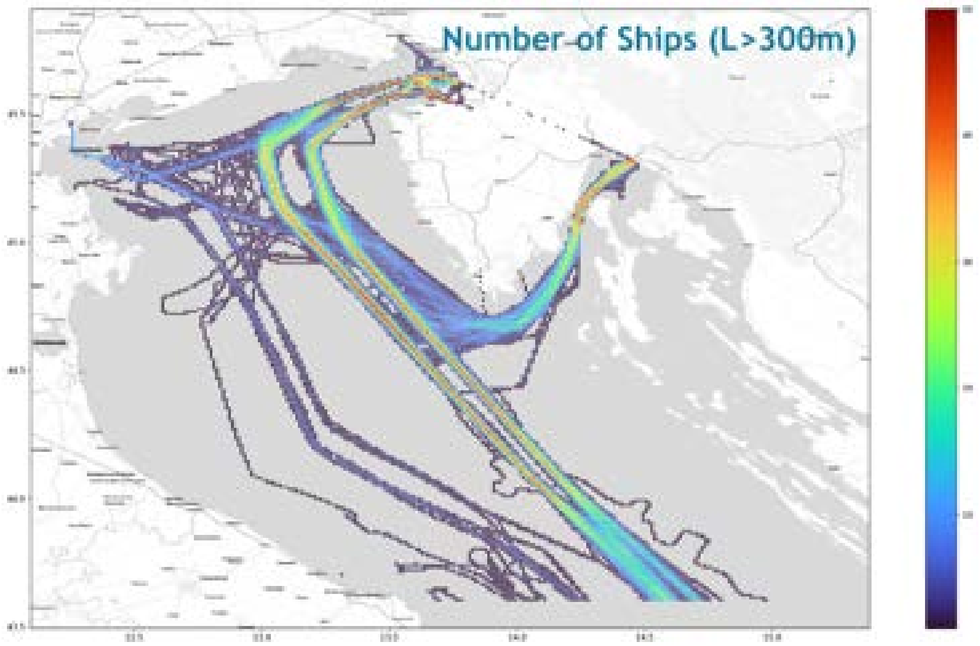


Figure 22: Ships position distribution (L>300m).

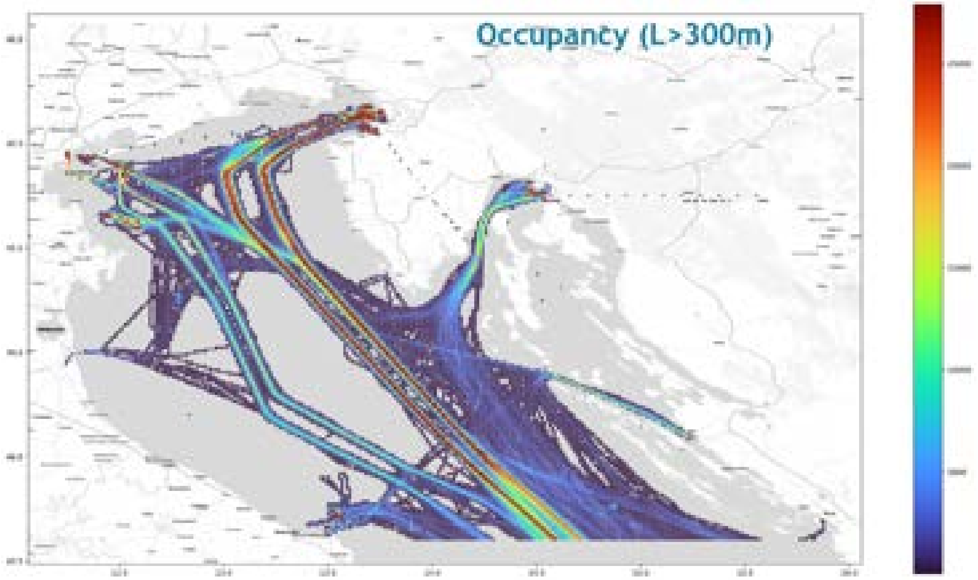


Figure 23: Temporal distribution (L>300m).

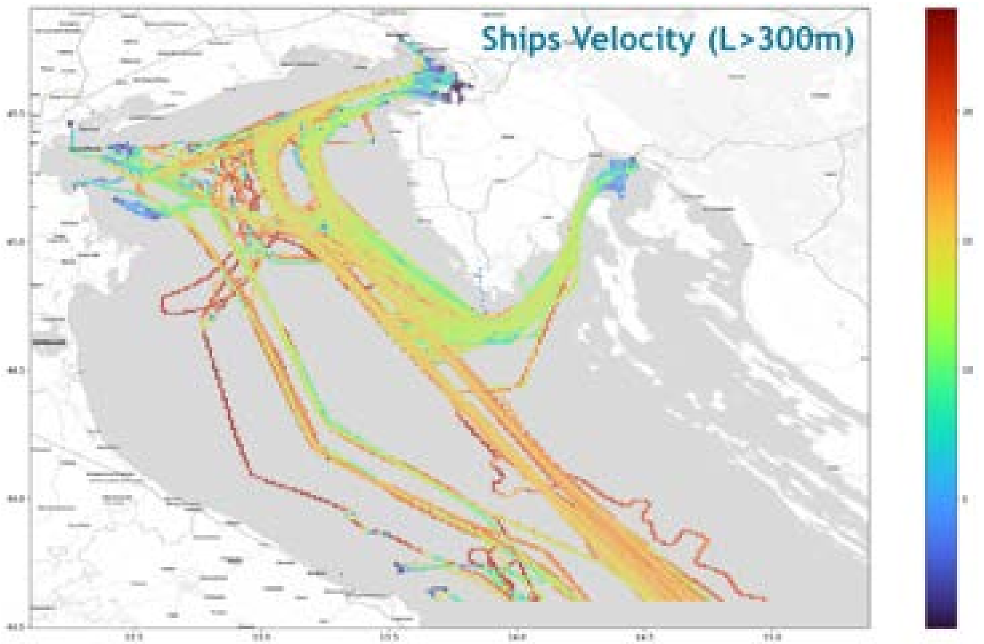


Figure 24: Ship velocity distribution (L>300m).

Figs. 25-26 shows the distribution of traffic as well as the density of ships, divided in four main categories: tankers, service vessels (well evident is a grid pattern of the trajectories of service vessels exploring for hydrocarbons under the seabed in Croatia), passenger ships (ferries and cruisers), and finally ro-ro ships, dry cargo ships such as container ships, general cargo ships, and bulk carriers. It can be seen that the vast majority of ships sail along the entire Adriatic Sea, irrespective of the type of ship.

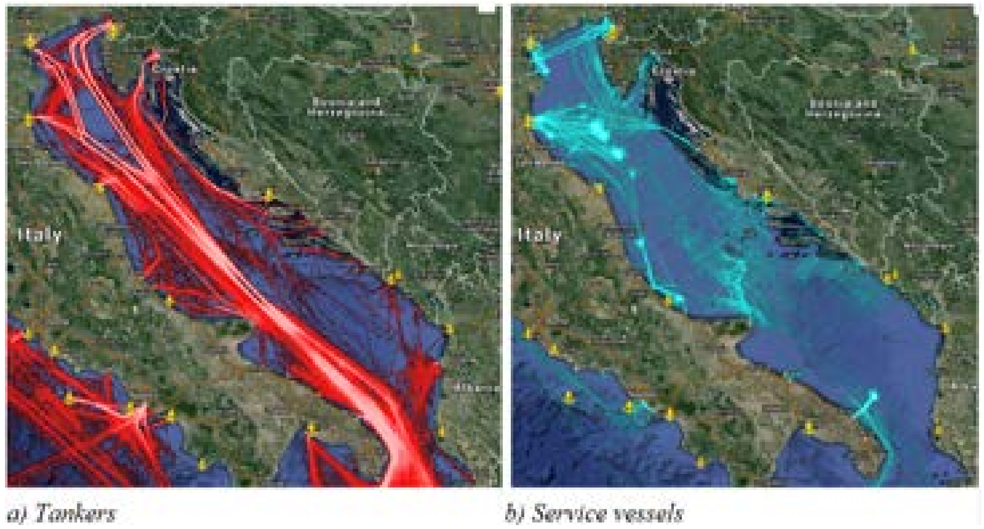


Figure 25: Traffic density for Tankers and Service vessels.

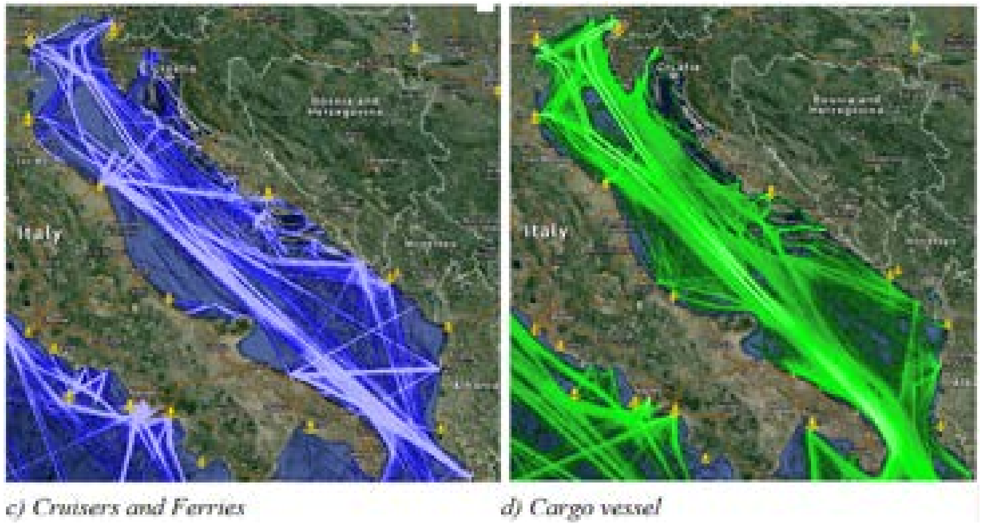


Figure 26: Traffic density for Cruisers and dry cargo ships.

2.4 Incidents and accidents – some examples

The traffic survey shows that shipping in the region is moderate, that there is a wide variety of ships, and that although there is a traffic separation scheme, accidents can happen. Figs. 27-30 provide several examples of possible incidents in the area. Fig. 27 shows a realistic example of a possible collision within a Traffic Separation Scheme (TSS). A ship sailing inside the TSS, "Trident Hope", assumed it had the right of way, and 6 minutes before the collision it started an avoiding maneuver.

Figure 27: Close encounter at the exit of the TSS - "Trident Hope".

Fig. 28 shows a near miss when the ship "Anamcara" intersected the TSS incorrectly and at the same time made two wrong turns inside the TSS.

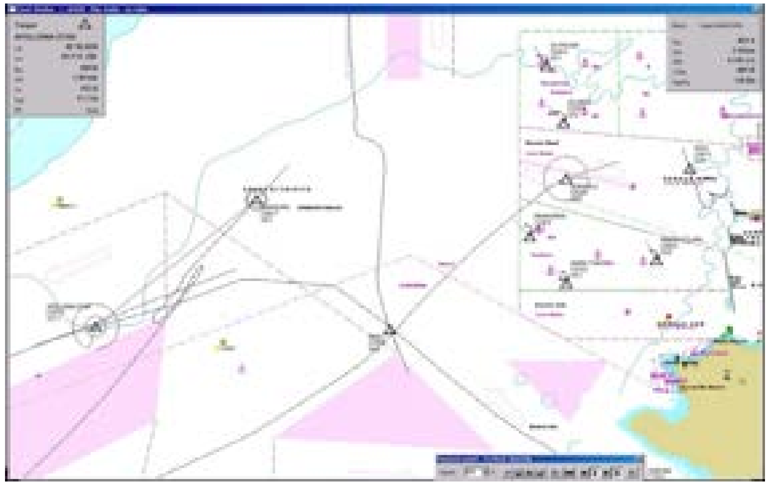


Figure 28: Near collision - "Anamcara".

Fig.29 shows a close encounter between the tanker "Seanostrum" and a ship improperly intersecting the TSS "Niyazi Gokalp".

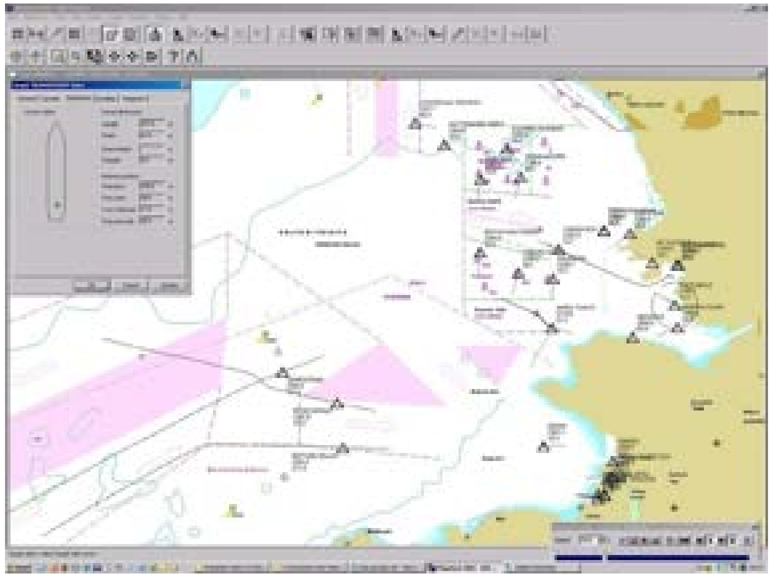


Figure 29: Close encounter of the "Niyazi Gokalp" with the tanker "Seanostrum".

The last example (Fig. 30) shows the large merchant ship "Und Atilm" (length 195 m - sister ship to the recently burnt "Und Adriyatik", it is noted that these ships generally violate traffic regulations and that they also discharge oily water into the sea - proof of which will follow below in the section on illegal discharges) passing through the anchorage at a high speed of 20.2 knots.

Figure 30: High speed crossing of an anchorage - "Und Atilm".

2.5 Ship collision risk assessment

Risk is assessed by first assigning a value to the probability of the event occurring and then to the severity of the consequences for shipping. Typically, two values are multiplied to form the risk matrix. Finally, the result is assigned to the risk matrix and classified as low, moderate, or high. The risk rating indicates the magnitude and acceptability of the risk and determines whether the task can be performed and when additional control measures are required to reduce the risk to ALARP (As Low As Reasonably Possible). The probability of collision and grounding for the Gulf of Trieste was first calculated in 2009 using a stochastic approach developed by Gucma et al. (2006), at a time when IWRAP was not available. The calculated unplanned event was significantly higher, mainly due to the 30% higher traffic volume, which was not as organized as it is now. Both approaches are presented here. A stochastic simulation model was used for the safety analysis of complex maritime traffic (Gucma et al., 2016). The modular structure of the model is shown in the figure below. This type of model can be used to analyse maritime traffic in different aspects: collision, grounding, collision with fixed objects, indirect collisions such as anchoring, and wave generation causing damage to the shore. The model can be extended and complemented with sub-models according to the research objectives. This modelling methodology is well established and has been applied in several case studies.

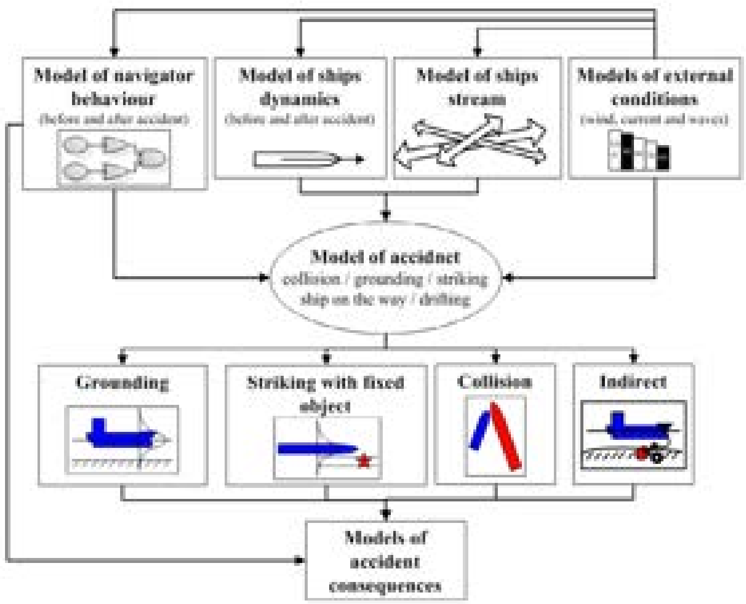


Figure 31: Diagram of the stochastic model for navigation safety assessment.

A simplified statistical model has been used to model the probability of a collision at sea. The model ignores a number of elements and their correlations/dependencies as it is simply based on statistical data obtained from observations of real shipping traffic. The biggest unknown parameter in this type of modelling is the exact number of close encounters. Some of them can be selected from the AIS archive, but it should be noted that these encounters are more numerous because the area off Koper is a crossing of shipping lanes, where there are often fishing boats and other vessels that are not included in the traffic archive. Therefore, the only way to determine the parameters for close encounters in such complex traffic regimes is to model traffic flows over longer periods of time. A simplification of the calculation is given by equating the collision probability over the whole area, which is also consistent with the available incident. The calculated collision probabilities for individual encounter states (head-on, crossing, and overtaking) are higher than 1*10-5, which is also the usual size class for the application of this type of safety analysis at sea. In the following, 30 typical waterways in the Gulf of Trieste are selected for input into the model, as shown in the following figures. First, the complexity of the traffic flows and trajectories is presented.

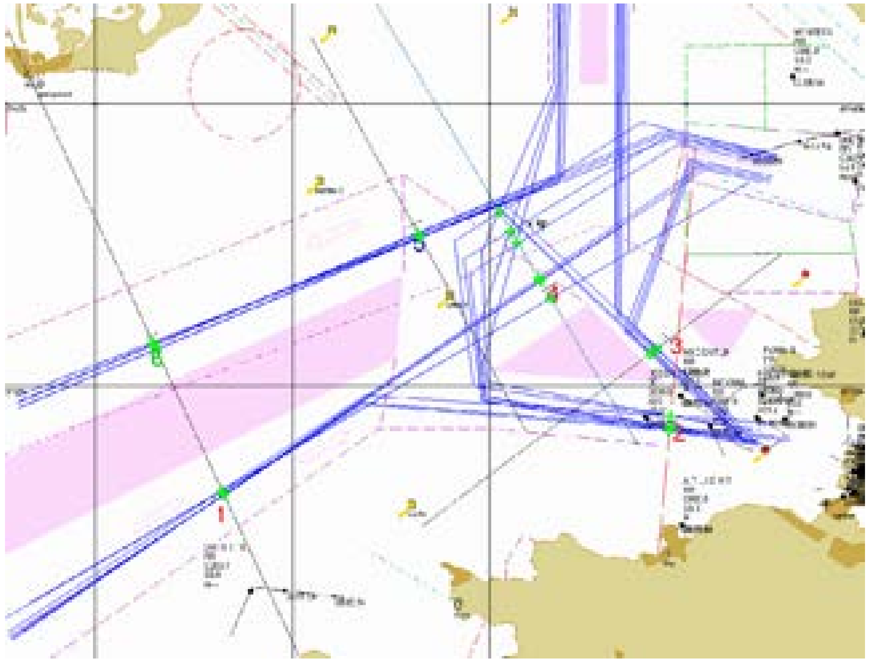


Figure 32: Selected fairways for modelling potential accidents in the Gulf of Trieste.

The traffic simulation is carried out in batches of 5 years. The increase in traffic over this period and the impact on safety can be analyzed relatively well. The results of the locations of potential incidents are presented in the next Figs. 33-34. The processed data show that vessels do not only sail in the regulatory areas, but also in the separation zones, in the lanes in the opposite direction, and in the local coastal traffic areas. Despite the separation scheme, inappropriate and dangerous maneuvers are sometimes made by vessels passing through the area (Fig. 33). However, this does not mean that it is always ships that violate the rules, as their *maneuvers* may be the result of violations by other smaller vessels (mainly boats) that do not transmit AIS and are not detected by radars.

The model showed that the highest density of collisions in the area is located between the separation lines - the so-called 'precautionary zone' (Fig. 34). The probability of a major accident occurring during this period is estimated to be once every 120 years. The simulation showed that the time between collisions with just a 30% increase in traffic, an accident can be expected every 80 years.

Table 4 gives the detailed positions with encounter types and expected spillage depending on speed, ship size, and ship loading condition for the Gulf of Trieste.

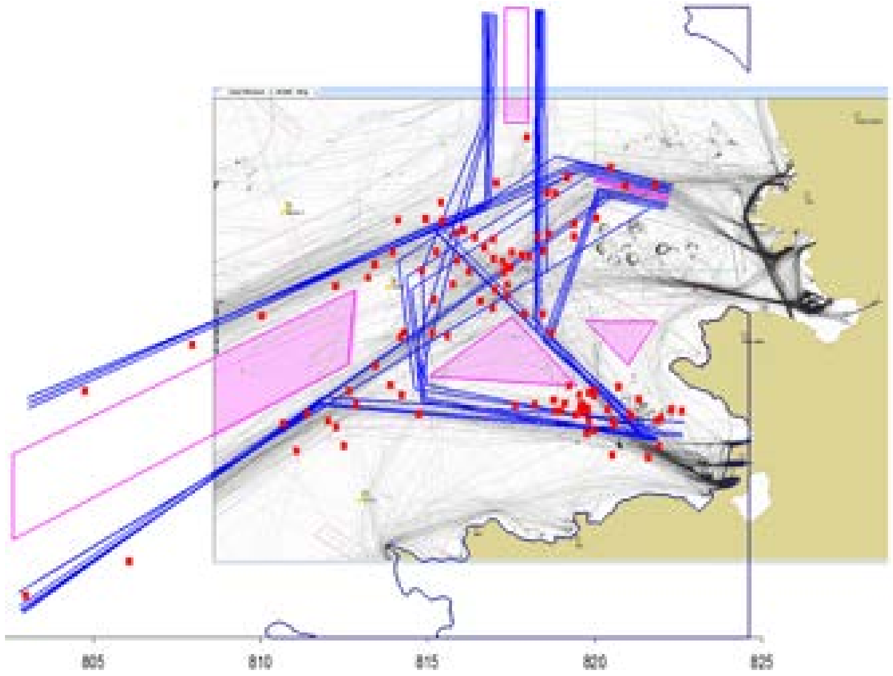


Figure 33: Analysis of the data relative to vessels sailing in the Gulf of Trieste.

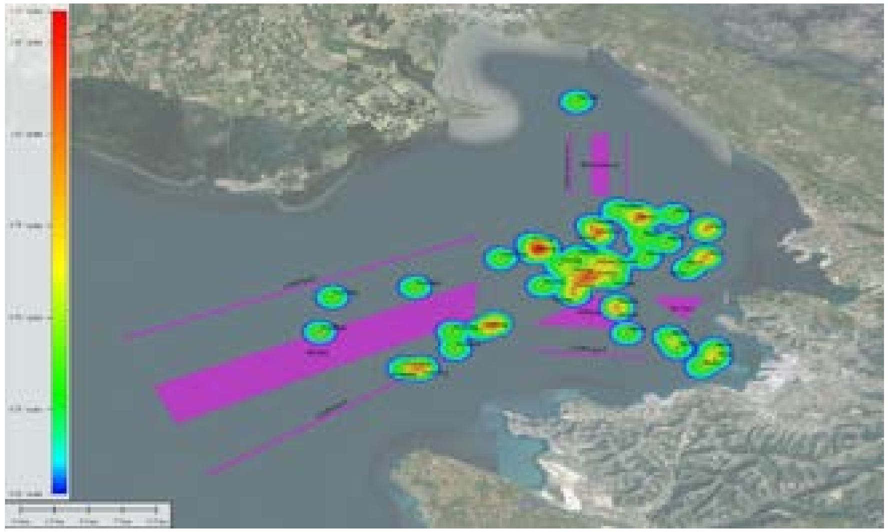


Figure 34: Simulation of possible collision locations.

Table 4: Potential accident locations in the Gulf of Trieste modelled stochastically, with indication of the type of accident, the type of oil product involved, and the estimated quantities of products released in the water.

Longitude	Latitude	Type of accident	Bunker Oil (HFO_&_LSFO)	Crude Oil	Product (diesel)
13.69392222° E	45.55979235° N	Allision	1000		5000
13.70292459° E	45.56518537° N	Allision	1000		5000
13.70252715° E	45.57119571° N	Allision	1000		5000
13.67819703° E	45.57220059° N	Allision	1000		5000
13.67304983° E	45.57920814° N	Allision	1000		5000
13.64519026° E	45.58184783° N	Allision	1000		5000
13.68556035° E	45.62439027° N	Allision	1000	15000	5000
13.65690631° E	45.63141912° N	Allision	1000	15000	5000
13.69676223° E	45.63165696° N	Allision	1000	15000	5000
13.69676223° E	45.63165696° N	Allision	1000	15000	5000
13.67110737° E	45.64130274° N	Allision	1000	15000	5000
13.65506813° E	45.64424405° N	Allision	1000	15000	5000
13.69695240° E	45.64918949° N	Allision	1000	15000	5000
13.69822560° E	45.65170179° N	Allision	1000	15000	5000
13.65092488° E	45.65531408° N	Allision	1000	15000	5000
13.65795693° E	45.65778071° N	Allision	1000	15000	5000
13.67599200° E	45.65971947° N	Allision	1000	15000	5000
13.65295331° E	45.66089701° N	Allision	1000	15000	5000
13.63890604° E	45.59745103° N	Crossing	1500	30000	15000
13.63855922° E	45.60017275° N	Crossing	1500	30000	15000
13.61030592° E	45.60711050° N	Crossing	1500	30000	15000
13.60945121° E	45.61050520° N	Crossing	1500	30000	15000
13.58976625° E	45.61298687° N	Crossing	1500	30000	15000
13.61615616° E	45.61684767° N	Crossing	1500	30000	15000
13.63630284° E	45.61790272° N	Crossing	1500	30000	15000
13.62449205° E	45.61830636° N	Crossing	1500	30000	15000
13.61960735° E	45.61869464° N	Crossing	1500	30000	15000
13.60886889° E	45.62023407° N	Crossing	1500	30000	15000
13.62366451° E	45.62615882° N	Crossing	1500	30000	15000
13.63806024° E	45.62619455° N	Crossing	1500	30000	15000
13.60155729° E	45.62660554° N	Crossing	1500	30000	15000
13.63005648° E	45.63064472° N	Crossing	1500	30000	15000
13.61270392° E	45.63237405° N	Crossing	1500	30000	15000
13.58491862° E	45.63429868° N	Crossing	1500	30000	15000
13.58887546° E	45.63645763° N	Crossing	1500	30000	15000
13.59034623° E	45.63867045° N	Crossing	1500	30000	15000
13.58274019° E	45.64074606° N	Crossing	1500	30000	15000
13.62706152° E	45.64607300° N	Crossing	1500	30000	15000
13.62623297° E	45.64818178° N	Crossing	1500	30000	15000
13.62217252° E	45.65244776° N	Crossing	1500	30000	15000
13.61213715° E	45.73400742° N	Crossing	1500	30000	15000
13.50790922° E	45.55830098° N	Overtaking	500	5000	5000
13.49845857° E	45.55875748° N	Overtaking	500	5000	5000
13.51051232° E	45.55931577° N	Overtaking	500	5000	5000
13.53190853° E	45.57147604° N	Overtaking	500	5000	5000
13.44308846° E	45.58248147° N	Overtaking	500	5000	5000
13.53044396° E	45.58270515° N	Overtaking	500	5000	5000
13.54964278° E	45.58444207° N	Overtaking	500	5000	5000
13.55830186° E	45.58758087° N	Overtaking	500	5000	5000
13.55833543° E	45.58795816° N	Overtaking	500	5000	5000
13.45125168° E	45.60558592° N	Overtaking	500	5000	5000
13.50567977° E	45.61209393° N	Overtaking	500	5000	5000
13.56222224° E	45.63088427° N	Overtaking	500	5000	5000
13.63880156° E	45.66263050° N	Overtaking	500	5000	5000

The numerical results were then expertly processed and extrapolated from the Gulf of Trieste to the entire North Adriatic region. Fig. 35 shows the locations of potential encounters in the Northern Adriatic Sea, while Table 5 gives more detailed positions with encounter types and expected spillage depending on speed, ship size and ship loading condition. The most dangerous areas for incidents are anchorages and locations where waterways intersect.

