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# **The social and environmental sustainability of the maritime industry**

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April 2014

Online at <https://mpra.ub.uni-muenchen.de/55327/>

MPRA Paper No. 55327, posted 17 Apr 2014 05:45 UTC

# The social and environmental sustainability of the maritime industry



**PhD in Social Sustainability and Development**

Paulo Moreira



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## ABSTRACT

Although in the recent years the trend is changing, still few international academic papers on this topic are available. On the other hand, there is a total void by national academicians regarding the production of literature on social and environmental sustainability of the maritime industry in parallel as in multiple aspects related to the maritime chain and the supply chain management seen in its global assumptions. Nevertheless, sustainability in its different components – economical, social and environmental – is becoming a major concern for citizens, on the basis of participatory citizenship or as aggregated sources of social capital, public and private policy makers and governments. As concern about climate change grows and that the events of maritime disasters multiply, there is an entire industry, which despite of being vital to the world economy and for the welfare of the people, continues to be managed in a way that requires no more regulation but their actual application. An industry for the future but at the same time one that largely contributes to emissions and several forms of air and marine pollution and which cannot continue to use the planet seas and oceans as sewage. Thus, we chose to extract from scratch the fundamentals through elaborate work of collecting and analysing institutional information and by unroll the intricate web that this issue, being transversal to the entire maritime industry, incorporates. So we focused on the norms and laws issued by agencies and sectoral organizations of regulatory nature and the methodology is based in the paradoxical confrontation between occurrences and existing legislation.

**Keywords:** social and environmental sustainability; international shipping



## INTRODUCTION

*“Transportation is an essential component of any programme for sustainable development because the world relies on a safe, secure and efficient international shipping industry.”*

The above statement, written by Koji Sekimizu, Secretary - General of the International Maritime Organization (IMO), the UN agency for regulating traffic and maritime trade that adds 170 countries, highlights the relevance of in-depth study of issues related to world maritime trade. The maritime market is the most important link in the maritime chain. However there is a noticeable lack of the importance of the maritime component which fits the present paper into the overall scope of investigation and, by fitting within the social and environmental sustainability issues of sea borne industry, a pioneer condition.

The sea borne trade stands for Global Distribution Networks as flows that connect the origin and the destination for about 90 % of the goods produced worldwide. Shipping is merely a component of integrated logistics networks that enables the circulation and distribution of loads; the *sea leg* in the Anglo-Saxon terminology. The other two components are port and logistics markets from whose sum results the so called maritime chain, bounded at the origin by the foreland and by the hinterland for the final destination of the flows. The three dimensions of sustainable development: economic, environmental and social, in the context of maritime transportation reach a differentiator degree compared to other activities, sectors or industries. This is due to some specificities such as scale (the intensity of flows, size of vessels and their emissions), geographic scope (it is a truly global industry) and concomitant dimensions of tragedies when they occur. This is still an industry that, as we shall see throughout this work, exhibits poor applicability of international regulations which allows to negligence, to sloppiness and exacerbated easy profits opportunism, revealing an operating framework that is guided either both by lack of respect to the workforce and to environmental regulations.

By force of the growing number of vessels operating , the exponential increase in its scale, the emerging new routes that cross waters of extreme sensibility that already have weak levels of resilience, urges once and for all that international organizations and member states, stop producing only mere legal acts and begin effectively to prevent and monitor more than penalize offenders or simply mitigating the effects of disasters, for that the seas of the planet no longer be the sewage they are becoming and whose survival humanity depends on and with the respect that deserve all the species that inhabit.

This paper is structured as follows: Section 1 describes the maritime sector and international and European regulatory organizations as well as both existing socio - labour and environmental instruments, focusing the analysis on the freight



segment, excluding the cruise and pelagic fishing for reasons that go beyond this analysis. This Section also debates the non-compliance between regulation, norms and rules and the effective practice for a true ocean governance be implemented in the Oceans, on the view that this aim will provide an end to impunity and the true state of free riding existing at seas at this precisely time. Section 2 discusses about problems linked to emissions of combustion gases of these class of vessels in the origin of major sources of pollution - nitrogen dioxide (NO<sub>2</sub>), sulphur dioxide (SO<sub>2</sub>), carbon monoxide (CO), ozone, benzene and particulate matter of various heavy metals in coastal areas and sea areas exposed to large traffic flows and also the issue of the bio invasive species. This section is dedicated also to the analysis of socio - labour problems, marine safety and security of both people and goods, transportation of undeclared dangerous cargoes and an insight about the merchant fleets sailing under flags of convenience (FoC), which underlie the occurrence of accidents and spills of environmentally devastating proportions. Section 3 is based on the change in the energy propelling forms of the next generation vessels: energy efficiency and the use of new energy sources framed in the paradigm of environmental sustainability for an industry that is expected to grow exponentially in the coming decades. Corrective actions to make the maritime industry ethically responsible should be announced at the end of this work. However, it was intended above all to provide an overview of this subject little known. Those relevant questions remain therefore to be discussed and addressed in another paper.

## **1. The global shipping industry: an overview**

The weight of maritime trade globally turns it into a magnifying glass to examine the global economy and its geographical architecture. Modern society depends crucially on Maritime Transportation System, its benefits and proper operations. Over the past 50 years retail prices in the U.S. rose by 700 % but the shipping costs raised only 70 % (only 1 cent of dollar for carrying a beer can). The international shipping industry employs more than 1.5 million seafarers and many other port and logistics workers who are responsible for the safe and reliable delivery of food, raw materials, energy and consumer goods to seven billion people every day and is an essential component of world's economy. It is worth mentioning the creation of value and aggregate flows of the Maritime Transportation System, where a chain of actors share and delivers value (Figure 1).

It is important to understand that when it comes to shipping, we are referring not only to the market and sector: This activity enables the sane existence of all other industrial, professional, and I&D activities worldwide. One example is the European Space Agency's Ariane rockets launched from French Guiana facilities because shipping allowed the shipment and the assembly of its parts.

If all stakeholders in the maritime transport sector, by meeting their different functions work together in the support of this value chain, shipping will both work well for all stakeholders and will have a sustainable future.

