

Introduction to Part I: The International Context



Angela Carpenter and Andrey G. Kostianoy

Abstract This book (Part 1 of a volume on Oil Pollution in the Mediterranean Sea) presents a review of knowledge on oil pollution in the Mediterranean Sea, through a series of chapters at an international level. The chapters consider various sources of oil entering the marine environment, activities such as numerical modeling of oil pollution in the Eastern and Western Mediterranean Basins, oil spill beaching probability assessment, and oil spill intervention activities. They also examine legislative measures in place to protect the marine environment of the Mediterranean from oil pollution, including the role of the Convention for the Protection of the Mediterranean Sea Against Pollution (Barcelona Convention, 1976) and its various protocols, in providing a framework under which nations across the region can work together to cooperate in preventing pollution from ships and from offshore exploration and exploitation activities or in the event of an emergency. The work of the Regional Marine Pollution Emergency Response Centre for the Mediterranean Sea (REMPEC), established under the Barcelona Convention to enhance collaboration and cooperation between national contracting parties, is also examined, including its role in national contingency planning and oil pollution preparedness and response activities. The International Maritime Organization has a role in protecting the Mediterranean Sea and its various regions through the International Convention for the Prevention of Pollution from Ships and its Protocols (MARPOL 73/78 Convention) and sets limits on discharges of oil from ships, while the European Maritime Safety Agency supports oil spill detection activities through satellite surveillance across the region. This book

A. Carpenter (✉)

School of Earth and Environment, University of Leeds, Leeds, UK

e-mail: a.carpenter@leeds.ac.uk

A. G. Kostianoy

Shirshov Institute of Oceanology, Russian Academy of Sciences, Moscow, Russia

S.Yu. Witte Moscow University, Moscow, Russia

e-mail: kostianoy@gmail.com

A. Carpenter and A. G. Kostianoy (eds.), *Oil Pollution in the Mediterranean Sea:*

Part I - The International Context, Hdb Env Chem (2018) 83: 1–8,

DOI 10.1007/698_2018_368, © Springer Nature Switzerland AG 2018,

Published online: 25 October 2018

brings together the work of scientists, legal and policy experts, academic researchers and specialists in various fields relating to marine environmental protection, satellite monitoring, oil pollution, and the Mediterranean Sea.

Keywords Barcelona Convention, EMSA, MARPOL Convention, Mediterranean Sea, Monitoring, Numerical modeling, Oil and gas exploration, Oil installations, Oil pollution, Oil spill preparedness, Oil spills, REMPEC, Shipping

Contents

References 6

The Mediterranean Sea is bounded by the coasts of Europe, Africa, and Asia, from the Strait of Gibraltar in the west to the entrances to the Dardanelles and the Suez Canal in the east [1]. It covers an area of approximately 2.5 million km² and has an average water depth of 1.5 km with a maximum depth of just over 5 km [2]. The Mediterranean Basin is approximately 4,000 km from east to west and has a maximum width of 800 km [2]. Twenty-one countries border the Mediterranean; in alphabetical order, they are Albania, Algeria, Bosnia and Herzegovina, Croatia, Cyprus, Egypt, Greece, Israel, Italy, Lebanon, Libya, Malta, Monaco, Montenegro, Morocco, Slovenia, Spain, Syria, Tunisia, and Turkey [2].

The Mediterranean Sea is a relatively small, semi-enclosed sea, with limited exchange of water with the Atlantic Ocean and Black and Red Seas and is divided into two deep basins, the Western and Eastern Basins, which are further subdivided into a number of sub-basins [2] (see Fig. 1). The Western Basin has an area of



