

Readiness of the Mediterranean Region to respond to Marine pollution by LSF

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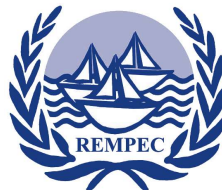
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**Mediterranean
Action Plan**
Barcelona
Convention





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INTERNATIONAL
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The WMU-Cedre study

STUDY ON THE READINESS OF THE MEDITERRANEAN REGION TO RESPOND TO MARINE POLLUTION INCIDENTS INVOLVING LOW-SULPHUR FUELS AND ALTERNATIVE FUELS

This activity is financed by the voluntary contribution from the Italian Ministry for Environment and Energy Security (MAES) and the IMO's Integrated Technical Cooperation Programme (ITCP), is implemented by the Regional Marine Pollution Emergency Response Centre for the Mediterranean Sea (REMPEC), in cooperation with the International Maritime Organization (IMO).

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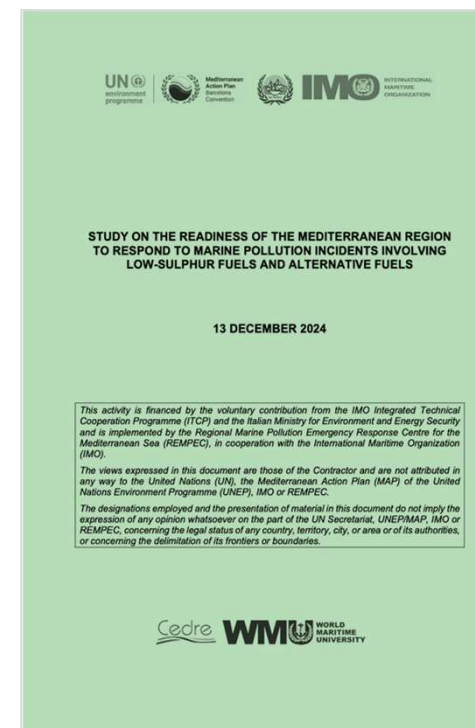
The WMU-Cedre study

Purpose of the study

- Assess the Mediterranean region's **capacity** to respond to marine pollution incidents involving low-Sulphur and alternative fuels
- Provide **actionable recommendations** to strengthen emergency response mechanisms

Specific Objectives

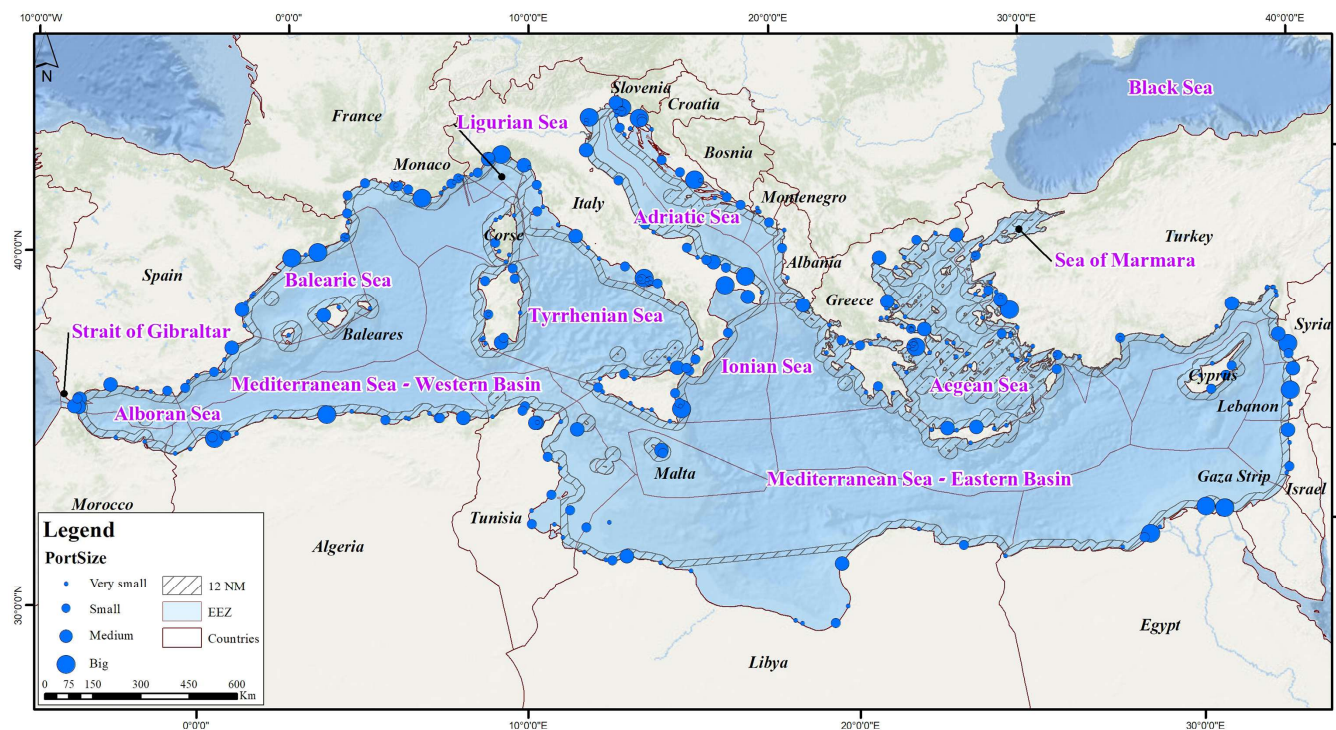
- **Identify and analyze** strengths, weaknesses, and gaps in **current readiness** of CPs to respond to spills involving low-Sulphur and alternative fuels
- **Assess risks and environmental behavior** of these fuels in marine environments
- **Review global best practices** and explore their applicability to the Mediterranean
- **Propose strategic recommendations** and a **roadmap** for enhancing response mechanisms, regulatory frameworks, and policy interventions





