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# From maritime salvage to IMO 2020 strategy: Two actions to protect the environment

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ABSTRACT

Marine protection is one of the main Sustainable Development Goals designed by the United Nations. Specifically, Goal 6.3 – Clean Water and Sanitation – defends that the spill of dangerous and pollutant substances must be eliminated. This principle is inherent in Maritime law since maritime salvage concerns not only vessels and cargo but also the marine environment. Since the *Torrey Canyon* accident in 1967, spilt crude has become the centre of attention of the International Maritime Organization (IMO). Nowadays, IMO has extended its scope of application to new threats, such as pollutant gas emissions. Its last approved strategy is IMO 2020, focused on the reduction of sulphur emissions by vessels. It came into force on the 1st of January 2020, becoming one effective measure to minimize the sulphur emissions to the atmosphere and to improve the environmental conditions, not only at the sea but also in the coastal and inland areas.

## 1. Introduction

In the last decades, the sea has become the centre of attention of the news due to the damages in the maritime environment. Lately, plastic has gathered all this attention due to two principal reasons. The first factor refers to the enormous quantity of this material in the sea: more than 5.25 trillion plastic particles – approximately, 268,940 t (Eriksen et al., 2014) – appreciated in, for example, the "garbage islands" such as the Great Pacific garbage patch with an area of 1,6 million $km^2$ (Lebreton et al., 2018). The second factor is explained by the fact that every decade there are fewer oil discharges in the water. From the first crude spills until the last sulphur emissions, society has developed an *environmental concern* (Pendón Meléndez and Romero Matute, 2017), so people are more aware of maritime pollution.

From a legal perspective, Maritime law standardises the sea and its aspects: from the transports to the insurances, but also the fishing and other activities related to the maritime sphere. Nevertheless, this environmental concern has not become part of the Law until maritime salvage; especially, since the '60s. specifically, the *Torrey Canyon* accident supposed an inflexion point in the conception of environmental maritime rescue) (Pendón Meléndez and Romero Matute, 2017). Thus, maritime salvage has been the first in putting the environment and pollution in the centre. From there until now, worldwide awareness has been created related to the environmental protection of the seas.

Nowadays, new strategies are being developed and created for the protection of the sea. Among them, it should be outlined the last one which came into force on the 1st of January of 2020. The International Maritime Organization (IMO)[1] approved the "IMO 2020", which is based on the reduction of the sulphur emissions from the vessels.

## 2. Origins of the environmental concern and the first response: maritime salvage

From the beginning of the 20th century, crude began to be used for the propulsion of vessels. This substance replaced coal for this purpose (Louzán Lago, 2012). Lately, World War II promoted a technological development that influenced, among other aspects, the creation of modern and improved vessels. The consumption of crude and other chemical substances increased during that century. Consequently, there was a significant rise in the commerce and transport of those dangerous substances (United Nations Conference on Trade and Development, 2018).

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[1] The International Maritime Organization (IMO) was created to regulate maritime safety in the international sphere. It is a specialized agency of the United Nations with the faculty of developing international conventions for the protection of the sea. One of the most relevant of these conventions is the SOLAS Convention (Safety of Life at Sea Convention) which was adopted in 1914 after the Titanic incident.

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When any one of those vessels had an accident, it had serious environmental consequences.[2] Nevertheless, until 1960 neither the organizations nor the society cared so much about them.[3] The environmental concern developed some years later.

The first maritime accident which is usually cited is the *Torrey Canyon* in 1967. This vessel ran aground in the western coast of Cornwall in 1967; its cargo capacity was 120,890 t of crude oil. Approximately, 30,000 t were spilt into the sea and 100 miles of coastline were affected. Later, due to bad weather and strong winds, the vessel broke her back and it caused another spillage of 30,000 t (Comité Maritime International, 2003). Some days after that, the British Naval and Air Forces bombed the vessel to set fire to the vessel and limit the disaster. Nevertheless, this strategy caused more damages than benefits, especially in marine biodiversity. This accident showed that, generally, the governments or the authorities had not had any procedures to follow on those occasions. For that reason and due to its serious environmental consequences too, this accident marked a turning point for maritime salvage and, eventually, for environmental protection.

To begin, the Inter-Governmental Maritime Consultative Organization (IMCO) – from 1982 called International Maritime Organization (IMO)[4] – decided to revise the OILPOL 1964/62 Convention.[5] At the same time, the media covered the *Torrey Canyon* accident, allowing society to start being conscious of this and other disasters. On the other hand, the international sphere reacted creating, among other aspects, the International Oil Pollution Compensation Funds (IOPC Funds). The IOPC Funds were created to compensate the victims of the oil pollution accidents.[6]

Unfortunately, that was not the only grave accident at the sea.[7] Five years later of the *Torrey Canyon*, the vessel *Sea Star* provoked a spill in the Oman Gulf of 115,000 t of crude oil. Three years later, the *Jakob Maersk*, charged with oil from Iran wrecked ashore in the port of Leixoes (Portugal).[8] Only a year later, in 1976, a new spill hit the Spanish shoreline: the oil tanker *Urquiola*, with a cargo of more than a hundred thousand of crude, wrecked causing serious damages in the coast of Ferrol, Ares and La Coruña. In 1978, it happened the gravest maritime accident in Europe with a spill of, approximately, 223,000 t of crude (Kifrier, 1978): the oil tanker *Amoco Cádiz* had grounded at Portsall Bay (France). The vessel suffered a power failure and the rudder did not respond nor could be repaired. Finally, the ship drifted into the rocks and it broke apart. This accident showed what could happen when a "giant" tanker could spill its cargo.

Despite the mentioned accidents above, in 1979 the hugest maritime accident happened: the *Atlantic Empress* wrecked causing a spill of almost 300,000 t of crude on the coast of Tobago. This VLCC[9] crashed with another vessel, the *Aegean Captain*, on the 19th of July of 1979 (Hooke, 1997).[10]

Taking into consideration those incidents, different actors of the maritime sphere[11] point out the incapacity to establish a new adaptable legal regime to the changes at the end of the 20th century[12]; especially about not only the technical novelties that allowed to develop vessels for the transport of dangerous substances or its cargo capacity but also the consequences in maritime accidents. The environmental concern was developing not only in society but also in international institutions. One of IMO's responsibilities is "Implementation, Control and Coordination";

[2] Ship accidents are not the only source of serious maritime pollution. Prior to the entry into force of the 1989 International Convention on Maritime Salvage, the largest oil spill at sea occurred in 1979, with the puncture at an exploratory oil well – *Ixtoc-1* – in the Gulf of Mexico. Approximately 480,000 tons of oil were released over a period of 10 months (Burgherr, 2007). Subsequently, in 2010, the *Deepwater Horizon*, an oil platform located in the same Gulf, sank producing a spill of some 779,000 t of crude oil (Beyer et al., 2016).

[3] For example, the accident that involved *The E.H. Blum* at the East coast of the United States. *The E.H. Blum* was the biggest oil tanker in its period with a cargo of 11,600 t. From this accident it is relevant the fact that was widely cover by the media, for example, in this article of The New York Times, of the 19th of February 1942: https://www.nytimes.com/1942/02/19/archives/tanker-wrecked-off-us-east-coast-by-mines-or-uboat-the-eh-blum-one.html. Nevertheless, that apparition in the news was very local and cause, generally, no effect in the international sphere or the global society.

[4] In 1982, this organization became the International Maritime Organization, leaving behind the term "consultative".

[5] The OILPOL 1954/62 Convention was approved before the *Torrey Canyon* incident in 1967 to prevent pollution of the sea by oil discharged from ships. However, the efforts made in this Convention did not collaborate in the prevention of that accident or its consequences. The original text of the OILPOL Convention was approved in 1954; later, it was updated in 1962 (OILPOL 62), 1969 (OILPOL 69), and 1971 (OILPOL 71). Finally, the OILPOL Convention was subsumed by the International Convention for the Prevention of Pollution from Ships (MARPOL Convention) in 1973.The MARPOL Convention has been the result of several years of efforts from different nations with maritime tradition. Thus, the first national legislation for the prevention of pollution at the sea was the Oil in Navigable Waters Act, of the United Kingdom in 1922. Two years later, the United States —which was then the first country in the production of oil— enacted the Oil Pollution Act which forbids any discharge of any type of hydrocarbons within its three nautical miles of territorial waters. Later, this country was the host of the Oil Pollution of Navigable Waters, an international conference about the oil pollution control at sea. This conference took place in the United States from the 8th to the 16th of June of 1926. The main maritime countries were invited to it accompanied by its experts in the field. During the conference, the host, along with the United Kingdom, convinced other attendee countries to agree to some pollution control zones up to 50 nautical miles from the nearest shoreline. Indeed, in some special locations, this zone will be expanded until 150 nautical miles. After World War II, the crude transport from the Middle East increased considerably; therefore, so did crude spills. In this context, the United Kingdom organized a second international conference in 1954 where it was adopted the OILPOL (International Convention for the Prevention of Pollution of the Sea by Oil) (Louzán Lago, 2012).