Fig. 1 The Mediterranean Basin and its waters. Source: UNEP-MAP – Barcelona Convention ([2], p. 19). Available at https://wedocs.unep.org/bitstream/handle/20.500.11822/364/sommcer_eng.pdf?sequence=4&isAllowed=y

approximately 0.9 million km² and includes within the Algerian-Balearic Basin, the Catalano-Balearic Sea, the Gulf of Lion, the Ligurian Sea, and the Tyrrhenian Basin [2]. At its western end is the 14-km-wide and 290-m-deep Strait of Gibraltar through which the Mediterranean Sea connects to the Atlantic Ocean [2]. Two large rivers drain into the Western Basin: the Ebro which has a drainage region covering the southern flanks of the Pyrenees and northern flanks of the Iberian Cordillera and flows into the Catalano-Balearic Sea and the Rhone, which has a drainage region covering the central Alps, Lake Geneva, and southeastern France and flows into the Gulf of Lion [2]. The Eastern Basin has an area of approximately 1.7 million km² and includes the Strait of Sicily, the Adriatic Sea, the Ionian Sea, the Levantine Basin, and the Aegean Sea [2]. It contains the deepest part of the Mediterranean, the Hellenic Trench, which runs from the western Peloponnese region of Greece to southeast of the island of Rhodes and which reaches a depth of 5,267 m off the Peloponnese [2].

The Mediterranean Sea faces multiple pressures and threats from human activities including threats to coastline stability and erosion resulting from population growth, the use of low-lying delta areas for dwellings, coastal modifications resulting in redistribution of sediments, and the construction of artificial coast areas in areas across the northern Mediterranean [2]. Other threats to the region include eutrophication, where inputs of dissolved nitrogen and phosphorus from wastewater, fertilizers, and sewage, for example, result in nutrient over-enrichment causing harmful algal blooms; the introduction of nonindigenous species entering the region through waterways such as the Suez Canal, being transported on the hulls of ships and in ballast water, and through aquaculture activities; marine litter; marine noise; and physical damage to the sea-floor from fishing, offshore construction, dredging, and rigs [2].

There are multiple sources of pollution entering the marine environment, including land-based sources (point-source and nonpoint-source), atmospheric deposition, riverine discharges, and marine activities including shipping, mining, and oil and gas exploration and exploitation [2]. Pollution includes organic matter entering coastal and marine waters from both domestic and industrial sources, with 37% of coastal settlements having inadequate or no wastewater treatment facilities for sewage in 2012 [2]. Heavy metals including lead, mercury, cadmium, zinc, and copper have been found in coastal sediments across the northern Mediterranean and have been linked to industrial and domestic waste discharges and to activities in harbors [2], while hazardous persistent organic pollutants (POPs) such as polychlorinated biphenyls (PCBs), dichloro-diphenyl-trichloroethanes (DDTs), and hexachlorobenzenes (HCBs) have also been found in northern areas ranging from Spain into and around the Adriatic (for HCBs very high levels were identified in Turkish waters in 2011) [2]. These substances were generally identified in the vicinity of industrial and urban areas and in the mouths of rivers such as Rhone and Ebro and offshore from ports such as Piraeus near Athens [2]. Maritime traffic is also a source of chemical compounds such as tributyltin (TBT) used in antifouling paints and polyaromatic hydrocarbons (PAHs) from oil discharges and accidental spills [2]. The latter are generally found in sediments near ports and industrial areas, and high levels have been linked to refineries, terminals, and ports [2].

Between 2000 and 2009, it was estimated that 4.2 thousand tonnes of oil was spilled in Western Mediterranean waters, 0.1 thousand in the Adriatic Sea, 5.5 thousand tonnes in the Central Mediterranean, and 19.2 thousand tonnes in the Eastern Mediterranean [2]. In the case of the Eastern Mediterranean, 13,000 tonnes originated from an incident at the Jiyeh power plant in Lebanon in July 2006 [3]. In the case of the Western Mediterranean, the major oil spill from the *MV Haven* in April 1991 off Genoa resulted in a spill of 144,000 tonnes of oil, making it the fifth largest oil spill recorded since 1967 [4]. In 2017 it was noted that the rate of accidents has gone down in the Mediterranean despite an increase in shipping traffic, and it was concluded that the international regulatory framework, both through the IMO and regional cooperation activities, has had a positive impact on reducing accidents [5]. Despite this, however, it was considered that the risk of spills from oil tankers and also vessels transporting hazardous noxious substances (HNS) cannot be completely eliminated, while illicit spills continue to occur and require ongoing monitoring to identify the source of such spills [5]. Even as this volume was underway, and a chapter on shipping and oil transportation in the Mediterranean Sea had been completed [6], a spill occurred in Greek waters in September 10, 2017, where the *Agia Zoni II* tanker was wrecked and subsequently sank near the port of Piraeus and off the coast of Salamina, Greece [7]. The oil tanker was carrying fuel oil and marine gas oil, the vast majority of which was contained and removed using oil spill cleanup units [8], but an estimated 700 tonnes of oil were spilled as a result of this accident [6].