The Mediterranean Region

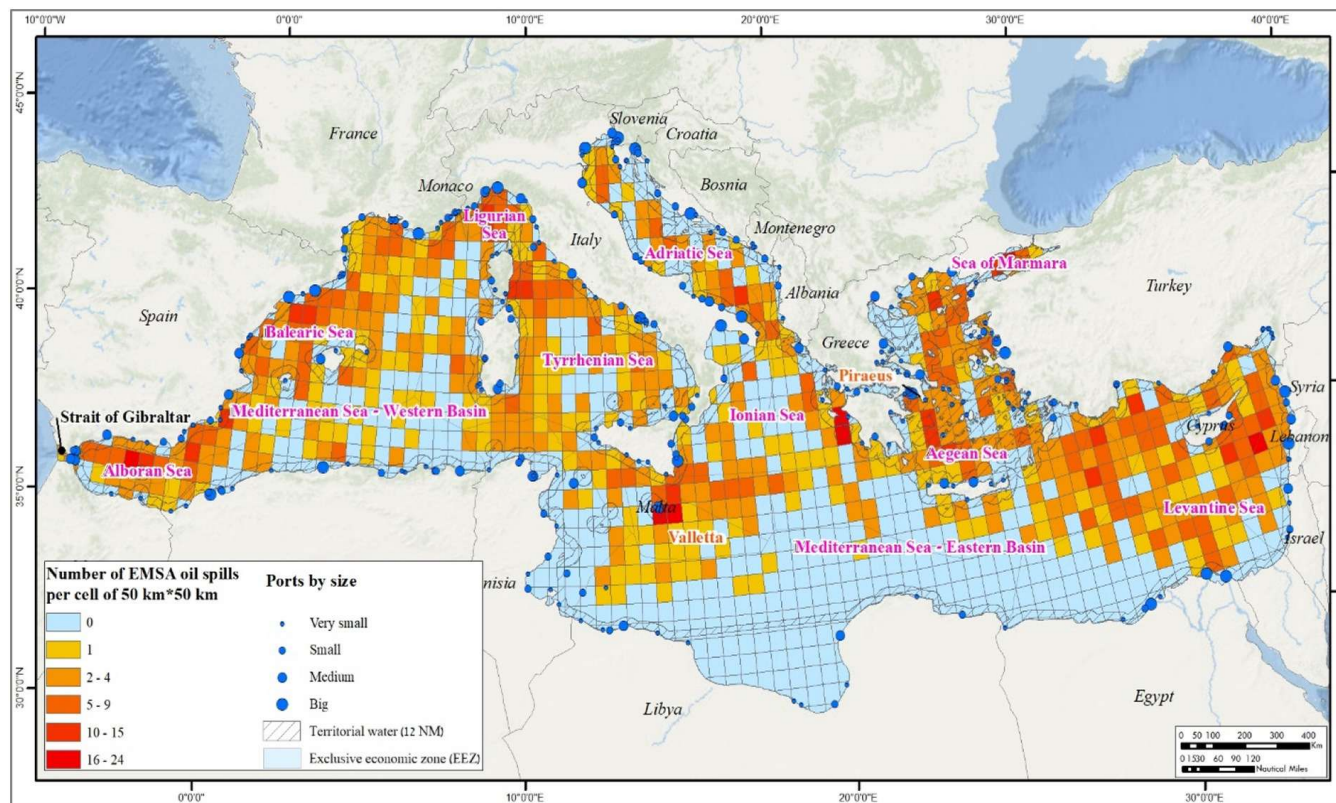
The Mediterranean Region



Spatial distribution of EEZs and territorial waters in the Mediterranean Sea.

Port symbol size is according to the categories defined by the World Port Index 2019

Significance of readiness for the Mediterranean



Distribution of 2066 EMSA oil spills in the Mediterranean Sea: 2015–2017

Physical and chemical properties of LSF

Some critical questions for responders

- Does LSF flow?
- Does LSF spread?
- Can LSF be dispersed?
- Can LSF be recovered?
- How can we plan for better LSF response?

Physical and chemical properties of LSF: Implications for spill response in the Mediterranean

Significant challenges due to its physical and chemical characteristics

- **Persistence** in the marine environment, driven by low evaporation rates and high viscosity, could complicate clean-up efforts and require extended recovery operations.
- **Rapid emulsification** in the Mediterranean's warm waters may exacerbate the problem, creating stable water-in-oil emulsions that are difficult to manage.
- **Variable viscosity** limits effectiveness of chemical dispersants, often necessitating mechanical recovery that is resource-intensive and time-consuming.

Characteristics of the Mediterranean Region: Implications for LSF spill response

Warmer sea
surface
temperature

Accelerated
evaporation rate

Increased
emulsification
rate

High salinity
levels

Denser
fractions driven
into water
column

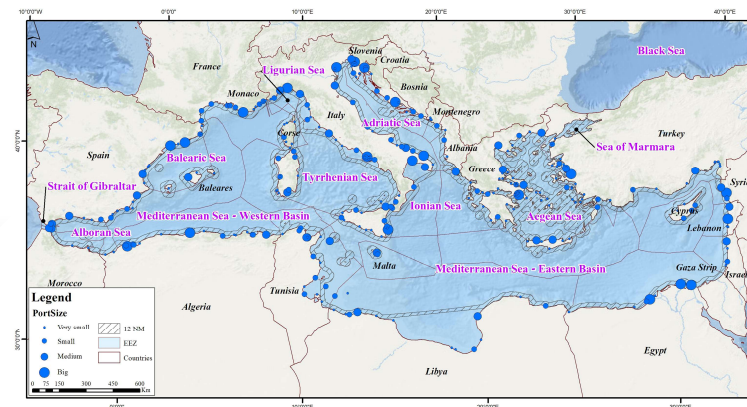
Complicates
recovery efforts

Limited wave
action in calmer
seas

Restricts
natural
dispersion

Active
intervention +
advanced
containment

Operational constraints



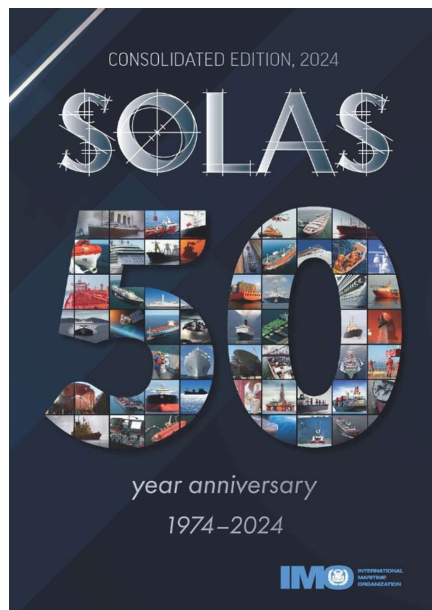
Ecological sensitivity

- Vulnerable ecosystems
- Seagrass meadows
- Coral reefs
- Wetlands

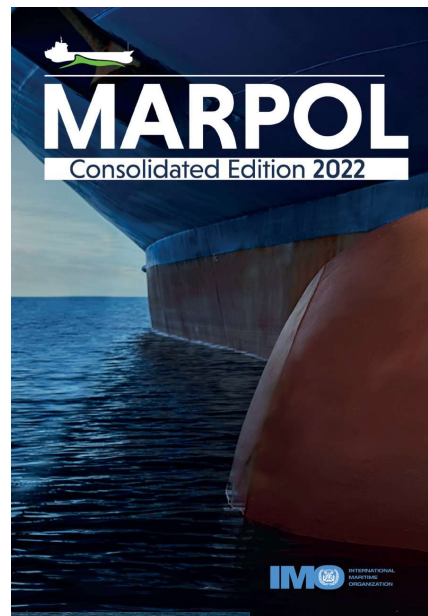


LSF Regulatory Perspectives

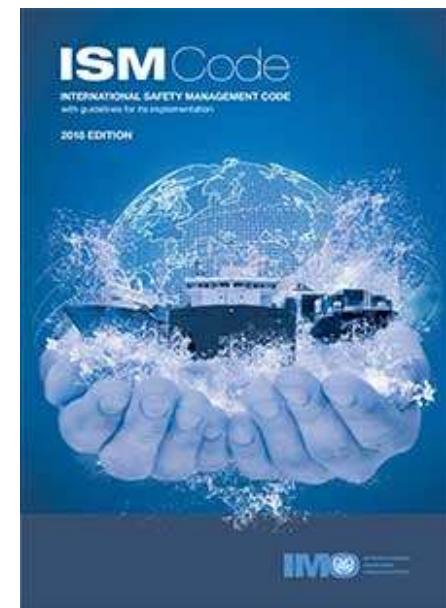
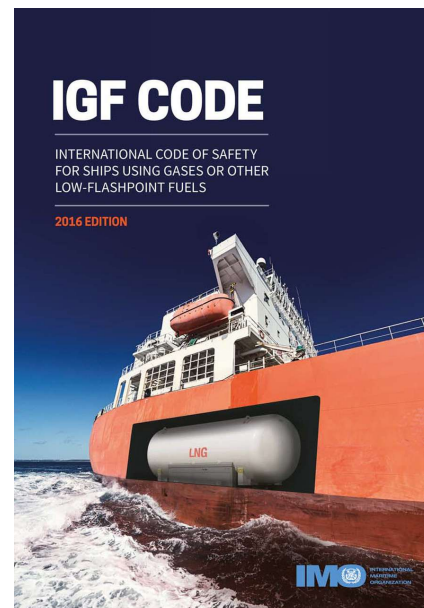
Prevention