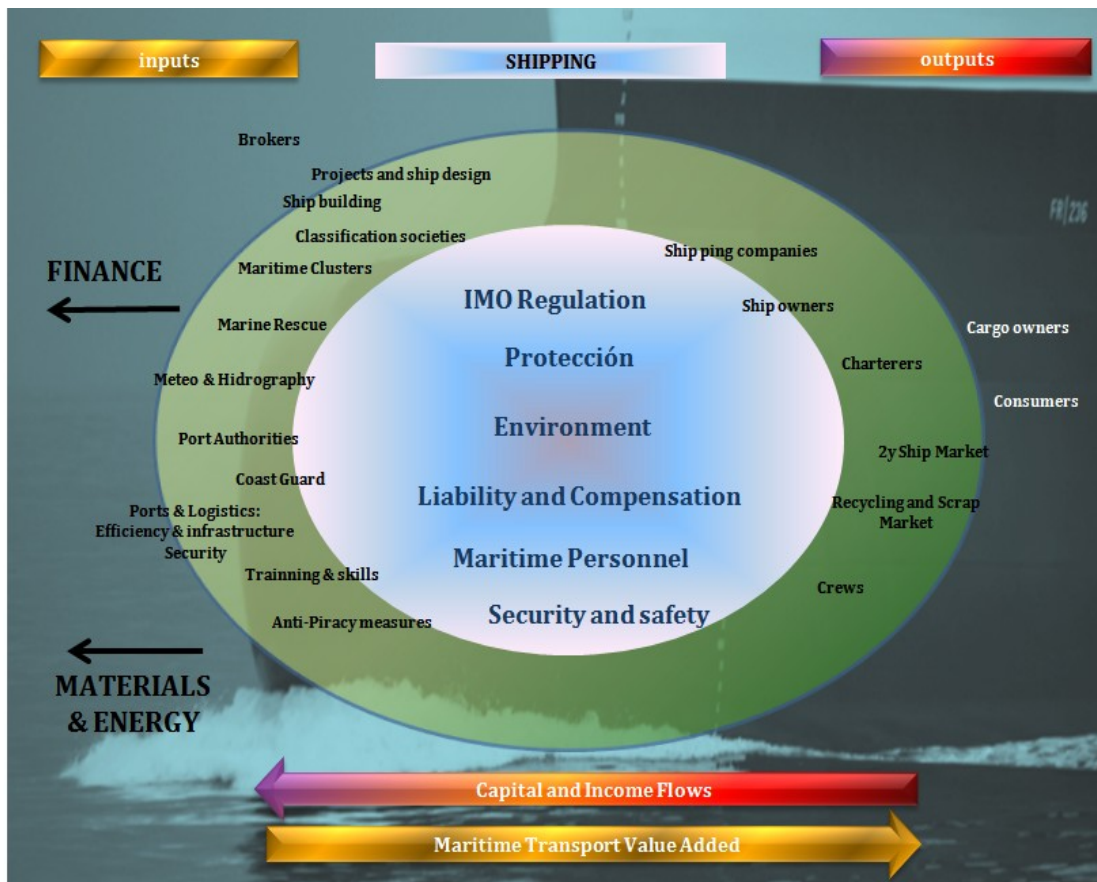


Figure 1. Flowchart of the World Maritime System.  
Source: Own elaboration (IMO adapted).

## 1.1 Shipping and social sustainability

A report published by the European Risk Observatory (EU-OSHA), which covers the whole transport sector, highlighted, relating to maritime transportation, the following hazards, risks and problems in the field of Occupational Safety and Health (OSH):

- i) Adapting the work to the diversity of all workers, including immigrants environment;
- ii) Discrimination between men and women in access to functions and very different tasks;
- iii) Infectious diseases;
- iv) Confinement and isolation;
- vi) (*no*) Applicability of EU legislation and legislation on OSH ships sailing under flags of third countries.

However, the Maritime Transportation System is subject to a complex set of policies and regulations. On the side of labour law we have the Maritime Labour Convention, 2006, which, in respect by the International Labour Organisation

(ILO) Declaration on Fundamental Principles and Rights at Work of 1998 states that "(...) *an instrument condensed single and coherent for the integration of all standards contained in international conventions and recommendations of existing maritime labour as well as the fundamental principles set out in other international labour conventions* " (Preamble) and entered into force in August 2013.

This law is binding on all signatories members (56 to date, representing 80% of world GT but without the ratification by the United States or China, for example) and was born on the pretense of bringing together governments, employers and workers to promote decent work and social justice. Thus, of all dispersed laws and regulations available results a single one. Simple, coherent and wide, recognizes that maritime work represents special risks to life and health because of the hostility of the sea and the nature of working conditions on board. But, at same time, recognizes that better working conditions and a dignified professional achievement are of utmost importance to entice young seafarers at sea. By decent work it means that, irrespective to the flag of the ship and the kind of trading, workers are entitled to good living conditions, regular communications with home, ensuring regular payments, proper medical care and well being, repatriation and social security benefits.

#### 1.1.1 Legislative measures versus factual reality

But these are good intentions. Most merchant fleet ship crews are individuals from developing countries (e.g. the Philippines, Bangladesh), the only ones who are willing to accept the harsh conditions of work on board, wages that even not being miserable are at risk of not being paid, and staying weeks or months without seeing their families. But seafarers are not only those coming from countries with poor living conditions; also nationals of European countries face the excesses of unscrupulous owners. It is no coincidence that the actions undertaken by the ITF (International Transport Workers' Federation) in favour of the recovery of unpaid wages continue to multiply.