The majority of oil and gas exploration activities have occurred in the Eastern Mediterranean Basin, including along the northern and central Italian coasts of the Adriatic Sea where there were approximately 90 offshore platforms in 2007 [9], while there have been major natural gas finds in the waters of Israel [10, 11], exploration activities taking place off the coast of Cyprus [12], and new exploration activities planned in Greek waters in the coming years [13]. Oil and gas exploration activities pose a threat to the marine environment, the seabed, and sea-bottom habitats and species [14], and oil contamination can persist in the marine environment for many years, depending on the oil type, the location of a spill, and the area in which the contamination occurs [15, 16]. In the Western Mediterranean, Algeria is one of the top three oil producers in Africa and is a potential source of oil pollution on the southern shore of the Western Basin of the Mediterranean Sea since it has six coastal terminals for the export of petroleum products, together with five oil refineries (three in coastal cities), located along its coastline [17]. Between 1988 and 1997, some 22,563 tonnes of oil entered the Mediterranean Sea annually from coastal refinery effluent sources. Of this, it was estimated that around 2,971 tonnes per year came from Algerian coastal refineries (the largest volume for an individual country) [18].

There are in place a range of standards for oil pollution from both shipping and oil and gas exploration and exploitation in the region. The *Protocol for the Protection of the Mediterranean Sea against Pollution Resulting from Exploration and Exploitation of the Continental Shelf and the Seabed and its Subsoil* (Offshore Protocol, 1994) sets out standards for the disposal of oil and oily waste from oil and gas installations in the region [19]. This is one of a number of Protocols to the 1976 *Convention for the Protection of the Mediterranean Sea Against Pollution* (Barcelona Convention) [20],

other Protocols to which include the *Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources and Activities* (LBS Protocol) [21] and the *Protocol on the Prevention of Pollution of the Mediterranean Sea by Transboundary Movements of Hazardous Wastes and their Disposal* (Hazardous Waste Protocol) [22].

The Convention and its Protocols, together with the work of the Regional Marine Pollution Emergency Response Centre for the Mediterranean Sea, a body established to support Mediterranean coastal states in combatting oil pollution and dealing with its consequences, are discussed in this volume, as are the roles of the European Maritime Safety Agency in monitoring and protecting the region through satellite surveillance and provision of oil spill cleanup resources and the role of the International Maritime Organization and the *International Convention for the Prevention of Pollution from Ships* (MARPOL Convention) [23], under Annex I on Oily Wastes, of which the Mediterranean Sea has special status which establishes strict limits on the volume of oil that can be legally discharged¹ which the Adriatic Sea holds Particularly Sensitive Sea Area (PSSA) status, with even tighter restrictions than for the rest of the Mediterranean.

Other chapters appearing in this volume include the history, sources, and volumes of oil pollution in the Mediterranean; an examination of shipping and oil transportation and the hazards that are presented by pipelines and tankers and an examination of oil and gas production activities that have, and continue, to take place in the region; a discussion on oil spill intervention measures at international, regional, and national levels (including intervention planning); oil spill beaching probability through the use of maps and simulations to provide vulnerability analysis and risk assessment in the Mediterranean; an overview of EU, nationally and regionally funded oil spill response projects that contribute to protecting valuable marine ecosystems; a summary of major oil spill numerical predictions in the Eastern Mediterranean, including application of oil spill models to real-life oil pollution accidents and spills; and a chapter on oil spill numerical modeling in the Western Mediterranean for over 15 years and using a range of different ocean and atmospheric forecasting models.