SOLAS Chapter II-1
Part G (MSC.1/Circ.1455)
Part F (MSC.1/Circ.1212/Rev.1)

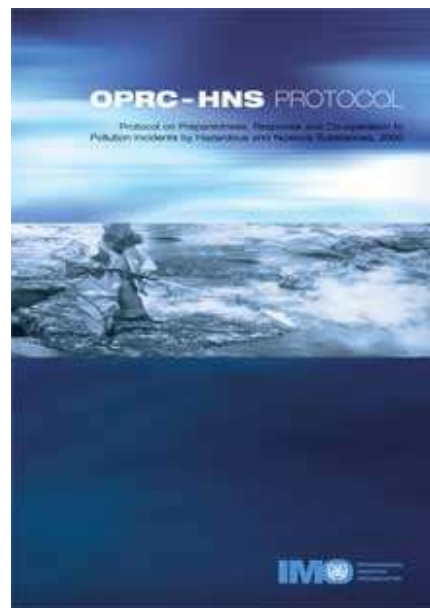
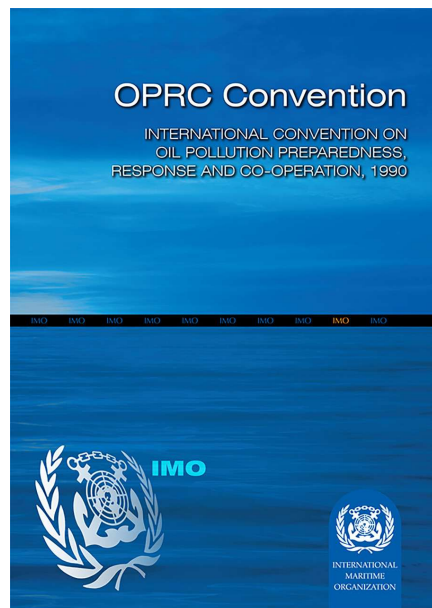


Annex I, SOPEP
Annex VI Regulation 14
PPR Product Data Sheet
IBC Code
GESAMP Hazard Profile



Spill response
Training

Readiness for response



PROTOCOL CONCERNING COOPERATION IN PREVENTING POLLUTION FROM SHIPS AND, IN CASES OF EMERGENCY, COMBATING POLLUTION OF THE MEDITERRANEAN SEA

The Contracting Parties to the present Protocol,

Being Parties to the Convention for the Protection of the Mediterranean Sea against Pollution, adopted at Barcelona on 16 February 1976 and amended on 10 June 1995,

Desirous of implementing Articles 6 and 9 of the said Convention,

Recognizing that grave pollution of the sea by oil and hazardous and noxious substances or a threat thereof in the Mediterranean Sea Area involves a danger for the coastal States and the marine environment,

Considering that the cooperation of all the coastal States of the Mediterranean Sea is called for to prevent pollution from ships and to respond

Protocol Concerning Cooperation in Preventing Pollution from Ships and, in Cases of Emergency, Combating Pollution of the Mediterranean Sea

Adopted on 25 January 2002, in Valetta

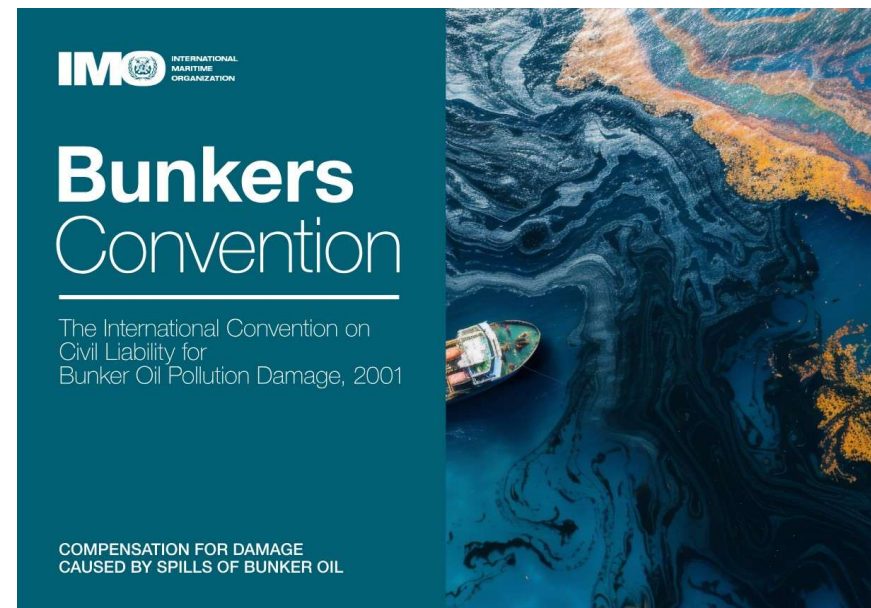
Acknowledging also the contribution of the European Community to the implementation of international standards as regards maritime safety and the prevention of pollution from ships,

Recognizing also the importance of cooperation in the Mediterranean Sea Area in promoting the effective implementation of international regulations to prevent, reduce and control pollution of the marine environment from ships,

Recognizing further the importance of prompt and effective action at the national, subregional and regional levels in taking emergency measures to deal with pollution of the marine environment or a threat thereof,

Applying the precautionary principle, the polluter pays principle and the method of environmental impact assessment, and utilizing the best available techniques and the best environmental practices, as provided for in Article 4 of the Convention,

Liability and compensation



1996 LLMC Protocol

IOPC Fund

2003 HNS Convention

Standards for Low-Sulphur and Alternative Fuels

Category	Conventions	Key Focus Areas
Prevention	MARPOL Annex VI	Limits SOx, NOx, and PM emissions
	SOLAS & IGF Code	Safety standards for low-flashpoint fuels (e.g., LNG, hydrogen, ammonia)
	ISM Code	Enhances operational safety onboard ships
	EU Sulphur Directive (2012/33/EU)	Enforces Sulphur content limits in marine fuels
Response	OPRC Convention	Global framework for oil pollution response
	OPRC-HNS Protocol	Extends OPRC to hazardous and noxious substances, applicable to alternative fuels
	Barcelona Convention 2002 Prevention and Emergency Protocol	Regional response framework for pollution incidents, including oil and hazardous substances
Liability	Civil Liability Convention (CLC 1992)	Shipowner liability for oil pollution damage
	Bunker Convention (2001)	Liability for bunker oil pollution incidents
	HNS Convention (2010) (<i>not in force</i>)	Comprehensive liability for hazardous and noxious substances spills, including alternative fuels