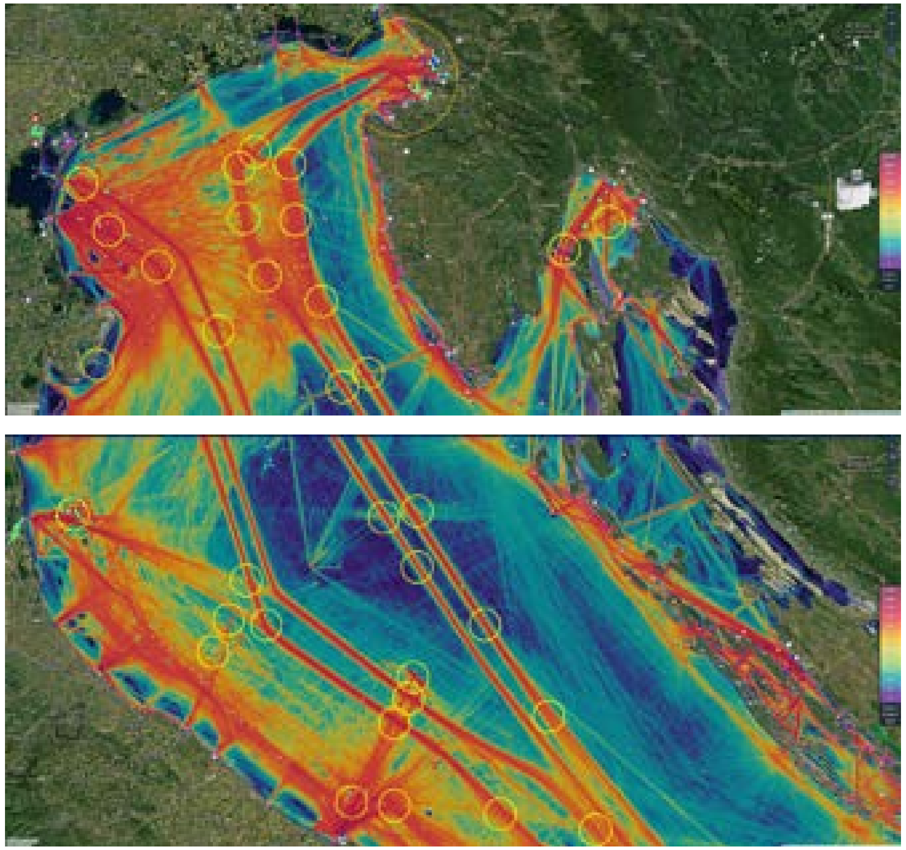


Figure 35: Probable accident locations in the Northern Adriatic Sea.

Table 5: Potential accident locations in the North Adriatic Sea - an extrapolated qualitative approach, with indication of the type of accident, the type of oil product involved, and the estimated quantities of products released in the water.

Longitude	Latitude	Type of accident	Bunker Oil (HFO_&_LSFO)	Crude Oil	Product (diesel)
14.48815016° E	43.64815717° N	Crossing	1500	15000	15000
14.11154590° E	43.68319013° N	Crossing	1500	15000	15000
13.54751533° E	43.69720331° N	Allision	1000		5000
13.66837902° E	43.73573956° N	Crossing	1500		15000
13.69465374° E	43.94243399° N	Crossing	1500		15000
14.25868431° E	43.97571530° N	Overtaking	500	5000	5000
13.74720317° E	44.00199001° N	Crossing	1500		15000
13.78048448° E	44.06154604° N	Allision	1000		5000
13.04128914° E	44.10533723° N	Allision	1000	10000	5000
13.20944732° E	44.18591302° N	Crossing	1000		5000
13.06931550° E	44.22269763° N	Allision	1500		15000
14.02921846° E	44.22620092° N	Overtaking	500	5000	5000
13.14288471° E	44.31553496° N	Crossing	1000		5000
13.79800096° E	44.35407121° N	Overtaking	500		
13.77172624° E	44.50296126° N	Crossing	1500	30000	15000
13.65962079° E	44.50296126° N	Crossing	1500		15000
12.98873971° E	44.67111944° N	Overtaking	500		
13.41088681° E	44.77271501° N	Crossing	1500		15000
13.50372414° E	44.80424467° N	Crossing	1500	30000	15000
12.93969357° E	44.90233694° N	Overtaking	500	5000	5000
13.31980113° E	45.00743581° N	Crossing	1500	15000	15000
13.12711988° E	45.05473030° N	Crossing	1500		
12.70146948° E	45.08450831° N	Crossing	1500		
14.23941618° E	45.14231268° N	Crossing	1500	15000	15000
12.51754647° E	45.18435223° N	Crossing	1500		5000
13.03778584° E	45.19661376° N	Overtaking	500	5000	5000

13.23046709° E	45.20537200° N	Overtaking	500		
14.42333919° E	45.23865331° N	Crossing	1500	15000	5000
12.41419925° E	45.32798734° N	Allision	1000	10000	5000
12.99924959° E	45.35951700° N	Crossing	1500		
13.19543414° E	45.37878513° N	Crossing	1500	30000	15000
13.05530232° E	45.40681149° N	Crossing	1500		
12.42470914° E	44.49945797°N	Allision	1500	5000	5000

2.6 Discussion

Shipping is perhaps the most international of the world's major industries - and potentially one of the most dangerous. It has always been recognized that the best way to improve safety at sea is to develop international rules that are followed by all shipping nations.

The traffic, density, and classification of maritime traffic in the North Adriatic have been presented in detail in this part of the study. A stochastic model has been applied to the extended area of the Gulf of Trieste, which is undoubtedly the riskiest area due to the numerous shipping lanes, the presence of a large number of hazardous substances, the shallow sea and the sensitive coastal zone. The results obtained are then extrapolated to the whole of the northern Adriatic using an experimental method. The predicted quantities of fuel and/or cargo discharged were also given. The probability of a major accident occurring during this period is estimated to be once every 120 years. A more accurate estimate would be obtained by IWRAP by analyzing a larger amount of AIS data, but the time and personnel cost for it exceeded NAMIRS funds and timetable. Thus, such an analysis is planned in the future.

3

Oil spill simulations and exposure estimation

3 / Oil spill simulations and exposure estimation

3.1 Introduction

This section is devoted to the presentation of the oil spill simulations performed for the definition of the exposures (Task 2) of the area of interest, in the context of the Activity 2.1 – Environmental Risk Assessment of NAMIRS. The Lagrangian particle tracking model LTRANS-Zlev (Laurent et al., 2020) including the oil spill module OILTRANS was used to perform the oil spill simulations coupled with an MITgcm (Massachusetts Institute of Technology general circulation model, (Marshall et al., 1997) implementation for the Adriatic Sea (Querin et al., 2016), employing an evolution of the model (Silverstri et al. ,2020), and applied in other studies (Melaku Canu et al., 2015; Bruschi et al., 2021) and research projects (Bendoni et al., 2022, Canu et al., 2022).

3.2 Oil spill simulations set up

In section 2.5 three types of oil were identified as major potential threats for the area of interest: bunker oil, diesel oil, and crude oil. In order to obtain a statistical representation of the exposure, multiple oil spill simulations were performed from different release coordinates and repeated in time once a day every day for a one-year period (2018). Every oil spill simulation consisted in the release of 200 Lagrangian particles, advected by currents and wind drift using a Runge-Kutta scheme of 2nd order for a 10 day long time interval with an additional horizontal turbulent diffusivity of 10 m2/s and stranding along the coast whenever the particles would approach at less than 10 meters from the border of the basin. The oil spill module OILTRANS computed the weathering processes to which the oil was subject, among them the initial spreading of the oil slick, the evaporation, the emulsification, and the vertical dispersion in the water column.

For every oil type (bunker, diesel, crude) the simulations were performed modeling oil spill releases according to the estimations made in section 2.5 of the position and volumes of oil susceptible to be released at the different coordinates. Two sets of oil spill simulations were performed, distinguished by the method obtained to define the oil spill release positions. In the first set of simulations 54 potential oil spill release sites were simulated, the coordinates and volume of the oil spills that were modeled are defined in Table 4: they were determined using the stochastic method described in section 2.5. The second set of simulations is made by 33 potential oil spill release sites, the coordinates and volume of those oil spills are defined in Table 5, they were obtained using an extrapolated qualitative approach based on expert knowledge.

At every potential incident site, among those 54+33 sites, the quantity of bunker, crude, and diesel oil susceptible to be released, as estimated in Tables 4-5, were used to define the quantity of oil to be released in the simulations. Every type of oil was modeled using a specific parameterization of the OILTRANS module, as described in Table 6: the specific oils to model were identified thanks to SIOT (Società Italiana per l'Oleodotto Transalpino S.p.A.), the main operator in the transportation of oil and oil products in the whole Mediterranean Sea, based in Trieste harbor, and providing a big portion of oil demand in Central Europe through the Transalpine Pipeline. After the stakeholders' workshop in Trieste, SIOT provided information on the most common oils travelling in the Northern Adriatic Sea and some of their characteristics, which were complemented from literature (see Table 6). SIOT's help was much appreciated and instrumental for obtaining good results for NAMIRS.

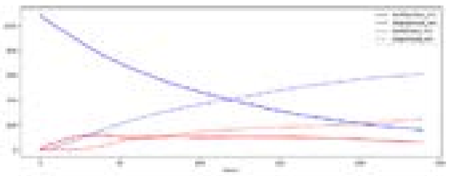
Table 6: Model parameterization of the different oil types. These parameters are those of the specific oils "*Bunker C Fuel Oil 171*", "*Diesel Fuel Oil (1994) 242 & 254*" and crude oil "*Arabian light 46*" taken from the Canadian catalogue of Crude Oil and Oil Product Properties (Jokuty et Al., 1999, revised 2022). The Fingas evaporation equation of type 1 is $\%Evap = (A + B \times T_w) \times \ln(t) \times (1 - W_c)$ while type 2 is $\%Evap = (A + B \times T_w) \times \mathrm{sqrt}(t) \times (1 - W_c)$ where T_w is the water temperature, t is time and W_c is the water content.

	bunker	diesel	crude
API	11.4	37.2	19.66
Dynamic viscosity at 15°C	8.706	4.5	0.014
SARA asphaltenes content	11%	0%	3%
SARA resin content	17%	2%	6%
SARA saturated compounds	25%	76%	51%
Evaporation Fingas A parameter	0.31	0.31	2.52
Evaporation Fingas B parameter	0.045	0.018	0.037
Evaporation Fingas equation type	1	2	1

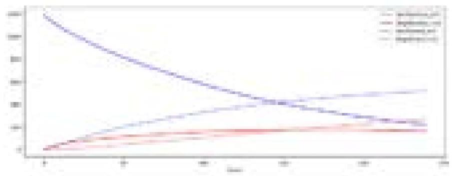
The total number of oil spill simulations that were run varies according to the type of oil, as not all oil types were identified as threats on every release site. The number of oil spill simulations that were run are 19440 for the stochastic bunker oil, 19440 for the stochastic diesel oil, 17280 for the stochastic crude oil, 11880 for the expert bunker oil, 9360 for the expert diesel oil and 5400 for the expert crude oil. For every set of simulations and every oil type the results were aggregated by summing the oil quantities in every cell of the domain, taking as initial time the instant of the release of every oil spill.

3.3 Oil spill simulations results

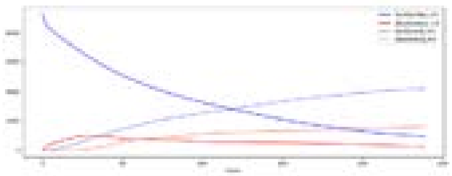
The results of the oil spill simulations allow to assess, for every oil type and every set of simulations, as presented in Fig. 36, the average volume of oil remaining on the surface, stranding on surface, dispersed in the water column, and stranded at depth, within the water column. One can see that bunker and diesel oil behave in similar ways, with a relatively slow dispersion in the water column resulting in a quantity of stranded oil more important on the surface respect to the quantity of oil stranded at depth. Crude oil tends instead to disperse faster in the water column resulting in almost identical quantities of oil stranded on the surface respect to the oil stranded at depth.



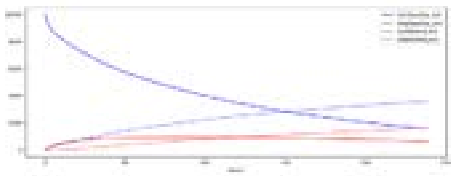
a) Stochastic bunker oil average volume



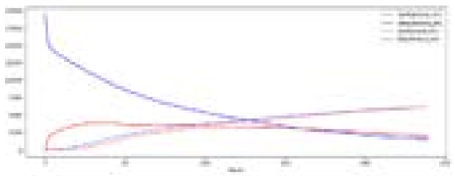
d) Expert bunker oil average volume



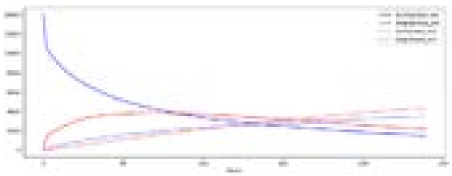
b) Stochastic diesel oil average volume



e) Expert diesel oil average volume



c) Stochastic crude oil average volume



f) Expert crude oil average volume

Figure 36: Average volumes of oil remaining on the surface (continuous blue line), stranding on surface (dashed blue line), dispersed in the water column (continuous red line) and stranded in the water column (dashed red line), for every set of simulations (Stochastic and Expert) and every oil type (bunker, diesel and crude).

The oil spill simulations allowed to produce maps of oil density every 3 hours after the release. In order to give an overview of the results, we chose to present in this report in Figs. 37-38 (respectively for the Stochastic and Expert sets of simulations) only the bunker oil maps at two time-instants: 11 hours and 23 hours after the release of the oil spills. These maps allow to identify which open sea areas and which coastal areas are more susceptible to be impacted by the oil spills, according to the threat defined by the release sites and oil volumes defined in Tables 4-5.

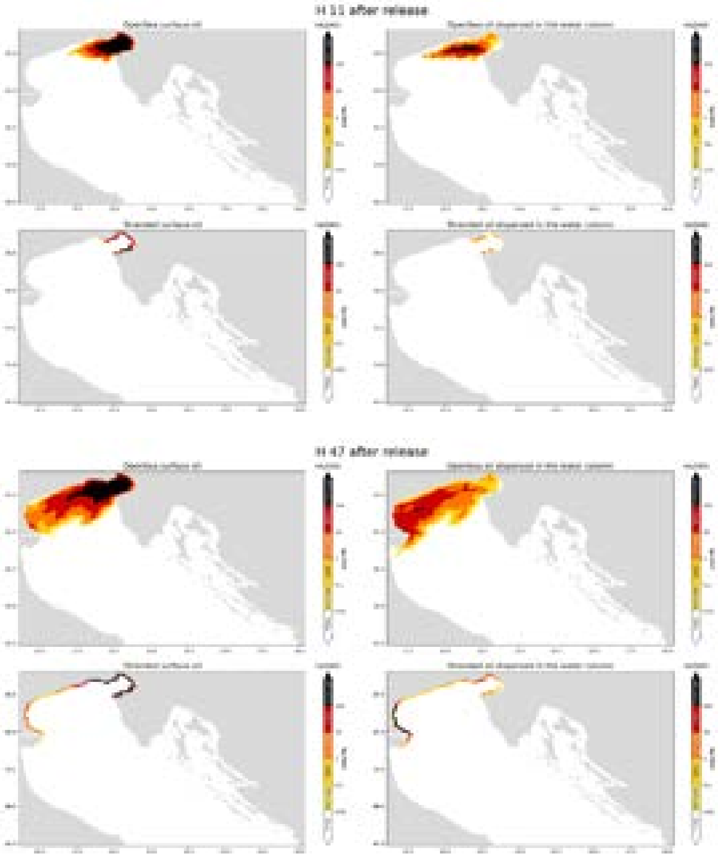


Figure 37: Stochastic set of simulations for the bunker oil type at 11 hours (top) and 47 hours(bottom) after the release of the oil spills.

The Figure 37 highlights that potential bunker oil slicks in the Gulf of Trieste (Stochastic set of release sites) represents a threat limited to the Gulf of Trieste itself for the first 11 hours after a potential incident, with oil stranding mainly on the surface respect to the oil stranded at depth.

Instead, after 2 days of transport the threat extends along the Italian coasts up to the Po River delta. Regarding the surface stranded oil, the major exposure remains along the coasts of the Gulf of Trieste, while at depth larger quantities of oil stranded along the coastal areas between Venice and the Po River delta.

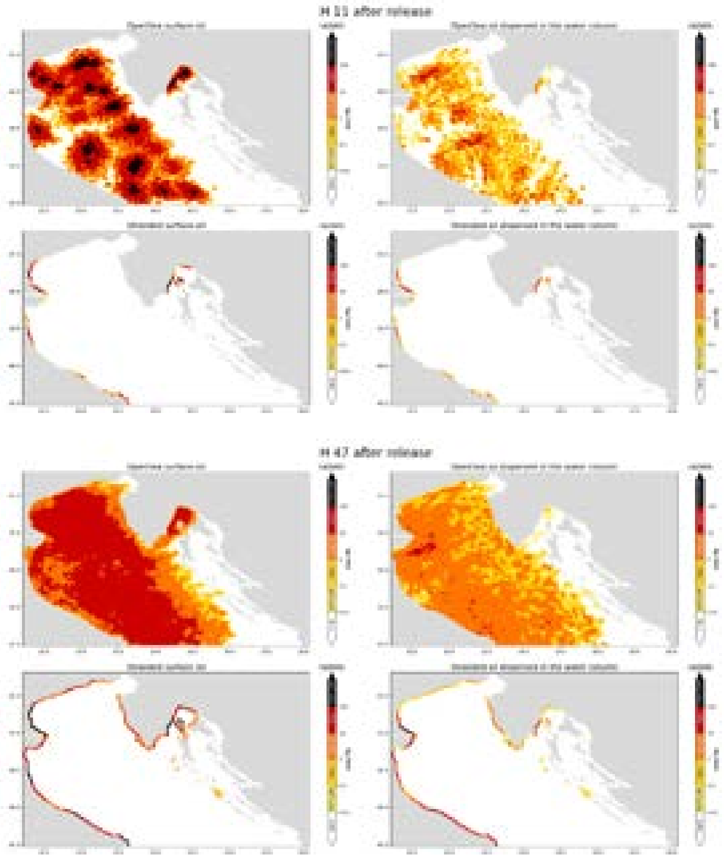


Figure 38: Stochastic set of simulations for the bunker oil type at 11 hours (top) and 47 hours(bottom) after the release of the oil spills.

Fig. 38 shows that potential bunker oil slicks released along the main traffic routes of the northern Adriatic (Expert set of release sites) represent a threat (both on surface and at depth) at short time interval (11 hours) for local costal segments, namely between Venice and the Po River, close to the Italian cities of Ravenna and Ancona, and on the northern part of the Croatian Island of Cres and the continental area closer to it next to Rijeka. Two days after the release, instead, most of the northern Italian coasts are concerned by stranded oil (except for the Gulf of Trieste) and in Croatia the threat extends along all the Istrian peninsula from Rijeka to Savudrija.

4

Stakeholders' involvement

4 / Stakeholders' involvement

4.1 Introduction

One of the main goals of NAMIRS 2.1 was the assessment of the vulnerability of coastal areas of the Northern Adriatic Sea. This can be done in a purely objective manner by conducting scientific research on which types of coasts are the most sensitive to oil spills (e.g., ESI, see Petersen et al., 2019). However, such approach would neglect the subjective value represented by the coast for the different stakeholders, i.e., for those who have a direct, tangible or intangible interest in the areas to remain unaffected by the consequences of oil spills. The stakeholders can have an interest because they engage in economic activities in the coastal areas (maritime transportation, harbour activities, tourism, mariculture, fishery, etc.), because they value the pristine state of the area (i.e., consider its social, cultural, landscape values), or because they are engaged in activities related to environmental protection or cleaning, either as part of NGOs, public bodies (research institutes, local government), or of private enterprises in this sector.

Thus, the partners of NAMIRS choose an inclusive, participative, holistic approach to the assessment of the coastal areas' vulnerability in the Northern Adriatic Sea, by combining expert knowledge with the stakeholders' involvement. In particular, a specific Coastal Vulnerability Assessment (CVA) method was developed in the form of a questionnaire to be compiled by stakeholders during purposedly organized workshops. The CVA was developed according to the guidelines of the Delphi method, applied in the IALA PAWSA risk assessment method (IALA, 2022). Since the goals of the risk assessment in NAMIRS is different than the one addressed in the PAWSA methos, the CVA procedures were adapted to the specific needs of this project.

The outcomes of the workshops were processed and joined with expert knowledge from literature in order to permit to classify the coastal areas based on their vulnerability to oil spills. GIS maps of vulnerability indexes related to the different considered vulnerability factors were also produced. Coastal vulnerability estimations will help in establishing priority areas for intervention in case of oil spills.

4.2 NAMIRS vulnerability factors

The first step in the CVA procedure was the identification of the vulnerability factors. Three different factors of vulnerability were identified:

- Geomorphological factors
- Environmental factors
- Socioeconomic factors

Geomorphological factors are related to the typology of the coast. Different stakeholders can give a different value to a coastal stretch, depending on the possible use there are making of them: e.g., some may value the coast for its recreational potential, outside of established beach resorts, others as place for an economic activity (hotel, camping, restaurant). Thus, if a coast is low or high, easily reachable or inaccessible, sandy or rocky, natural or artificial, it all plays a role in the value assigned to it by a potential stakeholder.

Environmental factors are related to important environmental features such as protected areas, important habitats, presence of protected or important species. Also in this case we expect that the value assigned by different categories of stakeholders, based on their interest and knowledge, may be different. For instance, people form the research sector or working in environmentalist organizations will have a different consideration for the protected areas and for their different level of protection. An interesting outcome will be also the valuation for coastal areas without any type of legislative protection.

Socioeconomic factors are those most dependent on the subjective perception of the stakeholders. For a mariculturist any possible disruption of mariculture activities would be seen as much more impacting then the pollution of a beach. On the other hand, the owner of a beach resort might value much more the protection of the beach, than of the mussel or fish farms in front of it. Even more complex is the evaluation of factors that are not measured in monetary terms: the aesthetic value of a pristine, natural coastline, or the cultural and historical value associated to the seafront of an old seaside town, might not be easily transformed in monetary value. Fig. 39 shows a schematic representation of the three groups of vulnerability factors considered for NAMIRS CVA process.

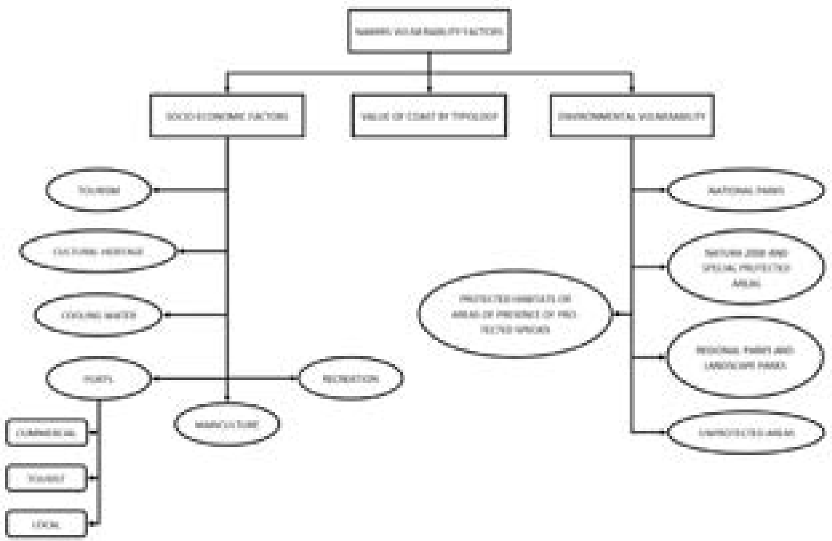


Figure 39: Schematic representation of the vulnerability factors considered in NAMIRS CVA.

4.3 CVA questionnaire structure

4.3.1 CVA Step 1

Step 1 of the CVA asked participants to indicate their role in the assessment process, their role in oil spill cleaning activities in general, and their level of familiarity with vulnerability factors. This resulted in a numerical value for the participant's level of knowledge for each of the available factors.
Roles were divided into the following categories:

- environmental association and NGO;
- business sector employer (fishermen, shipping, touristic facilities etc.);
- scientist, professor, or teacher;
- civil servant/elected official;
- citizen.

Then, the participants had to state how would they participate in oil spill clean-up operations, should an oil spill occur, by selecting one of the following options:

- would be in action per his/her duty;
- would step in action only if requested;
- would only actively monitor the cleaning procedures and offer suggestions or proposals to an appropriate service;
- would monitor the event as a citizen;
- would not be interested.

Level of familiarity with each factor was determined by asking the participants to answer the following questions with scores from 1 to 9, the former presenting the lowest level of familiarity, while latter presents the highest:

- To what extent are you, in this moment, familiar with the problem of oil spills as a whole?
- To what extent are you, in this moment, familiar with the geomorphological state of our coast (relating to different coast type cleaning difficulty)?
- To what extent are you, in this moment, familiar with environmental protection (areas with different protection status levels)?
- To what extent are you, in this moment, familiar with oil spill cleaning and intervention technology?
- To what extent are you familiar with the socio-economic value of the various stretches of coastline dedicated either to tourism, recreation, mariculture, cultural heritage, economy, etc.?

The goal of Step 1 questions was to allow the research team to possibly take into account the expertise and familiarity of each of the respondent. Obviously, the opinion of a persona professionally involved in oil spill management outweighs the opinion expressed by a person with a lower level of involvement or knowledge in the issue.
After completing the self-assessment step, the participants were shown a navigational chart with 12 areas, where an oil spill is most likely to occur due to high traffic density and the presence of either drilling platforms, LNG terminals, etc. They were asked to choose three areas where they believed an oil spill is most likely to occur.
Participants could choose between the following 12 areas:

1. Trieste anchorage
2. Crude oil terminal SIOT - Trieste
3. Koper anchorage
4. Rijeka anchorage as well as JANAF and INA terminals
5. Venice anchorage
6. Vela Vrata
7. LNG terminal Rovigo
8. Southern entrance/exit to/from separation scheme
9. Northern entrance/exit to/from separation scheme
10. Separation triangle in the Gulf of Trieste
11. Platforms in North Adriatic near to the coast
12. Platforms in North Adriatic between separation zones
13. Other (please mark on the chart)

Please note that while Croatian workshops took place, the 4th option was solely represented by Rijeka anchorage without INA and JANAF terminals. After one of the participants of Croatian workshop added INA terminal under the optional 13th answer, the research team decided to add those two terminals to the 4th answer. The decision to join them with Rijeka anchorage is due to their close proximity to each other.

4.3.2 CVA Step 2

In Step 2 of the CVA participants were asked to rate the values assigned to each vulnerability factor using scores from 1 to 9, where 1 represents the lowest level of vulnerability, and 9 the highest level of vulnerability.