[6] Its legal framework was the 1969 International Convention on Civil Liability for Oil Pollution Damage (1969 Civil Liability Convention) and, later, the 1971 International Convention on the Establishment of an International Fund for Compensation for Oil Pollution (1971 Fund Convention). Nowadays, these funds still exist; they are formed by two intergovernmental organizations: the 1992 Fund and the Supplementary Fund. Its work is to facilitate the compensations for the damages produced by crude spills and maritime accidents. For more information, its webpage can be consulted: https://www.iopcfunds.org/es/.

[7] Fourteen of the twenty maritime accidents with more spill from 1967 (Torrey Canyon) happened before the International Convention on Salvage of 1989 came into force. For further information, it can be consulted the Oil tanker spills Statistics 2019 report by ITOPF (International Tanker Owners Pollution Federation Limited) in https://www.itopf.org/knowledge-resources/data-statistics/. ITOPF is a not-for-profit organization which assists maritime actors in the response to pollution accidents with crude: http://www.itopf.org/.

[8] After the running aground, it was an explosion in the engine room; the fire in the vessel provoked that the oil tanker broke in three parts. Even though two of them sunk, the prow kept afloat until she arrived at the land. Half of the 88,000 t that was carrying that oil tanker burnt, causing pollution not only in the water but also in the air. Part of the remaining crude spilt into the water; the other part arrived at the shore (Duerden, 1976).

[9] Very Large Crude Carrier: it has capacity for 250,000 DWT (deadweight tonnes).

[10] For further information, it may be consulted the ITOPF webpage about this incident: https://www.itopf.org/in-action/case-studies/case-study/atlantic-empress-west-indies-1979/.

[11] Those actors are not only salvors but also P&I Clubs and insurances. In this process also collaborated some local governments and lobbies not specially related to the maritime field but with other interests such as environmental protection (Darling and Smith, 1991; Miller, 1981).

[12] Furthermore, LOF 80 – LOF or Lloyd's Open Form – already began to adapt this reality with the safety net, as it will be explained in infra 3.2.1. LOF 80 and the safety net. Notwithstanding that it will be developed later, LOF is a salvage contract form designed by Lloyd's. Its version of 1980 was quite relevant because it introduced a new concept for salvage: "the safety net" which, for the first time, allowed salvors to recover its expenses (and a little margin of benefit) if they had assisted an oil tanker.

therefore, this organization must detect any problems that could affect the maritime sphere, adopt legislation in consequence and then, Governments will be responsible for implementing them. The environment became a central element in salvage since it was impossible to conceive maritime salvage ignoring the protection of the marine resources. Among other aspects, a new legal concept became to be necessary.

For that reason, the Legal Committee of the IMO requested the *Comité Maritime International* (CMI)[13] to examine the principles of Private law about maritime salvage. Maritime salvage is a Private law institution that consists of the assistance of a vessel or cargo in peril at the sea. In the international sphere, it was first regulated by the Brussels Convention on Assistance and Salvage at Sea of 1910. This Convention had only 19 articles and it was quite simple. Nevertheless, it regulated for the first time some basic principles of maritime salvage which gave the text recognition and success. Among other aspects, it considered the basic elements for salvage: the assistance, the object of salvage, the peril, the success and the award. Related to the success, the International Convention of 1910 established this element as necessary to consider an operation maritime salvage. Thus, the Convention regulated the basic principle of salvage: no cure-no pay.

The principle no cure-no pay established that salvors are entitled to receive a reward when they achieve total o partial success in a maritime salvage operation. This principle was defined in the case *The Fusilia,*[14] "where no property has been salved, and life alone had been preserved from destruction, not suit for salvage reward could be maintained". In this way, the success, or "requirement of success" (Shaw, 1996), is formed by two elements. The first is the success, strictly speaking, which means that the salvors must recover any element with economic utility. The success of the operation may be total or partial.[15] Thus, the assistance is complete when the economic value of the salved object is higher than what could have been lost if salvage had been not rendered (Le Clère, 1954). The second element is the beneficial service and consists of the causal link between the salvage operation and the salved values. The beneficial service requires that the operation of salvage contributes to achieving success. In this way, the salvor must participate in the operation that rescues the objects from the peril and assistance the vessel or its cargo. In conclusion, success is achieved when salvors save the property to its owner. If the salvors did not complete the salvage operation or they left the vessel in a worse or more dangerous condition than before, they will not have the right to recover an award.[16]

On the contrary, there is an *exception* to the principle no cure-no pay, which is called "engaged services" or "services at the request".[17] If the object of the salvage contract consists of the render of salvage services, it will be fulfilled if the salvors performance those services. For example, in *The Undaunted,*[18] the vessel lost its anchor due to the strong winds. A merchant's vessel went to lend some service to the ship in peril. Thus, she was commanded to find the lost anchor. In the meantime, *The Undaunted* reach its safety. In this case, the tribunal gives an award to the crew and captain of the merchant's vessel even though their services did not collaborate in helping the vessel in peril.

Following these engaged services, other countries, such as Italy, have promoted salvors' remuneration even though they have not achieved any success.[19] In this way, success is not a necessary element for salvage; salvors would recover a reward for their expenses. Additionally, if they achieve success in their operation, they are entitled to receive an award (Volli, 1957).

Traditionally, the principle no cure-no pay was enough to motivate salvors to perform maritime salvage operations. Despite the risk suffered by the salvors, the award was enough to pay salvors' expenses and a rise for the risk in the operation. Nevertheless, in the cases when there is not property to save or the salvors have not achieved any (economic) success, they did not have the right to obtain a reward.

From the '60s this principle, until then, the basis of maritime salvage, began to show its inadequacy in some cases which can be explained by two factors. First, 10 years before, the number of vessels of the global fleet had grown about 136% and the gross tonnage, around 382% (Coulthard, 1983). Nevertheless, this growth was not reflected in the salvors' awards. This is always limited by the value of the salvage property (Article 2 of the 1910 Convention and, later, Article 13.3 of the 1989 Convention). Even though generally, the value of the vessels had increased due to the novelties in technology and security, when a vessel had an accident, the reparation cost may be higher than the repaired ship. Taking that into consideration, in some cases, shipowners preferred to declare total loss (Coulthard, 1983) than repairing the vessel. Consequently, if, eventually, there was not salved property, salvors could not receive any award. The second factor is the fact that maritime accidents with serious environmental consequences, were progressively more frequent. Thus, coastal states and society, in general, were more aware of this situation and considered it necessary to repair de damage.

As time has gone by, the 1910 Brussels Convention began to show its inadequacy for the demands of the new industry of salvage.[20] As it has been exposed, the maritime accidents from the '60s needed a modern regulation for the protection of the maritime environment. After the *Atlantic Empress* accident, the CMI created a specific subcommittee to study the maritime salvage and, additionally, to write a draft of a new

[13] This non-governmental and not-for-profit international organization was established in Antwerp in 1897. Thus, it is the oldest organization that exclusively concerns the unification of Maritime law and its practices (Frawley, 2004). Its actual main objective continues to be contributing by all appropriate means and activities to the unification of Maritime law. For further information, its webpage can be consulted: https://comitemaritime.org/.

[14] (1865) Brown & Lush 345 (1865) 167 ER 391.

[15] *The Tojo Maru*, 1972, A.C., 242–293.

[16] *Owners of S.S. Melanie* v. *Owners of S.S. San Onofre* [1925] A.C. 246–262.

[17] Previously and despite the weight of the no cure-no pay principle, salvors could obtain a reward even though they had not achieved any success in the maritime salvage. Exceptionally, they could receive a reward from a national fund such as the Mercantile Marine Fund in the United Kingdom *ex* article 554.3 of the Merchant Shipping Act of 1894, related with the life maritime salvage: "Where the vessel, cargo, and apparel are destroyed, or the value thereof is insufficient, after payment of the actual expenses incurred, to pay the amount of salvage payable in respect of the preservation of life, the Board of Trade may, in their discretion, award to the salvor, out of the Mercantile Marine Fund, such sum as they think fit in whole or part satisfaction of any amount of salvage so left unpaid». Thus, life salvage was more dependent on the "traditional" salvage —based on the no cure-no pay principle— than the "environmental salvage" (Chen, 2001).

[18] (1860) Lush. 90 at 92.