Regulatory readiness of Low-Sulphur and Alternative Fuels

Fuel Type	ISO Standards	IMO Safety Standards (SOLAS)	IMO Environmental Standards (MARPOL)
Conventional Fuels (Diesel/ Gas Oil/ Fuel Oil)	ISO 8217:2017 ISO PAS 23263:2019	SOLAS Chapter II (Flashpoint >60°C) SOLAS Chapter II-1 Part F and G (low-flashpoint fuels)	MARPOL Annex I (oil spills and discharges) MARPOL Annex VI (SOx, NOx, PM)
Low Sulphur Fuels (LSFO)	ISO 8217:2017 ISO PAS 23263:2019 (0.50% Sulphur)	SOLAS Chapter II-1 Part F and G IGF Code (for low-flashpoint fuels)	MARPOL Annex VI (SOx)
Bio/Synthetic Liquid Fuels (HVO, FAME)	EN 14214:2012 EN 15940:2016 ISO in progress (revision of ISO 8217 for HVO/FAME)	SOLAS Chapter II-1 Part G (low-flashpoint fuels) IGF Code MSC.1/Circ.1212/Rev.1	MARPOL Annex VI (SOx reduction, biofuel blends)
Methanol	ISO/AWI 6583 (in progress) IMPCA Methanol Reference	SOLAS Chapter II-1 Part G (low-flashpoint fuels) MSC.1/Circ.1621	MARPOL Annex VI (CO ₂ and NOx) MARPOL Annex II (no specific provisions for spills)
Ethanol	No marine standards available	SOLAS Chapter II-1 Part G MSC.1/Circ.1621	MARPOL Annex II (minor hazard classification, no spill guidelines) MARPOL Annex VI (CO ₂ , NOx)

IMO GreenVoyage2050

Regulatory readiness of Low-Sulphur and Alternative Fuels

Fuel Type	ISO Standards	IMO Safety Standards (SOLAS)	IMO Environmental Standards (MARPOL)
Dimethyl Ether (DME)	No marine standards available	SOLAS Chapter II-1 Part G MSC.1/Circ.1212/Rev.1	MARPOL Annex VI (CO ₂ , NO _x) IGC Code prohibits toxic cargo as fuel
Liquefied Natural Gas (LNG)	ISO 23306:2020	SOLAS Chapter II-1 Part G IGF Code	MARPOL Annex VI (CO ₂ , NO _x) Methane-slip not regulated
Ammonia	No marine standards available	SOLAS Chapter II-1 Part G (in development) Draft IGF interim guidelines	MARPOL Annex VI (NO _x) MARPOL Annex II (ammonia as category CONTRACTING substance)
Hydrogen	ISO 14687:2019	SOLAS Chapter II-1 Part G MSC.420(97) for bulk carriage Draft IGF interim guidelines	MARPOL Annex VI (NO _x)
Propane/ Butane (LPG)	No marine standards available	SOLAS Chapter II-1 Part G IGF Code (draft guidelines expected 2023)	MARPOL Annex VI (CO ₂ , NO _x)

IMO GreenVoyage2050



The Mediterranean Region: Response preparedness

Preparedness Level of Contracting Parties

Ratification Status of Key IMO Instruments for Pollution Prevention, Response and Compensation among Contracting Parties to the Barcelona Convention

Regional snapshot

- Significant alignment with key IMO instruments
- Requirement for alignment with Annex VI of MARPOL
- Gaps also remain in ratification of OPRC-HNS Protocol 2000 and FUND PROT 2003

MARPOL 1973/78

OPRC 1990

CLC PROT 1992

SAR 1979

FUND PROT 1992

Bunkers 2001

MARPOL PROT 1997

Salvage 1989

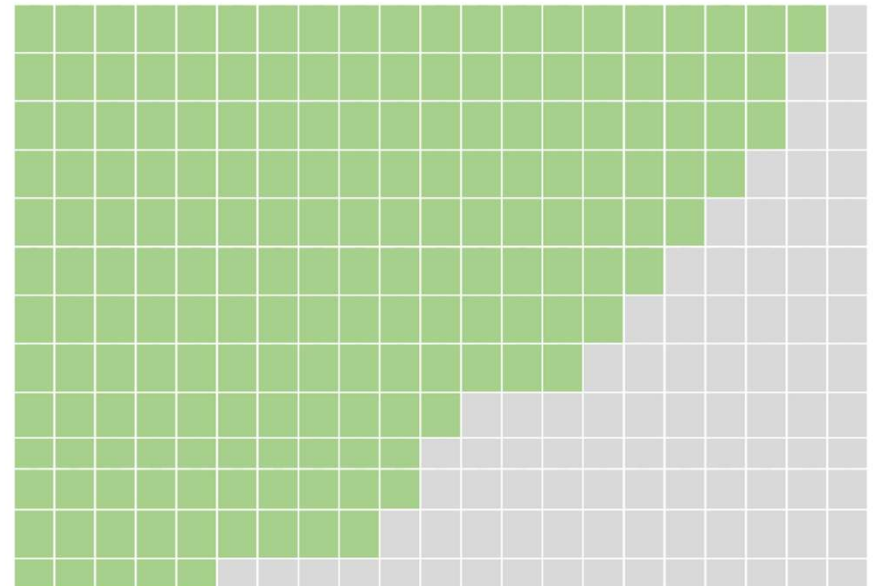
LLMC 1976

OPRC-HNS PROT 2000

LLMC PROT 1996

FUND PROT 2003

WRC 2007



Regulatory Alignment of Contracting Parties

Key findings

- Score for **training**, indicates a need for enhanced training programs and regular drills
- Insufficient **logistical** support, which can impact the timely deployment of resources during incidents
- Limited **financial and administrative frameworks**, potentially hindering efficient resource allocation and operational readiness
- A need for ongoing improvements and sustainable practices to maintain readiness levels over time.
- Gaps in **data management and tracking systems** critical for effective incident response and decision-making
- Room for enhancement of **operational readiness**, especially for alternative fuel-related incidents



Collective regional preparedness scores based on assessment of Contracting Parties to the Barcelona Convention using RETOS™ tool (Adapted from REMPEC, 2023)

Key indicators of readiness

National legislation																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
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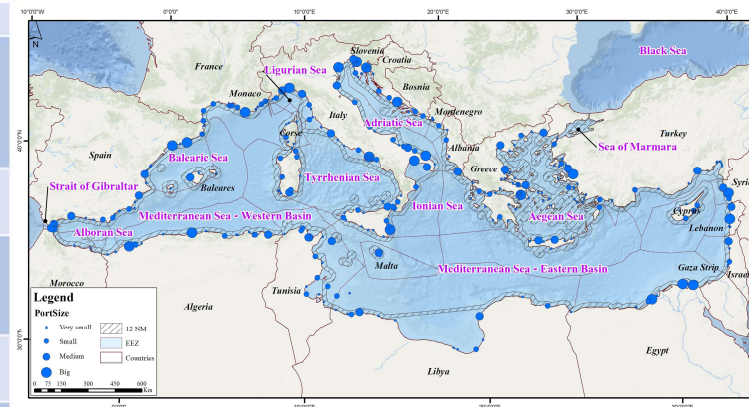
Status of preparedness *(September 2024)*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
LSAF handled at national ports																					
Previously experienced LSAF spills																					
Policy implemented on low-Sulphur fuels																					
Policy implemented on LNG fuels																					
National plan updated for LSAF spills																					
National plan equipment adequate for effective response																					
Response equipment available at major ports																					
Sufficiency of response equipment at major ports for LSAF																					
National stockpile of response equipment available																					
Expertise available for LSAF spills																					
Drills carried out for LSAF spills																					
Participated in regional/international exercises for LSAF																					
Modelling software available for managing LSAF spills																					
Drones being explored for LSAF spill response																					
EIA conducted for LSAF spills																					
Best practices adopted for LSAF spills																					
Investment in R&D for response to LSAF spills																					