- i) *"i) "Croatian, Greek and Slovenian crew members of the Egyptian-owned, Panama-flagged Navi Wind, who had been stranded in Argentina, Newfoundland, Canada since October, were finally able to return home just before Christmas after the ITF helped them to retrieve almost USD100,000 in back wages owed to them "(January 10, 2014)."*
- ii) *"The ITF has initiated arrest proceedings on behalf of the crew of the Marshall Islands-flagged M/S Isis, which is moored at Tilbury, England and whose crew are owed at least USD130,000 in pay. The decision to arrest the vessel follows the delivery of a written warning to Athens-based company Derna Carriers over its negligence and evasion of its responsibilities", (January 23, 2014).*

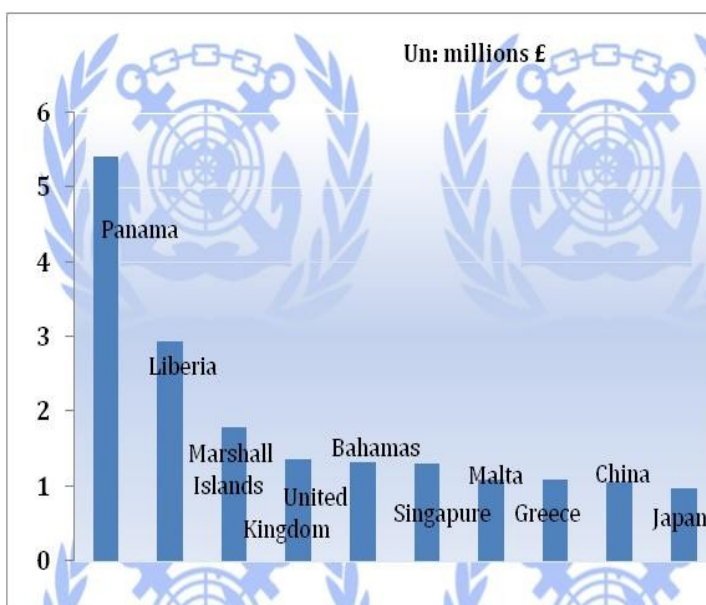
Both quotations, among other events, are available on the ITF website at: [http://www.itfseafarers.org/maritime\\_news.cfm](http://www.itfseafarers.org/maritime_news.cfm)

## 1.2 Shipping and environmental sustainability

From the side regarding the prevention of risks of marine pollution legislation is also abundant and produced by international and regional organizations. The International Convention for the Prevention of Pollution from Ships (MARPOL) was adopted in 1973 and amended in 1978. While this legislation has been established for several decades, the shipping industry has been criticized for being too slow to adapt to an environmentally sustainable behavior. Only in 2011 is that the members of the International Maritime Organization (IMO) agreed to add a regulation to MARPOL Annex VI on air pollution with regard to CO<sub>2</sub> emissions. The International Maritime Transport is not included in the Kyoto Protocol and the IMO suffers pressure from the European Union to deal with the problem, or at least to apply regional regulations.

### 1.2.1 International regulatory instruments: the International Maritime Organisation (IMO)

The IMO is a specialized agency of the United Nations for the standardization of safety and environmental performance of international shipping. Its main role as can be read in the respective website is to "(...) *create a regulatory framework for the sector of fair and efficient maritime transport which can be universally adopted and implemented.*" However these assumptions, as we shall see throughout this paper, are easily turned and distorted by expedients which, being legal in terms of international law, have turned into real mechanisms for tampering with rules and regulations adopted multilaterally in the form of Convention. And not least because the IMO Conventions have in fact very limited powers of action not being oblivious to the fact that among the major contributors are countries who most prevaricate (Table 1).



This happens due to the fact that fleets flying under FoC turn small countries into true thalassocracies. The UK itself comes in fourth position just because the flag of convenience records of Gibraltar, Isle of Man and the Cayman Islands. The jurisdiction of a country in terms of the applicability of regulations emanating from the Maritime Law applies only in territorial waters considered as an integral part of the country.

Table 1. IMO: main contributing countries  
Source: Own elaboration (from IMO)

When a given vessel, as repeatedly happens to ships flying a Flag of Convenience, after inspection performed by port authorities, is considered inconsistent with safety rules and existing refusal by the owner or master of the vessel to resolve or mitigate such defects, legal power delegated to the Port Authority (Port State Control) can be applied coercively but there are ways to turn around. When an offence, accident or incident occurring in international waters the applicability penalty points to the flag State and not to the ship owner, which in most cases is not resident and has a diverse nationality of the country of favour. And it is precisely in this aspect that things get complicated because IMO, for her, has no jurisdictional powers to apply the Convention and contentious issues are relegated to the scope of the countries involved. This is something of excessive reasonableness when we know that in international waters the law enforcement is a matter of each nation and many of them do not perform with sufficient accuracy or legitimacy, something that usually happens with FoC ships as we will see in Section 2. Another serious flaw pointed out by different stakeholders (The International Chamber of Shipping, The International Union of Marine Insurance, The International Salvage Union) to the inertia of the IMO to enforce the agreements, relates to the issue of safe havens to ships in danger of sinking after collision that although advocated by the signatory nations in practice has been host when the situation arises<sup>1</sup>.

Underlying the measures recommended by the IMO which broadly covers the entire spectrum of international shipping, from the design of ships, construction, equipment, operations and availability, is the guarantee that this sector of activity is considered safe, environmentally sound and energy efficient. It is supposed that international shipping industry will reduce CO<sub>2</sub> emissions by 20% by 2020, with significant further reductions thereafter. The IMO Agreement entered into force in January 2013 and is the first international agreement containing binding and mandatory measures to reduce CO<sub>2</sub> emissions so far agreed for an entire industrial sector. We wait up for their real applicability.

### **1.2.2 Multilateral Treaties: The United Nations Convention on the Law of the Sea (UNCLOS)**

The UN Convention on the Law of the Sea is a multilateral treaty concluded under the auspices of the UN in Montego Bay, Jamaica, on 10 December 1982 that defines and codifies inherited concepts of customary international law relating to maritime issues as territorial sea, exclusive economic zone, continental shelf, among others, and the general principles for the exploitation of natural resources of the sea, like the living resources, soil and subsoil. This Convention also established the International Tribunal for the Law of the Sea, with jurisdiction over disputes concerning the interpretation and application of that treaty. The Convention sets the outer limit of territorial waters at 12 nautical miles (22 km), defining it as a sea area contiguous to the territory of the coastal State and upon

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<sup>1</sup> The Maritime Maisie odyssey is the finished image of this statement. <http://www.maritime-executive.com/article/LR-Says-Maritime-Maisie-is-Severely-Impaired-2014-02-17/>



which extends its sovereignty. Creates, in addition, one contiguous zone with 12 nautical miles, within which the coastal State may exercise jurisdiction with respect to certain activities like smuggling and illegal immigration, and an exclusive economic zone (EEZ), with a 200 nautical miles from shore outer boundary line and the inner boundary as the outer edge of the territorial sea in which the coastal state has sovereignty to the exploitation of natural resources in water, seabed and subsoil (Figure 2). The coastal State also has jurisdiction over the area in the preservation of the marine environment, scientific research and installation of man-made islands.