[19] This is established in articles 491 and 492 of the *Codice della navigazione* of 1942. The first one is related to the maritime salvage of a vessel or an aircraft: "*l'assistenza e il salvataggio di nave o di aeromobile, che non siano effettuati contro il rifiuto espresso e ragionevole del comandante, danno diritto, entro i limiti del valore dei beni assistiti o salvati, al risarcimento dei danni subiti e al rimborso delle spese incontrate, nonché, ove abbiano conseguito un risultato anche parzialmente utile, a un compenso* (…)". Article 492 of this *Codice* is related to maritime salvage of cargo: "*il salvataggio di cose, che Non sia effettuato contro il rifiuto espresso e ragionevole del comandante della nave o dell'aeromobile in pericolo o del proprietario delle cose, dà diritto, nei limiti stabiliti nell'articolo precedente, al risarcimento dei danni, al rimborso delle spese, nonché, ove abbia conseguito un risultato anche parzialmente utile, a un compenso determinato a norma del predetto articolo*". For more information, *vid.* RIGHETTI, *Trattato di Diritto Marittimo*, Milán, 1994, p. 649. Those articles of the *Codice* as this italian doctrine bases the critics to the adoption of the International Convention on Salvage of 1989 (Celle, 2010).

[20] This Convention had some modifications to adapt itself to the new conditions of the navigation; for example, the progress from the steamboat to the propulsion engine since it meant that vessels could carry its fuel. In those cases where the vessel had an accident and the hull broke, the crude could spill; therefore, there would be a crude spill with all its environmental consequences. Nevertheless, it became insufficient to the environmental concern which had already begun developing.

international convention to regulate the maritime salvage which would be given to the IMO for its exam. At the same time, the company Lloyd's developed its own *solution* to protect the environment in maritime salvage with the approval of LOF 80.[21]

The CMI also organized the XXXII International Conference of the CMI[22] held in Montreal on the 24th–29th of May of 1981. In this conference, the CMI purposed the draft to the IMO (Darling and Smith, 1991). The CMI draft not only adapted the general rules of the maritime salvage but also introduced new previsions to motivate the saviour with the final purpose to protect the maritime environment in their services.[23]

Despite the first movements towards a new legal regime of maritime salvage, in the '80s occurred six of the twenty biggest maritime accidents.[24] In 1982 the *Castillo de Bellver* spilt more than 252,000 t of crude, becoming the third accident with the biggest spill.[25] In 1983, when the mentioned subcommittee was working on the revision of the 1910 Convention on Salvage, the IMO declared that maritime salvage should be a priority in the following two years. Moreover, it was arranged that the research of this topic by the IMO should have as a foundation the study made by the CMI.[26] The Legal Committee of the IMO analysed every article of the CMI draft, concluding with the first version of the draft during its fifty-third session.[27] Linked with these ship accidents, there was a legislative process to solve past errors and face the future with better preparation. Many normative advances had been achieved better environmental maritime security. It can be highlighted, maybe due to its relevance and international origin, the International Convention for the Prevention of Pollution from Ships (MARPOL).[28]

Nevertheless, something else was necessary. Thus, the IMO in 1984, held two international conferences where two protocols were approved: first, the Protocol to Amend the International Convention on Civil Liability for Oil Pollution Damage of 1984[29] and, second, the International Convention on Civil Liability for Oil Pollution Damage (CLC), later replaced by the one approved in 1992.[30] Finally, in 1989, between the 17th and the 18th of April was held the International Conference on Salvage (Comité Maritime International, 2003). In this conference, the text was finally approved, adopting the new International Convention, named "International Convention on Salvage" concluded in London on the 28th of April 1989.

### 2.1. LOF 80 and the safety net

Although a contract is not mandatory to perform a salvage operation, most salvage operations are rendered based on an agreement between the parties (Brice, 2011). Parties in the contract may opt for any of the different standard contracts used in the practice. There exist several forms of salvage agreements. Among others, *Le Contrat d'Assistance Maritime*, from France; the TOF – *Turkish Maritime Organization Salvage and Assistance Agreement* – from Turkey; the MARSALV – *U.S. Navy Salvage Agreement* – from the United States, the JSE – Japanese Shipping Exchange Salvage Agreement – or the *Standard Form of the Maritime Arbitration Commission*, designed by China. Notwithstanding the circumstances that influence the parties to use any of those models,[31] *Lloyd's Open Form of Salvage Agreement*, known simply as "LOF" and designed by Lloyd's[32] is the most extended and relevant one.

In the XIX$^{th}$ century, salvors began to use some contracts for their performance of salvage operations. The most distinguished were the ones designed by Lloyd's. Its first form was published in 1892 named *Lloyd's Standard Form of Salvage Agreement – No cure-No pay.*[33] In 1908 it was decided that Lloyd's form should be the only one employed in maritime salvage contracts (Thomas, 1978). LOF became an instrument that regulated the salvage operation between the contractor and the owner of the vessel or property. Its main objective was to salvage the property; therefore, there is no reference to life salvage. Since its version of 1908, some characteristics of Lloyd's have been maintained, such as the determination of the price by an arbitrator (Petrinović et al., 2013).

[21] This contract will be considered *infra* 3.1 LOF 80 and the safety net.

[22] This conference was held in the Bonaventure Hotel in Montreal from the 24th to the 29th of May. In the agenda it was planned the revision of the Brussels Convention of 1910; moreover, it was expected to examine the responsibility of the shipper about hazardous and dangerous cargo. IMO's webpage counts on some interesting documents as the files of this conference: https://comitemaritime.org/publications-documents/documents-of-interest/.

[23] This pollution risk was expected not only from the spills of the transport of crude but also from any possible failure of the vessels (Gaskell, 1986).

[24] Starting with the Irenes Serenade which provoked a spill of 94,000 t of crude at the Navarino Bay (Greece) after some explosions in the forecastle of the vessel. ITOPF's webpage counts on a summary of this accident: https://www.itopf.org/in-action/case-studies/case-study/irenes-serenade-greece-1980/. Also, the doctrine has pronounced about it (Hooke, 1997). More accidents happened in the previous years of the approval of the Convention OF 1989. Among others, there should be pointed out the Nova, the Odyssey, the Khark 5, the Exxon Valdez and the Christos Bitas; which in its travel from Rotterdam to Belfast, spilt more than 4000 t of crude in 1978 (Bourne, 1979).

[25] The Castillo de Bellver burnt the 6th of August of 1983. Despite its huge spill of crude, damages to the marine environment were not as serious as others as the Amoco Cádiz (Moldan et al., 1985; Wardley-Smith, 1983). It must be considered that in maritime accidents it is not only relevant the amount of cargo spilt, but also what type of cargo is it, the meteorological characteristics, the capacity and the speed of the authorities' intervention, etc.

[26] Report of the Legal Committee of the work of its 50th session, Document LEG 50/8.ou

[27] Report of the Legal Committee of the work of its 53rd session, Document LEG 53/8.

[28] This International Convention is the most important regarding the prevention of pollution of the marine environment by vessels. It was adopted in 1973 and it has been amended later by different protocols to keep it up to date. The Convention is divided into six technical Annexes which develop different special aspects of pollution prevention.

[29] Later replaced by the International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (FUND) of 1992. For further information, it can be consulted: http://www.imo.org/en/About/Conventions/ListOfConventions/Pages/International-Convention-on-the-Establishment-of-an-International-Fund-for-Compensation-for-Oil-Pollution-Damage-(FUND).aspx.

[30] IMO's webpage of this convention can be consulted in http://www.imo.org/es/about/conventions/listofconventions/paginas/international-convention-on-civil-liability-for-oil-pollution-damage-(clc).aspx.

[31] For example, the enormous weight of the carriage of goods in China, the relevant commerce in the English Channel or the importance of the Strait of Istanbul may explain the creation of the Chinese, French and Turkish standard contracts of salvage.

[32] Lloyd's is a business empire based on a concentration of specialist underwriting experts which more than fifty leading insurance companies, 200 registered Lloyd's brokers and a global network of over 4000 local coverholders. They can be considered as a unique insurance market which brings together syndicates and underwrites companies and programmes. Its web page can be consulted in https://www.lloyds.com/.

[33] This form was designed by Sir Henry Hozier, Lloyd's secretary, (Petrinović et al., 2013) for a salvor operating in The Dardanelles (Miller, 1981). It was later revised in 1896, 1897 and 1908 before being officially published (Kennedy, 2010).

Nowadays this form is known as *Lloyd's Open Form*[34] or, simply, as LOF. Its last version is LOF 2020.[35]

LOF 80 is one of the past versions of this contract and it was quite relevant due to the incorporation of the *safety net*. Before LOF 80, this contract form – or any other standard form of salvage – exclusively established the principle no cure-no pay for the earning of a salvage remuneration. Principle no cure-no pay considers that if the salvor does not achieve any result or success in the salvage operation, he or she has no right to earn any remuneration, neither a reward for their expenses. Under this principle, the salvor needs to succeed in the recovery of the property in peril to get paid.