Results of WMU questionnaire survey

Regional bilateral arrangements

Contracting Party	Sub-regional agreements
Six Adriatic countries	Multilateral Agreement on the Adriatic Plan
Algeria	Trilateral agreement with Morocco & Tunisia
Cyprus	Trilateral agreement with Egypt and Israel
Egypt	- Jeddah Convention - Trilateral agreement with Israel & Cyprus
	Gulf of Aqaba plan with Israel and Jordan
France	- Bonn Agreement - Lisbon Agreement - RAMOGE Agreement with Italy and Monaco - Lion Plan with Spain
Greece	- Bilateral agreement with Italy - Trilateral agreement with Cyprus and Israel
Israel	- Sub-regional plan with Egypt and Cyprus - Gulf of Aqaba plan with Egypt and Jordan - Trilateral agreement with Cyprus and Greece
Italy	- RAMOGE Agreement with France and Monaco - Bilateral agreement with Greece
Malta	Drafting bilateral agreement with Sicilian Coast Guard
Monaco	RAMOGE Agreement with France and Italy
Morocco	- Lisbon Agreement - Trilateral Agreement with Algeria and Tunisia
Spain	- European Community Task Force; - observer in Bonn Agreement - Lion Plan with France
Tunisia	Trilateral agreement with Algeria and Morocco
Turkiye	Bucharest Convention



National plan areas requiring attention

Areas meriting attention

- No specialized equipment for pollution control
- No specific policy for dispersants
- No dedicated or outdated contingency plan
- Limited equipment for HNS spills, relying on oil spill resources
- No significant national oil spill response mechanism
- Limited response equipment
- Lack of clarity on dispersant policy in newly redrafted NCP
- Limited Tier 2/3 response capabilities
- Lack of coordination, particularly in stockpile maintenance
- Updated National Contingency Plan needed
- No dispersant-testing procedures

Areas meriting attention

- Relies heavily on private resources
- Gaps in Tier 2/3 capabilities
- No risk analysis
- Limited human resources and financial commitment
- Lack of coordination among stakeholders
- Relies on neighbouring countries for equipment
- No significant incidents in the past: so, no previous learning experience from incidents
- Prohibition on dispersants
- Coordination between regional response centres need improvement
- Lack of knowledge of communication plans among stakeholders



Best practices

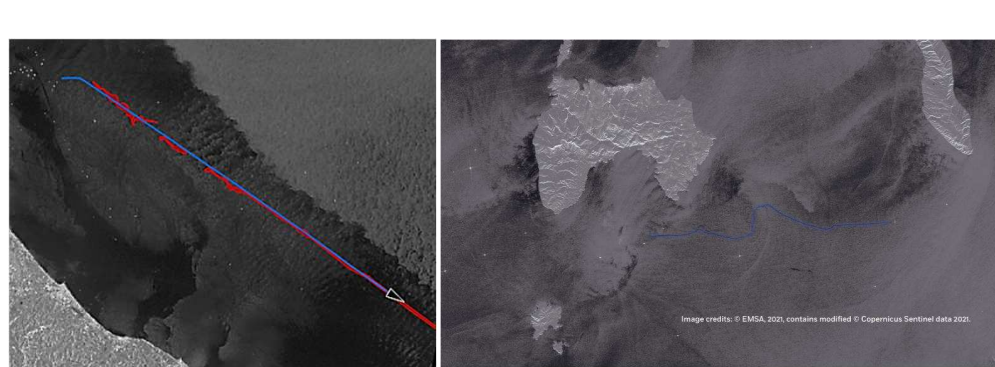
Monitoring systems

EMSA CleanSeaNet

- Synthetic Aperture Radar

USCG sail drone

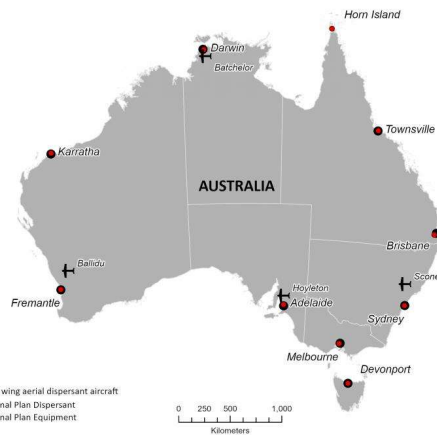
- Low-cost unmanned surface system



Stakeholder integration and training

AMSA

- Cooperation with university and industry for bioremediation techniques for alternative fuels



UK MCA

- UK NCP simulation exercises every 18 months



Pre-positioned equipment inventories

ROPME Sea Area

- CHEMPLAN
- Marine Emergency **Mutual Aid** Centre
- Four regional stockpiles of tier2/3 equipment



North American ECA

- Pre-positioned equipment in high-risk areas
- Cryogenic booms for LNG spills
- Vessel of opportunity programs



Coordinated regional response

CEPCO flights

- HELCOM Coordinated Extended Pollution Control Operations flights



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Illegal discharges under joint surveillance in the Baltic and North Seas

Posted on June 12, 2015

Aircraft from six countries from Baltic Sea (HELCOM) and North Sea (Bonn) areas carried out a joint international aerial surveillance operation, classified until finish, with the purpose of detecting illegal discharges at sea starting on 5 June and completing yesterday. Photo: HELCOMThe operation hosted by the Danish Defence Command resulted with only one observation of a minor discharge of vegetable oil and another spot of an unknown substance detected in the 62,000 sq km operation area over Skagerrak and Kattegat during 42 total flight hours. The 2015 Super CEPCO – Coordinated Extended Pollution Control Operation – was participated by Denmark, Finland, Germany, Ireland, Norway and Sweden. Such coordinated assignment is a regular biannual effort of the HELCOM member states, this time conducted jointly with the Bonn Agreement and with the Danish Defence Command Air Station Aalborg (DXT) as a base. The success of this initiative is the continuous process that will help to reduce the risk of a spill.