Firstly, the participants were asked to assess the vulnerability of the socioeconomic factors (see Fig. 39) that may be affected by an oil spill, which include tourism, cultural heritage, cooling water stations, ports, recreational areas (man-made structures built along the coast for sports and other recreational activities), and maricultures (without distinction for fish farms, shellfish farms, or other types of mariculture). Ports were further divided into commercial (e.g., Trieste, Koper, Rijeka), tourist (marinas), and local ports (i.e., small harbours typically found in old seaside towns, which are used by local fishermen or local owners of pleasure boats).

Secondly, the participants were asked to assess the values of different types of coasts. The following coast types were identified in the Northern Adriatic Sea based on information from the EMODnet portal (see Section 5):

- Erodible rock with sediments at the base
- Extended beaches (> 1 km)
- Small beaches (< 1 km)
- Artificial coastline
- Muddy coastline
- Non-erodible rock without sediments at the base
- Harbour area

Finally, the participants were asked to evaluate the vulnerability of environmental factors, i.e., considering the protection status of the coastal areas in the Northern Adriatic Sea. The following categories of protections status have been identified for NAMIRS goals, considering the different terminology and protections levels in use in the three North Adriatic countries:

- National Parks and Marine Protected Areas
- Natura 2000 and special protection areas
- Unprotected areas
- Regional parks and Landscape parks
- Protected habitats or areas of presence of protected species

In order not to influence the evaluation of the participants, the different categories of protection were not ordered according to an increasing or decreasing level of legislative protection.

4.3.3 CVA Step 3

Step 3 asked participants to state their comparative importance rating of each group of vulnerability factors with scores from 1 to 9, which were then converted to percentage ratios.

4.4 Stakeholders' workshops

Three stakeholders' workshops were organized, each one in a different partner country, in order to involve as much as possible, the local stakeholders into the process of risk management.
The workshops were organised by three project partners: UL FPP from Slovenia, OGS from Italy, and ATRAC from Croatia, with the goal to obtain subjective estimations of coastal vulnerability on the shores of the Northern Adriatic Sea. The participants met at each of the organised workshops either live in-situ, or online via a provided link to the digital version of the CVA questionnaire. The workshops proceeded in a completely anonymous way but with known participants.

4.4.1 Workshop in Croatia

The workshop for the Croatian stakeholders was organized by ATRAC on September 29th, 2022, at the ATRAC premises in Rijeka.
The stakeholder mapping for the Croatian workshop was done by compiling all the previous contacts ATRAC has collected during its work in the relevant sector. It included all governmental and non-governmental entities, public and private sectors that are engaged in environmental protection activities and oil spill prevention and clean-up. That list was then reduced to stakeholders that could benefit from the NAMIRS project or their input was important to the project's goals. The invitation for the workshop was sent by e-mail.

Among the governmental stakeholders, the following were invited to participate:

- Ministry of Maritime Affairs, Transport and Infrastructure
- Ministry of Environmental Protection and Energy
- Ministry of the Interior
- Istra County
- Primorje – Gorski kotar county
- Lika – Senj County
- Zadar county
- Croatian Hydrocarbon Agency
- Croatian Coast Guard
- State Audit Office
- Šibenik – Knin County
- Port Authorities
- Civil protection

Among non-governmental stakeholders, the following were invited:

- Private companies for oil spill prevention and clean-up
- Oil companies
- Touristic offices
- Faculty of Maritime Studies of the University of Rijeka
- Municipalities
- National parks
- Nature parks

The workshop started with a presentation from ATRAC's director, Vedran Martinić, who at the beginning shortly presented ATRAC and its activities. He then proceeded with explaining the ESI index, different types of the coast, and specificities of the Croatian coastline. He gave a few examples of case studies that happened during the years in which the coastline was heavily polluted, and of the techniques that were used for cleaning the specific coast. Then, Valter Suban (UL-FPP) explained the questionnaire as well as its purpose and led the compilation by the participants. The workshop ended with a discussion from the participants which opened some interesting questions about our capabilities in case of a major oil spill.

Figure 40: Two photographs from the Croatian stakeholders' workshop in Rijeka at ATRAC premises, on September 29th, 2022.

4.4.2 Workshop in Slovenia

The workshop for the Slovenian stakeholders was organized by UL-FPP on October 6th, 2022, at the UL-FPP premises in Portorož.
Stakeholder mapping for Slovenian Coastal Vulnerability workshop was undertaken by means of identifying all governmental and non-governmental, public and private services and societies that either engage in environmental protection activities, run a business with a social or economic value, or otherwise deal with oil spill prevention and clean-up. The research team first identified four important classes of tasks related to oil spill detection and clean-up, i.e., prevention, preparedness and monitoring activities (PPM); detection and alerting tasks (DA); cleaning and cleaning-related activities (CCRA); post cleaning operations (PCO). Any service which engages in any of the tasks falling in either of the four classes, was suitable for participation in the Coastal Vulnerability Assessment Workshop.

Since UL-FPP is familiar with all official services who engage abovementioned activities, most of the governmental stakeholders were contacted by a telephone call or were sent an official invitation by e-mail. Most of the non-governmental stakeholders, however, were contacted and invited via e-mail only. All contact addresses were found online on each of the stakeholder's web pages.

Among the governmental stakeholders, the following were invited to participate:

- Ministry of Infrastructure (Slovenian Maritime Administration)
- Ministry of Defense (Administration for Civil Protection and Disaster Relief)
- Ministry of Agriculture, Forestry and Fisheries (Fishery Inspection)
- Ministry of Environment and Spatial Planning (Slovenian Environmental Agency (ARSO), VGP Drava, Institute for Water of the Republic of Slovenia, Slovenian Water Agency)
- Ministry of the Interior (Police)
- Ministry of Health (National Institute for Public Health)
- Ministry of Finances (Financial Administration)

Among research and educational stakeholders, the following were invited to participate:

- National Institute for Biology
- Coastal municipalities
- Gymnasium, electro and nautical school Piran
- Turistica (University of the Littoral - Faculty of Tourism Studies)
- FHŠ (University of the Littoral - Faculty of humanistic studies)
- University of the Littoral - Biotechnical faculty
- Maritime museum Piran
- Managers of coastal and marine protected areas

Among the economic operators, the following were invited to participate:

- Petrol (Fuel company)
- Luka Koper INPO
- TGZ Portorož (Tourism)
- Adria Tow company
- Piloti Koper (harbour pilots)
- Among the non-governmental stakeholders, the following were invited:
- Morigenos (NGO for marine mammal monitoring and protection)
- DOPPS (NGO for birds monitoring and protection)
- PINA
- Trinity

Figure 41: Two photographs from the Slovenian stakeholders' workshop in Portorož at UL-FPP premises, on October 6th, 2022.

The workshop was organised live on the premises of UL-FPP and online via a prearranged link to a Zoom meeting. All the important stakeholders (first team responders, environmental protection agencies, etc.) were present, with only a couple of stakeholders who engage in touristic activates being absent. The workshop started with the presentations from Valter Suban (UL-FPP), Vinko Bandelj (OGS), and Vedran Martinić (ATRAC) relating to coastal clean-up, to the oil spill problem in general, and to the importance of vulnerability mapping. Before participants started filling out the questionnaire for coastal vulnerability evaluation, Valter Suban gave them a quick presentation on the structure of the questionnaire and the meaning behind its questions.

4.4.3 Workshop in Italy

The workshop for the Italian stakeholders was organized by OGS on October 13th, 2022, at the OGS premises in Via Beirut 2 in Trieste.

The stakeholder mapping for the Italian workshop was done starting from different lists of stakeholders that OGS already compiled in several past projects: HarmoNIA (Harmonization and Networking for Contaminant Assessment in the Ionian and Adriatic, Seas, EU ADRION, 2018-2019), ADRIREEF (Innovative exploitation of Adriatic Reefs in order to strengthen blue economy, EU Interreg Italy – Croatia, 2018-2021), FAIRSEA (Fisheries in the Adriatic region - a Shared Ecosystem Approach, EU Interreg Italy - Croatia, 2019-2021), SHAREMED (Sharing and Enhancing Capabilities to Address Environmental Threats in Mediterranean Sea, EU Interreg-MED, 2019-2022). Since each one of these projects had a different objective and goals, and thus possibly a different set of interested stakeholders, the lists were pruned of all the stakeholders that might not be relevant for NAMIRS and complemented with other stakeholders in order to satisfy NAMIRS goals.

The area of interest for the Italian stakeholders' mapping was the entire Northern Adriatic coast of Italy, from region Marche to region Friuli-Venezia Giulia. Four categories of stakeholders were deemed interesting for NAMIRS purposes: Public authorities, Research and environmental services, Protected areas managers and NGOs, and Economy sector. All four categories can be involved in the management of the oil spill, of the cleaning and restoration measures that need to take place after an oil spill or can represent stakeholders impacted by the consequences of an oil spill. The four categories reflect the "roles" that the participants had to assign themselves to in CVA Step 1. For all stakeholders cited below the roles and contact information of the contact persons were searched online on publicly accessible websites of the stakeholders or extracted from the existing lists of stakeholders of the projects cited above. When appropriate, more than one email address was contacted for each stakeholder.

In the category Public authorities, we listed local (coastal municipalities) and regional (four regions: Marche, Emilia Romagna, Veneto, Friuli-Venezia Giulia) territorial public authorities: they are those whose officials are elected by citizens and are the direct responsible for the local and regional policies, including environmental issues and economic sector. Thus, we included here also the environmental protection agencies (ARPA) that are in Italy organized on a regional level, civil protection, and public authorities promoting economy (e.g., FLAC and GAC), which are usually promoted either by regional government or by the most important municipalities. In the Public authorities category also other authorities were included, such as the port authorities of the major ports in the area, the firefighters, the Coast Guard (also one of the partners in NAMIRS), and the Italian Court of Auditors. Furthermore, the CEI – Central European Initiative, an intergovernmental organization promoting collaboration in the wider central European area was also invited as stakeholder: while CEI is also the LP of NAMIRS, it is not actively involved in the activities of 2.1 (as it is not the Italian Coast Guard), thus no conflict of interest was detected. The total number of stakeholders in this category was 34, but for many of them several different possible contacts were identified. In some cases, the contacts were of front offices or public relation offices, in other cases we tried to identify the administrative structure of the public authority that might be most interested into NAMIRS goals (e.g., environmental, tourism or economic regional directorates, or relevant city councilors).

The stakeholders for the category Research and environmental services were the easiest to be identified because of the many interactions that OGS has with similar institutions. Thus, the possible stakeholders to invite were identified based on personal relationships of members of the OGS NAMIRS workgroup with other researchers and scientists, on past participations in common projects with similar goals and objectives, and on the existing lists of stakeholders of the projects cited above. We included in this category public research institutions such as universities and research institutes, but also private research institutes, cooperative for environmental services, as well as companies for environmental services. Cooperatives for environmental services often employ scientist who are great experts for local environmental features and can provide consultancy services to local authorities in dealing with environmental problems, participate in monitoring programs and in scientific projects. Companies for environmental services are economic players and should be put in the category of Economy sector, but they also provide services in case of oil spill, such as consultancy and cleaning service, and sell specific equipment for intervention in case of oil spill. A rather crude way of explaining the rationale for the inclusion of the environmental companies in the category Research and environmental services is that these companies have a positive impact from an oil spill (because this is their core business), while the companies included in the category Economy sector are those that are generally negatively impacted by an oil spill (i.e., tourism, productive activities, mariculture and fishery operators). The total number of stakeholders identified in this category was 27, but for many of them several different persons were contacted. This was the case, e.g., for the University of Trieste (6 employees contacted) and the CNR-ISMAR institute of Venice (8 employees contacted).

In the category Protected areas managers and NGOs we included stakeholders that are involved in the management of protected areas, in environmental protection, or in environmental education. Many of these are organizations with national and local offices, and where possible both were contacted: this was the case, e.g., of WWF, Marevivo, LIPU.

Some of them are generalist environmental organizations, others more specifically dealing with the protection of marine ecosystems, and possibly also involved in monitoring or citizen science projects, such as DelTa, Dolphin Biology and Conservation, Fondazione Cetacea. We included in this category also nautical societies, sport fishing associations, and scuba diving clubs (including the association of the Italian scientific scuba divers AIOSS). All these stakeholders may be strongly impacted by the consequences of an oil spill but can also be seen as sentinels distributed along the coastline that have a day-to-day knowledge of the state of the sea, and their members may be counted on as possible volunteers to join operations after an oil spill. The total number of stakeholders in this category was 42 and also in this case, more than one email address was contacted when needed.

The last category, Economy sector, was devoted to economy operators in the field of tourism, nautical sector, and fishery and aquaculture. All these activities are in general negatively impacted by an oil spill. Among the nautical sector stakeholders there were very big players, such as Fincantieri, the biggest Italian ship building company, Ocean s.r.l, provider of marine services on a local and regional level, as well as the regional Maritime Technology Cluster FVG, and the nautical engineering company MICAD. In the touristic sector we contacted several associations of touristic operators (hotels, camping facilities) in the coastal areas of the Northern Adriatic Sea, including beach resorts and marinas. Fishery and aquaculture operators were the most abundant stakeholders represented in this category, due to the small size and huge number of these operators in the area, and also due to many contacts that OGS has already established with this sector in past projects. One of the most important stakeholders in this group was undoubtedly SIOT (Società Italiana per l'Oleodotto Transalpino S.p.A.), who is the main operator in the transportation of oil and oil products in the whole Mediterranean Sea, based in Trieste harbor, providing a big portion of oil demand in Central Europe through the Transalpine Pipeline. The total number of stakeholders in this category was 36.

The total number of contacted Italian stakeholders across all four categories was 139. An email inviting them to attend the NAMIRS Italian workshop, explaining the goals of the project and the structure and goal of the workshop, was sent to 209 email addresses. Some of the addresses turned out inactive or unreachable, thus additional research was performed in order to find a valid email for these stakeholders, but not for all was this successful.

At the workshop 17 people participated in presence representing 12 different stakeholders, while 9 people, representing 7 other stakeholders, participated online. Table 7 shows the breakdown per category of the participants and stakeholders contacted and present at the NAMIRS workshop for the Italian stakeholders. At the workshop were also present members of the OGS NAMIRS workgroup, and representatives of partners in the project UL-FPP, ATRAC, CEI and of the Italian Coast Guard. Tables 8-11 cite all contacted stakeholders for each stakeholder category.

Table 7: Breakdown of the Italian stakeholders contacted and present at the workshop in Trieste per category of stakeholder.

	Public authorities	Research and environmental services	Protected areas managers and NGOs	Economy sector	Total
Contacted stakeholders	34	27	42	36	139
Contacted emails	65	57	49	38	209
Participating stakeholder	5	4	7	3	19
Participating people	5	10	8	3	26

The workshop opened with a welcome from the director of the Oceanography section of OGS, Cosimo Solidoro, who also briefly introduced the institute and in particular its Oceanography Section. Anna Marconato (CEI), project leader of NAMIRS, presented the project, its goals and mission. Followed a talk by Vinko Bandelj presenting the work being done in NAMIRS 2.1 activity Environmental Risk Assessment. Valter Suban presented the partner UL-FPP and its institutional activities, while Vedran Martinić presented the partner ATRAC and its main activities in the field of oil spill cleaning. After a coffee break, Fabrizio Gianni and Serena Zunino (both OGS) led the compilation of CVA questionnaires, by presenting the questions and illustrating them with figures and photographs for better understanding. The workshop ended with talks by Dario Giaiotti (ARPA-FVG), illustrating FIRESPILL (a project with many overlapping with NAMIRS), Riccardo Scottu (DESMI Ro-Clean A/S), presenting his company and its services for oil spill prevention and cleaning, and Donata Canu (OGS), presenting the ECHO group of OGS and its main scientific expertise.

Table 8: Stakeholders invited to the Italian workshop in the category of Public authorities.

PUBLIC AUTHORITIES				
N	**Name**	**Role**	**Contacts**	**Partecipated**
1	Regione FVG	Regional authority	4	
2	Regione Veneto	Regional authority	3	
3	Regione Emilia-Romagna	Regional authority	3	
4	Regione Marche	Regional authority	3	
5	ARPA FVG	Regional environmental agency	4	yes
6	ARPA Veneto	Regional environmental agency	2	
7	ARPA ER	Regional environmental agency	2	
8	ARPA Marche	Regional environmental agency	1	
9	Protezione civile	Civil protection of 4 regions	4	
10	Corte dei Conti	Court of Auditors	1	
11	Guardia Costiera Capitanerie di Porto	Coast guard	4	yes
12	Autorità di sistema portuale del Mare Adriatico Orientale	Port authority	1	
13	Autorità di sistema portuale del Nord Adriatico	Port authority	1	
14	Autorità di sistema portuale del Mare Adriatico centro-settentrionale	Port authority	1	
15	Autorità di sistema portuale del Mare Adriatico centrale	Port authority	2	
16	Comune Cesenatico	Local authority	1	
17	Comune Rimini	Local authority	1	
18	Comune Chioggia	Local authority	3	
19	Comune San Michele al Tagliamento	Local authority	2	
20	Comune Lignano Sabbiadoro	Local authority	2	
21	Comune Grado	Local authority	2	
22	Comune Monfalcone	Local authority	1	
23	Comune Duino-Aurisina – Občina Devin-Nabrežina	Local authority	2	
24	Comune Trieste	Local authority	4	
25	Vigili del Fuoco	Firefighters	2	yes
26	Comune di Staranzano	Local authority	1	yes
27	Aries - Azienda speciale della Camera di Commercio di Trieste	Public authority promoting economy	1	
28	FLAG GAC Friuli Venezia Giulia	Public authority promoting economy	1	
29	Vegal Venezia Orientale	Public authority promoting economy	1	
30	FLAG GAC Chioggia e Delta del Po	Public authority promoting economy	1	
31	Delta 2000 - Gruppo di Azione Locale Emilia-Romagna	Public authority promoting economy	1	
32	G.A.C. Marche Nord	Public authority promoting economy	1	
33	FLAG GAC Marche Centro	Public authority promoting economy	1	
34	CEI – Central European Initiative	Intergovernmental organization	1	yes

Table 9: Stakeholders invited to the Italian workshop in the category of Research and environmental services.

RESEARCH AND ENVIRONMENTAL SERVICES				
N	**Name**	**Role**	**Contacts**	**Partecipated**
1	OGS	Public research institute	3	yes
2	CNR-ISMAR Trieste	Public research institute	2	yes
3	CNR-ISMAR Venezia	Public research institute	8	
4	ISPRA - Chioggia	Public research institute	5	
5	Università di Trieste	Public university	7	yes
6	Università di Venezia - Ca' Foscari	Public university	3	
7	Università di Padova	Public university	2	
8	Università di Bologna	Public university	2	
9	Politecnico Marche	Public university	2	
10	Rete LTER-Italia	Monitoring network	1	
11	CORILA	Research consortium	1	
12	Thetis S.p.A.	Environmental services company	1	
13	SELC Società Cooperativa	Environmental education cooperative	2	
14	Shoreline - Soc. Coop. servizi per la qualità dell'ambiente marino	Environmental education cooperative	1	
15	Cestha	Environmental education cooperative	1	
16	Esplora s.r.l.	Environmental education cooperative	1	
17	GRUPPO C.S.A. S.P.A.	Environmental services com-pany	1	
18	GreenSea	Environmental services company	1	
19	Cooperativa Sestante di Venezia	Environmental education cooperative	1	
20	Hyla Società Cooperativa	Environmental education cooperative	1	
21	Consorzio mediterraneo s.c.a.r.l.	Research consortium	1	
22	Fondazione ENI Enrico Mattei	Foundation	2	
23	DESMI	Environmental services company	1	yes
24	LaFornitrice	Environmental services company	1	
25	Istituto Delta – Ecologia applicata	Environmental services company	1	
26	Garbage Service Srl	Environmental services company	2	
27	t-ELIKA	Environmental services company	1	

Table 10: Stakeholders invited to the Italian workshop in the category of Protected areas managers and NGOs.

PROTECTED AREAS MANAGERS AND NGOS				
N	**Name**	**Role**	**Contacts**	**Partecipated**
1	AMP Miramare	Protected area	1	yes
2	Riserva naturale regionale delle Falesie di Duino	Protected area	1	
3	Riserva naturale Foce Isonzo – Isola della Cona	Protected area	1	
4	Associazione per la Laguna di Caorle e Bibione	Protected area	1	
5	Parco del Sile	Protected area	1	
6	Parco Lagunare	Protected area	1	
7	Associazione Naturalistica Cavallino	Protected area	1	
8	Tegnùe di Caorle P.to Falconera	Protected area	1	
9	Associazione tegnue di Chioggia	Protected area	1	
10	Delta Po Veneto Parco regionale	Protected area	1	
11	Ente Parco Delta del Po Emilia-Romagna	Protected area	3	
12	Ente Parco Naturale Regionale del Conero	Protected area	1	
13	Associazione Paguro	Protected area	1	
14	Adriapan - Adriatic Protected Areas Network	Protected area	2	
15	Amici della Terra	Environmental NGO	1	
16	Legambiente	Environmental NGO	1	
17	Greenpeace	Environmental NGO	1	
18	Italia Nostra	Environmental NGO	1	
19	Mareamico	Environmental NGO	1	
20	Marevivo	Environmental NGO	2	
21	FAI	Environmental NGO	1	
22	LIPU	Environmental NGO	2	
23	WWF Italia	Environmental NGO	3	
24	Oceanomare Delphis	Environmental NGO	1	
25	Fondazione Cetacea	Environmental NGO	1	
26	DelTa (Delfini e Tartarughe dell'alto Adriatico)	Environmental NGO	1	yes
27	Dolphin Biology and Conservation	Environmental NGO	1	
28	Associazione "Comitato per la casa dei pesci"	Environmental NGO	1	
29	AIOSS Associazione italiana operatori scientifici subacquei	Scientific scuba divers association	1	yes
30	FIPSAS Federazione Italiana Pesca sportiva ed Attività Subacquee	Sport fishing association, recognized as environmental protection association by the Ministry	1	
31	Lega Navale Italiana	Nautical association	1	yes
32	Assonautica	Nautical association	1	
33	ARCI PESCA FISA	Sport fishing association	1	

34	Barcolana	Nautical association	1	
35	SVBG	Nautical association	1	
36	Sirena	Nautical association	1	
37	Čupa	Nautical association	1	
38	Murena diving club	Scuba divers association	1	yes
39	Acquamission diving club	Scuba divers association	1	
40	Circolo sommozzatori trieste	Scuba divers association	1	
41	Scuba tortuga	Scuba divers association	1	
42	Club del gommone	Nautical association	1	

Table 11: Stakeholders invited to the Italian workshop in the category of Economy sector.

ECONOMY SECTOR				
N	**Name**	**Role**	**Contacts**	**Partecipated**
1	Associazione Riviera del Conero e Colli dell'Infinito	Tourism	1	
2	MARITIME TECHNOLOGY CLUSTER FVG s.c.a.r.l.	Nautical sector	1	
3	Fincantieri	Nautical sector	1	
4	Samer Seaports & Terminals	Nautical sector	1	
5	SIOT - Trieste Italian Society for the Transalpine Pipeline	Oil transport company	1	yes
6	Ocean s.r.l.	Nautical sector	1	
7	Cooperativa spiagge Ravenna	Tourism	1	
8	Destinazione Turistica Romagna	Tourism	1	
9	Porto turistico di Jesolo	Tourism	1	
10	Portopiccolo	Tourism	1	
11	Pro Loco Marina di Ravenna	Tourism	1	
12	Ravenna Incoming	Tourism	1	
13	Società Gestione Campeggi	Tourism	1	
14	AGCI FVG	Fishery & aquaculture	1	
15	AMA Associazione Mediterranea Acquacoltori	Fishery & aquaculture	1	

16	API (Associazione Piscicoltori Italiani)	Fishery & aquaculture	1	
17	CO.VE.P.A. - Consorzio Veneto Pesca Artigianale	Fishery & aquaculture	1	
18	Co.Ge.Mo. Monfal-cone - Consorzio gestione pesca compartimento di Monfalcone	Fishery & aquaculture	1	
19	COGIUMAR - Consorzio giuliano maricoltori	Fishery & aquaculture	1	
20	Federcoopesca	Fishery & aquaculture	1	
21	Federpesca	Fishery & aquaculture	1	
22	LegaCoopFVG	Fishery & aquaculture	1	
23	Legapesca	Fishery & aquaculture	1	
24	Organizzazione di Produttori della Pesca di fasolari dell'Alto Adriatico	Fishery & aquaculture	1	
25	Unci pesca (Unione Nazionale Cooperative Italiane della Pesca e Acquacoltura)	Fishery & aquaculture	1	
26	CO.GE.MO	Fishery & aquaculture	1	
27	CO.GE.VO Chioggia	Fishery & aquaculture	1	
28	CO.GE.VO. Venezia	Fishery & aquaculture	1	
29	Organizzazione di Produttori Bivalvia Veneto S.C.	Fishery & aquaculture	1	
30	Cooperativa Casa del Pescatore	Fishery & aquaculture	1	
31	Cooperativa Adriatica	Tourism	1	
32	Coop Copego	Fishery & aquaculture	2	
33	Anapi pesca (Associazione Nazionale Autono-ma Piccoli Impren-ditori della pesca)	Fishery & aquaculture	2	
34	FINALMAR	Fishery & aquaculture	2	
35	MICAD	Nautical sector	1	yes
36	Master Blue Growth	Tourism	1	yes

Figure 42: Two photographs from the Italian stakeholders' workshop in Trieste at OGS premises, on October 13th, 2022.

4.5 Workshops results and analysis of outcomes

This Section contains the results obtained from the three organised workshops in Rijeka, Portorož and Trieste, where in total 104 people participated either in-situ or online via provided links to the digital versions of the questionnaire. The research team processed the obtained results to gather raw statistical information from each of the workshops, which will be subjected to further processing in the following phases of NAMIRS.
For easier understanding of the question list in the column on the left of the following tables, please refer to the following legend:

- Q4a – Socio-economic factors/mariculture
- Q4b – Socio-economic factors/tourism
- Q4c – Socio-economic factors/recreation
- Q4d – Socio-economic factors/cultural heritage
- Q4e – Socio-economic factors/cooling water stations
- Q4f – Socio-economic factors/commercial ports
- Q4g – Socio-economic factors/tourist ports
- Q4h – Socio-economic factors/local ports
- Q5a – Geomorphology/erodible rock with sediments at the base
- Q5b – Geomorphology/extended beaches (> 1 km)
- Q5c – Geomorphology/small beaches (< 1 km)
- Q5d – Geomorphology/artificial coastline
- Q5e – Geomorphology/muddy coastline
- Q5f – Geomorphology/non-erodible rock without sediments at the base
- Q5g – Geomorphology/harbour area
- Q6a – Environment/national parks and marine protected areas
- Q6b – Environment/Natura 2000 and special protected areas
- Q6c – Environment/unprotected areas
- Q6d – Environment/regional parks and landscape parks
- Q6e – Environment/protected habitats or areas of presence of protected species
- Q7a – Comparison/socioeconomic factors
- Q7b – Comparison/environmental factors
- Q7c – Comparison/geomorphological factors
- Q7d – Comparison/socioeconomic factors to %
- Q7e – Comparison/environmental factors to %
- Q7f – Comparison/geomorphological factors to %

The raw statistical data showcased in the tables are coloured in shades of green, yellow and red. Numbers marked in green represent the lowest level of vulnerability, yellow ones represent a medium level of vulnerability, and red ones a high level.

The self-assessment of the 104 participants gave as a result 7 representatives of environmental organisations and other NGOs, 13 members of business sector, 30 scientists, professors, or teachers, 48 civil servants or elected officials, 5 citizens, while one participant did not answer to this question. This is shown in Fig. 43, with numbers related to answers through the following legend:

- 1 = environmental association and NGO;
- 2 = business sector employees (fishermen, shipping, touristic facilities etc.);
- 3 = scientist, professor, or teacher;
- 4 = civil servant/elected official;
- 5 = citizen.