Nevertheless, sometimes accidents happen. A vessel may get sunk or get damaged because of different factors during the navigation: bad weather, heavy winds, dysfunction of its equipment or machinery, etc. Additionally, in a maritime accident where mainly crude but also any other pollutant substances are the cargo, they could provoke damages to the maritime environment. Under these circumstances, the principle no cure-no pay generally would not offer any reward for the salvors. The vessel may be recovered but, in general, there is no success in recovering the cargo since it is completely damaged. For that reason, when there was a salvage operation to protect the environment, salvors were not used to receiving any reward for their service. In this way, there were no economic incentives for the salvors to risk their lives and to perform an "environmental salvage". Thus, no cure-no pay principle became insufficient to confront the problems that emerged in maritime salvage (Chen, 2001).

After the *Amoco Cádiz* incident in 1978 and the *Christos Bitas* in the same year, Lloyd's Committee decided to revise the LOF 1972 – current at that moment. From this meeting, the Committee designed a new proposal based on two principal aspects (Bessemer Clark, 1980; de la Rue and Anderson, 2012; Jarvis, 1985). The first one, salvors must protect the environment in their performance of a salvage operation. As compensation, they will receive a special remuneration for their services. The second aspect will deal with the creation of a specific fund (*Pollution Fund*) for oil tankers. This fund will pay the salvor a compensation if he or she would have prevented, minimized or controlled the pollution from those vessels.

Considering that, LOF 80 introduced a new concept: the *safety net*.[36] For the first time, LOF 80 was the first standard contract creating an "exception" to the no cure-no pay principle (Gold, 1989), which was considered insufficient for the salvors who assist an oil tanker (Tsimplis, 2018). This safety net will apply in those cases where an oil tanker[37] would have suffered an accident and salvors would have prevented the spill of the cargo,[38] whenever the salved property was insufficient to pay the expenses of the salvor. Additionally, they could receive an increase of up to 15% of their expenses if they would have protected the environment. This last compensation was known as *enhancement reward* (Kerr, 1989). Thus, the business *world* was the first in being sensitive about "maritime salvage" or, at least, about the marine environment and its protection. It was so relevant that, some years later, the international organizations – such as CMI and IMO – took this contract as a reference to design the special compensation in the International Convention on Salvage of 1989.

### 2.2. The special compensation of Article 14 of the 1989 Convention

The International Convention on Salvage came into force on the 14th of July of 1996 after the ratifying of 15 countries. After the maritime accidents happened in the 20th century, this new convention allowed to adapt the salvage industry to modern times.[39] Consequently, the Convention of 1989 adapts the previous one of 1910, not only taking advantage of the experience of almost 80 years (Pendón Meléndez and Romero Matute, 2017) but also leaving a mark on the environmental concern in the maritime sphere. For example, since 1970, spills of crude have been decreasing not only in quantity (tonnes) but also in accidents. Meanwhile in the 70's the average of spills was 78,800 t, in the last decade of 2000–2010, this has been reduced to 18,100 t. Nowadays, from 2010 this number is, approximately, 6400 t of crude. Accident numbers have also decreased. For example, in the '70s there were around 250 incidents. Between 2010 and 2018, there *only* have been seventeen maritime accidents (*Oil Tanker Spill Statistics 2019*, 2020).

The biggest incorporation of the 1989 Convention is contained in Article 14: the special compensation.[40] LOF 80 was the inspiration for this article (Brice, 2011).[41] However, before the International Convention on Salvage was approved, another event took place: the Montreal Conference was celebrated in 1981. In this conference, the *safety net* was planned to be extended to every vessel (Shaw, 1996) – since the LOF 80 was only applicable to oil tankers. Besides, the percentage of LOF 80 (15%) was designed to increase up to 100%. These two measures were known as the "Montreal compromise" (Brice, 1990; Shaw, 1996). Some years later, in the Diplomatic Conference which was held in London in

[34] The term "open" refers to the quantity of the remuneration as a flexible aspect. Moreover, it allows that the referee or tribunal can determine it (Gaskell, 1986).

[35] Lloyd's has published different versions of LOF in previous years, specifically in 1896, 1897, 1908, 1924, 1926, 1950, 1953, 1967, 1972, 1980, 1990, 1995, 2000 and 2011.

[36] The clause 1 (a) of LOF 80 established that: "The Contractor agrees to use his best endeavours to salve the and/or her cargo bunkers and stores and take them to (see note 3) or other place to be hereafter agreed or if no place is named or agreed to a place of safety. The Contractor further agrees to use his best endeavours to prevent the escape of oil from the vessel while performing the services of salving the subject vessel and/or her cargo bunkers and stores. The services shall be rendered and accepted as salvage services upon the principle of 'no cure—no pay' except that where the property being salved is a tanker laden or partly laden with a cargo of oil and without negligence on the part of the Contractor and/or his Servants and/or Agents (1) the services are not successful or (2) are only partially successful or (3) the Contractor is prevented from completing the services the Contractor shall nevertheless be awarded solely against the Owners of such tanker his reasonably incurred expenses and an increment not exceeding 15% of such expenses but only if and to the extent that such expenses together with the increment are greater than any amount otherwise recoverable under this Agreement. Within the meaning of the said exception to the principle of 'no cure—no pay' expenses shall in addition to actual out of pocket expenses include a fair rate for all tugs craft personnel and other equipment used by the Contractor in the services and oil shall mean crude oil fuel oil heavy diesel oil and lubricating oil".

[37] Its application exclusively to oil tankers has provoked a rejection in the doctrine since there are other dangerous toxins in any vessel that affect the maritime environment. This was, unfortunately, demonstrated in the accident of El Paso Paul Kayser, an LNG (Liquefied Natural Gas Carrier) in 1979 which grounded in Algeciras' Bay (Gold, 1989; Jar Torres, 2018). Nevertheless, there should not be underrated the LOF 80 criteria because it established a precedent that will be later copied by international organizations.

[38] Clause 1 (a) of LOF 80 considers exclusively the prevention of the pollution. However, it does not establish anything about the contention or minimization of the pollution caused by the oil tanker.

[39] Apart from the exception of article 6.3, the 1989 Convention maintains the principles of the previous Convention of Brussels of 1910 (Brice, 2011). The objective of the International Convention on Salvage of 1989 is again shown: the protection of the maritime environment.

[40] This term was coined for what the doctrine had been calling "environmental salvage" (Pendón Meléndez and Romero Matute, 2017) (Mandaraka-Sheppard, 2013) (Chen, 2001).

[41] LOF 80 includes in its terms – 1 (a) Clause – the no cure-no pay principle except for those situations when the salved cargo came from an oil tanker or a tanker laden. For this exception to apply, it is necessary to fulfil some circumstances: there must not be "negligence on the part of the Contractor and/or his Servants and/or Agents (1) the services are not successful or (2) are only partially successful or (3) the Contractor is prevented from completing the services".

1989 it was reached a more ambitious objective: the redaction of Article 14 of the International Convention on Salvage; known as the "London compromise", and eventually, as the special compensation.[42]

The special compensation of the 1989 Convention applies to every vessel which by itself or its cargo threatened damage to the environment. It should not be understood as an award but as a compensation for the out of pocket expenses[43] that the salvor has incurred to perform the salvage (Mandaraka-Sheppard, 2013).[44] Additionally, when salvor would have prevented or minimized the damage to the environment, the special compensation may be increased up to a maximum of 30% of the expenses incurred by the salvor. Moreover, if the tribunal – arbitral or jurisdictional – considers it fair and just to do so, it may increase the special compensation further, but up to a maximum of 100% of the expenses incurred by the salvor.

To summarize, four requirements could be pointed out for the application of Article 14 of 1989: first, a salvage operation must be rendered to a vessel which by itself or by its cargo consists of a threat to the environment[45] (Article 14.1). Second, salvors had to have prevented or minimized the damage to the environment. Third, the tribunal would be discretional to decision about what percentage increases the salvors' compensation (Kennedy, 2010). Fourth and last, the special compensation will only be paid when the regular compensation – Article 13 – would be inferior. As a result, this special compensation motivates those salvors to perform salvage operations to any vessel with dangerous or pollutant cargo and not only oil tankers (Darling and Smith, 1991).

According to Article 6.1 of the 1989 Convention, the parties of the salvage contract can make an exception to the no cure-no pay principle; they can also establish another form to calculate salvors' compensation. Nevertheless, the protection of the maritime environment is an imperative aspect for the parties. Thus, Article 6.3 of the 1989 Convention considers that under no circumstances, parties cannot avoid their duties to prevent or minimize damage to the environment.

### 2.3. SCOPIC clause

The origin of the *Special Compensation P&I Club clause* or SCOPIC clause is the judicial resolution of the case *The Nagasaki Spirit*[46] adopted by the House of Lords[47] in 1997. In this case, the tribunal considered that the salvors must receive the special compensation, based on Article 14.2 of the International Convention on Salvage of the 65% of their out of pocket expenses. It was the first judicial decision that pronounced about the special compensation of Article 14 (Bonaisses, 1995). Not only salvors (International Salvage Union) but also other actors in the salvage industry such as the International Chamber of Shipping, London assurances, P&I Clubs (Wetterstein, 1999) felt, generally, disappointed by the result of this case (Hodges and Hill, 2001).