Work started on this volume in November 2015 when a number of authors were approached to contribute to a volume on oil pollution in the Mediterranean Sea. The response to those invitations was overwhelmingly positive, with the large number of chapters making it necessary to produce the volume in two parts – Part I on the International Context and Part II on National Case Studies. Following final agreement with Springer-Verlag, in December 2015 to go ahead with this volume, it took just over two and a half years to bring together all the chapters.

This two-part volume follows on from earlier volumes in the Handbook of Environmental Chemistry Series which examined oil pollution in the Baltic Sea [24] and in the North Sea [25], and, following on from this Mediterranean volume,

¹For further details on these limits, see <http://www.imo.org/en/OurWork/Environment/SpecialAreasUnderMARPOL/Pages/Default.aspx>.

plans are already in place for a volume on “Oil Pollution in the Black Sea” which will be presented in two parts. Part I of this volume on the Mediterranean Sea contains 15 chapters including the Introduction and Conclusions, written by the volume editors. Part II contains a further 12 chapters including Introduction and Conclusions, again written by the volume editors, and includes 10 national case study chapters presenting and covering 9 Mediterranean countries (in the case of Italy, there are two chapters, one excluding and one covering Italian waters within the Adriatic Sea). It was not possible to include, in Part II, a chapter from every state bordering the Mediterranean Sea, due to geopolitical problems in the region (particularly in the east and along the North African coast). However, many of the chapters in Part I do include material that covers the entire Mediterranean Sea and its basins and sub-basins.

The book is aimed at a wide audience of national, regional, and international agencies and government bodies, together with policy makers and practitioners in the fields of shipping, ports and terminals, oil extraction, and environmental monitoring, for example. It is also aimed at graduate and undergraduate students in marine environmental sciences, as well as policy studies and legislative studies. The volume as a whole will provide a valuable resource of knowledge, information, and references on oil pollution in the Mediterranean Sea.

Acknowledgments The research by A.G. Kostianoy was partially supported in the framework of the Shirshov Institute of Oceanology RAS budgetary financing (Project N 149-2018-0003).

References

1. International Hydrographic Organization (1953) Limits of the Oceans and Seas. Special Publication No. 28, 3rd edn. IMP, Monte-Carlo. <https://epic.awi.de/29772/IHO1953a.pdf>
2. UNEP-MAP (2012) State of the Mediterranean marine and coastal environment. UNEP-MAP – Barcelona Convention, Athens. https://wedocs.unep.org/bitstream/handle/20.500.11822/364/sommcer_eng.pdf?sequence=4&isAllowed=y
3. UNEP MAP (2017) Barcelona Convention – Mediterranean 2017 quality status report. Results and status, including trends (CI19). <https://www.medqsr.org/results-and-status-including-trends-ci19>
4. ITOPF (2015) Oil tanker spill statistics 2014. International Tanker Owners Pollution Federation Limited (ITOPF), London http://www.itopf.com/fileadmin/data/Documents/Company_Lit/Oil_Spill_Stats_2014FINALlowres.pdf
5. UNEP MAP (2017) Barcelona Convention – Mediterranean 2017 quality status report land and sea-based pollution: common indicator 19 etc. Conclusions (CI19). <https://www.medqsr.org/conclusions-ci19>
6. Girin M, Carpenter A (2017) Shipping and oil transportation in the Mediterranean Sea. In: Carpenter A, Kostianoy AG (eds) Oil pollution in the Mediterranean Sea: part I – the international context. Handbook environmental chemistry. Springer, Berlin. https://doi.org/10.1007/698_2017_6
7. World Maritime News (2018) ITOPF: two large oil spills reported in 2017. <https://worldmaritimeweb.com/archives/241402/itopf-two-large-oil-spills-reported-in-2017/>. Accessed Jun 2018