Figure 43: Breakdown of the self-assessed role of the participants to all three workshops.

The participants were asked to state their task in the case of an oil spill event. The chart in Fig. 44 shows a distribution of participants by their stated tasks, based on the following legend:

- 1 = would be in action per his/her duty;
- 2 = would step in action only if requested;
- 3 = would only actively monitor the cleaning procedures and offer suggestions or proposals to an appropriate service;
- 4 = would monitor the event as a citizen;
- 5 = would not be interested.

From a total of 104 participants, there were 35 people who would be in action per their duty, 23 people who would step in action if requested, 24 people who would actively monitor the situation and offer suggestions to appropriate services, 21 people who would monitor the event as a citizen, and no persons who would not be interested.

Figure 44: Breakdown of the self-assessed task in case of oil spill of the participants to all three workshops

4.5.1 Slovenian results

A total of 54 people participated in the Slovenian CVA workshop, 14 of them live and 40 online. The self-assessment of the roles of the participants gave the following results: 29 civil servants or elected officials, 3 members of business sector, 16 scientists, professors, or teachers, 3 members of environmental organisations or other NGOs, and 3 citizens.

Live

In total, 14 people participated to the workshop in-situ. Of them 9 identified themselves as civil servants or elected officials, 1 as member of business sector, and 4 as scientists, professors, or teachers. Table 12 showcases the main statistics of vulnerability scores provided by participants for each vulnerability factor, indicated in the left column.

Table 12: Main statistics for vulnerability scores provided by participants to the live Slovenian workshop for each vulnerability factor: Average, Mode, Median, Standard deviation. In the leftmost column the corresponding question of the CVA, see legend in Section 4.5.

Question	Average	Mode	Median	Standard deviation
Q4a	6,8	9	8	2,5
Q4b	7,1	9	7	2,1
Q4c	5,6	5	6	1,7
Q4d	6,4	7	7	1,5
Q4e	4,9	3	5	2,4
Q4f	6,1	6	6	2,0
Q4g	6,4	8	7	2,0
Q4h	6,6	7	7	1,5
Q5a	7,1	9	8	2,5
Q5b	6,3	8	8	2,7
Q5c	6,8	9	8	2,3
Q5d	5,0	6	6	2,4
Q5e	6,0	7	7	2,3
Q5f	6,8	8	8	2,2
Q5g	5,9	6	6	2,2
Q6a	7,8	9	8	1,6
Q6b	7,8	9	8	1,6
Q6c	6,7	7	7	1,7
Q6d	7,6	9	8	1,5
Q6e	7,9	9	9	1,6
Q7a	7,4	7	8	1,5
Q7b	8,0	9	9	1,6
Q7c	6,9	8	7	1,6
Q7d	33%	29%	33%	/
Q7e	36%	38%	37%	/
Q7f	31%	33%	30%	/

On average, the participants of the live workshop gave the highest priority to various protected areas in the environmental vulnerability factors group, while lesser importance was given to geomorphological and socio-economic factors, although there were no major differences between them. However, it must be mentioned that the scores were very dispersed as it is indicated by the standard deviation.

The results for the question on the areas of highest oil spill probability at the live Slovenian workshop are shown on the chart in Fig. 45. To interpret the chart correctly, please refer to the areas list in Section 4.3.1 of this report.

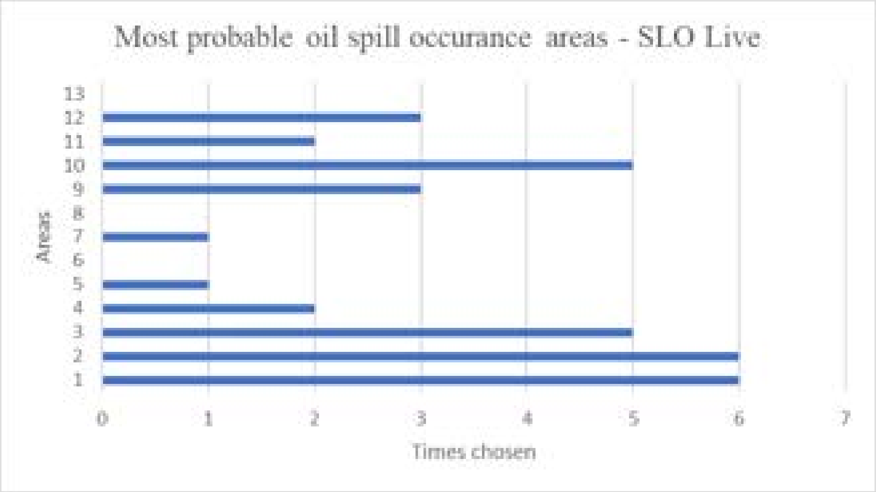


Figure 38: Most probable oil spill locations as selected by the participants to the live Slovenian workshop.

Online

A total of 40 people participated in the online workshop. Among them 20 identified themselves as civil servants or elected officials, 2 as members of business sector, 12 as scientists, professors, or teachers, 3 as members of environmental organisations or other NGOs, and 3 as citizens. Table 13 showcases the main statistics of vulnerability scores provided by participants for each vulnerability factor, indicated in the left column.

Table 13: Main statistics for vulnerability scores provided by participants to the online Slovenian workshop for each vulnerability factor: Average, Mode, Median, Standard deviation. In the leftmost column the corresponding question of the CVA, see legend in Section 4.5.

Question	Average	Mode	Median	Standard deviation
Q4a	7,2	8	8	2,0
Q4b	7,0	7	7	1,7
Q4c	5,9	6	6	2,0
Q4d	6,0	7	6	2,0
Q4e	5,6	5	6	1,6
Q4f	5,7	6	6	2,2
Q4g	5,9	6	6	2,0
Q4h	5,8	6	6	2,0
Q5a	8,1	9	9	1,3
Q5b	7,6	9	8	1,8
Q5c	6,1	7	7	2,4
Q5d	5,1	5	5	2,2
Q5e	6,6	7	7	1,9
Q5f	7,0	9	7	2,2
Q5g	4,8	3	5	2,3
Q6a	7,8	9	8	1,7
Q6b	7,7	9	8	1,6
Q6c	6,9	7	7	1,6
Q6d	7,3	7	7	1,7
Q6e	7,7	9	8	1,6
Q7a	6,9	7	7	1,5
Q7b	8,0	9	9	1,3
Q7c	7,3	8	8	1,7
Q7d	31%	29%	29%	/
Q7e	36%	38%	38%	/
Q7f	33%	33%	33%	/

The results of the online workshop very closely resemble those of the live workshop, the only difference being in geomorphology which was preferred over socio-economic factors. As it is indicated by the standard deviation, the scores were very dispersed.
The results for the question on the areas of highest oil spill probability at the online Slovenian workshop are shown on the chart in Fig. 46. To interpret the chart correctly, please refer to the areas list in the Section 4.3.1 of this report.

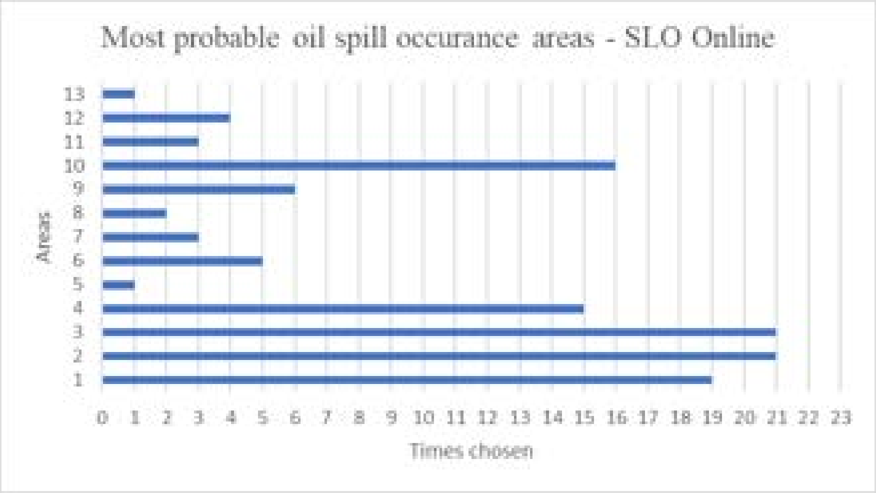


Figure 46: Most probable oil spill locations as selected by the participants to the online Slovenian workshop

4.5.2 Croatian results

A total of 24 people participated in the Croatian CVA workshop, which was held only live in Rijeka.
Among those who participated 16 identified themselves as civil servants or elected officials, 2 as scientists, professors, or teachers, and 6 as members of the business sector.
Table 14 showcases the main statistics of vulnerability scores provided by the participants for each vulnerability factor, indicated in the left column. Last three lines, however, slightly differ from the Slovenian and Italian ones. This is because the first version of the CVA questionnaire did not ask participants to compare the three factors with scores from 1 to 9, but solely with a percentage ratio. While the results between all three workshops are comparable, because the scores can be transformed to percentage ratios, the Croatian ones did not provide the participants' general assessment of importance (e. g., if a participant would give scores 3, 3, 3, to three vulnerability factors, and another scores 9, 9, 9, the percentage scores would be in the same ratio of 33%, 33% and 33%, but it is clear that the second participant deems all three factors to be much more important than the first one).

Table 14: Main statistics for vulnerability scores provided by participants to the Croatian workshop for each vulnerability factor: Average, Mode, Median, Standard deviation. In the leftmost column the corresponding question of the CVA, see legend in Section 4.5.

Question	Average	Mode	Median	Standard deviation
Q4a	8,6	9	9	0,7
Q4b	8,3	9	9	0,8
Q4c	7,4	9	8	1,5
Q4d	6,9	9	7	1,7
Q4e	6,1	6	6	1,6
Q4f	6,8	7	7	1,9
Q4g	7,5	9	8	1,8
Q4h	6,6	7	7	2,2
Q5a	7,0	8	8	1,0
Q5b	8,0	9	9	1,4
Q5c	7,4	8	8	1,5
Q5d	5,3	5	5	2,0
Q5e	6,3	6	6	2,1
Q5f	4,7	5	5	1,9
Q5g	5,5	7	6	2,4
Q6a	8,8	9	9	0,6
Q6b	8,3	9	8	0,7
Q6c	7,5	9	8	1,3
Q6d	7,8	8	8	1,2
Q6e	8,5	9	9	1,0
Q7d	32%	30%	30%	/
Q7e	39%	40%	40%	/
Q7f	29%	20%	30%	/

The results of the Croatian workshop show the highest assessed importance being given to environmental and socioeconomic factors, while geomorphological factors were not estimated to be as important. As was the case with Slovenian workshop results, the Croatian ones show high dispersion too.
The results for the question on the areas of highest oil spill probability at the Croatian workshop are shown on the chart in Fig. 47. To interpret the chart correctly, please refer to the areas list in the Section 4.3.1 of this report.

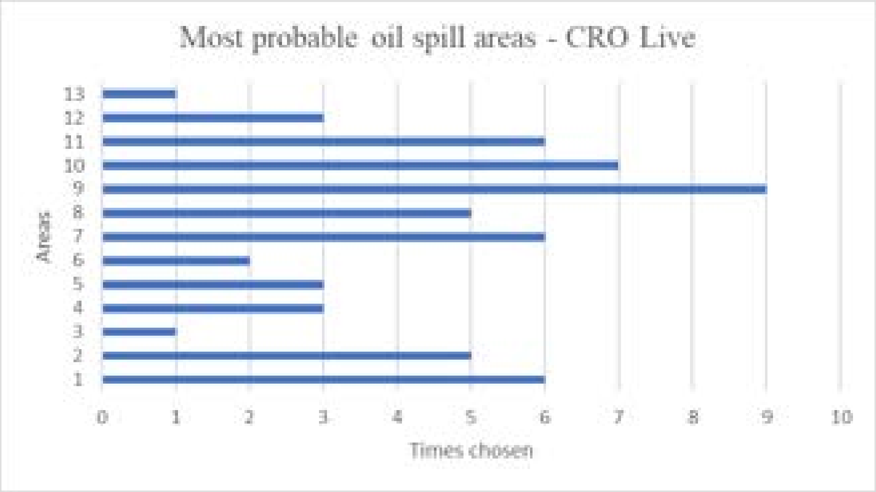


Figure 47: Most probable oil spill locations as selected by the participants to the Croatian workshop.

4.5.3 Italian results

A total of 26 people participated in the Italian CVA workshop, 10 of them online and 16 live. Among them, 12 identified themselves as scientists, professors, or teachers, 4 as members of business sector, 3 as civil servants or elected officials, 4 as members of environmental organisations or other NGOs, 2 as citizens, and one participant did not answer to this question.

Live

The workshop was conducted at the same time live as well as online. Of a total of 26 participants, 16 people participated live. Among them 7 identified themselves as scientists, professors, or teachers, 2 as members of business sector, 1 as civil servant or elected official, 1 as citizen, and 1 did not answer this question. Table 15 showcases the main statistics for each vulnerability factor, indicated in the left column.

Table 15: Main statistics for vulnerability scores provided by participants to the live Italian workshop for each vulnerability factor: Average, Mode, Median, Standard deviation. In the leftmost column the corresponding question of the CVA, see legend in Section 4.5.

Question	Average	Mode	Median	Standard deviation
Q4a	8,3	9	9	1,3
Q4b	8,1	9	9	1,0
Q4c	7,6	9	8	1,6
Q4d	7,3	7	7	1,3
Q4e	5,5	6	6	2,0
Q4f	6,6	9	7	2,4
Q4g	7,4	9	8	1,4
Q4h	6,9	9	7	1,8
Q5a	7,3	8	8	1,8
Q5b	8,1	9	8	1,3
Q5c	7,8	7	8	1,2
Q5d	5,8	6	6	1,9
Q5e	7,7	9	9	1,9
Q5f	6,6	6	7	2,1
Q5g	5,6	9	6	3,0
Q6a	8,5	9	9	0,8
Q6b	8,3	9	9	1,4
Q6c	6,9	7	7	1,2
Q6d	8,3	9	9	1,0
Q6e	8,4	9	9	1,3
Q7a	7,5	7	8	1,1
Q7b	8,7	9	9	0,5
Q7c	7,4	7	7	1,4
Q7d	32%	30%	32%	/
Q7e	37%	39%	38%	/
Q7f	31%	30%	30%	/

The participants gave the highest priority to environmental factors, while socio-economic and geomorphological factors were estimated to be almost equally important. Once again standard deviation highlights high score dispersion.
The results for the question on the areas of highest oil spill probability at the live Italian workshop are shown on the chart in Fig. 48. To interpret the chart correctly, please refer to the areas list in the Section 4.3.1 of this report.

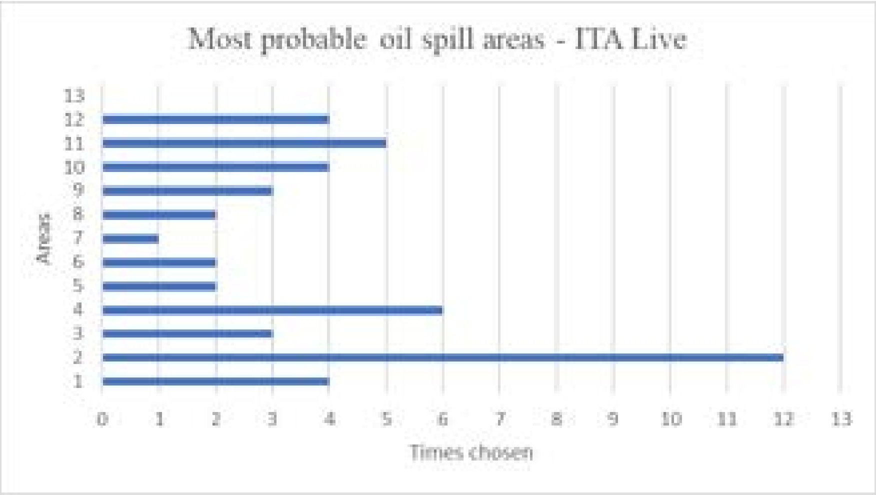


Figure 48: Most probable oil spill locations as selected by the participants to the live Italian workshop.

Online

From the total of 26 participants, 10 participated online. Among them were 5 scientists, professors, or teachers, 1 civilian, 2 members of business sector and 2 civil servants or elected officials. As was the case in the tables showcased above, the one below provides the same information.

Table 16: Main statistics for vulnerability scores provided by participants to the online Italian workshop for each vulnerability factor: Average, Mode, Median, Standard deviation. In the leftmost column the corresponding question of the CVA, see legend in Section 4.5.

Question	Average	Mode	Median	Standard deviation
Q4a	8,3	9	9	0,8
Q4b	7,4	8	8	1,1
Q4c	6,9	8	8	1,6
Q4d	7,2	7	7	1,0
Q4e	6,4	7	7	1,3
Q4f	5,3	6	6	1,8
Q4g	6,3	7	7	1,9
Q4h	6,0	6	6	2,0
Q5a	6,7	8	7	1,9
Q5b	7,3	9	8	1,6
Q5c	7,8	7	8	0,8
Q5d	4,3	6	4	1,9
Q5e	7,0	8	8	1,4
Q5f	6,9	8	8	1,9
Q5g	4,1	2	4	2,3
Q6a	8,4	9	9	0,8
Q6b	7,9	9	9	1,4
Q6c	7,3	7	7	1,4
Q6d	8,3	9	9	1,0
Q6e	8,8	9	9	0,4
Q7a	7,8	8	8	1,1
Q7b	8,5	9	9	1,3
Q7c	7,0	7	7	1,3
Q7d	33%	33%	33%	/
Q7e	36%	38%	38%	/
Q7f	30%	29%	29%	/

Unlike in the previous workshops, the participants of the online Italian workshop gave a higher priority to socio-economic factors then to geomorphology, while environmental factors were assessed in the same manner as before and given the top priority. However, the scores were highly dispersed as it is shown by standard deviation values.
The results for the question on the areas of highest oil spill probability for those participating online to the Italian workshop are shown on the chart in Fig. 49. To interpret the chart correctly, please refer to the areas list in the Section 4.3.1 of this report.

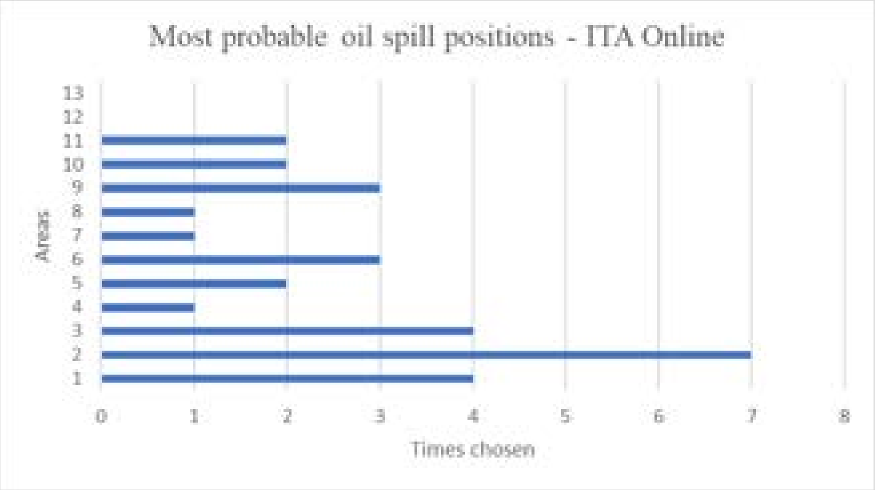


Figure 49: Most probable oil spill locations as selected by the participants to the online Italian workshop.

4.5.4 Joint workshop results

Table 17 shows the joint results of the three organised stakeholders' workshops.

Table 17: Main statistics for vulnerability scores provided by participants to all three stakeholders' workshops for each vulnerability factor: Average, Mode, Median, Standard deviation. In the leftmost column the corresponding question of the CVA, see legend in Section 4.5.

Question	Average	Mode	Median	Standard deviation
Q4a	7,8	9	8,8	1,8
Q4b	7,6	9	8	1,5
Q4c	6,7	7	8	1,9
Q4d	6,8	7	7	1,7
Q4e	5,7	5	6	1,8
Q4f	6,1	6	7	2,1
Q4g	6,7	8	7	1,9
Q4h	6,4	7	7	2,0
Q5a	7,2	9	8	1,8
Q5b	7,5	9	8	1,8
Q5c	7,2	7	8	2,0
Q5d	5,1	6	5	2,1
Q5e	6,7	9	7	2,0
Q5f	6,4	7	7	2,2
Q5g	5,2	5	6	2,5
Q6a	8,2	9	9	1,3
Q6b	8,0	9	8	1,4
Q6c	7,1	7	7	1,4
Q6d	7,8	9	8,5	1,5
Q6e	8,3	9	9	1,4
Q7a	7,4	7	8	1,4
Q7b	8,3	9	9	1,2
Q7c	7,1	8	7	1,5
Q7d	32%	29%	32%	/
Q7e	36%	38%	38%	/
Q7f	31%	33%	30%	/

The joint results highlight that the highest priority was given to the environmental factors, while socio-economic and geomorphological factors were given similar levels of priority with the slight advantage of the former.
The research team also separately calculated measures of central tendency and standard deviation for each of the self-assessed categories of stakeholders. In this way, possible differences in the answers due to the different background of the participants can be assessed.
Table 18 shows joint results of answers provided by members belonging to either environmental organisations or other NGOs.

Table 18: Main statistics for vulnerability scores of each vulnerability factor provided by participants that self-assessed as members of Environmental organizations of NGOs in all three stakeholders' workshops: Average, Mode, Median, Standard deviation. In the leftmost column the corresponding question of the CVA, see legend in Section 4.5.

ENVIRONMENTAL ORGANISATION OR NGO				
Question	**Average**	**Mode**	**Median**	**Standard deviation**
Q4a	7,4	9	9	2,8
Q4b	7,6	9	9	2,2
Q4c	7,3	9	9	2,6
Q4d	7,0	9	8	2,6
Q4e	4,6	6	5	1,6
Q4f	4,7	5	5	2,1
Q4g	6,4	6	6	2,3
Q4h	6,3	6	6	2,2
Q5a	7,3	9	8	2,3
Q5b	5,9	8	7	2,9
Q5c	6,7	9	8	3,1
Q5d	4,7	2	5	2,4
Q5e	8,6	9	9	0,8
Q5f	6,9	9	7	2,5
Q5g	2,3	1	2	1,6
Q6a	7,7	9	9	2,6
Q6b	8,0	9	9	2,6
Q6c	7,4	9	8	1,9
Q6d	7,6	9	9	2,6
Q6e	7,7	9	9	2,6
Q7a	7,1	7	7	1,6
Q7b	8,7	9	9	0,7
Q7c	6,9	8	8	1,9
Q7d	31%	29%	29%	/
Q7e	38%	38%	38%	/
Q7f	30%	33%	33%	/

Table 19 shows joint results of answers provided by employees of the maritime business sector.

Table 19: Main statistics for vulnerability scores of each vulnerability factor provided by participants that self-assessed as members of the Business sector in all three stakeholders' workshops: Average, Mode, Median, Standard deviation. In the leftmost column the corresponding question of the CVA, see legend in Section 4.5.

BUSINESS SECTOR				
Question	**Average**	**Mode**	**Median**	**Standard deviation**
Q4a	8,2	9	9	1,2
Q4b	7,9	9	9	1,5
Q4c	6,7	9	7	2,0
Q4d	6,9	7	7	1,5
Q4e	5,5	3	6	2,1
Q4f	7,4	9	8	2,1
Q4g	7,0	9	8	2,1
Q4h	6,8	9	7	2,2
Q5a	7,3	8	8	1,4
Q5b	7,8	9	9	1,6
Q5c	7,2	9	8	1,9
Q5d	5,0	3	5	2,5
Q5e	6,3	5	6	1,7
Q5f	5,8	8	6	2,4
Q5g	5,3	7	6	2,6
Q6a	8,2	9	9	1,2
Q6b	7,7	8	8	1,4
Q6c	6,9	5	7	1,5
Q6d	7,7	9	8	1,4
Q6e	8,5	9	9	0,9
Q7a	7,1	9	7	1,8
Q7b	8,3	9	9	1,1
Q7c	8,0	9	8	1,1
Q7d	30%	33%	29%	/
Q7e	35%	33%	38%	/
Q7f	34%	33%	33%	/

Table 20 shows joint results of answers provided by those that in the three workshops identified themselves as scientists, professors or teachers.

Table 20: Main statistics for vulnerability scores of each vulnerability factor provided by participants that self-assessed as Scientist, professor or teacher in all three stakeholders' workshops: Average, Mode, Median, Standard deviation. In the leftmost column the corresponding question of the CVA, see legend in Section 4.5.

SCIENTIST, PROFESSOR OR TEACHER				
Question	**Average**	**Mode**	**Median**	**Standard deviation**
Q4a	7,8	9	8	1,7
Q4b	7,2	7	7	1,5
Q4c	6,2	7	7	2,0
Q4d	6,2	7	7	1,8
Q4e	5,9	5	6	1,4
Q4f	5,6	6	6	2,4
Q4g	6,3	6	7	1,9
Q4h	6,0	6	6	2,0
Q5a	7,8	9	8	1,6
Q5b	7,4	8	8	1,9
Q5c	6,6	7	7	1,8
Q5d	4,8	6	5	2,2
Q5e	6,8	9	7	2,0
Q5f	6,8	7	7	2,2
Q5g	5,0	3	5	2,5
Q6a	7,9	9	8	1,3
Q6b	7,8	9	8	1,3
Q6c	6,8	7	7	1,2
Q6d	7,3	8	8	1,4
Q6e	8,0	9	9	1,4
Q7a	6,8	7	7	1,5
Q7b	8,0	9	9	1,3
Q7c	7,0	7	7	1,8
Q7d	31%	30%	31%	/
Q7e	37%	39%	38%	/
Q7f	32%	30%	31%	/

Table 21 shows joint results of answers provided by participants to all three workshop who self-assessed as civil servants or elected officials.

Table 21: Main statistics for vulnerability scores of each vulnerability factor provided by participants that self-assessed as Civil servant, elected official in all three stakeholders' workshops: Average, Mode, Median, Standard deviation. In the leftmost column the corresponding question of the CVA, see legend in Section 4.5.

CIVIL SERVANT, ELECTED OFFICIAL				
Question	Average	Mode	Median	Standard deviation
Q4a	7,6	9	8	1,9
Q4b	7,6	9	8	1,6
Q4c	6,6	8	7	1,8
Q4d	6,6	5	7	1,7
Q4e	5,8	5	6	1,9
Q4f	6,1	6	6	1,8
Q4g	6,7	8	7	2,0
Q4h	6,2	7	7	2,0
Q5a	7,4	9	8	1,9
Q5b	7,7	9	8	1,6
Q5c	7,1	8	8	2,0
Q5d	5,5	5	5	1,9
Q5e	6,3	7	7	2,1
Q5f	6,1	9	6	2,2
Q5g	5,5	7	6	2,2
Q6a	8,3	9	9	1,2
Q6b	8,0	9	8	1,2
Q6c	7,1	7	7	1,5
Q6d	7,8	9	8	1,4
Q6e	8,2	9	9	1,3
Q7a	7,5	8	8	1,2
Q7b	8,2	9	9	1,3
Q7c	7,3	8	8	1,4
Q7d	33%	32%	32%	/
Q7e	36%	36%	36%	/
Q7f	32%	32%	32%	/

Table 22 shows the joint results of answers provided by participants to all three workshop who self-assessed as citizens.

Table 22: Main statistics for vulnerability scores of each vulnerability factor provided by participants that self-assessed as Citizen in all three stakeholders' workshops: Average, Mode, Median, Standard deviation. In the leftmost column the corresponding question of the CVA, see legend in Section 4.5.