Consequently, the mentioned actors above met in autumn of 1997 to create a new proceeding; they expected it to be simpler than the special compensation described in Article 14 of the 1989 Convention. Therefore, it was due to a business initiative that maritime salvage – and, especially, environmental salvage – evolved to better protection of the maritime environment and salvors' rights. The result was the SCOPIC Clause in august of 1999 (Kennedy, 2010). This alternative system allowed the P&I Clubs to have some control of the payment to the services rendered (Browne, 1999). It was finished a year later, entering into force simultaneously with LOF 2000 (Kennedy, 2010). The SCOPIC Clause can be defined as a *particular* clause – even though because of its length has sometimes been considered as an independent "contract" – which establishes the specific proceeding and award of a precise salvage operation (especially for but not only, environmental salvage). It can be considered as a huge development in maritime salvage, and it is expected to be used or incorporated into a LOF contract.

SCOPIC Clause gives both parts of the contracts some advantages: the salvor does not have to prove the threat to the environment. On the other hand, the remuneration is rated and detailed in Annex A with the prediction that the salvor could earn a remuneration with an increase of 25%. Nevertheless, if the parties decide to apply SCOPIC, the remuneration of the contract will be based on this clause, but not in Articles 13 or 14 of the International Convention on Salvage.

SCOPIC clause can be incorporated into LOF 2020. Lloyd's form establishes in its box number 7 the following question and the possibility to answer: "Is the Scopic Clause incorporated into this agreement? State alternative: Yes/No". Besides, Clause C of LOF 2020 indicates that "Unless the word 'No' in Box 7 has been deleted this agreement shall be deemed to have been made on the basis that the Scopic Clause is not incorporated and forms no part of this agreement. If the word 'No' is deleted in Box 7 this shall not of itself be construed as a notice invoking the Scopic Clause within the meaning of sub-clause 2 thereof'. Therefore, it is necessary to follow what sub-clause 2 of SCOPIC Clause indicates; that is: "The Contractor shall have the option to invoke by written notice to the owners of the vessel the SCOPIC clause set out hereafter at any time of his choosing regardless of the circumstances and, in particular, regardless of whether or not there is a 'threat of damage to the environment' (…)". Once SCOPIC is invoked, the owners

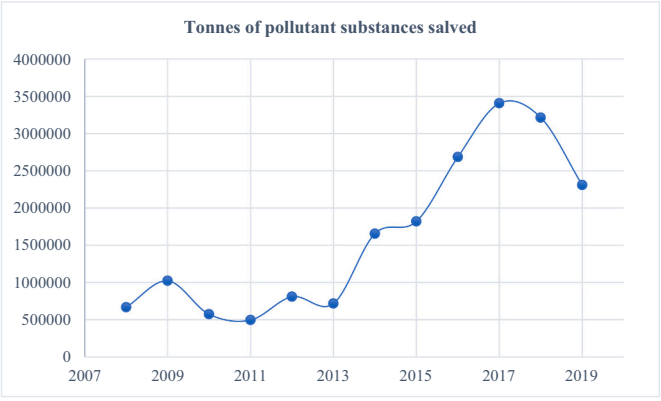


**Fig. 1.** Number of potential pollutant substances saved by the International Salvage Union (ISU) (The International Salvage Union (ISU) is an association formed by fifty-five marine salvage companies from more than thirty countries in the world. Associated with it there are some members such as P&I Clubs, marine insurers, marine law firms, marine consultancies, national response organizations, etc. This association offers marine salvage to recover property and protect the marine environment. Its webpage can be consulted in https://www.marine-salvage.com/.) expressed in tonnes (2008–2019). Own elaboration from data provided by the ISU.

[42] Including the "special" they pretended to bring to light that this compensation distances from the traditional principle no cure-no pay, introducing a new concept in maritime salvage (Chen, 2001).

[43] Article 14.3 of the International Convention on Salvage establishes that "salvor's expenses for paragraphs 1 and 2 means the out-of-pocket expenses reasonably incurred by the salvor in the salvage operation and a fair rate for equipment and personnel actually and reasonably used in the salvage operation, taking into consideration the criteria set out in article 13, paragraph 1 (h), (i) and (j)".

[44] On the other hand, salvors must achieve any result with the environment (Fernández-Guerra Fernández, 1993). Nevertheless, article 14.1 of the International Convention on Salvage does not establish any success —in contrast, article 14.2— since it considers only two conditions to apply: to carry out any salvage operation in respect of a vessel which by itself or its cargo threatened damage to the environment, and to fail to earn a reward under article 13 at least equivalent to the special compensation assessable under this article 14.

[45] Thus, it is not necessarily real damage to the environment but a threat that is going to happen.

[46] *The Nagasaki Spirit* [1997] 1 Lloyds Rep 323.

[47] Previously on the Commercial Court [1995] 2 Lloyd's Rep. 44, 46–47 and, later the Court of Appeal [1996] 1 Lloyd's Rep. 449.

of the vessel must provide to the Contractor within two working days a bank guarantee or P&I Club letter providing security in the sum of three million dollars, inclusive of interest and costs.

When SCOPIC is invoked, the special compensation of Article 14 of the 1989 Convention is not applicable in favour of the SCOPIC Clause. The award calculated by this clause is also supplementary to the remuneration of Article 13 of the 1989 Convention; except for those cases when it is lower than the award described in Article 13. Under this assumption, the remuneration obtained by Article 13, would have a reduction of 25%.

In SCOPIC, the award is rated in Appendix A. This document reflects the daily tariff rate for personnel reasonably engaged on the contract and any necessary time in proceeding to and returning from the casualty. Additionally, it could be paid 25% more of the quantity calculated. Shipowners are responsible for paying the special compensation and the SCOPIC Clause; however, in practice, P&I Clubs pay for it.

Between 1999 and 2018, SCOPIC has been incorporated in 31% of the total cases where LOF was adopted (Jianping, 2018). Thanks to this clause, only in 2019, 2.3 million tonnes of pollution have been saved (Wingrove, 2020). Compared to 2011, when they salved 496,331 t of pollutants substances (Herbert, 2013), it implies a great step into marine protection (Fig. 1).

## 3. Current situation of maritime salvage

The number of maritime accidents which have provoked spills at the sea has been drastically reduced since the '70s. In that decade, there was an average of seventy-nine accidents per year. In contrast, between 2010 and 2019 there have been only six (*Oil Tanker Spill Statistics 2019*, 2020), which implies a reduction of 92%. Similarly, the crude spill has been reduced since 1970 until today in a 95%: from an average of 319,500 t of crude per year, in 2010 there have been spilt *only* 16,000 (*Oil Tanker Spill Statistics 2019*, 2020). Indeed, 99,99% of this cargo, which is transported by the sea, arrives safely at its destiny (*Oil Tanker Spill Statistics 2019*, 2020).

Nevertheless, maritime accidents are still a huge threat to the environment. Some maritime routes cross the Large Maine Ecosystems.[48] This aspect, among others, carry a higher presence of the media in the case of a maritime accident.

Maritime salvage is a very competitive industry. Nowadays, there exist around six operators who control the majority of the salvage operations (Chiu et al., 2017; Chiu, 2020; Mišo Mudrić, 2010). The International Salvage Union has power over 90% of the salvage industry, although they *only* represent sixty salvage operators (Chiu et al., 2017; Mišo Mudrić, 2010; Petrinović et al., 2013). Additionally, the salvage industry is declining (Brice, 2011). The reduction of maritime accidents is good news for the environment but worrier for this industry: its future is uncertain. Nowadays, the global benefit of the salvage business is around 100 million dollars per year ("The Future of LOF", 2008); a lower quantity than the desired by salvors.

Salvage "crisis" is also affecting the use of LOF causing a reduction in its usage (Hall, 2017). Nevertheless, and after more than one century of history, LOF is still the most used form in the world. On the contrary, this relevant form is facing some challenges. In the first place, technological progress has achieved more safety navigation, which means fewer accidents. Second, the economic crisis which began in 2008 affected the economy in general and the salvage industry in particular. There were fewer vessels in operation, which also meant a lower possibility of an accident or the necessity of salvors' operations. Currently, the shipping

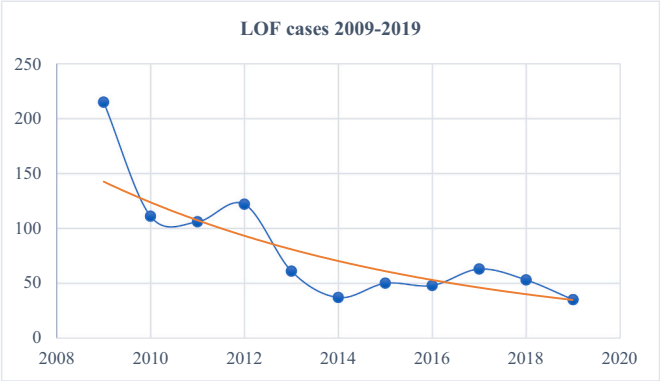


**Fig. 2.** Number of maritime salvage operations using Lloyd's Open Form between 2009 and 2019. Own elaboration with the data available in Lloyd's.