Sulphur Inspectors

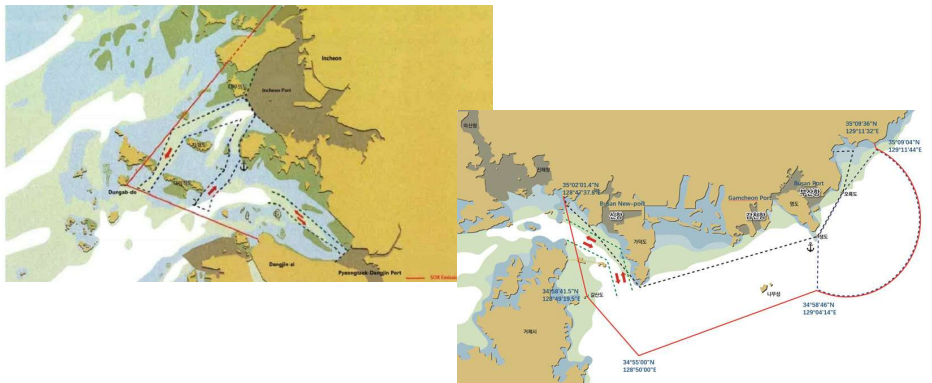
- HELCOM and Bonn Agreement shared expertise



Incentives and deterrence measures

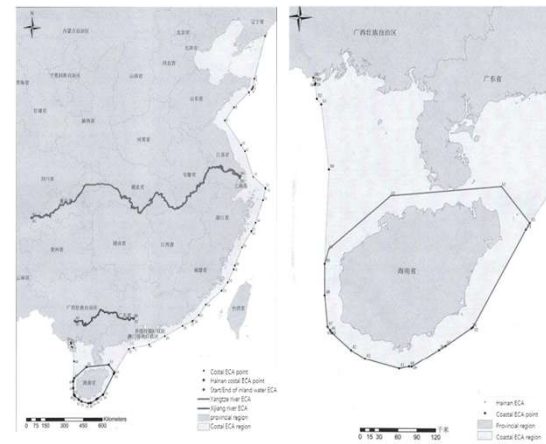
Korean ECA

- Vessel Speed Reduction (VSR) incentives



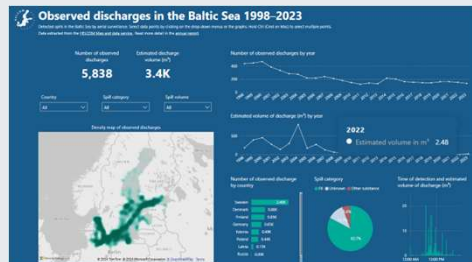
Chinese ECAs and Hong Kong ECA

- Deterrent punishments
 - failure to use compliant fuel
 - failure to maintain record



Potential innovative solutions for the Mediterranean

AI powered predictive models



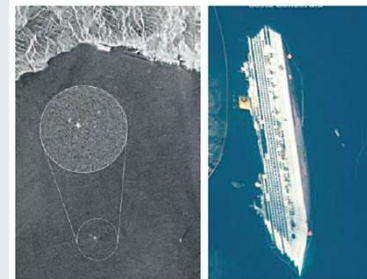
Next-Generation dispersants



Bioremediation



Drones and satellites





Recommendations

Recommendations: 4 Focus areas



**Policy and regulatory
improvements**



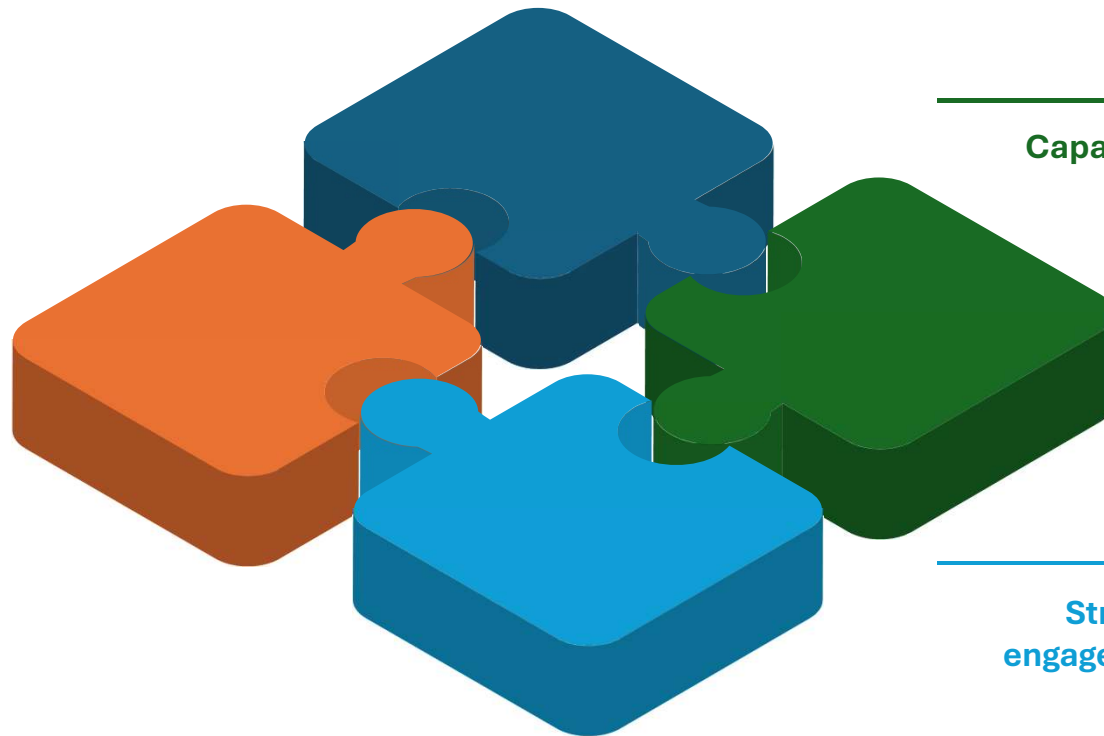
**Enhancing response
mechanisms**



Capacity building and training



**Strengthening stakeholder
engagement and collaboration**



1

Policy and regulatory improvements

- Updating and aligning **national regulatory frameworks**
 - Ratification and transposition of key IMO conventions
 - Incorporation of alternative fuel response strategies
 - Ensuring consistent enforcement and compliance
- Developing **regional guidelines** for low-sulphur and alternative fuel spills
- Strengthening **enforcement mechanisms**
 - Implementing more stringent inspections
 - Increasing penalties for non-compliance
 - Utilizing advanced monitoring technologies
- Establishing clear **liability and compensation** framework for alternative fuels
 - Defining responsibilities of key stakeholders
 - Ratifying and implementing existing conventions
 - Developing national and regional guidelines