CITIZEN				
Question	Average	Mode	Median	Standard deviation
Q4a	8,0	8	8	0,7
Q4b	7,2	7	7	1,1
Q4c	6,8	7	7	0,8
Q4d	7,0	7	7	0,7
Q4e	5,4	7	6	2,1
Q4f	7,2	7	7	0,9
Q4g	7,0	7	7	1,2
Q4h	6,6	7	7	1,1
Q5a	6,6	9	8	2,9
Q5b	8,4	9	9	0,9
Q5c	7,2	7	7	2,0
Q5d	5,2	4	4	2,8
Q5e	7,0	8	8	2,0
Q5f	7,2	9	8	2,0
Q5g	6,2	5	5	2,7
Q6a	8,8	9	9	0,4
Q6b	8,8	9	9	0,4
Q6c	7,6	7	7	1,3
Q6d	8,6	9	9	0,9
Q6e	8,6	9	9	0,9
Q7a	7,4	8	8	1,5
Q7b	8,2	9	9	1,3
Q7c	7,2	7	7	0,4
Q7d	32%	33%	33%	/
Q7e	36%	38%	38%	/
Q7f	32%	29%	29%	/

In Figs. 50-69 the participants' rankings of the different vulnerability factors are shown as graph charts.

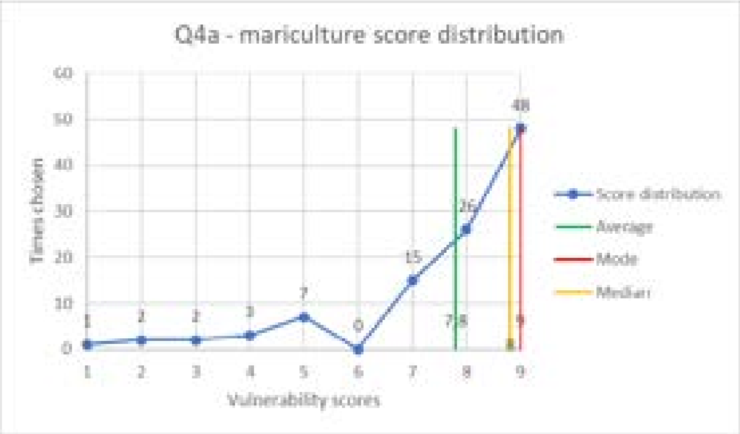


Figure 50: Graph chart of the rankings assigned to Q4a vulnerability factor by participants to all three workshops. Blue = score distribution, Green = average score value, Red = mode of score values, Yellow = median score value.

Figure 51: Graph chart of the rankings assigned to Q4b vulnerability factor by participants to all three workshops. Blue = score distribution, Green = average score value, Red = mode of score values, Yellow = median score value.

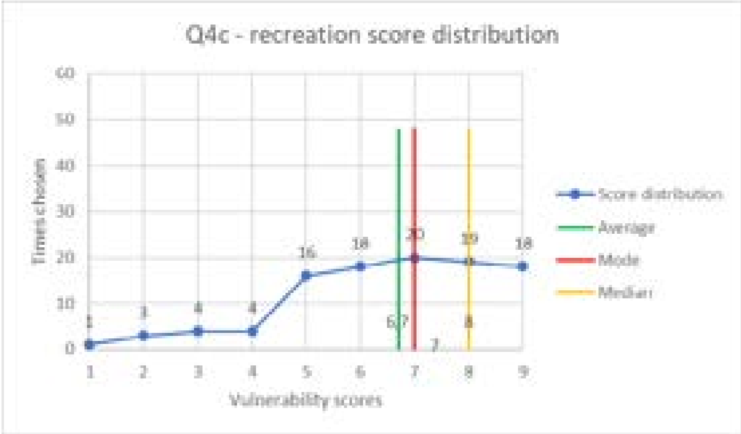


Figure 52: Graph chart of the rankings assigned to Q4c vulnerability factor by participants to all three workshops. Blue = score distribution, Green = average score value, Red = mode of score values, Yellow = median score value.

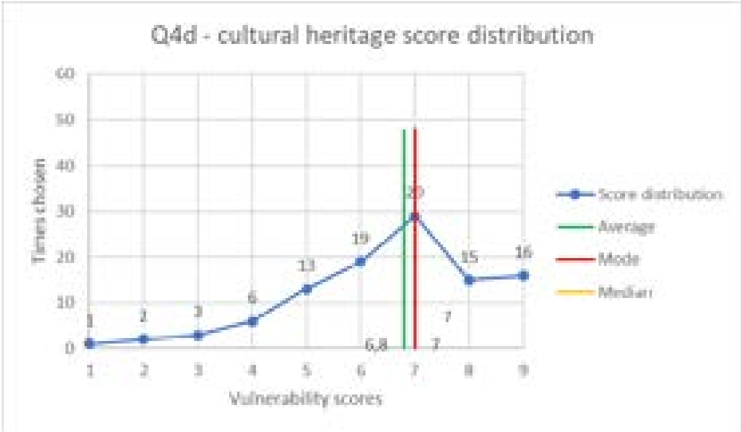


Figure 53: Graph chart of the rankings assigned to Q4d vulnerability factor by participants to all three workshops. Blue = score distribution, Green = average score value, Red = mode of score values, Yellow = median score value.

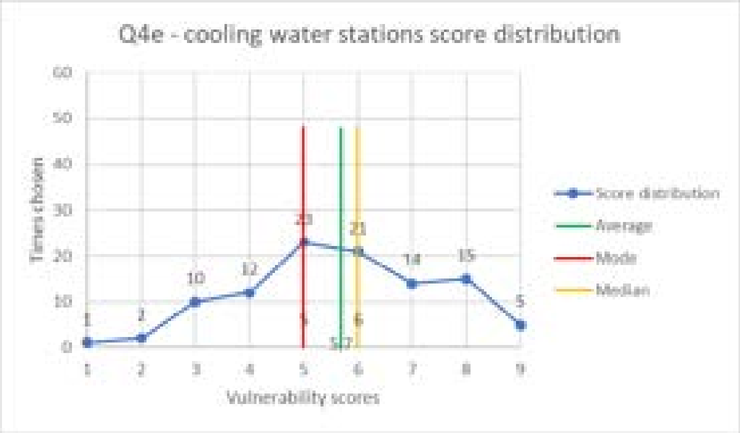


Figure 54: Graph chart of the rankings assigned to Q4e vulnerability factor by participants to all three workshops. Blue = score distribution, Green = average score value, Red = mode of score values, Yellow = median score value.

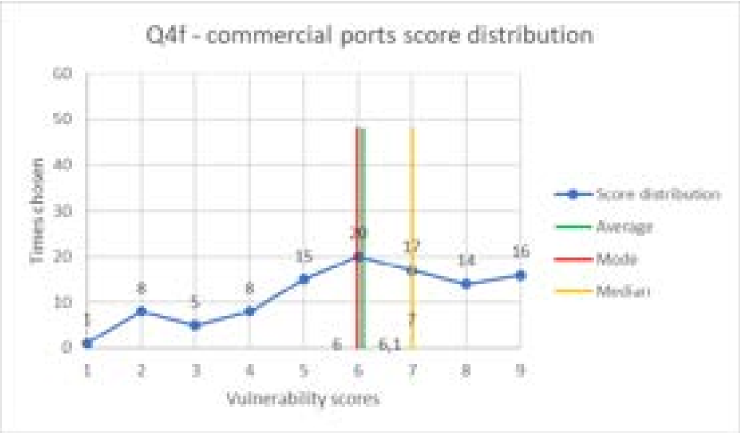


Figure 55: Graph chart of the rankings assigned to Q4f vulnerability factor by participants to all three workshops. Blue = score distribution, Green = average score value, Red = mode of score values, Yellow = median score value.

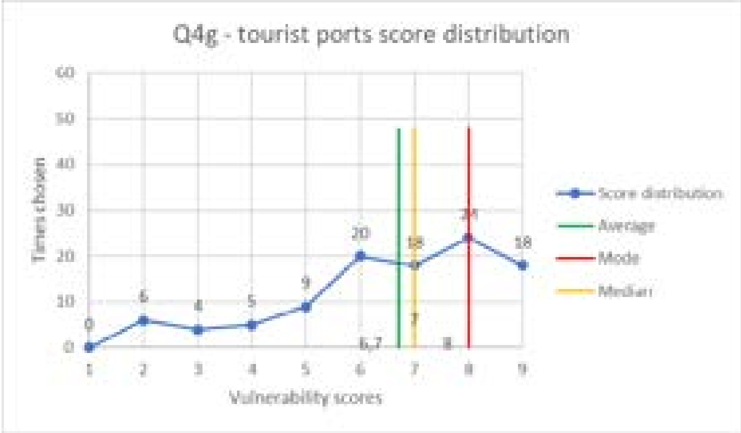


Figure 56: Graph chart of the rankings assigned to Q4g vulnerability factor by participants to all three workshops. Blue = score distribution, Green = average score value, Red = mode of score values, Yellow = median score value.

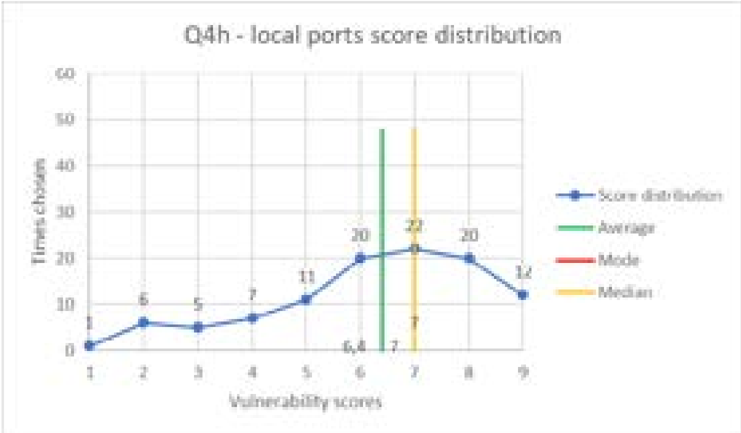


Figure 57: Graph chart of the rankings assigned to Q4h vulnerability factor by participants to all three workshops. Blue = score distribution, Green = average score value, Red = mode of score values, Yellow = median score value.

Figure 58: Graph chart of the rankings assigned to Q5a vulnerability factor by participants to all three workshops. Blue = score distribution, Green = average score value, Red = mode of score values, Yellow = median score value.

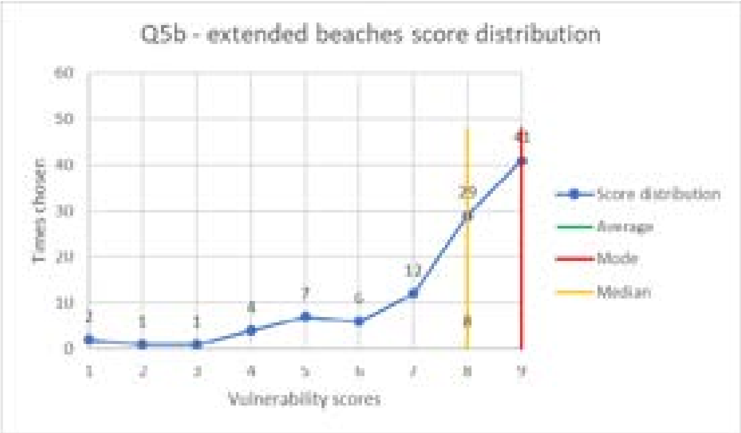


Figure 59: Graph chart of the rankings assigned to Q5b vulnerability factor by participants to all three workshops. Blue = score distribution, Green = average score value, Red = mode of score values, Yellow = median score value.

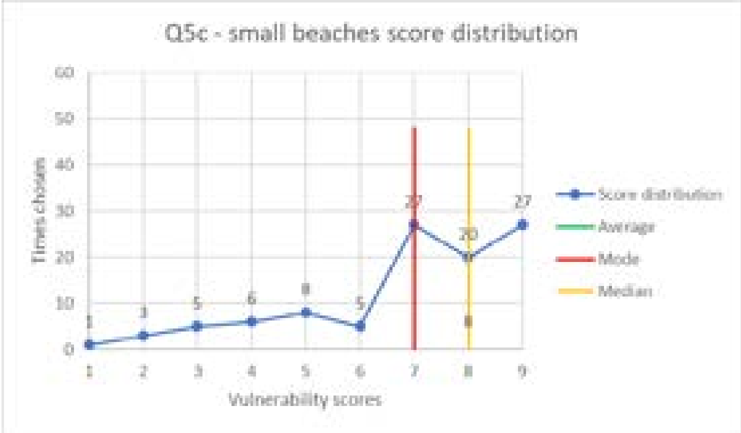


Figure 60: Graph chart of the rankings assigned to Q5c vulnerability factor by participants to all three workshops. Blue = score distribution, Green = average score value, Red = mode of score values, Yellow = median score value.

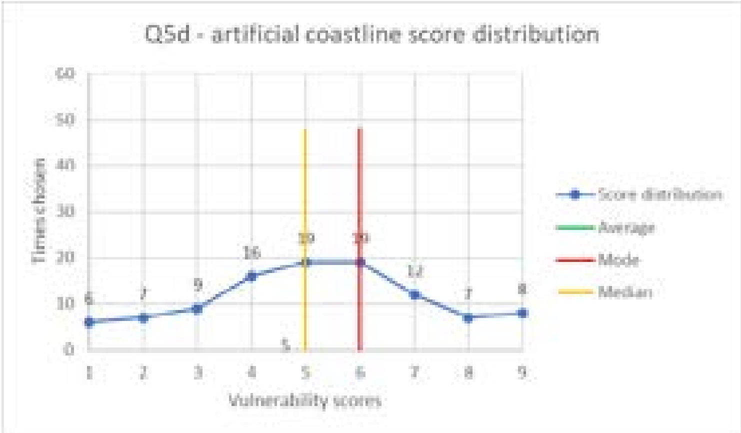


Figure 61: Graph chart of the rankings assigned to Q52 vulnerability factor by participants to all three workshops. Blue = score distribution, Green = average score value, Red = mode of score values, Yellow = median score value.

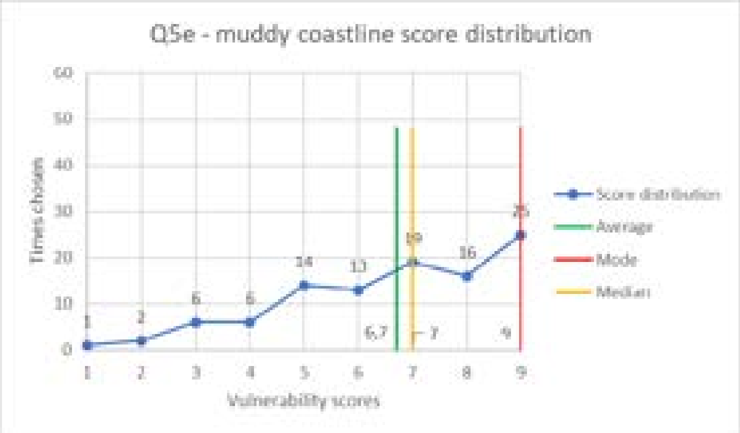


Figure 62: Graph chart of the rankings assigned to Q5e vulnerability factor by participants to all three workshops. Blue = score distribution, Green = average score value, Red = mode of score values, Yellow = median score value.

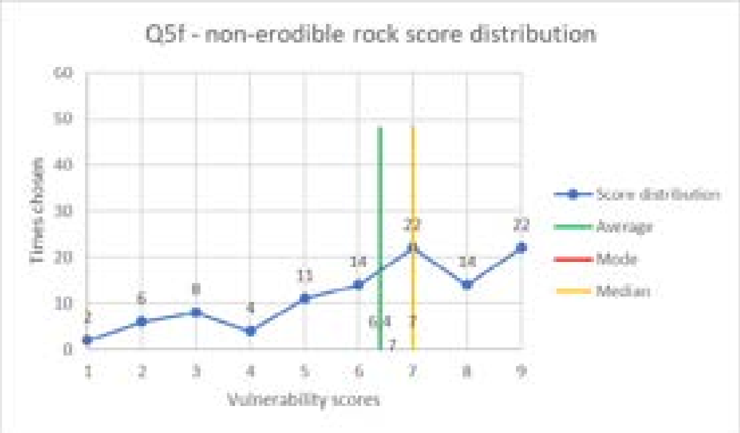


Figure 63: Graph chart of the rankings assigned to Q5f vulnerability factor by participants to all three workshops. Blue = score distribution, Green = average score value, Red = mode of score values, Yellow = median score value.

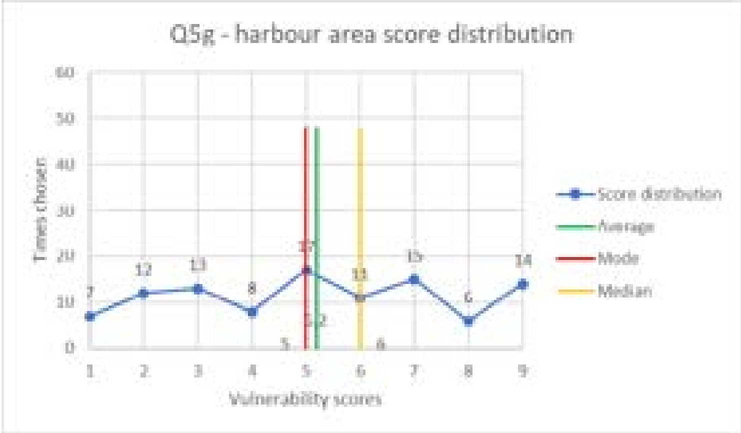


Figure 64: Graph chart of the rankings assigned to Q5g vulnerability factor by participants to all three workshops. Blue = score distribution, Green = average score value, Red = mode of score values, Yellow = median score value.

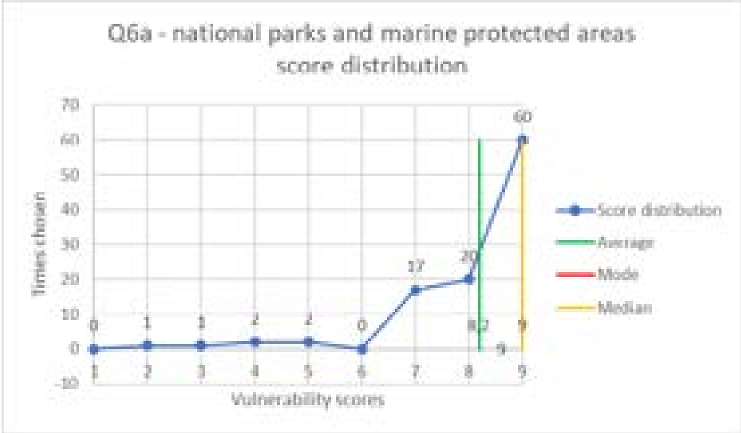


Figure 65: Graph chart of the rankings assigned to Q6a vulnerability factor by participants to all three workshops. Blue = score distribution, Green = average score value, Red = mode of score values, Yellow = median score value.

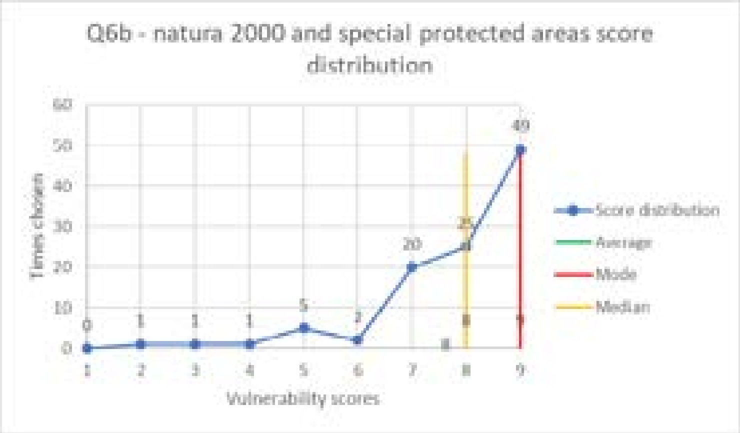


Figure 66: Graph chart of the rankings assigned to Q6b vulnerability factor by participants to all three workshops. Blue = score distribution, Green = average score value, Red = mode of score values, Yellow = median score value.

Figure 67: Graph chart of the rankings assigned to Q6c vulnerability factor by participants to all three workshops. Blue = score distribution, Green = average score value, Red = mode of score values, Yellow = median score value.

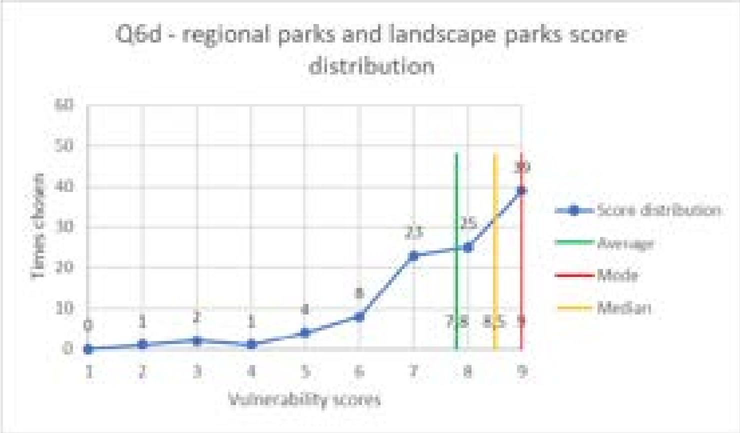


Figure 68: Graph chart of the rankings assigned to Q6d vulnerability factor by participants to all three workshops. Blue = score distribution, Green = average score value, Red = mode of score values, Yellow = median score value.

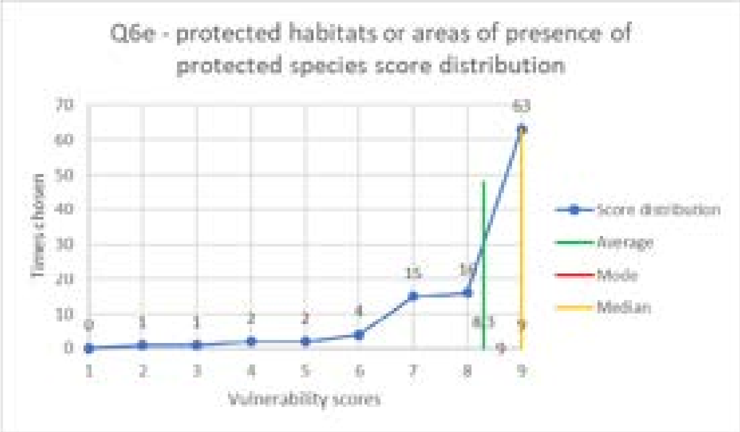


Figure 69: Graph chart of the rankings assigned to Q6e vulnerability factor by participants to all three workshops. Blue = score distribution, Green = average score value, Red = mode of score values, Yellow = median score value.

The graphs show that most participants refrained from using the lowest available scores, most likely due to not having a complete perspective over the importance of some of the vulnerability factor groups, which led to overestimation of the vulnerability for some factors. This is also highlighted by the overall standard deviation values which show high dispersion. In general, it can be observed that the highest rankings are those most favoured for all vulnerability factors.

In Fig. 70 the results on the most probable position of oil spill incidents in the Northern Adriatic Sea according to all the participants to the three workshops are shown.

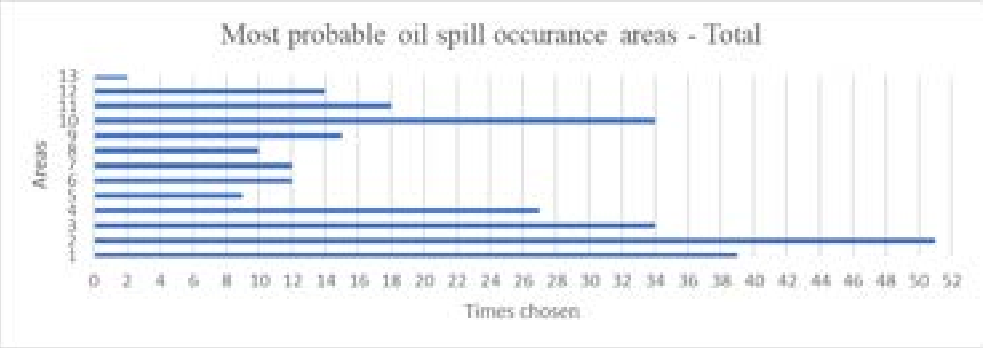


Figure 70: Most probable oil spill locations as selected by the participants to all three stakeholders' workshops.

It can be seen that the participants perceived as the most dangerous areas the SIOT terminal in Trieste, the Trieste anchorage, the separation triangle, and the Koper anchorage. Two participants indicated additional positions for incidents involving oil spills. The first participant indicated the INA terminal in front of Rijeka (see 4.3.1: this choice was later included into the 4th option, so this area was chosen 28 times in total), while the other did not suggest any alternative position.
In general, the results to this question were as expected, with two exceptions, first being the high number of times the SIOT terminal was selected, the second being the low number of times the Venice anchorage was selected. In fact, SIOT terminal was the people's first choice by a large margin, probably also because of the memories of the terrorist attack in 1972. On the other hand, the latter was chosen fewer times than expected, most likely because there were not many participants from that region, but predominantly from Slovenia, Croatia, and the FVG region in Italy.

4.6 Discussion

The cumulative score distribution graphs of each vulnerability factor highlight how most participants refrained from using the whole available spectre of scores ranging from the lowest to the highest, but mostly used scores of the upper half, which can be interpreted in two ways.

The first assumption based on the results would be that participants simply deem all the vulnerability factors to be very important and consequentially would not neglect any of them should an oil spill occur. Another hypothesis is that workshop participants lacked proper knowledge on some of the vulnerability factors, which resulted in overestimation. A better explanation from the organizers on the vulnerability factors might have enlarged the range of values used by the participants. Nevertheless, all participants belonged to a group of experts, and we can consider that in any case they had sufficient knowledge for an informed compilation of the questionnaires.

The joint results highlighted that the participant stakeholders assigned the highest priority, with a share of 36%, to the environmental factors, while socio-economic and geomorphological factors were given similar levels of priority topping 32% and 31% respectively. Thus, all three groups of vulnerability factors were valued in a similar way from the stakeholders. More detailed analysis might bring in the spotlight possible different rankings assigned by the different categories of stakeholders.

The result on the group of environmental vulnerability factors were in part surprising. All categories of protection were assigned high vulnerability values by the stakeholders. This might have been the result of a conscious choice by the stakeholders. Nowadays the environmental conscience is very high and perhaps the stakeholders perceived that no area, protected or unprotected, should be degraded by the consequences of an oil spill. On the other hand, perhaps the communication from the organizers as to what are the unprotected areas was not sufficient. In fact, it seems as if the stakeholders did assign a high vulnerability to unprotected areas precisely because they are not protected. With the same logic, a protected area, being already protected, was considered less vulnerable to oil spills. This might have been addressed better by the organizers, since a pollution from and oil spill would degrade the protected and the unprotected areas in the same way. Nevertheless, inherent in the system of nature protection and conservation is the idea that areas need different protection according to their importance. Thus, areas more deserving protection, get higher levels of protection (i.e., at the level of MPAs or National Parks), while areas less deserving protection, get lower forms of protection (e.g., Natura2000 or protected habitats according to one of the EU directives). The results of the stakeholders' workshops might have been different if we chose to ask about the "value" or "importance" of the environmental factors, rather than about the "vulnerability".