(and salvage) industry would probably be affected by the COVID-19 crisis.[49] Another critic received by LOF has been its excessive cost. Factors as the mentioned ones have influenced the use of LOF or any other form of salvage contract, and it is expected that in the present and future they will continue affecting.

Related to "environmental salvage", some governments have shown some reservations in using LOF for this type of salvage in the last decades. Although LOF allows the invocation of the SCOPIC clause or the special compensation of Article 14 of the 1989 Convention, it is still based on the no cure-no pay principle. Thus, if an environmental salvage happens, there are doubts about obtaining an equitable remuneration for the salvors; especially in those cases where the risk is high and the value of the property is less considerable ("The Future of LOF", 2008). Consequently, there has been shown the possibility to need a LOF form with zero tolerance for pollution. Reasons like the ones expressed above have influenced the reducing use of Lloyd's form (Fig. 2).

As can be seen in the graphic, the trend is clearly in decline. There has been a descent of the use of Lloyd's Open Form in the salvage cases. Nevertheless, when the situation of danger is particularly difficult, the priority is clear: LOF contract is the first option (Chiu, 2020).

## 4. The most recent strategy: IMO 2020

### 4.1. Sulphur and the environment

Maritime salvage has not been the only strategy designed by the

[48] These are big zones in the oceans which span coast areas, river basins and estuaries up to the sea limit of the continental shelves. They are great areas (200.000 km$^2$ or more) which include bathymetry, hydrography, productivity, and tropically dependent populations. Their resources are generally used for fishing, leisure activities and other benefits (Sherman, 2005).

[49] The pandemic situation has led some international maritime organizations and associations to propose recommendations to increase safety in maritime navigation, not only in the salvage industry. For example, the IMO has published some protocols to ensure safe ship crew changes and travel during the Coronavirus (COVID-19): https://www.imo.org/en/MediaCentre/PressBriefings/pages/41-crew-change-protocols.aspx. Other organization that has cared about the modifications in the shipping industry due to COVID-19 is BIMCO (Baltic and International Maritime Council) which has created an entire webpage to publish recommendations for this specific situation: https://www.bimco.org/covid19. Among other aspects, it must be highlighted the Crew Change Clause for Time Charter Parties 2020. As it is explained by BIMCO, this clause is designed to give the owners the freedom to deviate for crew changes under the circumstances caused by the pandemic. Additionally, it provides an option for charterers to contribute to the crew change in recognition of the extraordinary cost of making a COVID-19 related crew change. More related to the insurance and salvage industry, P&I Clubs have also designed some strategies to make shipping safer. Specifically, the International Group has launched an online digital tool to assist shipowners, charterers, operators and other parties in the maritime sector to track country and port specific advice, detailing the measures being put in place in response to the COVID-19 pandemic.

International Maritime Organization to protect the environment. As crude, sulphur is a pollutant element that causes terrible consequences for the environment and human health. Ocean's atmosphere is extremely sensitive to air pollution in chemical, climatic and physics grounds (Capaldo et al., 1999). Considering that, the last IMO's proposal is based on the reduction of sulphur emissions.

Among the pollutant emissions related to shipping, it is possible to find carbon dioxide ($CO_2$), nitrogen oxides ($NO_X$), sulphur dioxide ($SO_2$) and carbon monoxide (CO) (Matthias et al., 2010). Approximately, the shipping industry generates 15% of the world's nitrogen oxides ($NO_X$), 13% of global sulphur gas[50] and 2.6% of global carbon dioxide emissions. These environmental effects could be even more prejudicial in the coastal areas. Approximately, 20% of the emissions are discharged within the first 12 nautical miles (González-Cancelas et al., 2013). Moreover, about 70% of ship emissions occur within 400 km of land (Corbett et al., 1999). More than half of those emissions are produced by vessels of more than 500 GRT (gross register tonnage); and approximately, 45% of the emissions derive from vessels with flags in the European Union (González-Cancelas et al., 2013).

Sulphur oxides can produce several damages not only to the environment but also to people. It is a toxic gas, affecting the breathing system and especially the lungs and mucosa. Every year, almost 64,000 deaths (Corbett et al., 2016) are attributable to particular matters (PM) emissions since they can cause cardiovascular and lung cancer.

Besides, its effects may get worse when sulphur dioxide – or nitrogen oxides ($NO_X$) – reacts with water, oxygen and other chemicals present in the atmosphere ("Substance Infocard: Sulfur", 2007; What is Acid Rain?, 2020). Thus, it can become sulphuric acid and produce acid rain, which provokes negative effects on the soil, marine ecosystems, the forest, buildings and constructions, etc. (Singh and Agrawal, 2007). With the approval of IMO 2020, it is expected to save more than 570,000 premature deaths between 2020 and 2025 ("Implementation of Sulphur 2020 Limit - Carriage Ban Adopted", 2018).

### 4.2. IMO 2020

Maritime salvage was an inflexion point in Maritime law due to its response to marine protection. Since then, international organizations and local governments have promoted some strategies to prevent maritime pollution. The most recent one is the IMO 2020. This strategy was designed by the IMO and it is focused on the reduction of sulphur emissions. The main type of crude used for fuel in vessels is heavy fuel oil which is derivative from the waste of the crude distillation. The crude contains sulphur which, after the combustion in the engine of the vessel, reacts with oxygen creating sulphur oxides ($SO_X$). This gas is liberated into the atmosphere becoming a very pollutant element.

Before 2020, the IMO already designed some rules to limit sulphur emissions from the ships. Specifically, it was in 2005 when the first rules came into force with the Annex V and Annex VI of the MARPOL Convention. In this proposal, the global limit for sulphur emission from vessels was 4.50%.[51] This measure entered into force in 2005 and it was revised in 2008.[52] In 2012, the limit was revised and set at 3.50%. But it was 8 years later, in October 2016,[53] when the IMO announced that the date when this measure will become effective would be the 1st of January 2020. With the beginning of 2020, this limit has been again reduced; nowadays it is determined at 0.50%.[54] In some zones, this limit is stricter. Every vessel which operates outside the designed control zones[55] must respect a limit of 0.10% of the emissions. Additionally, in March of 2020, another amendment of Annex VI of the MARPOL Convention came into force.[56] This amendment established the prohibition of the transport of non-compliant fuel oil used by vessels.

As a result of the implementation of this strategy, it is expected to reduce approximately 75%–80% of the total $SO_X$ emissions from vessels (Burel et al., 2013; Sofiev et al., 2018). With this proposal, it is hoped to improve the atmosphere quality and obtain benefits for both humans, fauna and flora. For example, its implementation will reduce cardiovascular disease and lung cancer mortality by approximately 68% by 2025. Moreover, it can also help reducing childhood asthma morbidity (Sofiev et al., 2018).

Nevertheless, there are some disadvantages too. To begin, there has been an increase in low-sulphur fuel demand. Consequently, it has been a significant increase in the prices of this type of fuel (Muenster, 2020). Therefore, shipowners have started to include this increase as surcharges in the price of the freight. Among others,[57] there can be found: BAF (Bunker Adjustment Factor), MFR (Marine Fuel Recovery), FAF (Fuel Adjustment Factor) or GFS (Global Fuel Surcharge). Another disadvantage is that the IMO does not have the necessary resources to control that every vessel fulfils this limit. Flag states are responsible for the sulphur emission's control. Thus, every ship must obtain a bunker delivery note, which will contemplate the sulphur content of the fuel oil used. Moreover, vessels will need an International Air Pollution Prevention (IAPP) Certificate, provided by its flag state. This certificate will prove the information that the vessel is using fuel oil with sulphur that does not exceed the limit. Apart from flag states, port and coastal states can verify this information due to Port State Control (PSC). Finally, the immediate dramatic reduction of sulphur in the atmosphere could be prejudicial for the environment if $CO_2$ is not already reduced, because $SO_2$ is one of the elements which cools the atmosphere (Ji, 2020; Laakso et al., 2017).

#### 4.2.1. Main solutions to adapt to IMO 2020

The scenario left by IMO 2020 has obligated the shipowners to obey this strategy by four principal solutions. The first one consists in to continue using HSFO[58] and install technology to help them fulfil the IMO's strategy; for example, with the use of an exhaust gas cleaning system (EGCS), known as scrubbers. The technology used by the

[50] In Europe in 2013, these percentages were very similar: 18% of NOx emissions and 18% of SOx (Halff et al., 2019).