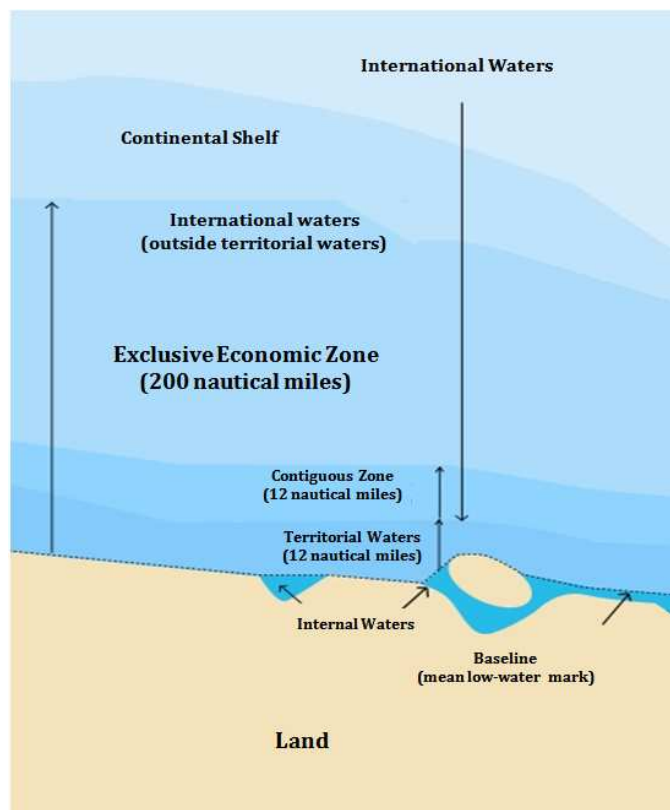


Figure 2. Delimitation of territorial and international waters. Source: Own elaboration (UNCLOS adapted)

According to the Convention, foreign ships are subject to the jurisdiction of the State in whose waters they are; exceptions are military and State owned vessels, to whom applies jurisdiction immunity.

Foreign vessels found in the territorial and EEZ waters shall enjoy the right of the regime of innocent passage, defined as continuous, rapid and orderly. However, the coastal State has the right to regulate this kind of passage, so as to ensure the safety of navigation, protection of various equipments and environmental protection.

The deep sea is defined as the maritime areas which are not under the jurisdiction of any State. On international waters applies the principle of freedom of: navigation, over flight, fishing, scientific research, installation of cables and pipelines and construction of man-made islands. The only jurisdiction applicable to a ship on the deep sea is the one of the State whose flag the vessel is flying, which contradicts the ability of international organizations to oversee and act on the deep sea, although is stated by the EU, as can be read in the paragraph *e* of article 3 in the Directive 2005/35/EC.

### 1.2.3 Regional agreements: the *Port State Control (PSC)*

In 1978, several European countries agreed in signing a memorandum of understanding (MoU) to audit if the on board working conditions were according

to ILO standards. For what interests us most in terms of Europe, it was agreed in 1982 the Paris Memorandum of Understanding (Paris MoU), establishing the designated Port State Control, extended to 26 European countries and Canada. In practice, this was a reaction to the failure of flag States - especially those flags of convenience delegating the task to fulfil in classification societies the functions of inspection and certification. Currently there are around the world several PSC agreements (Figure 3).

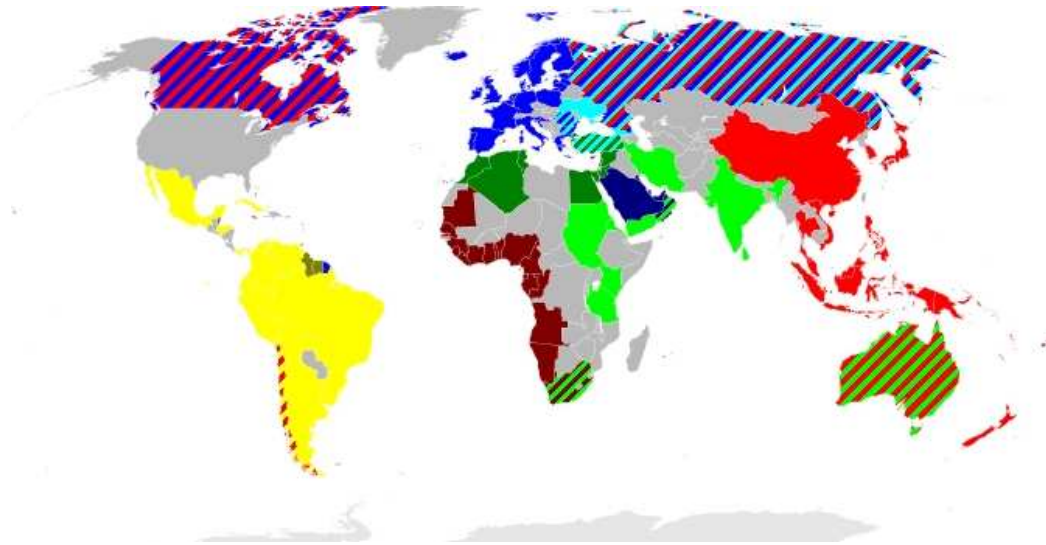


Figure 3. PSC Agreements (Port State Control). The signatories of the MoU are blue, the signatories of the MOU Tokyo are red, Indian Ocean (green), Mediterranean (dark green), Acuerdo Latino (yellow), the Caribbean (olive), Abuja (dark red), Black Sea (cyan) and Riyadh (navy blue). Source: Wikipedia.