2 Capacity building and training

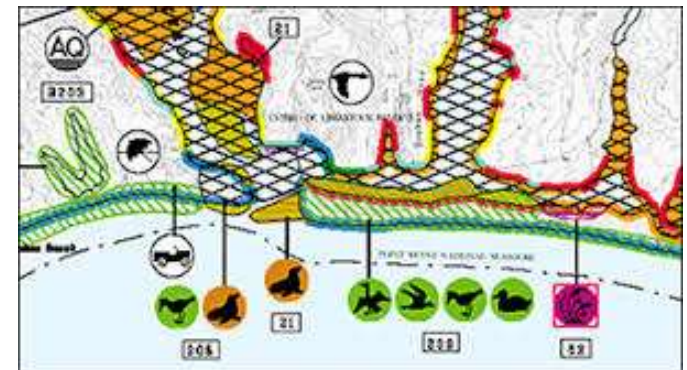
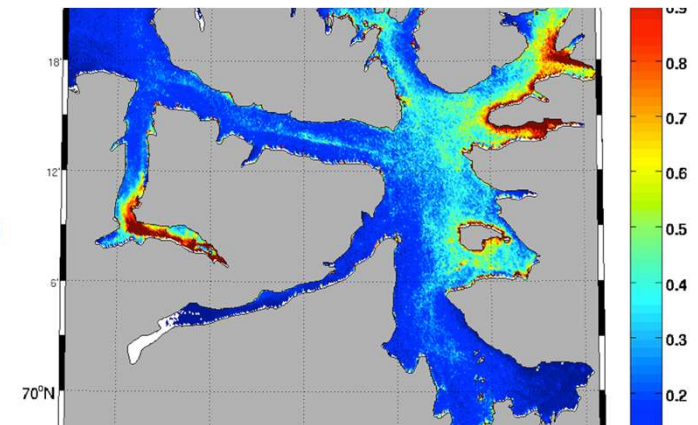
- Developing **specialized training** programs for alternative fuels
- Implementing **simulation-based training** for spill response
- Establishing **certification** standards for responders
- Conducting **regional training** workshops and drills
- Building a **pool** of regional experts
- Enhancing knowledge-sharing **platforms**
- Investing in **R&D** for response innovations



<https://www.marineboard.eu/marime-chemical-pollution>

3 Improving response mechanisms

- Developing fuel-specific response **protocols**
- Investing in specialized response **equipment**
- Implementing real-time **monitoring and detection systems**
- Developing fuel dispersion and impact **models**
- Establishing rapid response units (**hubs**) for high-risk areas
- Enhancing cross-border response **coordination**
- Utilizing **data** from past incidents and drills
- Environmental Sensitivity Index (**ESI**) for response planning
- Enhancing communication and public **awareness** protocols
- Evaluating and **updating** response mechanisms regularly

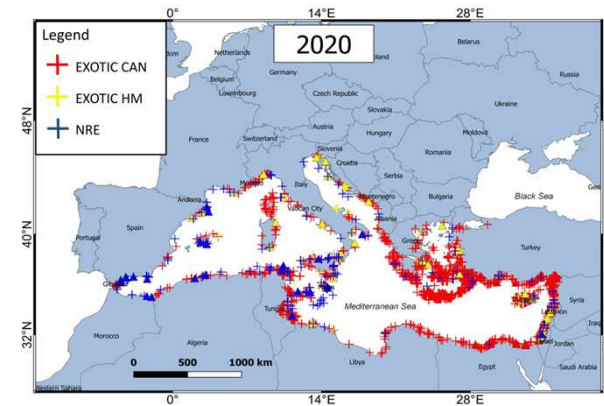


4

Enhancing stakeholder engagement and collaboration

- Establishing a regional **stakeholder forum** on pollution response
- Strengthening partnerships with the **private sector**
- Engaging **local communities** in response preparedness
- Enhancing collaboration with **scientific and research institutions**
- Facilitating cross-border resource sharing
- Supporting **regional training** programs and joint drills
- Mediterranean **database** of pollution response resources
- Encouraging transparent communication and **information sharing**
- Promoting Public-Private-NGO **partnerships** for environmental stewardship
- Leveraging REMPEC's role for enhanced regional coordination

ORMEF: Occurrence Records of Mediterranean Exotic Fishes database



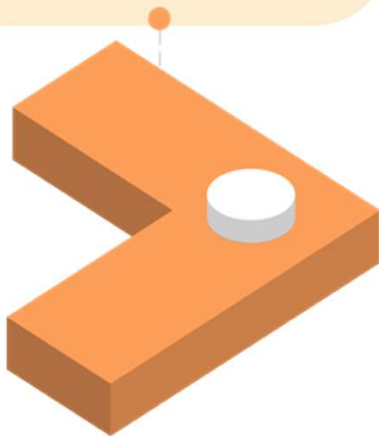


Strategic Roadmap

Strategic Roadmap

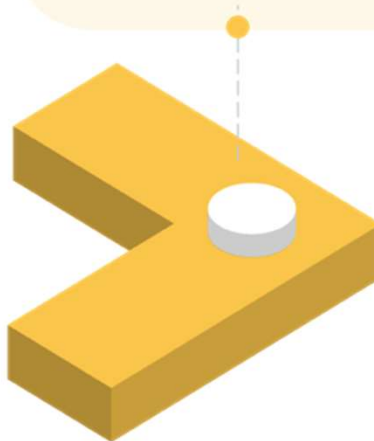
Short-term (0–2 Years) Laying the Foundation

- Regulatory alignment and enforcement
- Initial training and awareness programs
- Establishing foundational response readiness
- Stakeholder collaboration and knowledge-sharing mechanisms



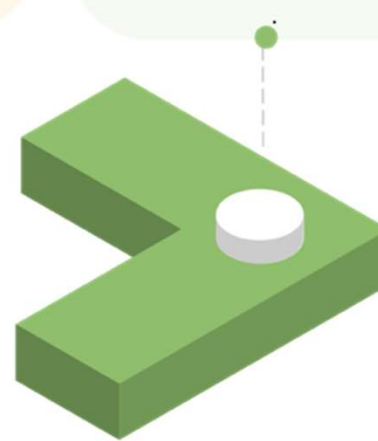
Medium-term (2–5 Years) Strengthening Preparedness

- Expanding regional coordination mechanisms
- Scaling up training and certification standards
- Developing specialized response hubs and tools
- Promoting research and technology adoption



Long-term (+5 Years) Achieving and Sustaining full operational readiness

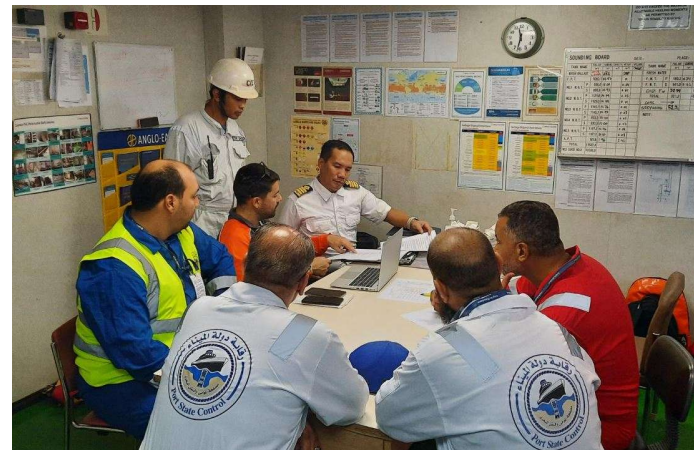
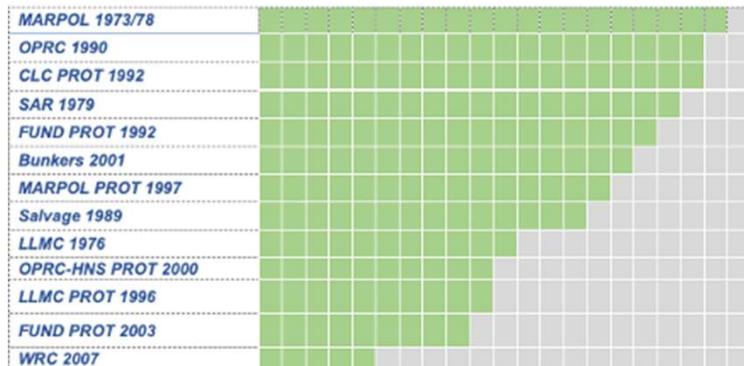
- Full harmonization of regulatory and operational frameworks
- Deployment of AI-powered and predictive monitoring technologies
- Establishing permanent training centers and multi-stakeholder partnerships
- Promoting continuous research, development, and adaptation