8. World Maritime News (2017) Tanker sinks off greece, oil clean-up ops launched. <https://worldmaritimeneews.com/archives/229593/tanker-sinks-off-greece-oil-clean-up-ops-launched/>
9. Trabucco B, Maggi C, Manfra L, Nonnis O, DiMento R, Mannozi M, Lamberti CV (2012) Monitoring of impacts of offshore platforms in the Adriatic Sea (Italy). In: El-Megren H (ed) Advances in natural gas technology. IntechOpen, London, pp 285–300
10. Galil B, Herut B (2011) Marine environmental issues of deep-sea oil and gas exploration and exploitation activities off the coast of Israel. IOLR report H15/2011, Annex II. http://www.sviva.gov.il/subjectsEnv/SeaAndShore/MonitoringandResearch/SeaResearchMedEilat/Documents/IOL_deep_sea_drilling_Israel2011_1.pdf
11. Offshore Technology (2017) Noble energy hires Ensco's drillship for offshore work in Israel. Offshore-Technology. <https://www.offshore-technology.com/news/newsnoble-energy-hires-enscos-drillship-for-offshore-work-in-israel-5907504/>
12. Pappas J (2013) Mediterranean Sea plays offer new opportunities. Offshore Magazine, 73(7). <https://www.offshore-mag.com/articles/print/volume-73/issue-7/offshore-mediterranean/mediterranean-sea-plays-offer-new-opportunities.html>
13. Offshore Staff (2018) Energean, BP extend offtake agreement for the Prinos oil field offshore Greece. Offshore Magazine. <https://www.offshore-mag.com/articles/2018/02/energean-bp-extend-offtake-agreement-for-the-prinos-oil-field-offshore-greece.html>
14. Carpenter A (2018) Oil pollution in the North Sea: the impact of governance measures on oil pollution over several decades. In: Hydrobiologia North Sea open science conference proceedings. <https://doi.org/10.1007/s10750-018-3559-2>
15. Tansel B (2014) Propagation of impacts after oil spills at sea: categorization and quantification of local vs regional and immediate vs delayed impacts. Int J Disaster Risk Reduct 7:1–8. <https://doi.org/10.1016/j.ijdrr.2013.11.001>
16. Kingston PF (2002) Long-term environmental impacts of oil spills. Spill Sci Technol Bull 7 (1–2):55–61
17. Benmecheta A, Belkhir L (2016) Oil pollution in the waters of Algeria. In: Carpenter A, Kostianoy AG (eds) Oil pollution in the Mediterranean Sea: part II – national case studies. Handbook environmental chemistry. Springer, Berlin. https://doi.org/10.1007/698_2016_57
18. GESAMP Joint Group of Experts on the Scientific Aspects of Marine Pollution (2007) Estimated of oil entering the marine environment from sea-based activities. Rep. Stud. GESAMP #75. IMO, London. http://www.gesamp.org/data/gesamp/files/media/Publications/Reports_and_studies_75/gallery_1042/object_1042_large.pdf
19. UNEP (n.d.) Protocol for the protection of the Mediterranean Sea against pollution resulting from exploration and exploitation of the continental shelf and the seabed and its subsoils (Offshore Protocol). <https://wedocs.unep.org/rest/bitstreams/2336/retrieve>
20. UNEP (1976) Convention for the protection of the Mediterranean Sea against pollution (Barcelona Convention). http://wedocs.unep.org/bitstream/id/53143/convention_eng.pdf
21. United Nations (1980) Protocol for the protection of the Mediterranean Sea against pollution from land-based sources. http://wedocs.unep.org/bitstream/id/53203/protocollbs_with_annex4-eng.pdf
22. UNEP (1976) Protocol on the prevention of pollution of the Mediterranean Sea by transboundary movements of hazardous wastes and their disposal. <https://wedocs.unep.org/rest/bitstreams/2593/retrieve>
23. International Maritime Organization (2015) International convention for the prevention of pollution from ships, 1973, as modified by the protocol of 1978 (MARPOL 73/78). IMO, London [http://www.imo.org/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Prevention-of-Pollution-from-Ships-\(MARPOL\).aspx](http://www.imo.org/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Prevention-of-Pollution-from-Ships-(MARPOL).aspx)
24. Kostianoy AG, Lavrova OY (2014) Oil pollution in the Baltic Sea. The handbook of environmental chemistry, vol 27. Springer, Berlin
25. Carpenter A (2016) Oil pollution in the North Sea. The handbook of environmental chemistry, vol 41. Springer, Berlin