On Port State Control regime, the inspection of ships is made by the inspectors of the port of call. The official website of the Paris MoU notes at this time a total of 56 arrests of vessels (<https://www.parismou.org/detentions-banning/current-detentions>), including a Portuguese vessel (the *Portalegre*) held in the French port of Bordeaux<sup>2</sup>.

Every day a number of ships are selected for control inspection in the whole region of the MoU. To facilitate this selection, the central database known as “THETIS” is consulted by PSC inspectors. This information system, organized by the European Maritime Safety Agency, inform the PSC national authorities of which vessels should be inspected, providing also reports of previous inspections and vessels are categorized according to the risk profile, as follows: low, normal and high and degree of compliance as: white, grey and black list.

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<sup>2</sup> Which along with the *EMIL*, a Finnish flag ship, are the only two EU vessels currently held in the Paris MoU region.

#### 1.2.4 Regional organizations: the European Maritime Safety Agency (EMSA)

The European Maritime Safety Agency was established by Regulation (EC) n. 1406/2002 of the European Parliament and of the Council of 27 June 2002 and is based in Lisbon but the official working language is English. This Agency in general terms provides technical and scientific assistance to countries of the European Union and to the Commission with a view to a correct application of legislation on maritime safety, monitoring its implementation and evaluation of their effectiveness. Was born as a response from the Commission to the accident involving the oil tanker "Erika" which sank on 12 December 1999 in the Bay of Biscay, France (Figure 4).

*"The spill of 20 tons of fuel oil from this 25 year old ship has polluted 400 km of coastline and killed more than 150,000 birds.*

*Nearly nine years later, Total – together with the ship owner, the manager and the company that assigned the navigation certificate - will have to pay 154 million Euros to the French State and 38 million to regions and municipalities affected by the oil spill.*

*The captain of the "Erika", Karun Mathur, was exonerated of any responsibility in the sinking".*



Source: Jornal Público, 16-01-2008

Figure 4. The "Erika" is a typical case of negligence.

To collect what interests us directly for the preparation of this paper, regarding the fight against pollution and living conditions aboard ships, we have to call upon related legal acts, including the reading of Directive 2009/16 / EC of 23 April, on the inspection of ships by the Port State Control and the Directive 2005/35/EC of 7 September, on ship pollution and on the introduction of sanctions, including criminal sanctions in case of infringements (Annex 1).

Since March 1, 2013, the EMSA got a broader mandate extended to control, combat and response to marine pollution caused by oil and gas installations. Other documentation provided by the Agency (see bibliography), whose quality and intensity of actions and plans poured in there can overly optimistic ideas in regard to marine pollution available means, be it air or sea. However what one should keep in mind is always the fear of occurrences rather than mitigating the effects. If this is an intensive industry which by nature involves risks and the fallibility of the human factor and knowing also that zero risk does not exist, it should however be aware that most disasters in the sea are perfectly avoidable if the law is effectively enforced. This inevitably requires a strong enforcement and severe punishment of offenders, although the EU itself has numerous questions about the effectiveness of repressive acts.



## **2. EMISSIONS, BIOINVASION, ACCIDENTS AND SPILLS**

There is a strong element of environmental impact associated with the risk of vessels such as fuel leakage caused by accidents and sinking largely bound to the transport of large volumes of oil across sensitive areas. Fires aboard constitute a major threat to the lives of the crew and repeatedly end up in environmental tragedies. Although all types of vessels are considered vulnerable to incidents and accidents, those who for obvious reasons cause most concern are those carrying pollutants and loads of great potential to cause an environmental disaster.

### **2.1 Pollution, environment, disasters, victims and the human element**

The maritime industry is run by people who design, build and own the ships, manning, maintain, repair and rescue them. These are people who regulate, examine, cover the damages and investigate the accidents. Therefore, by relying on so much upon the human factor, the global shipping industry is a dangerous place to work. But it's not just humans who are victims when something goes wrong. The entire marine element suffers such losses including animals belonging inherently to the aquatic environment and others who depend directly on it for their survival, which naturally includes the birds. Every day, on average (2005-2008), the industry losses two ships, \$ 4 million in damages are paid and the lives of hundreds of people and their businesses ashore radically change forever.

Human behavior is the source of virtually all this loss, but according to Gregory and Shanahan (2010, p. 15) the human factor is also the reason why the loss is not bigger. The real problem in industries so critical in safety and security factors such as maritime is that some errors have such serious consequences that need to be avoided before they turn into disasters.

#### **2.1.1 Pollution and Environment: Air emissions**

A container ship can carry onboard thousands of metric tons of fuel oil for consumption, which in itself is a strong environmental pollutant. According to the European Monitoring and Evaluation Program (EMEP), transiting ships in European waters were responsible for about 7800 tonnes of nitrogen emitted in the European Union in 2009. Vessels are a great source of many pollutants, including: nitrogen dioxide (NO<sub>2</sub>), sulphur dioxide (SO<sub>2</sub>), carbon monoxide (CO), ozone, benzene, particles, and various heavy metals (Figure 5).



Figure 5. Burning fuel for the propulsion of ships is one of the main sources of emissions of sulphur dioxide.

Ships are responsible for high emissions of SO<sub>2</sub>, compared with other modes of transport. Compared with highway and rail, ships cause more SO<sub>2</sub> emissions in grams per tonne-km (Figures 6 and 7). SO<sub>2</sub> emissions are directly related to the sulphur content of the fuel burned. However, there are technical means by which these pollutants can be cut by 80-90 percent, and very good cost benefit relation compared to similar results in land modes.