Laying the foundation

Short-term (0-2 years)

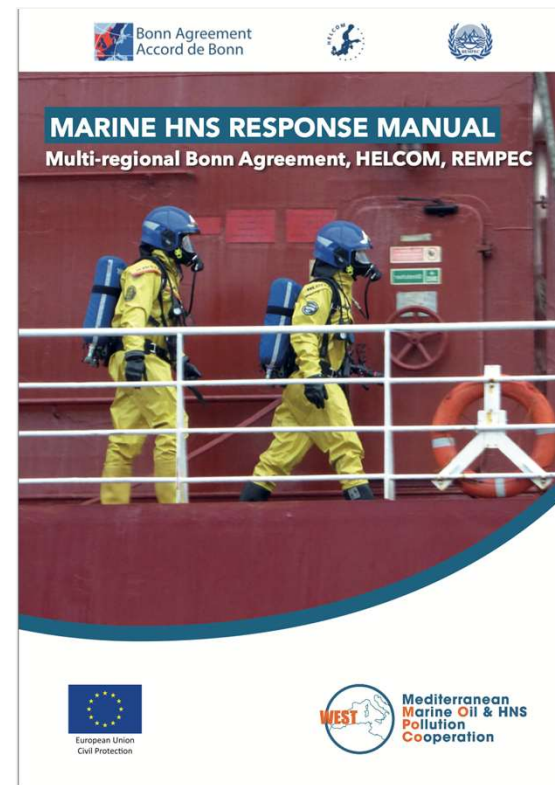
- Review and update national contingency plans
- Gap analysis of key IMO instruments
- Initiate specialized training programs
- Establish initial resource networks and stockpiles



Building capacity and Regional Cooperation

Medium-term (2-5 years)

- Ratification of missing IMO instruments
- Implementation of regional guidelines
- Conduct joint spill response exercises
- Enhance public-private partnerships



Source: REMPEC

Achieving full operational readiness

Longer-term (5+ years)

- Operationalize regional response networks
- Ongoing monitoring and evaluation
- Continuous adaptation of regulatory frameworks to emerging fuel technologies





Action Plan for Implementation

Action plan for implementation



Immediate actions:

Capacity-building and regional integration

- Expand training programs
- Strengthen REMPEC's role in coordination
- Implement resource allocation plans



Source: REMPEC

Mid-term actions: Strengthening Preparedness

- Establish national implementation committees
- Identify resource gaps
- Develop a stakeholder engagement strategy



Source: HELCOM

Longer-term actions: Sustain Preparedness

- Integrate spill preparedness into national policies
- Encourage research and innovation



Funding and support mechanisms

- National and regional funding initiatives
- International funding and technical assistance
- Industry contributions and public-private partnerships



Source: IOPC Funds

Capacity building and international cooperation

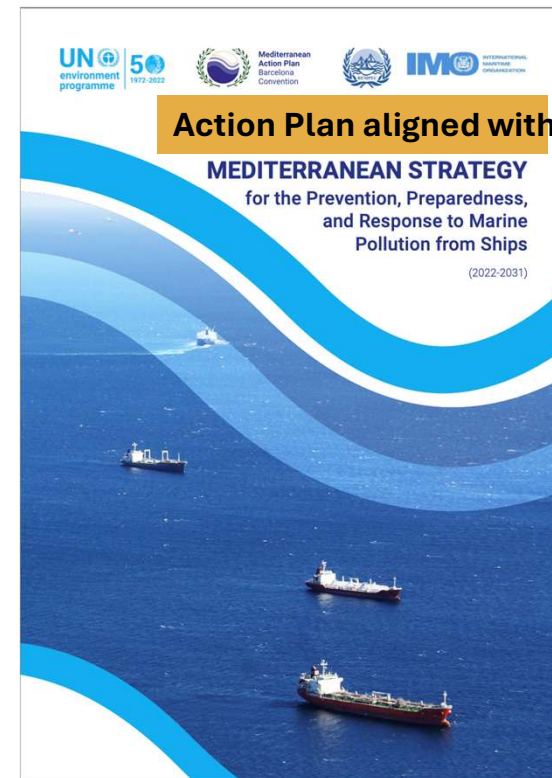
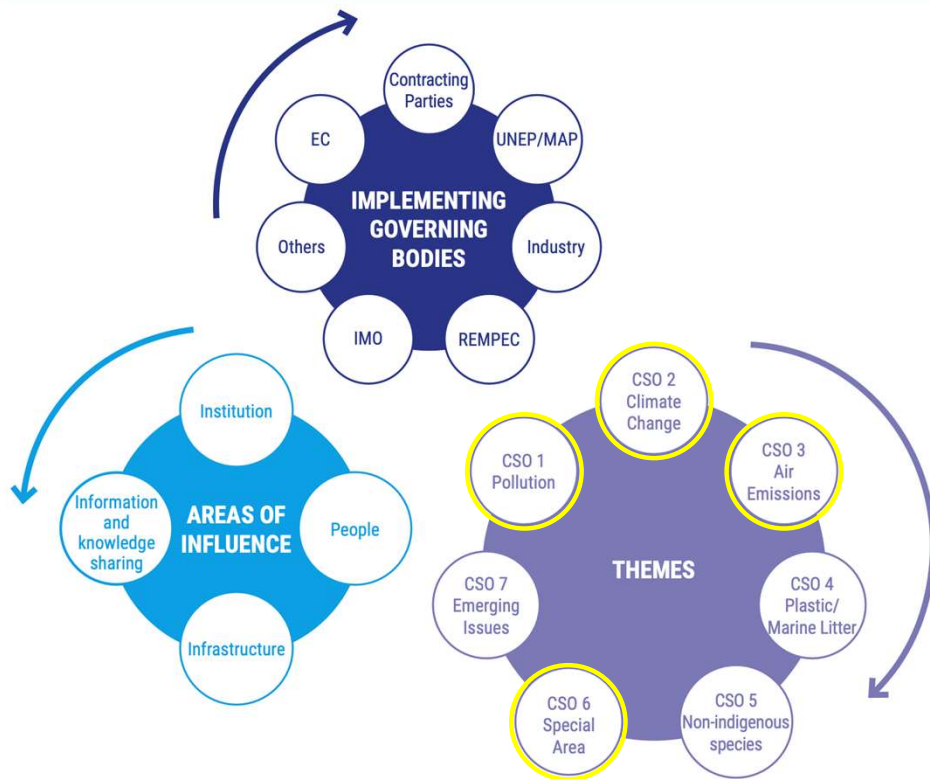
- **Capacity building for alternative fuel response**
 - Establish training Centres
 - Develop a network of experts and advisors
- **Fostering international cooperation and knowledge exchange**
 - Engage in global forums
 - Promote REMPEC's role in regional coordination



Source: REMPEC

Interlocking for delivering on the Action Plan

CSOs + areas of influence + implementing / governing bodies





People. Development. Impact.



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Thank you

Questions or comments?



**Mediterranean
Action Plan**
Barcelona
Convention