In any case, the results for the group of environmental factors were too much compressed on the high end of the ranking: the lowest average value 7,1 was assigned to the category of unprotected areas, the highest 8,3 to protected habitats or areas of presence of protected species. To MPAs and National Parks, the highest levels of protection in Italy and Croatia respectively, the average value of vulnerability assigned by the participants was 8,2. If we used these values for the vulnerability index and vulnerability mapping, simply all areas of the Northern Adriatic coastline would require very high priority in case of oil spills… This is not practical from the point of view of intervention in case of oil spill and it is thus not useful in the frame of NAMIRS scope and goals. Thus, the research team decided not to use the results of the stakeholders' workshops regarding the vulnerability of environmental factors for vulnerability indexes and mapping derivation. Instead, we opted to use an expert knowledge approach and to assign vulnerability rankings to environmental factors proportionally to the level of legislative protection granted to each protected area. Thus, the MPAs and National Parks were rated highest, the unprotected areas lowest, on a ranking from 1 to 9 (more on this in Section 5).

For the group of geomorphological vulnerability factors, in the workshops we did not ask for "vulnerability" of the different types of coastlines, but for the "value" assigned to them by the stakeholders. This was done because the environmental vulnerability of the coastline is not a matter of subjective judgment, but of objective factors related to the substrate type (grain size, permeability, trafficability, mobility), slope of the shoreline, and its exposure to waves and tides. All these factors affect the fate of the oil particles that might reach the shore, as well as the cleaning methods to apply and their efficiency. Thus, in the vulnerability indexes and mapping, the stakeholders' evaluation of geomorphological factors was merged with the socioeconomic factors, since both express the perceived, subjective value of the stakeholders. On the other hand, in the computation of the geomorphological vulnerability index, we used a modified version of the NOAA ESI (Petersen et al., 2019) instead. The ESI index is an objective evaluation of the difficulty of cleaning each cost type, originally developed for US coasts, but here adapted to the Northern Adriatic Sea coast typologies (see the next Section).

The results of the stakeholders' workshops thus provided the necessary information in order to proceed with the computation of the vulnerability indexes and the production of vulnerability maps for the Northern Adriatic Sea. Based on these, suggestions for the prioritization of protection and cleaning of different coastal areas can be included in contingency planning for emergencies in the Northern Adriatic Sea. A possible future improvement would be to apply the Delphi method of priority selection. In the question on the "familiarity" with the topics of the questionnaire, the participants had to self-assess their level of knowledge on each of the vulnerability factors. The scores of those who expressed higher familiarity level, would have greater importance than the scores of participants with a lesser level of familiarity. In the Delphi method the participants are divided into three levels of knowledge, and the input of each of them is then adjusted to match the corresponding knowledge level. In this way, the answers can be weighted by the expertise of the stakeholders and more weight is given to those that have higher expertise in a certain field.

The involvement of the stakeholders already sparked some interesting developments. First of all, as already described in Section 3, the oil spill simulations set up was possible also thanks to the information on the most common oils travelling in the Northern Adriatic Sea and their characteristics provided by one of the stakeholders, namely SIOT: operating in the Trieste port this is Europe's largest crude oil terminal in the Mediterranean. SIOT's help was much appreciated and instrumental for obtaining good results for NAMIRS. Another stakeholder that participated in the Italian workshop, the Marine Protected Area of Miramare (the first MPA declared in Italy in 1986) asked OGS to help in the preparation of a specific contingency plan in case of oil spill for the area under protection. Thus, NAMIRS is already outgrowing its scope.

Besides obtaining valuable information for the goals of NAMIRS, and besides the above-mentioned developments, and while not being the main goal of the workshops, there were other benefits associated to the organization of the three stakeholders' workshop. One of them was the strengthening of the collaboration between NAMIRS partners, with frequent meetings and coordination between the organizers from the three involved partners (UL-FPP, OGS, ATRAC). Another is the outreach of the project and its goals to a wider public of persons, institution and companies, interested in the exploitation of the sea and of the coastal areas.

5

Vulnerability mapping and assessment

5 / Vulnerability mapping and assessment

5.1 Maps of vulnerability factors

Rapid interventions of the Coast Guard and Response Teams and decisions on priority areas to protect in case of an oil spill event, require detailed information and maps on coastal vulnerability that decision makers can easily and quickly consult.

To provide high-resolution maps of different vulnerability factors (VFs) and the total coastal vulnerability in the Northern Adriatic Sea, georeferenced data on the presence of the selected VFs in NAMIRS (Socioeconomic VFs, Environmental VFs, and Geomorphological VFs; see Section 4), was obtained by previous projects we carried out in the area, by searching on online databases and asking to colleagues that could store such data. A list of the maps of the VFs for each VF group is reported in Table 23 with information on the source, the file format, and a brief description.

Because most kinds of oil are less dense than water, most spilled oil floats on the water surface and it expects to affect mainly upper-sublittoral and surface organisms and structures. Thus, only VFs on the coastline and up to 5 meters depth were retained for the final coastal vulnerability assessment. The bathymetry chart of the Northern Adriatic Sea, used to clip all the maps, was derived from EMODnet – Bathymetry. In addition, a buffer of 3 nautical miles radius was drafted around the coastline to include only the VFs that are closer to the coast, being more prone to be affected by oil spill. Since the study area of the NAMIRS project includes only the marine portion of the Northern Adriatic Sea, coastal lagoons (i.e., the Venice lagoon and the Grado-Marano lagoon) were not considered in the analysis.

Finally, to create the maps of the VFs and of the total coastal vulnerability a score was assigned to each VF based on the mean scores given by the participants to the three workshops or according to our expertise. All operations and analyses on the maps and visualization were performed using the free and open source QGIS software with the WGS84 coordinate reference system (EPSG:4326).

Socioeconomic VFs – The selected socioeconomic VFs included 'Mariculture', 'Cultural heritage sites', 'Harbour areas', 'Recreational-touristic traits of coast', and the 'Value of coast by typology' (Table 23). The 'Mariculture' VF map was downloaded by the Adriplan data portal (http://data.tools4msp.eu/) and include location of shellfish and fish farms (Fig. 71). The map of 'Cultural heritage sites' VF was created by merging information from maps of archaeological and paleontological sites available on EMODnet – Geology (www.emodnet-geology.eu/), EMODnet Human Activities (www.emodnet-human-activities.eu/), and on the Bioportal of Croatia (bioportal.hr). A 100 m radius buffer was created around each cultural heritage point with the aim to cover as much as possible the total extension of the sites (Fig. 72). To have a more realistic representation of the

‘Harbour areas’ VF, the original map of points identifying the ports in the Northern Adriatic Sea, downloaded by the Adriplan data portal, was modified by adding additional ports after comparison with the Google Satellite map. Then, a 100 m, 250 m and 750 m radius buffer were drawn around local ports, marinas and commercial ports, respectively, and an intersection with the Northern Adriatic Sea coastline was performed to obtain a polyline shape file representing harbour areas (categorized in local ports, marinas, commercial ports) (Fig. 73). Since no maps reporting the recreational and touristic sites were available, a joined map of the ‘Recreational-touristic traits of coast’ VF was generated by intersection between the Northern Adriatic Sea coastline and a 100 m radius buffer drawn around the bathing water sites downloaded from EMODnet - Human Activities (Fig. 74). Although the number of traits of coast with recreational-touristic activities may be underestimated using the information on bathing water sites, this was the only available information that we could use as a proxy for deriving such VF. The ‘Value of coast by typology’ VF represents different geomorphological types of coasts, that expect to have a different value to the person who uses them for either environmental or socio-economic activities. The map of ‘Value of coast by typology’ was created by modifying a map of coastal typology in the Northern Adriatic Sea, download from EMODnet – Geology. Nevertheless, different classifications were used by the countries in their entries on the coast typology in the Northern Adriatic Sea. In fact, some categories were present only in Italy, others only in Slovenia, still others only in Croatia. In many cases these categories across different countries were related to the same coast typology. Thus, the original coastal geomorphologies reported in this map were merged in seven categories for simplicity: erodible rock with sediments at the base, extended beaches (> 1 km), small beaches (< 1 km), artificial coastline, muddy coastline, non-erodible rock without sediments at the base, and harbour area (Fig. 75). A value was then assigned to each of these coastal typologies according to the results of the questionnaires (see paragraph 4 and below). Although the ‘Cooling water stations’ VF was considered in the questionnaire provided to the participants of the workshops, no information on the location of this VF in the Northern Adriatic Sea was found, thus the cooling water stations were not included in the final coastal vulnerability map.

Table 23. List of the vulnerability factors used for the coastal vulnerability assessment.

VF	Type	Source	Description	VF group
Mariculture	Shape (polygons)	Adriplan data portal	Shellfish and fish farms	Socio-economic
Cultural heritage sites	Shape (points)	EMODnet geology and human activities; Bioportal Croatia	Archaeological-Paleontological sites	Socio-economic
Harbour areas	Shape (polylines)	Created in QGIS using the coastline of Northern Adriatic Sea, and a layer of ports downloaded from Adriplan data portal	Commercial-industrial ports, local ports, marinas. Further harbour areas were added to the original file after comparison with Google Satellite	Socio-economic
Value of coast by typology	Shape (polylines)	Modified in QGIS from a layer of coastal typology downloaded from EMODnet geology	The coastline of Northern Adriatic Sea is divided in polylines and classified according to the different coastal typologies (e.g., muddy coastline, erosion-resistant coast, harbour area). A value is then assigned to each typology according to the results of the questionnaires	Socio-economic
Recreational-touristic traits of coast	Shape (polylines)	Created in QGIS using the coastline of Northern Adriatic Sea, and the bathing water sites downloaded from EMODnet - Human Activities	The layer reports the traits of coast characterized by touristic and/or recreational activities	Socio-economic

VF	Type	Source	Description	VF group
National parks and Marine Protected Areas of National legislation	Shape (polygons)	Mapamed		Environmental
Regional parks and Landscape parks	Shape (polygons)	Mapamed		Environmental
Natura 2000 and special protection areas	Shape (polygons)	Mapamed		Environmental
Protected habitats and areas of presence of protected species	Shape (polygons, points)	EMODnet Biology (www.emodnet-biology.eu/)	Distribution of coralligenous and maerl	Environmental
	Shape (points)	EMODnet Biology; updated by Emmanuelle	Distribution of *Fucus virsoides*	
	Shape (points)	EMODnet Biology	Distribution of *Cystoseira* spp.	
	Shape (polygons, points)	Miramare MPA; EMODnet Biology	Distribution of *Pinna nobilis*	
	Shape (points)	EMODnet Biology	Distribution of habitat-forming invertebrates	
	Shape (points)	Bioportal of Croatia	Distribution of biocenoses	

VF	Type	Source	Description	VF group
	Shape (polygons, points)	Prof. Annalisa Falace, National Institute of Biology of Slovenia, EMODnet Biology	Distribution of seagrasses	
	Shape (points)	EMODnet Biology	Distribution of *Cladocora caespitosa*	
	Shape (points)	Falace et al 2015; Fortibuoni et al 2020; Gordini and Ciriaco 2020; Ponti 2020; Prof. Annalisa Falace; Adriblu data portal	Distribution of rocky outcrops (‘*trezze*’)	
Unprotected areas	Shape (polygons)	Created in QGIS by difference between the map of Northern Adriatic Sea marine region and the joined map of protected areas and species	Areas without the presence of any kinds of protected site or protected species and habitat	Environmental
Coast cleaning difficulty	Shape (polylines)	Created in QGIS using as a base the layer of coastal typology downloaded from EMODnet - Geology and the ESI ranking of NOAA (Petersen et al., 2019)	The coastline of Northern Adriatic Sea is divided in polylines and classified according to the different coastal typologies (e.g., muddy coastline, erosion-resistant coast, harbour area) and ESI ranking of NOAA	Geo-morphological

Figure 71. Map of the mariculture in the Northern Adriatic Sea.

Figure 72. Map of the cultural heritage sites in the Northern Adriatic Sea.

Figure 71. Map of the mariculture in the Northern Adriatic Sea.

Figure 74. Map of the recreational-touristic traits of coast in the Northern Adriatic Sea.

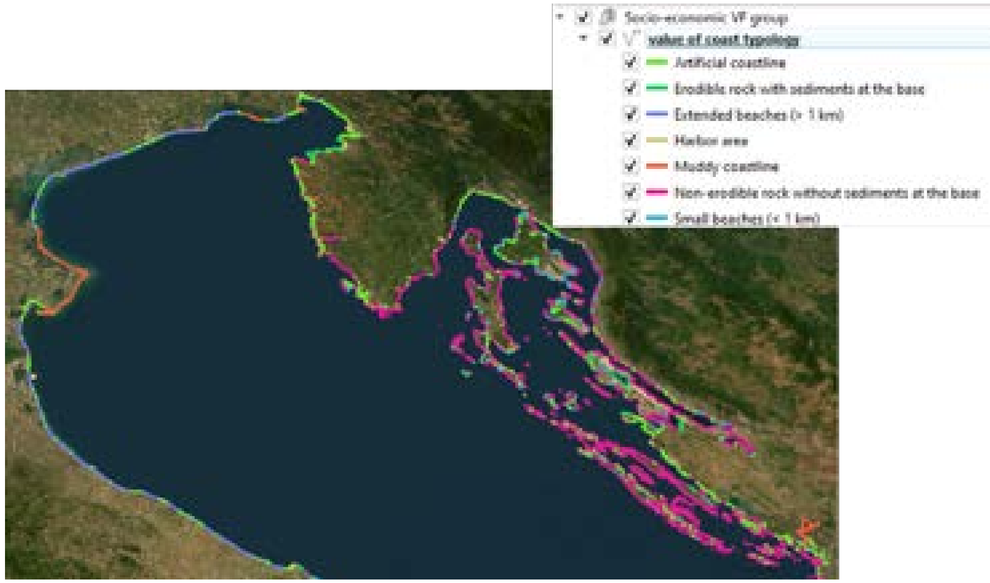


Figure 75. Map of the coastal typologies in the Northern Adriatic Sea. A value is then assigned to each typology according to the results of the questionnaires (not shown in the map).

To each socioeconomic VF the corresponding mean score as given by the participants to the three workshops was assigned. They ranged between 5.1 and 7.8 (Table 24). 'Mariculture' got the highest score, while the lowest value was assigned to the 'artificial coastline' category of the 'Value of coast by typology' VF.

Table 24. Score assigned to each socioeconomic VF.

Socioeconomic VF	Category of the socioeconomic VF	Score
Mariculture		7.8
Cultural heritage sites		6.8
Recreational-touristic traits of coast		7.15
Harbour areas	Local ports	6.4
	Marinas	6.7
	Commercial ports	6.1
Value of coast by typology	Erodible rock with sediments at the base	7.2
	Extended beaches (> 1 km)	7.5
	Small beaches (< 1 km)	7.2
	Artificial coastline	5.1
	Muddy coastline	6.7
	Non-erodible rock without sediments at the base	6.4
	Harbour area	5.2

Environmental VFs – The environmental VF group included 'National Parks and Marine Protected Areas (MPAs)', 'Regional and Landscape parks', 'Natura 2000 sites and special protection areas', 'Protected habitats or areas of presence of protected species', and 'Unprotected areas' (Table 25). The maps of the protected areas in the Northern Adriatic Sea were downloaded from MAPAMED (www.mapamed.org), a database of marine protected areas in the Mediterranean Sea. Nature reserves, Natural monuments, National special reserves, and Landscape parks were included in the 'Regional and Landscape parks' VF. All parks designed under an international legislation (e.g., Ramsar sites, SPAMI) were considered 'special protection areas' and included in a VF with Natura 2000 sites. The maps with the distribution of protected species and habitats in the Northern Adriatic Sea were obtained from literature, Adriblu data portal and colleagues (Tab. 23). A 100 m radius buffer was created around the occurrence points of species and habitat as a better proxy of their presence. The 'Unprotected areas' VF was obtained by subtracting the surface area of the joined map of protected areas and protected species and habitats to the map of the whole Northern Adriatic Sea marine region (Fig. 76).
Participants to the workshops assigned a mean score of 8.3 to protected species and habitats; 8.2 to national parks and MPAs; 8 to Natura 2000 and special protection areas; 7.8 to regional and landscape parks and 7.1 to unprotected areas. Since these scores would give a misleading result, increasing the importance of protected species and habitats respect to the Natura 2000 sites and regional parks, we decided to assign an arbitrary score (from 1 to 9) to the environmental VFs based on the level of formal protection granted to the different categories of protected areas (Tab. 25).

Table 25: Vulnerability scores assigned to each environmental VF.

Environmental VF	Score
National parks and MPAs	9
Regional and landscape parks	7
Natura 2000 and special protection areas	5
Protected species and habitats	3
Unprotected areas	1

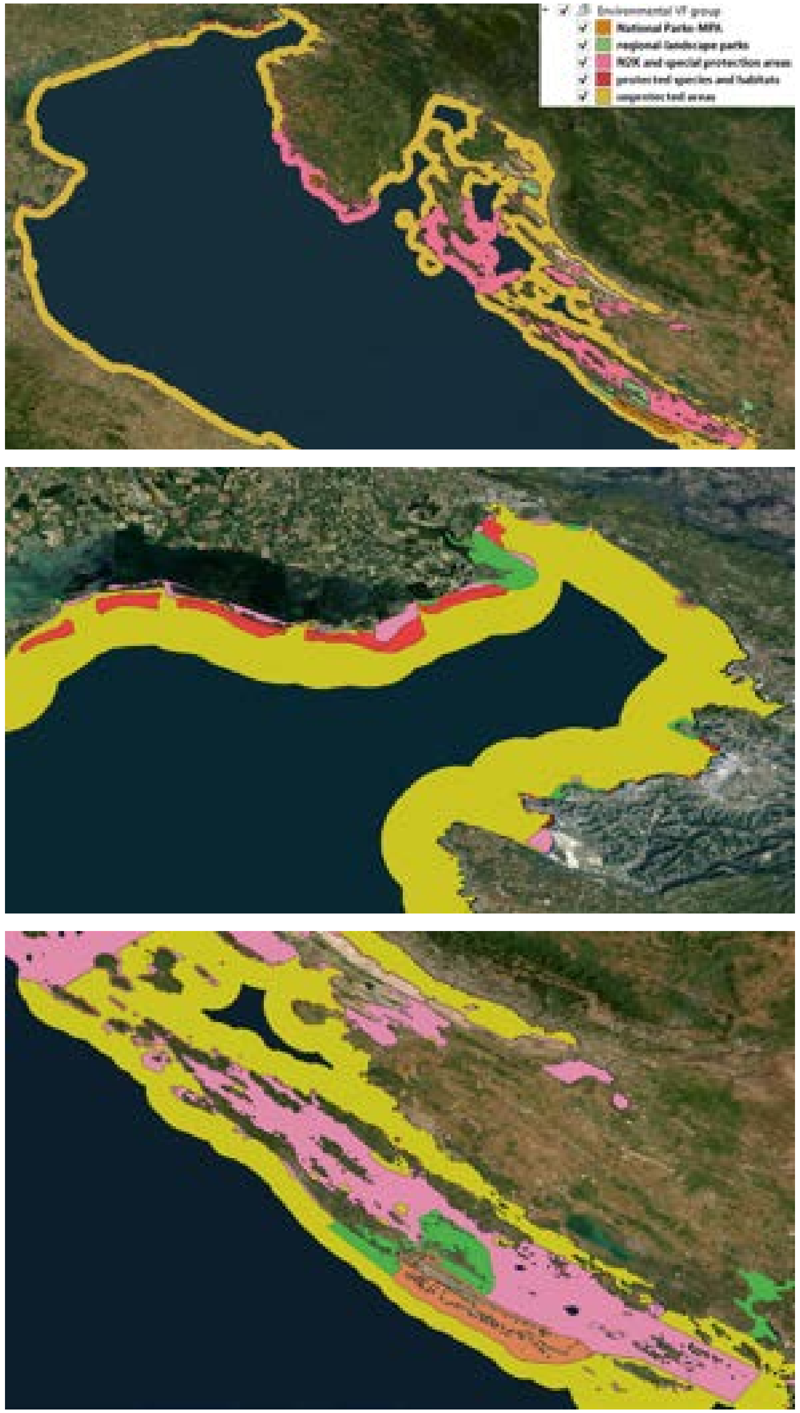


Figure 76. Map of the environmental VFs in the Northern Adriatic Sea. Details of the Gulf of Trieste and the coastline of the Kornati archipelago are also shown.

Geomorphological VFs – Since every beach or coastline is composed of different materials, which respond to oil in different ways, geomorphology must be taken into account as well.

To create a map with the information on the coast cleaning difficulty, coastal geomorphologies in the Northern Adriatic Sea, were downloaded from EMODnet – Geology. Nevertheless, different classifications were used by the countries in their entries on the coast typology in the Northern Adriatic Sea. In fact, some categories were present only in Italy, others only in Slovenia, still others only in Croatia. In many cases these categories across different countries were related to the same coast typology. These categories were compared and matched, as much as possible, Environmental Sensitivity Index (ESI) that assess the coastal sensitivity to oil spill (https://response.restoration.noaa.gov/oil-and-chemical-spills/oil-spills/shoreline-sensitivity-rankings-list, Petersen et al., 2019) (Table 26, Fig. 77). For instance, the categories 'Harbor area' and 'Coastal embarkment with construction' were unified and matched with the NOAA category 'Exposed solid man-made structures', while all the categories that identify small and pocket beaches were unified and matched with the NOAA category 'Mixed sand and gravel beaches' (see Table 26 for a complete correspondence between our categories and those identified by NOAA). To each identified category, a score was assigned according to the ESI ranking. This ranking ranges from 1 to 10: higher values indicate greater sensitivity to oil spill, thus, in our case, a value of 10 indicates a higher coast cleaning difficulty. The lowest scores are assigned to the coastal typology categories that are easier to clean such as 'Exposed rocky shores' and 'Exposed man-made structures' (score 1) and 'Fine to medium-grained sand beaches' (score 3). Intermediate scores are assigned to 'Mixed sand and gravel beaches' (score 5), and to 'Gravel beaches' and 'Riprap' (score 6). A high score (8) is assigned to 'Sheltered rocky rubble shores'. Since NOAA ESI attributes a rank from 7 to 10 to categories identifying estuaries and muddy coastlines (i.e., 'Exposed tidal flats', 'Sheltered tidal flats', 'Vegetated low banks', 'Salt- and brackish-water marshes'), we assigned a rank of 9 to these coastal typologies in the Northern Adriatic Sea. The ESI ranks 2, 4, and 10 were not assigned in the NAMIRS ranking since the categories of coastal geomorphology identified in the NOAA index with this score are not present in the Northern Adriatic Sea (e.g., 'Coarse-grained sand beaches' - score 4, and 'Inundated low-lying tundra' - score 10). Since the NOAA ranking scale goes from 1 to 10, while the rank scale proposed in the questionnaires presented to the participants ranged between 1 and 9, we rescaled the assigned ranks according to this range. The new ranking is reported in Table 26.

Coastal typology (EMODnet - Geology)	NOAA categories	NOAA rank	NAMIRS assigned rank	Rescaled NAMIRS rank
[illegible] rock and/or cliff, without loose erodible material at the fronting sea	Exposed rocky shores	1	1	1
Harbor area	Exposed, solid man-made structures	1	1	1
Coastal embankment with construction	Exposed, solid man-made structures	1	1	1
Sand beach fronting upland (> 1 km long)	Fine to medium grained sand beaches	3	3	2.78
Pocket beaches (< 100 m long)	Mixed sand and gravel beaches	5	5	4.56
Small beaches	Mixed sand and gravel beaches	5	5	4.56
Small beaches (100 to 1000 m long) [illegible]	Mixed sand and gravel beaches	5	5	4.56
[illegible]	Mixed sand and gravel beaches	5	5	4.56
Gravel beach fronting upland (> 1 km long)	Gravel beaches	6	6	5.44
Heterogeneous beach	Riprap	6	6	5.44
Artificial beach	Riprap	6	6	5.44
Artificial shoreline (walls, dike, quay) without beach	Riprap	6	6	5.44
Erodible rock and/or cliff, with rock waste and sediments (sand or pebbles) at its base	Sheltered rocky rubble shores	8	8	7.22
Beach, unspecified	Exposed tidal flats; Sheltered tidal flats; Vegetated l[illegible]	7-10	9	8.11
Beach that is part of extensive non cohesive sedimentary systems (barrier, spit, tombolo)	Exposed tidal flats; Sheltered tidal flats; Vegetated l[illegible]	7-10	9	8.11
Muddy coastline lagune	Exposed tidal flats; Sheltered tidal flats; Vegetated l[illegible]	7-10	9	8.11
Muddy coastline Po	Exposed tidal flats; Sheltered tidal flats; Vegetated l[illegible]	7-10	9	8.11
Muddy coastline, including tidal flat, salt marsh	Exposed tidal flats; Sheltered tidal flats; Vegetated l[illegible]	7-10	9	8.11
Estuary	Exposed tidal flats; Sheltered tidal flats; Vegetated l[illegible]	7-10	9	8.11

Table 26. Coastal typologies classified by sensitivity to oil via Environmental Sensitivity Index (ESI) values, defined by the NOAA, the modified ESI as applied in this project, and the new rank assigned to the coastal typologies for the coast cleaning difficulty map after being rescaled from 1 to 9.

Table 26. Coastal typologies classified by sensitivity to oil via Environmental Sensitivity Index (ESI) values, defined by the NOAA, the modified ESI as applied in this project, and the new rank assigned to the coastal typologies for the coast cleaning difficulty map after being rescaled from 1 to 9.

5.2 Mapping the coastal vulnerability

All maps of the VFs were transformed from vector to raster format with a 100x100m cell size, to calculate the coastal vulnerability index. Before raster conversion, a 50 m radius buffer was drawn around the polyline shape files (i.e., 'Value of coast by typology', 'Recreational-touristic traits of coast', 'Harbour areas', 'Coast cleaning difficulty') to embrace the whole trait of coast.

Separate vulnerability maps for each VF group were generated by overlapping all VF rasters and extracting the maximum value in each raster pixel (Figs. 78-80). Finally, a map of total coastal vulnerability was obtained with the same method (Fig. 81).

Although this method presents some limitation as only one VF is considered in each pixel, it guarantees adequate decisions on the priority areas requiring intervention in case of oil spill, because the most vulnerable VFs are selected to create the vulnerability maps. Vulnerability scores of the maps were then categorized in four classes and visualized in GIS with different colours: very low vulnerability (1-2, green), low vulnerability (3-5, yellow), medium vulnerability (6-7, orange), high vulnerability (8-9, red).

Figure 78. Maps of the coastal vulnerability for the socioeconomic VF group with details of the Gulf of Trieste and the coastline near Rijeka. The red color indicates higher coastal vulnerability.