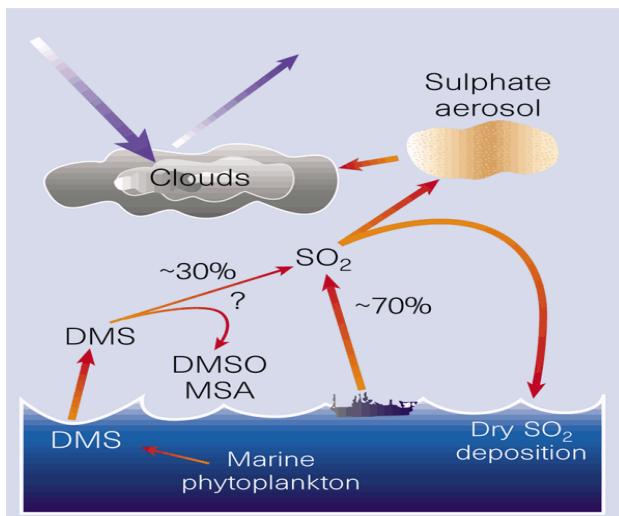


Figure 6. Though most of the pollutants are deposited at sea, maritime transport is a major source of acid rain and eutrophication in many European countries.

Source: <http://iopscience.iop.org>

Sulphur		NOx-nitrogen	
Denmark	28%	Denmark	26%
Netherlands	27%	Ireland	25%
Ireland	22%	Sweden	24%
Portugal	17%	Portugal	23%
France	16%	Norway	22%
Italy	16%	Netherlands	22%
Norway	15%	UK	21%
UK	15%	Spain	18%
Sweden	14%	Belgium	17%
Spain	13%	Italy	17%
Belgium	11%	France	16%

Figure 7. Example of countries where the proportion of sulfur oxides and nitrogen deposition are most marked 2012.

Source: <http://www.airclim.org>

Nitrogen oxides (NO<sub>x</sub>), sulphur oxides (SO<sub>x</sub>), and particulate matter (PM) are associated sub products of the combustion engines used in ships. NO<sub>x</sub> emissions from diesel engines are a function of engine design. Emissions of PM are strongly influenced by fuel and its sulphur content (Figure 8). Standards for these and other

air emissions are established by the International Maritime Organization as well as by national and regional authorities.

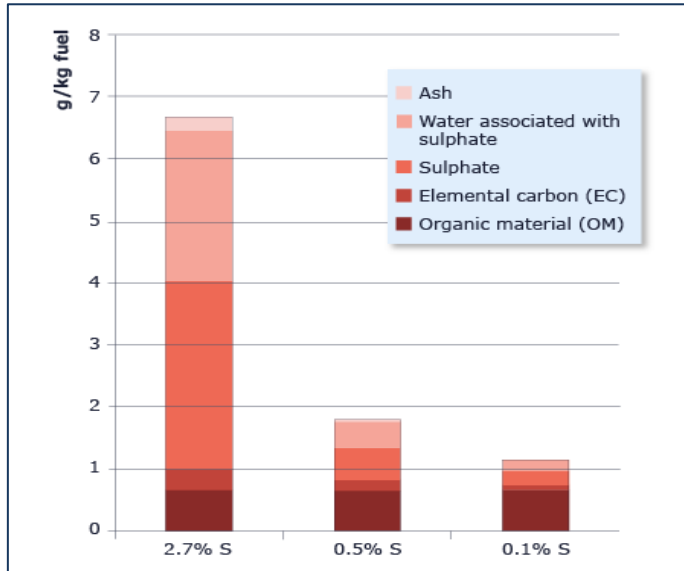


Figure 8. Example of particle composition after combustion of fuels with different sulphur contents.

Source: The European Academic and Industry Network for Innovative Maritime Training, Education and R&D

### 2.1.2 Pollution and Environment: invasive species (bio invasion)

**Ballast Water:** A Maersk’s Triple-E supports up to 60 million gallons of ballast water! The incoming water aboard at a call is contaminated with micro-organisms that thrive in the ballast tanks, which are then added to other ecosystems where they can cause irreversible damage (Figure 9). That's why by 2014 the 68,000 ships in the world will have to treat ballast water up to 10 micron to prevent the transfer of micro organisms from one ocean to another (Figure 10).



Figure 9. These micro organisms include bacteria, microbes, small invertebrate eggs, larvae and cysts of various species.



Figure 10. Ballast water is used to stabilize the ship as it receives or tranship cargo.

**Hull fouling:** The International Maritime Organization (IMO) is evaluating the issue of hull fouling as a potential vector for transfer of aquatic species. The potential transfer of vessels to aquatic species is a function of how effective is the anti fouling system used by a particular vessel<sup>3</sup>

**Aquatic species:** Includes species of aquatic plants and aquatic animals. Invasive aquatic plants are plants that have adapted to live in, on, or near water and can grow submerged or partially submerged in water. Aquatic animals require invasive aquatic habitats, but do not necessarily have to live fully in water.

### 2.1.3 Pollution and Environment: accidents and incidents

Another type of accidents that contribute to the risk of environmental disasters, even with a lesser degree of intensity, are accidents between vessels (Figure 11), the lack of stability of vessels caused by an error in the ballast weight distribution (Figure 12) and command errors during operations (Figure 13).



Figure 11. The "MV Springbo" and "MT Gas Roman" crashed at sea near the port of Singapore in 2003.

Figure 12. The "Cougar Ace" turned down due to stability problems with the ballast on his way to Vancouver in 2006.



Figure 13. The "Republic of Genoa" turned down at dock after a serious operational mistake.



<sup>3</sup> As well as in keel and rudder; propellers and shafts; anchor wells (including anchor chain and rope); water intakes and outlets; tenders and outboard motors; and sea strainers and internal water systems.



#### 2.1.4 Pollution and Environment: Offshore effects

In order to minimize the risk of oil spills, the EC Regulation requires that, since 2002, all tankers calling at a European port must be double hulled. Regrettably, the event that formed the basis of this decision was the sinking of the "Prestige" in 2002 off the Galician coast which caused the largest oil spill in the history of Spain whose effects still remain today (Figure 14) .



Figure 14. The "Prestige" a mono-hull oil tanker ship, sank in 2002 off the coast of Galicia and resulted in the largest oil spill in the history of Spain. Was registered in the Bahamas.