[51] All these numbers are expressed mass by mass (% m/m).

[52] In other modes of transportation, some strategies have already been adopted. For example, in the US trucks' emissions were already limited using ultra-low-sulphur diesel at the beginning of 1990. In 1993 the Environmental Protection Agency's Clean Air Act was approved and limit the sulphur content on-highway diesel. These limits were not only implemented in trucks but also other means of land transport affecting locomotive diesel fuel too (Muenster, 2020).

[53] OMI (MEPC 70).

[54] In 2010, the European Union established this limit in 0.1% for inland waterway vessels and ships at berth in the community ports (Directive 2005/33/EC). It can be surprising that IMO had considered a wider limit; however, it should be considered that this organization regulates for the entire world and has to give the opportunity to the most laggard countries to adapt.

[55] These zones are denominated Emission Control Areas (ECAs) or Sulphur Emission Control Areas (SECAs). They are areas where stricter controls on sulphur emissions are being carried. Those are the Baltic Sea area; the North Sea area; the North American area (covering designated coastal areas of the United States and Canada); and the United States Caribbean Sea area (around Puerto Rico and the United States Virgin Islands). Countries bordering the Mediterranean Sea are currently considering the possibility of applying to designate the Mediterranean Sea as one of these zones. Further information can be founded in http://web.unep.org/unepmap/world-environment-day-2019-%E2%80%9Cbeat-air-pollution%E2%80%9D.

[56] MEPC.305(73), Amendments to MARPOL Annex VI: Prohibition on the Carriage of Non-Compliant Fuel Oil for Combustion Purposes for Propulsion or Operation on board a ship.

[57] For example, MSC is including the BRC (Bunker Charge Mechanism) since the last four-month period of 2019 with a cost of annual fuel bill of two billion dollars; MAERSK is using the BAF fee applying since January 2019, with the same fuel bill as MSC; Hapag-Lloyd has been included MFR from January 2019, with an approximate cost of one billion dollars (Knowler, 2019).

[58] High Sulphur Fuel Oil.

scrubbers is very mature; nevertheless, its application in vessels is quite recent (International Maritime Organization, 2016).

There exist different types of scrubbers and some are more protective of the environment than others. First of all, it is possible to distinguish between dry and wet scrubbers. The first ones use dry chemicals to clean the emissions before they are expelled. The second ones use, generally, seawater as a cleaning system. Wet systems are divided into an open loop, close-loop or hybrid system (open/closed). The close-loop system needs the storage of wastewater to be discharged in a particular facility. On the contrary, scrubbers with an open-loop system may discharge wastewater into the ocean. Therefore, open-loop systems are more pollutant than other systems. Indeed, some countries have already banned the use of the open-loop scrubbers, such as China, Singapore and Fujairah (Jonathan and Chestney, 2019; Smith and Jaffe, 2019).

Scrubbers are not completely efficient, but they are close to; they can remove up to 99% of SOx and 98% of particulate matter from high-sulphur fuel (Wan et al., 2016). On the contrary, using a scrubber may be a double-edged sword because their technology is still recent and unproven (Smith and Jaffe, 2019). Installing a scrubber has another disadvantage: it requires space for its structure. In a vessel, every area count: using space for a scrubber means less space for the transport of goods, which is what, in the end, makes a profit in the vessel. In the case of close loop systems, there must be enough space too for the storage of wastewater.

Besides, other questions must be considered if shipowners chose this option. For example, the reliability of the system (International Maritime Organization, 2016) and its maintenance cost. Even though this is, in theory, the cheapest strategy, it has a great cost. Installing a scrubber in a VLCC may cost between two and eight million dollars (Knowler, 2019; Smith and Jaffe, 2019; Vis, 2018).[59] Even that, it is probable that the short-term expenditure would be higher than the medium or large term. Choosing this option will allow the shipowners to continue using HSFO which will, generally, reduce its price over time. Another advantage of installing scrubbers is their international availability. Even though installing scrubbers was thought to be chosen by, approximately, 15–20% of the vessels (Renshaw, 2020), this first solution has been adopted by, approximately, only 5% of the vessels in 2019 (Scerra, 2019).[60]

The second solution is to use another type of fuel[61] as Liquefied Natural Gas (LNG). LNG is natural gas that has been cooled at −162 °C (−260 °F). This option practically reduces to zero sulphur emissions since LNG does not use sulphur to operate. Besides, $NO_X$ emissions are reduced approximately by 80%–85%, $CO_2$ emissions are reduced by 20%–30% and the particle matter production is very low (Burel et al., 2013). Even though vessels that use LNG are considered to need less maintenance, it should be also weighed up that, generally, any of those vessels are more expensive than installing a scrubber – approximately about five million dollars more (Smith and Jaffe, 2019). Besides, vessels that begin to use LNG will need space to transport it. Therefore, they will reduce some cargo transport capacity (González-Cancelas et al., 2013). Another inconvenience in the use of LNG is that not only vessels will have to adapt, but also the ports themselves. Vessels using LNG will need specific structures where to provision and supply (González-Cancelas et al., 2013). Besides, nowadays, there is no global LNG bunker availability (International Maritime Organization, 2016).

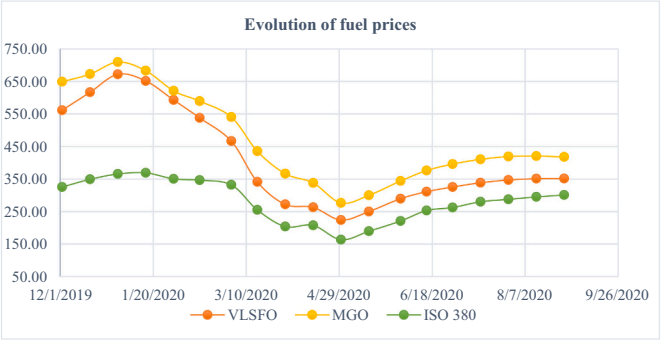


**Fig. 3.** Evolution of VLSFO, MGO and ISO 380 prices based on the Global 20 Ports Average ("Global 20 Ports Average", 2020). For the elaboration of this graphic fuel prices have been taken into consideration every 15 days approximately, depending on the availability of the market information.

On the other hand, this second strategy could be one of the most effective since LNG can reduce up to 90% of the sulphur emissions (Smith and Jaffe, 2019). Nevertheless, the use of LNG also has some environmental disadvantages. The principal one is the methane slips from LNG engines. Methane's warming potential is around 21–25 times higher than $CO_2$ (Burel et al., 2013; Nielsen and Stenersen, 2010). At the beginning of 2020, it was thought that between 15%–20% of vessels will switch to LNG, ammonia, biomethane, hydrogen or other bunker fuel alternatives (Renshaw, 2020). Nevertheless, already in 2019, only 0.6% of the global fleet used LNG as fuel.

The third option that shipowners have to adapt to IMO 2020 is to switch to a low content sulphur fuel (LSFO).[62] This option will reduce SOx emissions and its global availability is a great advantage too compared to LNG availability. On the contrary, VLSFO is generally more expensive than HSFO; for example, in 2019, the price per ton for HSFO was $420 versus $647 of MGO (Marine Gas Oil), one example of LSFO (Laval, 2019). The fuel cost is, approximately, 50% of the total cost of shipping (Laval, 2019). That is the reason why this choice is quite relevant.

After 2020, the price of LSFO was expected to increase due to IMO 2020 and maybe, in some years, its price would be more affordable for everyone. Therefore, it was thought that the use of scrubbers will facilitate the compliance of the IMO 2020 because shipowners expected to save much more money with this option. Nevertheless, this situation has turned out different. The marine fuel price has decreased since the beginning of the year, specifically, since the declaration of the pandemic situation due to COVID-19.[63] For example, in January, a scrubber equipped in a VLCC could net approximately 25,000$ per day more than a non-scrubber ship.[64] At the beginning of the year, compared to IFO

[59] This is an actual problem for some shipowners who cannot afford these payments, as it has been brought to light by the Filipino Shipowners Association (Liang, 2019). However, this price is relative. For example, since 2013 China has destined 150 billion dollars per year to fight the pollution. In contrast, with just 1% of that quantity, they could fund scrubbers for its entire container fleet) (Wan et al., 2016.

[60] At the end of 2018 less than 1% of the global fleet invested in scrubbers; approximately 70% of those vessels operated in the ECAs (Halff et al., 2019).

[61] Other fuels that have been considered for this option have been LPG, DME/Methanol, synthetic fuels and biofuels. Besides, it can be used nuclear energy too and, finally, renewable energy should not be dismissed. Even though this last option is still, in most cases, only a concept, renewable energy could work as a complement for other types of energy. Wind, solar and photovoltaics and biofuels are already in commercial use in some vessels (Mofor et al., 2015).