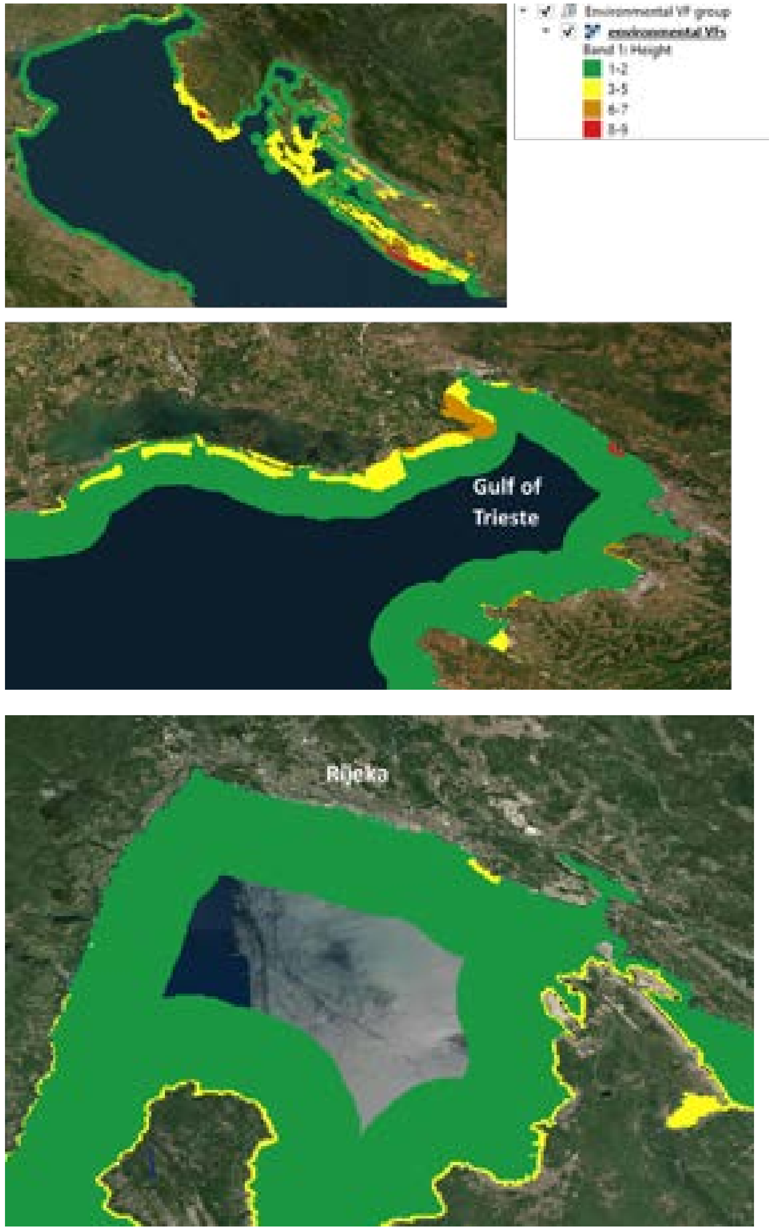


Figure 79. Maps of the coastal vulnerability for the environmental VF group with details of the Gulf of Trieste and the coastline near Rijeka. The red colour indicates higher coastal vulnerability.

Figure 80. Maps of the coastal vulnerability based on the coast cleaning difficulty with details of the Gulf of Trieste and the coastline near Rijeka. The red color indicates higher coast cleaning difficulty.

Figure 81. Maps of the total coastal vulnerability obtained by using information from all the selected VF groups. Details of the Gulf of Trieste and the coastline near Rijeka are also shown. The red color indicates higher coastal vulnerability..

5.3 GIS project and map visualization

All maps were included in a geopackage file for QGIS (Fig. 82). The GeoPackage open format is a container that allows to store GIS data (layers) in a single file. A single GeoPackage file can contain various data (both vector and raster data) in different coordinate reference systems, as well as tables without spatial information; all these features allow to share data easily and avoid file duplication.

In the geopackage file created for the NAMIRS project, and named 'NAMIRS CVA.gpkg', vector and raster maps of all VFs were included, together with the vulnerability maps (both the total coastal vulnerability map and the vulnerability maps of the single VF groups). In the geopackage file, a QGIS project, named 'NAMIRS project' was also uploaded (Fig. 82). Once the project is opened in the QGIS layer panel, the vulnerability maps can be visualized divided by VF group and with different colours according to the four classes of the vulnerability scores (Fig. 83).

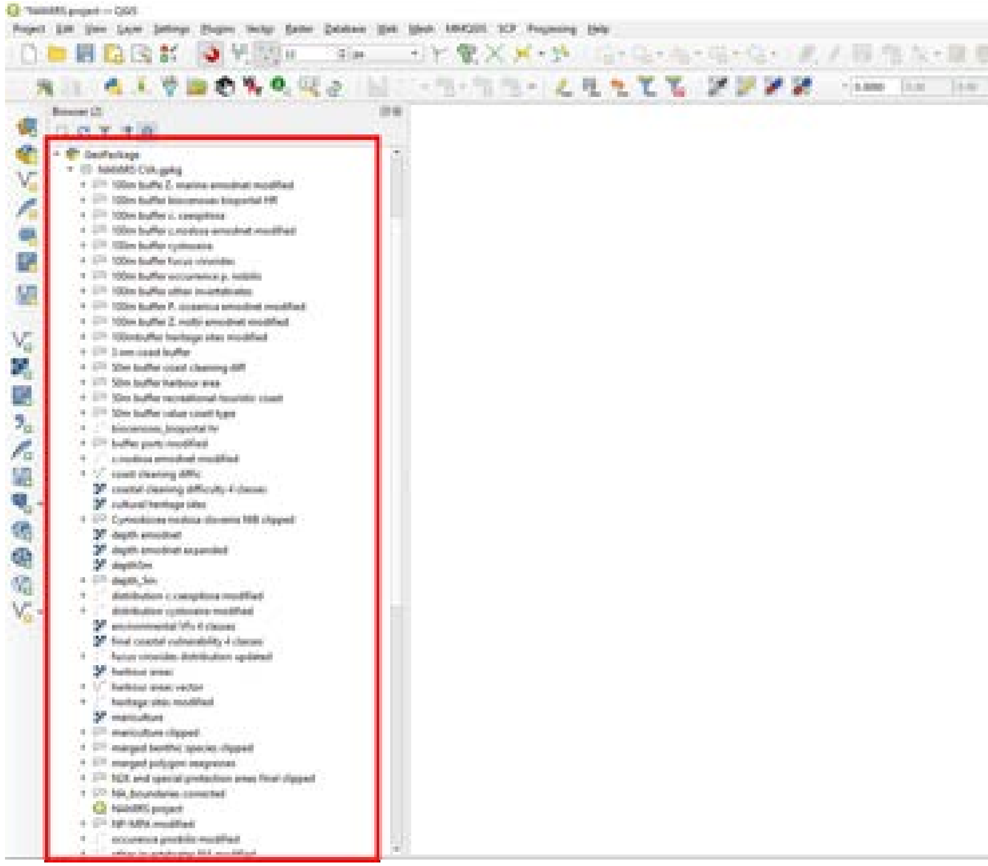


Figure 82. A screenshot of the geopackage file uploaded in QGIS with all the layers and the NAMIRS project (red box).

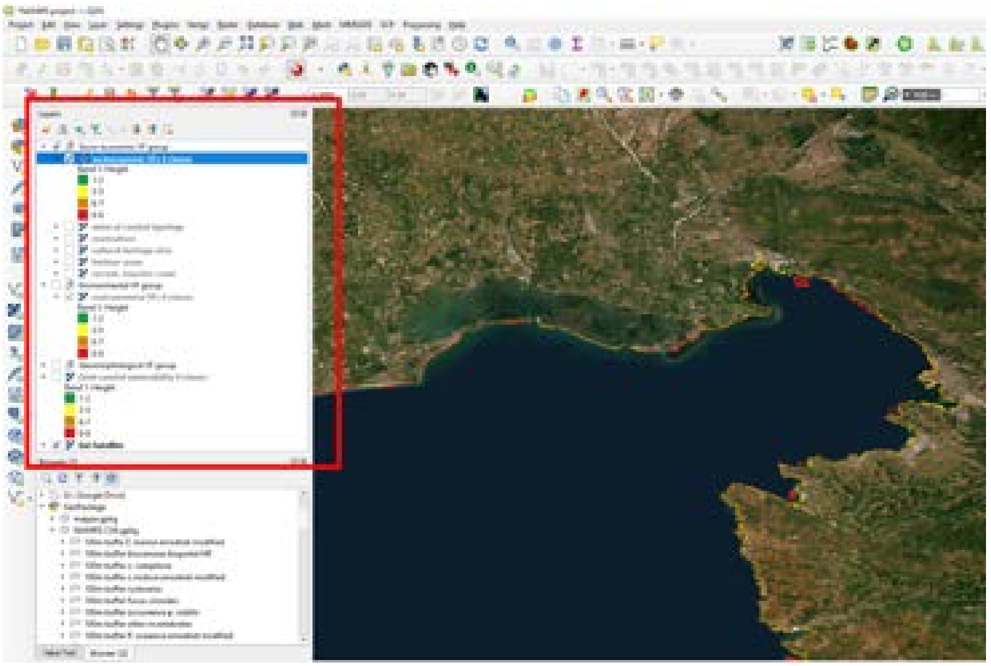


Figure 83. A screenshot of the NAMIRS project opened in the QGIS layer panel (red box). The symbology of the VF group maps is categorized in four classes representing the different levels of coastal vulnerability.

6

Cumulative oil spill risk index

6 / Cumulative oil spill risk index

6.1 Introduction

The term risk refers to the expected loss as a function of hazard, exposure and vulnerability (UNDRO, 1979; Cardona, 2005). Hazard is defined as a potentially damaging event which may cause the loss of biological organisms, environmental degradation, damages and degradation of structures with social and economic importance, and is strictly characterized by its location, intensity, frequency and probability (UNISDR, 2005). Exposure expresses how likely the receptors can be exposed to the abovementioned hazards. Thus, it depends on the type of hazard, on the mechanisms by which receptors can be impacted, and by their location. Vulnerability to a specific hazard is the propensity of the receptors (individuals, groups of people, species, habitats, ecosystems, but also social and economic systems, infrastructure, etc.) to be damaged if they are exposed to that hazard (Menoni et al. 2012).

In literature there exist different conceptual frameworks for the identification and quantification of the mutually interdependent concepts of Hazard-Exposure-Vulnerability-Risk (Landis 2004, Birkmann, 2007; Halpern et al., 2008). In this work, we followed the approaches developed in Menoni et al. (2012), Melaku Canu et al. (2015), Depellegrin et al. (2017), Menegon et al. (2018), Furlan et al. (2018), and in the projects HarmoNIA (Harmonization and Networking for Contaminant Assessment in the Ionian and Adriatic, Seas, EU ADRION, 2018-2019) and SHAREMED (Sharing and Enhancing Capabilities to Address Environmental Threats in Mediterranean Sea, EU Interreg-MED, 2019-2022), adapting them to the specificities of NAMIRS.

In particular, Task 1 (see Section 2) provided an estimate of the hazard related to oil spill in the Northern Adriatic Sea. The estimate was based on the analysis of the traffic in the area, considering routes, traffic density, type of vessels and their characteristics (length, speed, velocity, cargo). From the analysis we derived the information on the most probable location of incidents, the type of incidents (collision, allision, grounding), the type of vessels involved, and the type and quantities of possible oil spills.

In Task 2 (see Section 3) the information on the oil spill hazard was used to derive the information on the exposure of the coastal environment to oil spills in Northern Adriatic Sea. This was done by simulating oil transformation, advection, dispersal, and stranding with an oil spill model based on a Lagrangian particle tracking model on top of a specific North Adriatic 3D hydrodynamic model with real-world forcings (meteorological conditions, river inflows). The quantities of simulated oil particles that reach the coast over different periods of time provide the exposure of coastal receptors.

In Task 3 (see Sections 4-5) we identified the coastal receptors that can be impacted by an oil spill and assessed their vulnerability assigning weights through a combination of literature information, expert knowledge, and stakeholders' involvement.

The last step, described in this Section, is the integration of the exposure maps with the vulnerability maps in order to obtain the final risk assessment of coastal areas for oil spill in the Northern Adriatic Sea. These results will be then useful for contingency planning, which is one of the main expected results of NAMIRS.

6.2 Cumulative oil spill risk index

To calculate the risk index in NAMIRS, the maps of exposure related to the possible events of oil spill in the Northern Adriatic Sea (see Section 3) were multiplied to the maps of each vulnerability factor (environmental, geomorphological and socioeconomic) and the map of the total coastal vulnerability derived in Section 5.

Prior to conducting the analysis, we summed up the values of the exposure maps generated using expert and stochastic methods for each oil type (bunker oil, crude oil, and diesel oil) and each time step after the simulated oil spill. This allowed us to encompass all potential sites of oil spill release in the Northern Adriatic Sea. Furthermore, we summed the values of the maps representing the average volume of oil remaining on the surface, stranding on surface, dispersed in the water column, and stranded at depth, in order to have a unique map for each oil type and time step after the release. The maps of dispersed oil in the water column were first clipped to 5 meters deep since we considered vulnerability factors from the surface up to this depth.

For each type of oil, we then calculated the time it took for 30% and 50% of the oil released in each simulation to become stranded (at surface and in water column). To do that we divided the average volume of stranded oil (in m^3/km^2) in each time step by the total amount of oil released in each oil type simulation (Tables 27-29). The average volume of stranded oil in m^3/km^2 was obtained by summing the volume of oil in the map cells, multiplied by the area in km^2 of the cells and divided by the number of releases. For the bunker oil, 30% of oil stranded in 68 hours after the release and 50% stranded in 131 hours after the release. For the crude oil, 30% and 50% of stranded oil was reached after 83 and 173 hours, respectively, while for the diesel oil, 30% of oil stranded in 83 hours and 50% in 185 hours from the release.

Since the maps of the vulnerability factors range between 1 and 9 (see Section 5), to calculate the risk index the maps representing the 30% and 50% of stranded oil, for each oil type, were scaled at the same range of values. The minimum and maximum of the range (1 and 9) were matched with the minimum and maximum of the maps of 50% of stranded oil. After multiplying the hazard maps with the vulnerability factor maps and with the total coastal vulnerability map, a square root transformation was applied to convert the maps to the 1-9 range.

To be in accordance with the vulnerability factor maps, risk maps were created up to 5 meters of bottom depth and up to 3 nautical miles from the coast (see Section 5). For the same reason only the marine portion of the Northern Adriatic Sea was considered while coastal lagoons (i.e., the Venice lagoon and the Grado-Marano lagoon) were kept out of the analysis.

All operations and analyses on the maps and visualization were performed using the free and open source QGIS software with the WGS84 coordinate reference system (EPSG:4326).

Table 27. Computation of the percentage of bunker oil stranded after each hourly time step from the release. Time steps at which 30% and 50% of the released volume of oil is stranded on the coast are highlighted.

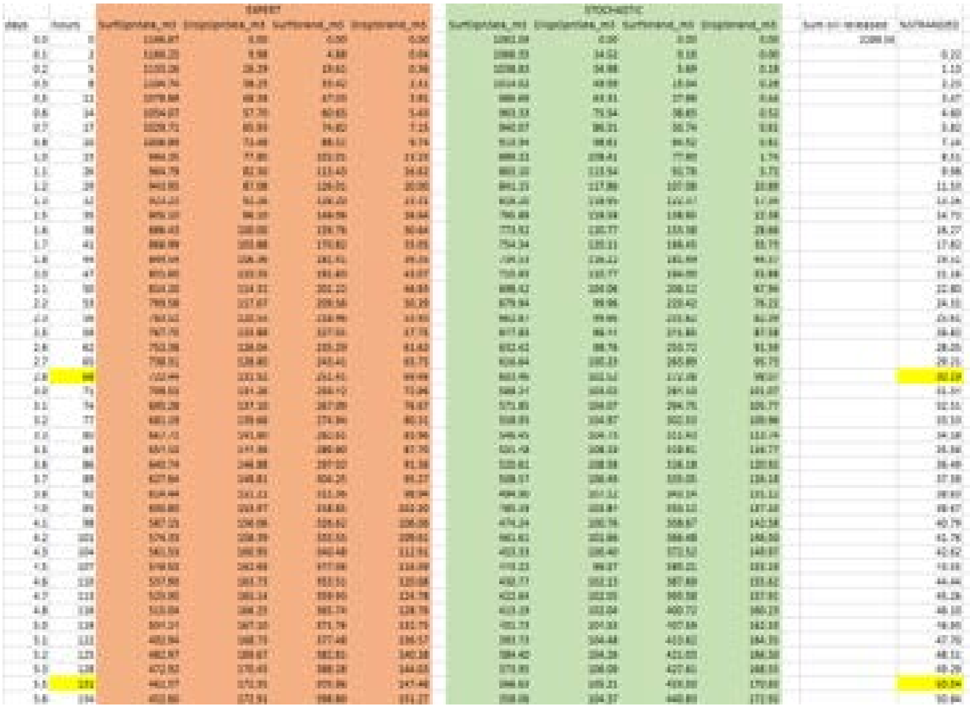


Table 28. Computation of the percentage of crude oil stranded after each hourly time step from the release. Time steps at which 30% and 50% of the released volume of oil is stranded on the coast are highlighted.

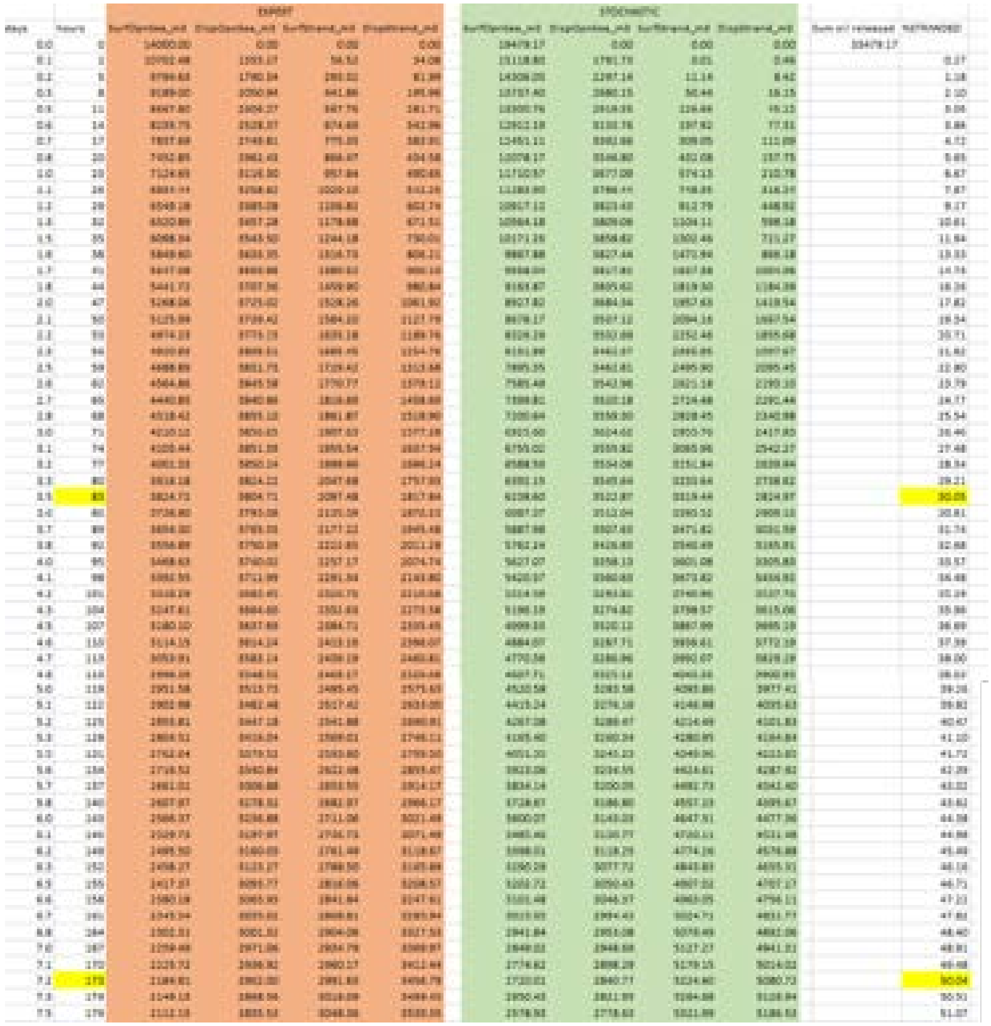
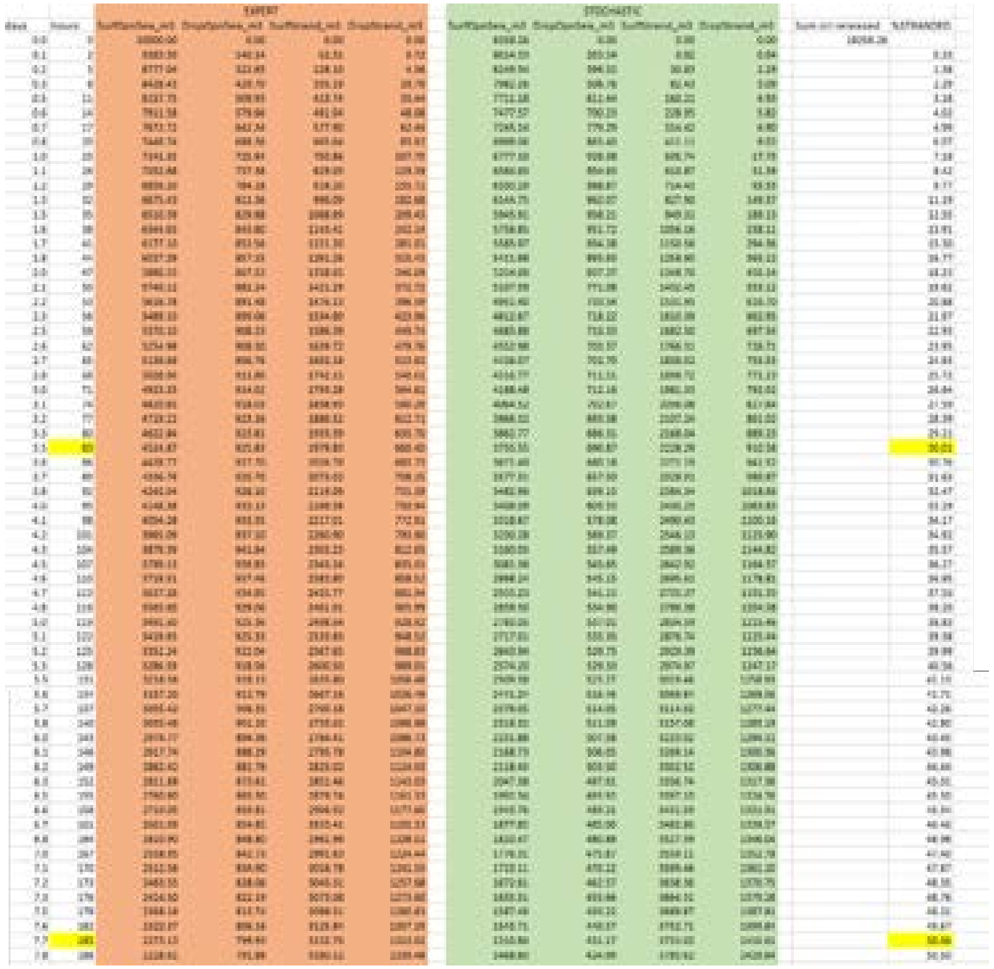


Table 29. Computation of the percentage of diesel oil stranded after each hourly step from the release. Time steps at which 30% and 50% of the released volume of oil is stranded on the coast are highlighted.



6.3 Maps of risk index for oil spill in Northern Adriatic Sea

The risk index calculated for the Northern Adriatic Sea showed that the areas with the highest risk are in the proximity of the Isonzo river mouth and Grado town, Trieste-Miramare coastline, Strunjan Landscape park and Debeli rtič in Slovenia and from Chioggia town to the Po Delta river. These areas are reached by the highest quantity of oil in case of incident and are particularly sensitive due to the presence of numerous recreational-touristic activities, protected species, such as *Cymodocea nodosa*, forming dense meadows at very shallow waters, protected areas (e.g., Miramare MPA, Strunjan Landscape park), aquaculture and muddy coastline that is very difficult to clean (see Section 5). Although the coastline of Veneto and Emilia-Romagna Regions had high values of vulnerability for the socioeconomic factors due to the presence of extended beaches (> 1 km) with several recreational and touristic activities, these areas did not get a high-risk value because the amount of oil calculated to strand on these coasts was minor compared to the volume that reached the gulf of Trieste and the Po Delta. The same consideration can be extended to the areas of Kornati and Brijuni National parks in Croatia.

The areas with the highest risk level are the same for each type of oil considered. The highest risk values were recorded for crude oil and diesel oil, particularly in the 50% stranded oil scenario, but after a longer time after release compared to bunker oil. Risk assessment based on 30% and 50% of stranded oil indicated, as expected, an increase in risk with the amount of stranded oil, yet the identification of areas most at risk remained similar between the two scenarios.

To give an overview of the results, some examples of the risk maps created with the single vulnerability factors are shown (Figs. 84-85). Figs. 86-91 present the final risk maps based on the 30% and 50% stranded oil, for the three oil types (bunker, crude, diesel), considering the total coastal vulnerability. As for the maps of the vulnerability factors (Section 5), risk scores were categorized in four classes and visualized in GIS with different colours: very low risk (1-2, green), low risk (3-5, yellow), medium risk (6-7, orange), high risk (8-9, red). Some areas have no risk values due to the presence of no data in the vulnerability factor maps or in the hazard maps. All maps were included in the geopackage file for QGIS already created for the vulnerability factor maps (see Section 5).

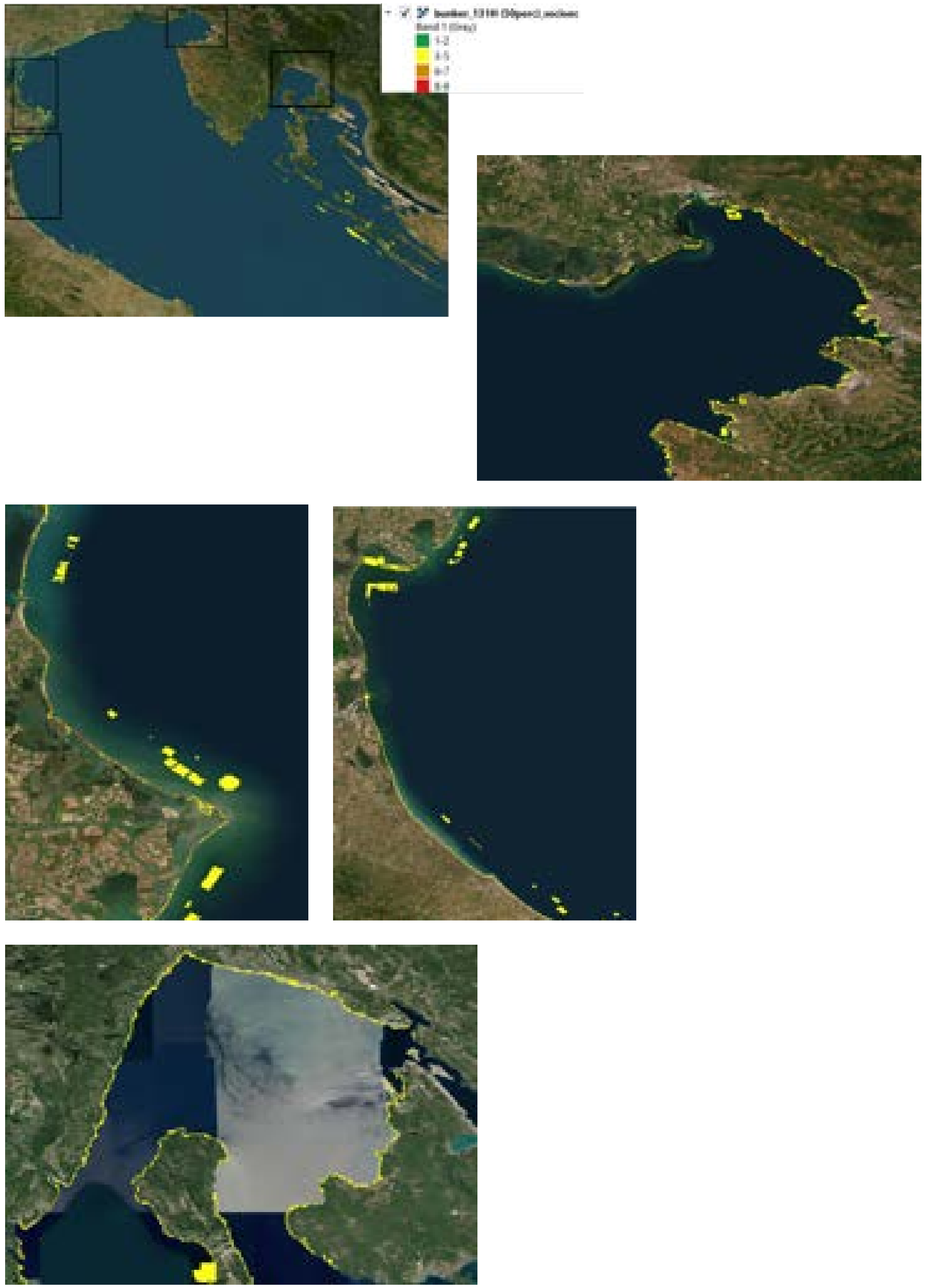


Figure 84. Close up of the Gulf of Trieste, the Po delta, the Emilia-Romagna coastline, and the Kvarner Gulf, with the risk values calculated with the 50% stranded bunker oil and the socioeconomic vulnerability factors.