#### 2.1.5 Pollution and Environment: onshore effects

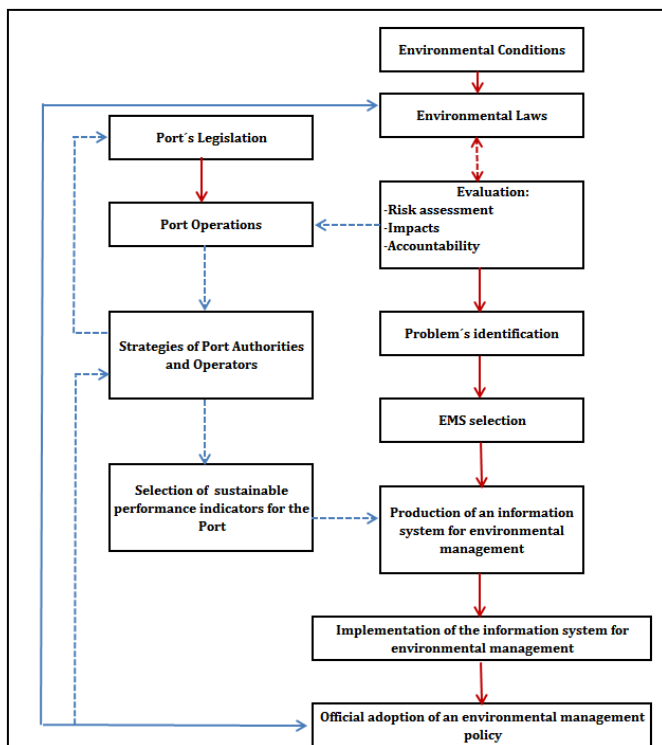
But also port activities are a source of negative externalities. The case of the port of Suape in Brazil's northwest coast is exemplary (Figure 15). The widening works caused the destruction of much of coastal mangroves changing the breeding area of the fearsome bulldog sharks, which migrated north and began attacking swimmers in the beaches of Recife, the State's capital (Figure 16).



Figure 15. Aerial view of the port of Suape, in the Brazilian State of Pernambuco.  
Source: news.seadiscovery.com



Figure 16. Warning signs of shark attack on the beach of Boa Viagem, Recife.  
Source: www.themalaysianinsider.com



Accordingly, in order to monitor and evaluate such negative impacts, ports must, among other planning acts with real degree and value of effectiveness and in respect for the environment and biodiversity, adopt an Environmental Management System (EMS).

An EMS should focus on issues such as water quality, air quality, waste management, habitat conservation, noise, dredging, contaminated soils, antifouling paints and energy consumption (Figure 17).

Figure 17. An environmental management system implies interdependence and information flows.  
Source: Own elaboration.

The certification process is expensive but many companies still choose to certify their management system. This is because having the system audited by an external body is to have a certificate that makes easiest the efforts of the company to communicate with suppliers, customers, regulators, competitors and society.

## 2.2. Safety and Environment: the issue of Flags of Convenience (FoC)

About 60% of the world fleet of commercial navy ships is recorded and flies under Flags of Convenience of countries that little (or nothing) respects the rules emanated by the International Maritime Organization (IMO). As mentioned in paragraph (4) of the preamble to Directive 2009/16/EC of 23 April 2009, "*The safety, pollution prevention and the conditions of life and work (...) can be significantly improved by the drastic reduction (...) of ships not complying with the standards through rigorous application of conventions, codes and international resolutions*". This law sets out the hierarchy of responsibilities of the parties. On first place, to the flag State the responsibility and zeal for safety, pollution and working conditions on board. In second, the ship owner responsibility for maintaining the ship and equipment and, third, the Port State Control must comply with these rules.

### 2.2.1 Flags of Convenience: legal piracy at sea?

A substantial number of countries that use this revenue source that presents in many aspects contours of social and fiscal dumping (akin to the designated tax havens which, not coincidentally, are home to much of the FoC), do not respect the standards which have been entered wilfully or for reasons that simply they do not have the means to do so. It should be noted that much of the GT registered in several countries over its useful life as ships registered in these states will probably never call ports of that country. The case of Bolivia, Nepal and Mongolia are noteworthy; landlocked countries that possess no coastline. But there are other shortcomings that derive from these at least anomalous records, allowing the flagrant disregard for the ethical standards of respect for the crew and the marine environment and that give rise to coarse tragedies (Figure 18).



Figure 18. Tragedies for crews and environment multiply with impunity.  
Source: Times of India

Vessels with registration in certain FoC countries that do not have reliable records about hiring procedures or secrecy about the identity of the owners of the vessels even begin to be explicitly seen as a potential vehicle for illegal actions; transporting undeclared hazardous materials and even potential terrorist acts (Figure 19).

For the ITF, it constitutes one Flag of Convenience when a ship has no bond between the owner and the flag of the vessel, i.e., when the beneficial ownership and control of the vessel are based in different countries of that flag the vessel belongs. In general, most of the FoC workers are not unionised and therefore unions have little bearing on what happens on board. The ITF fights since 1948 against Flags of Convenience and on behalf of the rights of workers. It intervenes in these cases to do what a single national trade union organization by itself does not have the strength to be able to do (Figure 20).





Figure 19. The containership "Hyundai Fortune" flying a Panamanian Flag of Convenience with hazardous material containers on board caught fire off the Gulf of Aden in 2006.



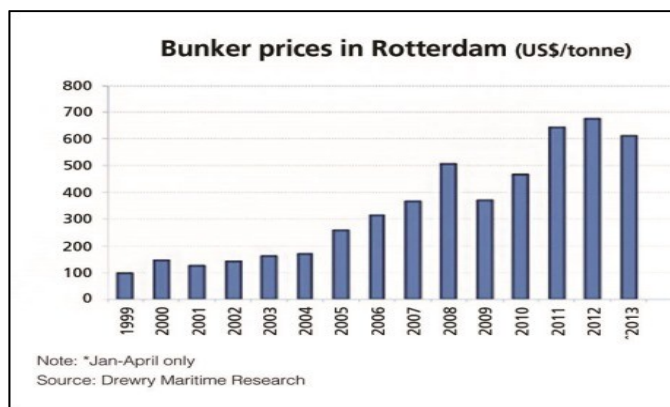
Figure 20 Flags of Convenience: a blacklist also with regard to the lack of conditions of life and work on board. Source: ITF

Currently, major FoC countries are Panama (39%), Liberia (23%), Marshall Islands (14%), Malta (9%), Bahamas (8%), Cyprus (4%), Antigua and Barbuda, San Vincent and Grenadines, Cayman Islands and Vanuatu.