[62] Low Sulphur Fuel Oil, which means that its sulphur content is below 0.50%. Ultra-low sulphur fuel oil (ULSFO) also exists with a maximum sulphur content of 0.10%

[63] Due to COVID-19 crisis, there was a proposal to approve oil-production cuts. This triggered a breakup in the dialogues between Russia and the Organization of the Petroleum Exporting Countries (OPEC). Russia left the agreement and OPEC+ alliance (this expression is used to refer those countries which do not participle in the OPEC but have a relevant role in the crude commerce, such as Mexico or Kazakhstan). Besides, COVID-19 has provoked a huge fall of the transport and travel, with the correspondent drop of the crude use.

[64] This proportion is based on TCE (time-charter-equivalent) terms. This rate "is calculated by taking the spot rate in dollars per ton of cargo and converting it to dollars per day, subtracting voyage costs including fuel" (Miller, 2020).

380,[65] (Fig. 3). VLSFO was around 300 $/t more expensive. Nevertheless, halfway through February, the difference between IFO 380 and VLSFO was 189.50 $/t. Additionally, on the 17th of June, this difference was only 67.50 $/t. At the beginning of 2020, it was expected that, approximately, 85% of the global container shipping fleet will change to the LSFO (Renshaw, 2020).

For that reason, some shipping companies, such as Maersk,[66] are innovating and creating their LSFO. Related to this option, some shipowners are trying another variation of the previous solution. They will continue using the HSFO but mixing it with other fuels with zero sulphur content (Li et al., 2020).

Final and unfortunately, there is a choice of non-compliance. IMO cannot control and inspect every vessel. Neither do have port or flag states. It was probable to find some vessels not fulfilling IMO 2020 and, indeed, there have already been (Wainwright, 2020).

## 5. The future: IMO 2030

Shipping is considered the most carbon-efficient mode of transport although it concentrates around 80% of the transport of goods. However, it is still its major polluter. The Paris Agreement is an international convention to fight climate change. One of its main objectives is to maintain the increase of the global temperature well below 2 °C and to effort to limit that increase to 1.5 °C. A good method to achieve it is to reduce greenhouse gas (GHG) emissions.

In the maritime sphere, the IMO began to discuss climate action in 1997. In 2011, the IMO adopted the Energy Efficiency Design Index (EEDI) – which was mandatory for every new vessel – and the Ship Energy Efficiency Management Plan (SEEMP) – for every ship –. Additionally, the IMO introduced some amendments to the Annex VI[67] of the MARPOL Convention; for example, every vessel should keep onboard a ship-specific Ship Energy Efficiency Management Plan (SEEMP) following the IMO's instructions. Some years later, in 2016, the IMO established a Data Collection System for fuel oil consumption of ships.[68] With this system, every vessel should report its fuel oil consumption. This information would be communicated to the flag state who would notify the IMO who would make an annual report.

In 2014, the last IMO greenhouse gas emissions study (Smith et al., 2014) revealed that the total shipping emissions were, approximately, 938 million tonnes $CO_2$ and 961 million tonnes $CO_2$eq. Facing that, in 2018 the IMO adopted an initial strategy for the reduction of greenhouse gas emissions from vessels. Therefore, the IMO became the first international organization "to adopt mandatory energy-efficiency measures" ("UN body adopts climate change strategy for shipping," 2018) that will affect an entire huge industry sector such as shipping[69] (Fig. 4).

Even though shipping is the most *eco-friendly* mode of transport, IMO pretend to turn it greener and cleaner. In 2008, the IMO approved some measures to reduce emissions of greenhouse gases under the Annex VI of IMO's pollution prevention treaty (MARPOL Convention). The second step of this strategy is the adoption of the "Initial IMO Strategy on the reduction of GHG emissions from ships". Its purpose is to reduce the annual GHG emissions by at least 50% by 2050 compared to data from 2008.[70] Therefore, the first step is to control shipping emissions. Later, the next step will be controlling and reducing the shipping industry's total emissions by 2050.

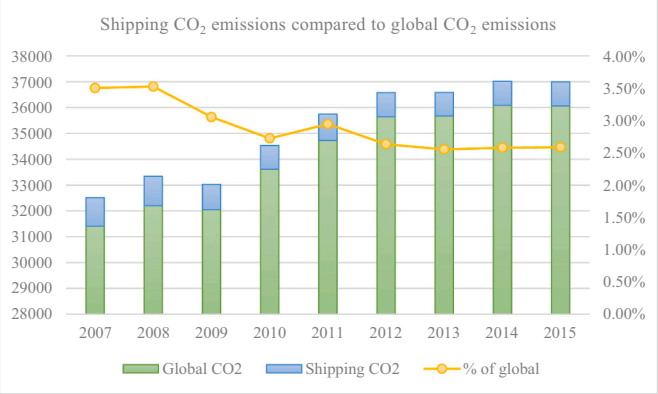


**Fig. 4.** Shipping $CO_2$ emissions compared to global $CO_2$ emissions. Own elaboration by data provided from and the International Maritime Organization (Information provided by IMO is from its Third Greenhouse Gas Study in 2014. The fourth study was expected to be presented at the 76th meeting of the Marine Environment Protection Committee (MEPC). However, due to COVID-19 this meeting was postposed and would probably take place in 2021.) and the International Council on Clean Transportation (Olmer et al., 2017; Smith et al., 2014).

Nevertheless, IMO 2030 is still growing by leaps and bounds. IMO is contemplating some measures to achieve the 2030 objective such as regulations in the vessels' speed (MEPC 74/7/8), measures to improve the energetic efficiency in ships (MEPC 74/7/2) or the establishment of engine power limitations to improve vessels' energy efficiency (MEPC 74/INF.23). For example, introducing engine power limitations of 40%–50% could reduce $CO_2$ emissions, between 1% and 4%, depending on the vessel type and size (Rutherford et al., 2020). If the limitation of engine power were 60%, the reduction of $CO_2$ in 2030 would be about 6% in existing vessels. Naturally, this quantity would be higher if this measure would be adopted by every new vessel too (Rutherford et al., 2020). One of the most specific documents with recommendations from IMO to adapt to its strategy IMO 2030 is MEPC.323(74). With this document, the International Maritime Organization invites the Member States to take regulatory, technical, operational and economic actions. Those include but are not limited to the provision of Onshore Power Supply, if possible, from renewable sources; safe and efficient bunkering of low-carbon and zero-carbon fuels; incentives of using those type of fuels; and support for the optimization of port calls.

In 2023 it will take place the first review of this strategy. Therefore, experts will examine if IMO 2030 is a realistic measure such as IMO 2020.

## 6. Conclusions

Maritime "environmental" salvage was the first strategy to fight marine pollution. Since its beginning in 1967, it has continued developing until the present days. Maritime salvage opened the door to maritime protection and, because of that, other strategies have been created to care about the marine environment. The latest strategy approved is IMO 2020, which focus on sulphur emissions. Its development has not been exempted from criticism. Nevertheless, it has marked a milestone in the protection of the environment related to sulphur emissions.

There should be taken into consideration that some exhaust gases will be discharged into the sea and not into the atmosphere; for example, if shipowners decide to use open-loop systems in the scrubbers. For that reason, IMO 2020 should not be the only strategy to protect the environment from sulphur emissions.

From maritime salvage to IMO 2020, the maritime international

[65] IFO 380 is one of the most commonly used types of heavy fuel oil produced by the distillation of crude oil. It is a type of LSFO.

[66] In 2019, Maersk announced that it was working with Koole Terminals to produce a 0.5% sulphur marine fuel. Its annual production was expected to cover 5–10% of Maersk's annual demand Maersk and Koole Terminals to produce 0.5% sulphur marine fuel in Rotterdam [WWW Document], 2019 to produce 0.5% sulphur marine fuel in Rotterdam," 2019).

[67] Resolution MEPC.203(62).

[68] Resolution MEPC.278(70).

[69] GHGs combining $CO_2$, $CH_4$ and $N_2O$.

[70] (RESOLUTION MEPC.304(72).

sphere has demonstrated that cares about the environment. Especially in Maritime law, different actors and not only governments have made this possible. Insurances, salvors, lobbies, NGOs, P&I Clubs, shipowners, etc. have collaborated for decades to prevent maritime pollution. And their journey does not end with IMO 2020. Greenhouse gases have not been forgotten. Thus, IMO 2020 is not the only strategy designed by this international organization to protect the air environment. IMO 2030 and, eventually, IMO 2050, would be implemented to control GHG emissions. IMO 2030 and IMO 2050 may be ambitious, but necessary to care about our sea.

## CRediT authorship contribution statement

**Paula Sáez Álvarez:** Conceptualization, Data curation, Resources, Software, Formal analysis, Visualization, Validation, Writing – original draft, Writing – review & editing.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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