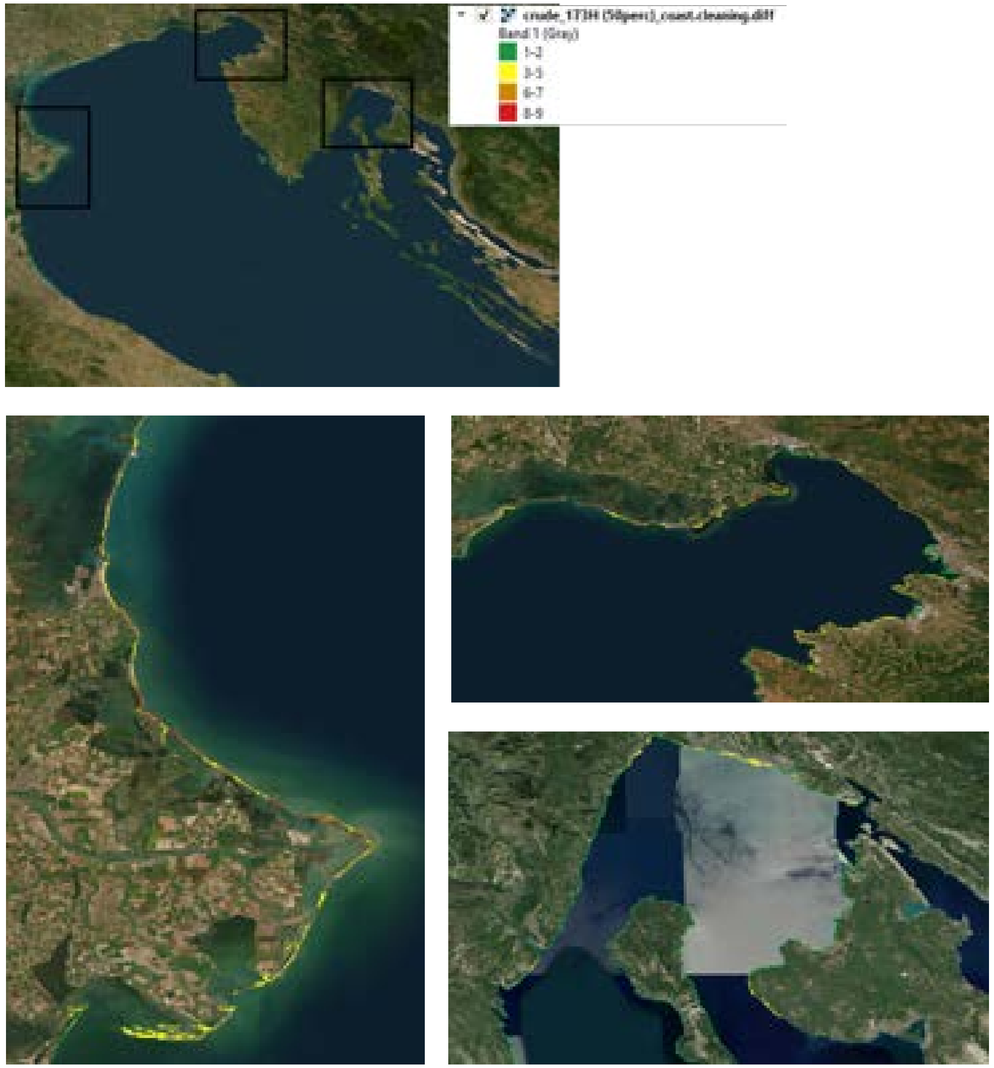


Figure 85. Close up of the Gulf of Trieste, the Po delta, and the Kvarner Gulf, with the risk values calculated with the 50% stranded crude oil and the geomorphological vulnerability factors (coast cleaning difficulty).

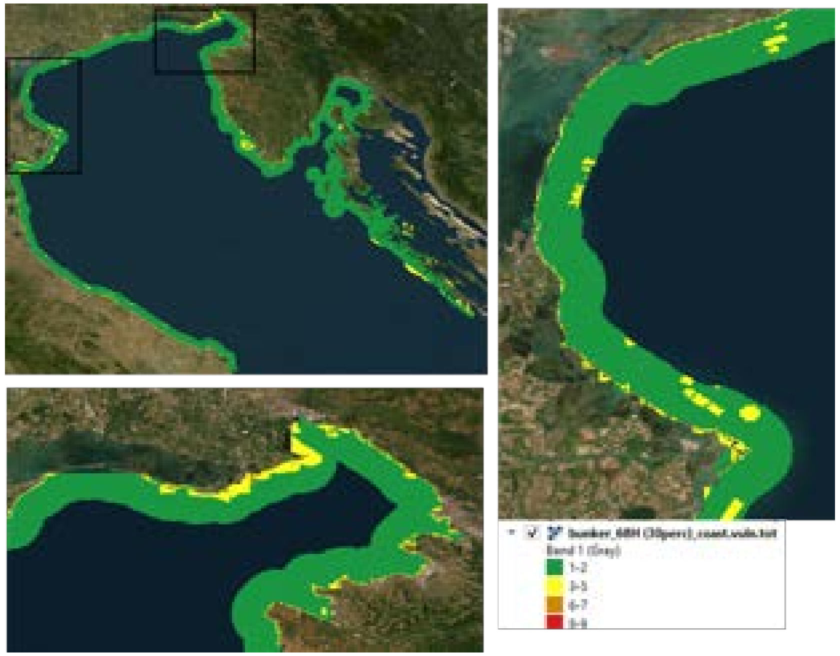


Figure 86. Maps of the risk index based on the 30% stranded bunker oil (68 hours after release) and the total coastal vulnerability with a zoom on the Gulf of Trieste and the Po delta.

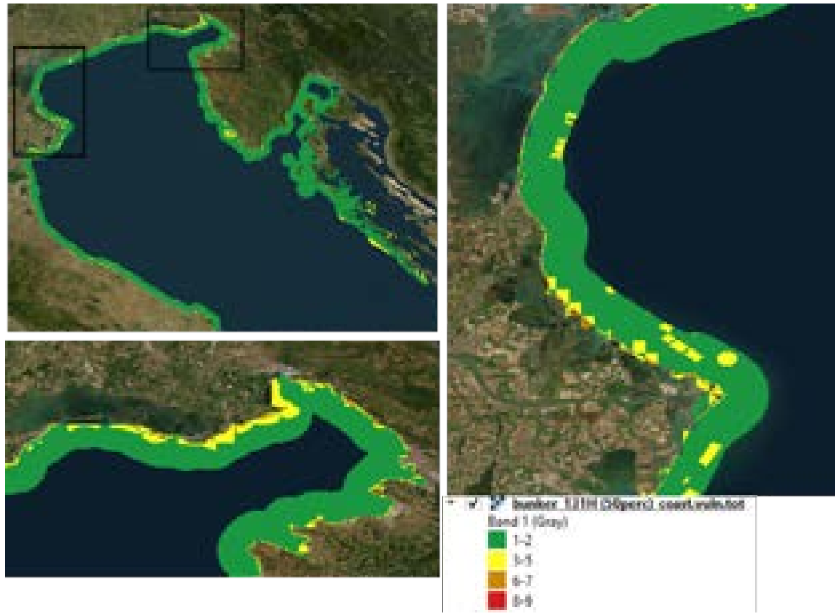


Figure 87. Maps of the risk index based on the 50% stranded bunker oil (131 hours after release) and the total coastal vulnerability with a zoom on the Gulf of Trieste and the Po delta.

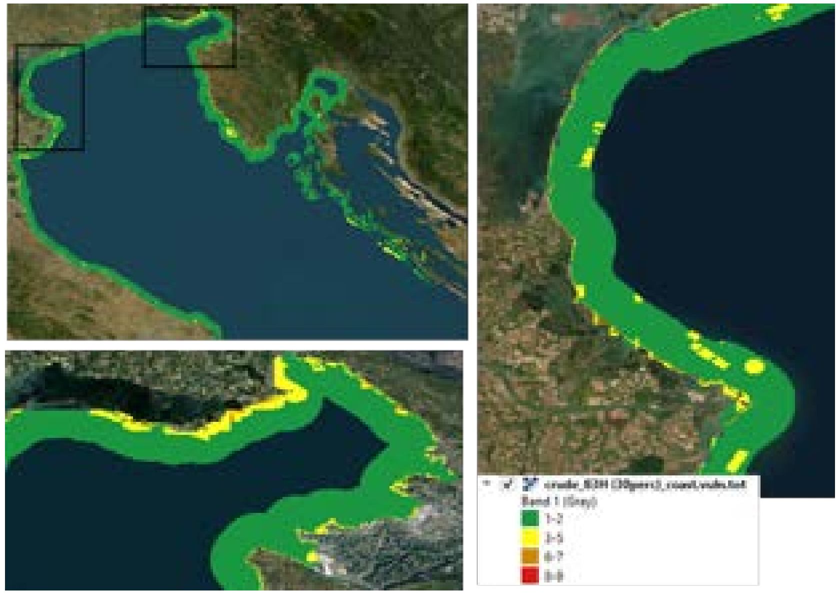


Figure 88. Maps of the risk index based on the 30% stranded crude oil (83 hours after release) and the total coastal vulnerability with a zoom on the Gulf of Trieste and the Po delta.

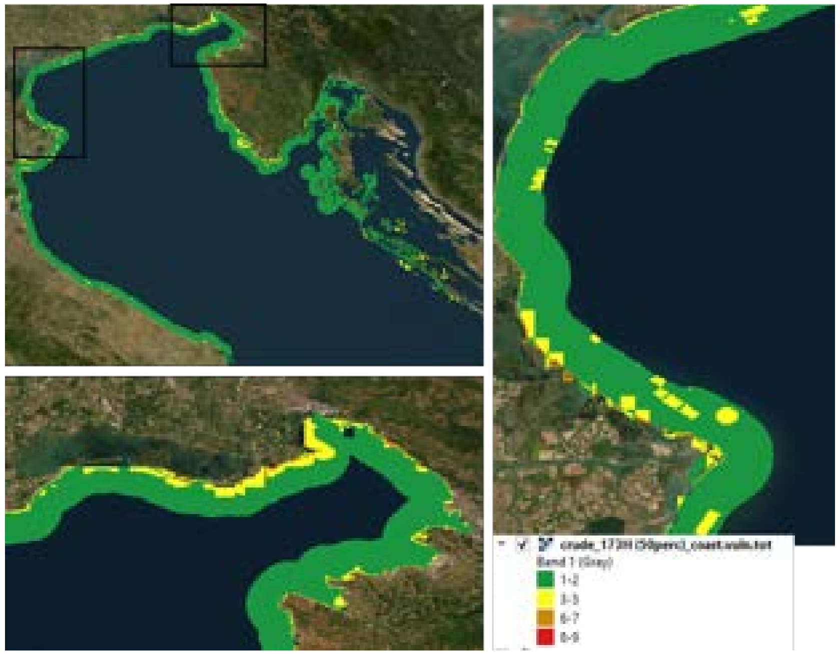


Figure 89. Maps of the risk index based on the 50% stranded crude oil (173 hours after release) and the total coastal vulnerability with a zoom on the Gulf of Trieste and the Po delta.

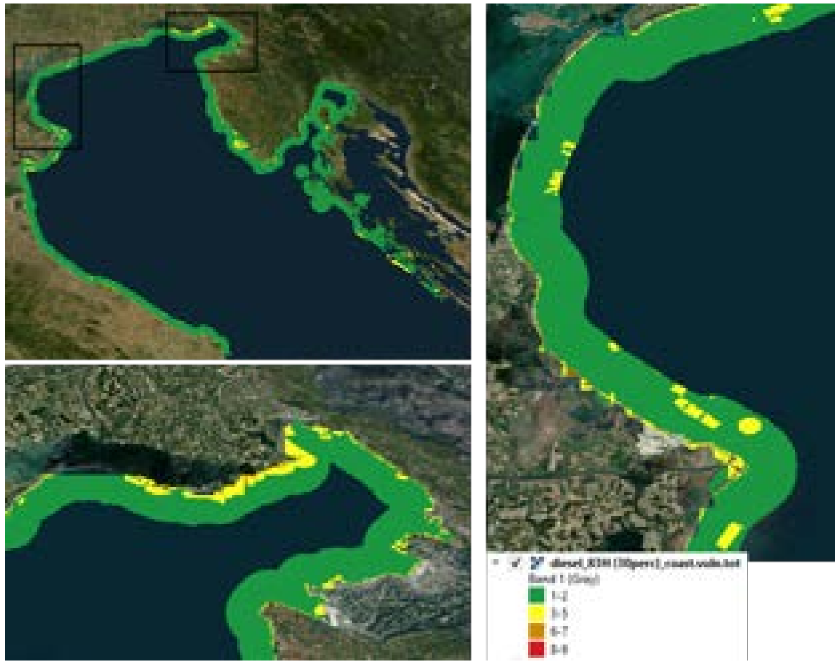


Figure 90: Maps of the risk index based on the 30% stranded diesel oil (83 hours after release) and the total coastal vulnerability with a zoom on the Gulf of Trieste and the Po delta.

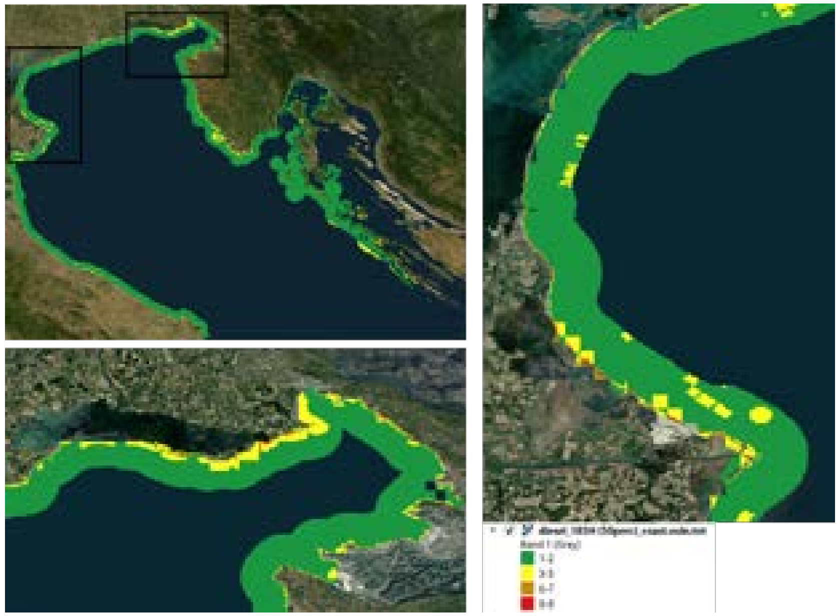


Figure 91. Maps of the risk index based on the 50% stranded diesel oil (185 hours after release) and the total coastal vulnerability with a zoom on the Gulf of Trieste and the Po delta.

7
Conclusions

7 / Conclusions

The Risk Assessment is a fundamental step in each contingency planning since it allows to identify the type of risk to which different areas are exposed, and to plan for possible mitigation measures, or for intervention measures in case of need. The results of NAMIRS Activity 2.1 will thus be useful in particular for NAMIRS Activity 2.3, but more in general they will contribute to the overall goals of the whole project.

The Risk Assessment in NAMIRS was performed applying a multidisciplinary, holistic, and participative methodology, integrating results of marine traffic analysis, oil spill simulations, marine spatial planning, stakeholders' involvement, literature information, and expert knowledge. While relying on established procedure in the scientific community, the methodology was adapted to the specific needs of the NAMIRS project. The results fulfilled the goals of Activity 2.1, but were also limited by the time, spatial, and financial constraints of NAMIRS. Thus, we list here some possible developments that might be explored in future projects.

Marine traffic analyses are the basis for hazard estimation in case of oil spills. Nevertheless, they are time and resource consuming. Thus, for NAMIRS we were able to perform these analyses limiting the rigorous statistical approach to the Gulf of Trieste (anyway the busiest area in the Northern Adriatic Sea), extrapolating the results to the rest of the study area. More significant results might be obtained by performing the analyses on a longer dataset of sea currents and including a larger study area.

The oil spill simulations were planned to give us a statistically significant estimation of the exposure of coastal areas to oil spills. Also in this case, extending the simulations to a longer timeframe would have increased the robustness of the results. Other possible developments include analysis per different meteorological scenarios (e.g., during extreme weather, considering different wind regimes), and the inclusion of additional type of oils. While we considered the most abundant oils being transported in the Northern Adriatic Sea, each oil has its own characteristics that make it more or less impacting in case of a spill, thus including more types of oil would strengthen the confidence in the results.

For the mapping of the receptors potentially impacted by an oil spill we relied mostly on publicly available databases of sea and coast use. While these databases are maintained by EU infrastructures (e.g., EMODnet), not always is the information in them accurate nor updated. There are also differences in how the information is provided by different countries, thus it was not straightforward to use this information for the purposes of marine spatial planning. Among the vulnerability factor groups, the one most lacking in information is also the one that might be considered the most immediately impacting on the life of people, i.e., the socioeconomic group. Among the databases that we accessed there were almost no information on areas devoted to different type of activities, e.g., touristic activities, industrial activities, recreation, etc. This is a major drawback for a proper assessment of the risk. The information gathered might be complemented assessing other, more specific databases (e.g., local regulatory plans), which are also less easily accessible. In some cases, the use of aerial photography or remote sensing (satellite) monitoring, through appropriate analysis approaches, might also improve the receptors identification and their vulnerability assessment.

The most obvious and ambitious development would be to enlarge the area of application of the risk assessment to the whole Adriatic Sea and possibly beyond. Disasters have no borders, and this is true in particular for disasters on sea, where the currents and winds can easily disperse the agent causing impact (e.g., pollutants, oil), thus reducing its impact, but can also spread it over huge areas, across different administrative and political entities, habitats, and human and non-human populations, effectively amplifying its impact. Thus, further cross-border cooperation in this field is of the utmost importance.

The result of the Environmental Risk Assessment of Activity 2.1 is a statistically based definition of the oil spill risk of coastal areas. Nevertheless, no statistical approach can be of much help during an emergency, when the field operators need to take fast and informed decisions in order to respond efficiently. Only an operative system, forced by real-time meteorological conditions, providing short-term forecasts of the fate of an oil spill can give useful information during an emergency. While the elements of such system are the same as those applied here (e.g., a high-resolution, 3D hydrodynamic model with a Lagrangian particle-tracking module able to simulate the fate of oils with different chemical and physical characteristics), the operational set-up of it exceeded the constraints of NAMIRS. Future projects should consider the possibility to build and implement a specific, real-time, possibly open and free, oil spill simulator, and to integrate it into the Standard Operating Procedures in case of incidents at sea.

One of the most interesting and useful activities in Activity 2.1 was the involvement of the stakeholders. With the workshops we collected useful information that allowed us to include not only our own, necessarily limited, knowledge and expertise, in the risk assessment procedure, but also the opinion of a much higher number of persons, institutions, and companies, directly involved in the exploitation of the sea and of the coastal areas. A possible refinement of the results obtained through the stakeholders' workshops would be to apply the Delphi method of priority selection, in order to weight stakeholders' answers by their respective expertise and increasing the confidence in the results. Furthermore, the NAMIRS partners plan later to open up the participation to the questionnaires to a general public (possibly online or during outreach activities). In this way, the opinion of selected experts collected during the workshops will be complemented by the opinions of a wider, non-professional public.

NAMIRS stakeholders' workshops already sparked some interesting developments. The oil spill simulations set up was possible also thanks to the information on the most common oils travelling in the Northern Adriatic Sea and their characteristics provided by SIOT, a stakeholder that participated in the Italian workshop. Furthermore, another stakeholder, the Marine Protected Area of Miramare, requested OGS help for the preparation of a specific contingency plan in case of oil spill for the area under protection. Our conclusion is that any future project in this field should foresee appropriate ways of stakeholders' involvement.

The workshops were also a good occasion for the outreach of the selected stakeholders on NAMIRS and its goals. The partners involved in Activity 2.1 plan further outreach activities, such as participations to international conferences and publication of scientific articles in international journals.

8

References

8 / References

Bendoni M., Laurent C., et al., 2022. Implementation of Lagrangian methods for pollutant transport and connectivity. Interreg-Med Sharemed Project Deliverable 4.6.1.

Birkmann J., 2007. Risk and vulnerability indicators at different scales: Applicability, usefulness and policy implications. Environmental hazards, 7(1), 20-31.

Bruschi A., Lisi I., De Angelis R., Querin S., Cossarini G., Di Biagio V., Salon S., Solidoro C., Fassina D., Ancona S., Silvestri C. 2021. Indexes for the assessment of bacterial pollution in bathing waters from point sources: The northern Adriatic Sea CADEAU service, J. Environ. Manag., 293, art. no. 112878, https://doi.org/10.1016/j.jenvman.2021.112878.

Burmeister et al., 2014. Assessing the Frequency and Material Consequences of Collisions with Vessels Lying at an Anchorage in Line with IALA iWrap MkII, TransNav, v.8, n.1, p.61-68.

Canu D., Zunino S. et al., 2022. Atlas of ecosystem status, pressures and environmental hazard index. Interreg-Med Sharemed Project Deliverable 4.3.1.

Cardona, O. D., 2005. Indicators for Disaster Risk and Risk Management. Program for Latin America and the Caribbean: Summary Report, Manizales, Columbia: Instituto de Estudios Ambientales, Universidad Nacional de Columbia, 2005.

Depellegrin, Daniel, Stefano Menegon, Giulio Farella, Michol Ghezzo, Elena Gissi, Alessandro Sarretta, Chiara Venier, and Andrea Barbanti. "Multi-Objective Spatial Tools to Inform Maritime Spatial Planning in the Adriatic Sea." Science of The Total Environment 609 (December 31, 2017): 1627–39. https://doi.org/10.1016/j.scitotenv.2017.07.264.

Falace A., Kaleb S., Curiel D., Miotti C., Galli G., Querin S., ..., Bandelj, V. 2015. Calcareous bio-concretions in the northern Adriatic Sea: habitat types, environmental factors that influence habitat distributions, and predictive modeling. PLoS One, 10(11), e0140931.

Fortibuoni T, Canese S, Bortoluzzi G, et al., 2020. Bathymetry data (GeoTIFF grid format) of the northern Adriatic tegnùe di Chioggia site collected in 2014-2015 for the DeFishGear project. Integrated Earth Data Applications (IEDA). https://doi.org/10.26022/IEDA/329815.

Furlan, Elisa, Silvia Torresan, Andrea Critto, and Antonio Marcomini. "Spatially Explicit Risk Approach for Multi-Hazard Assessment and Management in Marine Environment: The Case Study of the Adriatic Sea." Science of The Total Environment 618 (March 2018): 1008–23. https://doi.org/10.1016/j.scitotenv.2017.09.076.

Gordini E, Saul C, 2020. Bathymetry data (GeoTIFF grid format) of the northern-most Adriatic area: Interreg Ita-Slo 2007-2013 TRECORALA Project. Integrated Earth Data Applications (IEDA). https://doi.org//10.26022/IEDA/329903.

Gucma et al., 2021. Reconstructing maritime incidents and accidents using causal models for safety improvement: based on a case study. J Mar Sci Eng, no. 12, 1414, p. 14.

Halpern, B. S., S. Walbridge, K. A. Selkoe, C. V. Kappel, F. Micheli, C. D'Agrosa, J. F. Bruno, et al. "A Global Map of Human Impact on Marine Ecosystems." Science 319, no. 5865 (February 15, 2008): 948–52. https://doi.org/10.1126/science.1149345.

IALA, 2022. Guideline G1124 The Use of Ports and Waterways Safety Assessment (PAWSA) MkII Too.

Jokuty, Paula, et al., Environment and Climate Change Canada, A Catalogue of Crude Oil and Oil Product Properties (1999)- Revised 2022, Report EE-165, Environment and Climate Change Canada, 2022.

Landis, Wayne G. "Ecological Risk Assessment Conceptual Model Formulation for Nonindigenous Species." Risk Analysis 24, no. 4 (2004): 847–58. https://doi.org/10.1111/j.0272-4332.2004.00483.x.

Laurent C., Querin S., Solidoro C., Melaku Canu D., 2020. Modelling marine particle dynamics with LTRANS-Zlev: Implementation and validation. Environmental Modelling & Software, 125, 104621. https://doi.org/10.1016/j.envsoft.2020.104621.

Marshall J. C., Adcroft A., Hil C., Perelman L., Heisey C.,1997. A finite-volume, incompressible Navier-Stokes model for the studies of the ocean on parallel computers. Journal of Geophysical Research, 102, 5753–5766.

Melaku Canu D., Solidoro C., Bandelj V., Quattrocchi G., Sorgente R., Olita A., Fazioli L., Cucco A. 2015. Assessment of oil slick hazard and risk at vulnerable coastal sites. Marine Pollution Bulletin. Vol., 94, issue 1-2, 15 May 2015, Pages 84-95.

Menegon, Stefano, Daniel Depellegrin, Giulio Farella, Alessandro Sarretta, Chiara Venier, and Andrea Barbanti. "Addressing Cumulative Effects, Maritime Conflicts and Ecosystem Services Threats through MSP-Oriented Geospatial Webtools." Ocean & Coastal Management 163 (September 2018): 417–36. https://doi.org/10.1016/j.ocecoaman.2018.07.009.

Menoni S, Molinari D, Parker D, Ballio F, Tappsel S, 2012. Assessing multifaceted vulnerability and resilience in order to design risk mitigation strategies. Nat Hazards:1–26. https:// doi. org/ 10. 1007/ s11069- 012- 0134-4.

Petersen, J., et al. 2019. Environmental Sensitivity Index Guidelines, Version 4.0. NOAA Technical Memorandum NOS OR&R 52.

Ponti M., 2020. Single-beam bathymetry data (ESRI ASCII grid format) of selected mesophotic biogenic reefs from the northern Adriatic Sea. Integrated Earth Data Applications (IEDA). doi: 10.26022/IEDA/329803.

Querin S., Bensi M., Cardin V., Solidoro C., Bacer S., Mariotti L., Stel F., Malačič V., 2016. Saw-tooth modulation of the deep-water thermohaline properties in the southern Adriatic Sea. J. Geophys. Res. Oceans 121, 4585–4600. https://doi.org/10.1002/2015JC011522.

Silvestri C., Bruschi A., Calace N., Cossarini G., De Angelis R., Di Biagio V., Giua N., Peleggi M., Querin S., Saccomandi F., Salon S., Solidoro C., Spada E. CADEAU project - final report (2020) Figshare, https://doi.org/10.6084/m9.figshare.12666905.v1.

UNDRO, 1979: "Natural Disasters and Vulnerability Analysis": Report of Expert Group Meeting, 9–12 July 1979.

UNISDR, 2005. Hyogo framework for action 2005–2015: Building the resilience of nations and communities to disasters. In Extract from the final report of the World Conference on Disaster Reduction (A/CONF. 206/6) (Vol. 380). Geneva: The United Nations International Strategy for Disaster Reduction.

Kataložni zapis o publikaciji (CIP)
pripravili v Narodni in univerzitetni
knjižnici v Ljubljani
COBISS.SI-ID 181850115
ISBN 978-961-7041-14-9
(Fakulteta za pomorstvo in promet, PDF)