### 3. ENERGY EFFICIENCY AND NEW FORMS OF PROPULSION

#### 3.1 Energy efficiency: the slow steaming

For ships, the most effective measure of efficiency is in general to decrease the speed of the ship; the slow steaming. A reduction of 27 to 18 knots can make a saving of up to 59% fuel oil (4,000 metric tons) in a journey between Singapore and Rotterdam, i.e., between 2.4 / 2.8 M dollars. The pressure to reduce carbon emissions from ships has also directed shipping companies to implement the slow steaming. Another incentive is the cut in the cost of fuels which have high volatility in world markets. Graph 1 shows the evolution of prices in dollars of fuel oil in the Rotterdam market, the so-called bunker prices.



Graph 1. Evolution of fuel oil prices in Rotterdam Market. Source: Wärtsilä.



### 3.1.1 Energy efficiency: The TRIPLE-E

The Maersk 15,5 meters draught Triple-E ships are a class of vessels designed and optimised for lower speeds. Those are the largest ships in the world and the most recent; they rotate double propellers at a lower speed reducing consumption by 37% and CO<sub>2</sub> emissions per container by 50% (Figure 21).



Figure 21. 2 The Triple-E engines consume 37% less fuel oil and emit 37% less CO<sub>2</sub> per container. The ship itself is 95% recyclable. Triple-E (EEE) stands for **E**conomy of scale, **E**nergy efficient and **E**nvironmentally improved vessel. Source: Maersk

Fuel used in ships is often of poor quality and as such highly polluting and highly damaging to health. There are abundant alternatives available to save fuel. The reasons why are not implemented on a large scale can be attributed to technological, institutional and financial barriers.

Institutional barriers are several, such as shared incentives; for example, a shipper will not want to pay more for chartering a energy efficient ship, which means that an owner who invests in expensive technologies and then leases the ship will not be financially compensated for the costs of investment. Technological barriers include the specific designs of vessels that are incompatible with certain technologies and the potential risks with new technologies. An asymmetric information: customers and, in some cases, shippers, are unaware of the availability and impact of technology.

There may also be financial barriers, such as very short-time amortization investments in new technologies, because the externalities (health care costs and other damages associated with pollution) are not attributable to the sector. These barriers can be overcome, in part, by providing the market with better information on the potential for efficiency, promptness of technology delivery and the real costs. In some cases, regulation (or the threat of regulation) is a promoter. In anticipation of regulation capital will act as a driver to solve the problem.

### 3.2 New technologies and methods

The LNG propulsion technology is now available for tugs, ferries and mixed systems for larger scale merchant ships (Figure 22). Already SkySails® system tows the ship by using a dynamic sail which generates 25 times more energy per square meter than conventional wind propulsion systems. This equals up to 2,000 kW propulsion power in good wind conditions (Figure 23).



Figure 22. LNG vessel propulsion is already a reality in ferries, tugs and shallow draft vessels.



Figure 23. SkySails®. This technology promises to revolutionize the maritime industry.

#### 3.2.1 Optimisation and Environment: the Monalisa Project



MONALISA 2.0 is a project of Motorways of the Sea (MoS), implemented with support of the European Union, and aimed at providing a concrete contribution to more efficient, safer and environmentally friendly shipping.

That is done through the development, demonstration and dissemination of innovative e-navigation services for shipping industry, which can lay the groundwork for future international deployment.

The geographic scope of this initiative covers the Baltic Sea, the North Sea and the Mediterranean. However and surprisingly or not, Portugal is not part of the member states involved in this project, which are: Sweden, Germany, Greece, Spain, UK, Denmark, Malta, Finland and Italy.

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## Annex 1. Pollution from ships and sanctions by the EU

<b>Maritime Pollution</b> (CE Directive 2004/35 of 7 September 2005)	
Classification: hydrocarbons and noxious liquid substances	
<b>Discharges Without Consent</b>	<b>Deliberate discharges (sanctions)</b>
Inland waters of Member	State Flag
Territorial waters	Ship Owner
Straits and Channels	Captain or Commander
Exclusive Economic Zone	Shipper/Consignee
Deep Waters	Classification Society
<b>Exceptions (over control of)*</b>	
The vessel is outside a Special Area**	
To ensure safety	
To save lives	
Due to ship's breakdown	
Due to equipment breakdown	
* By technical constraints of ships, geographic and chemical composition of discharges	
** The Mediterranean, Baltic Sea, Black Sea, Red Sea, Gulf of Aden, Arctic , and Northwest European Waters	

Source: Own elaboration.

## GLOSSARY

**Maritime accident:** means a collision of vessels, stranding or other incident of navigation or occurrence on board a vessel or external to it resulting in material damage or imminent threat to a vessel or its cargo damage.

**Dumping:** i) Any deliberate release into the sea of wastes or other matter from vessels, aircraft, platforms or other structures; ii) any deliberate disposal at sea of vessels, aircraft platforms or other structures.

**Ship owner:** Company that promotes the commercial exploitation of ships, whether or not being the owner of the vessel. Their income usually comes from the value of cargo freight between two ports or daily rental of vessels.

**Bunker oil:** Type of fuel oil used in the propulsion of ships and aircraft. Its price follows the evolution of the price of crude oil, but also follows the requirements of the International Maritime Organization (IMO) for the use of fuels with low sulphur content.

**Maritime chain:** Generally represents the maritime, port and logistics markets.

**Draft:** Maximum depth reached by ship with a full load.

**Foreland:** Maritime space in which a port plays trade relations. Defines the interaction of a port with the global economy.

**LNG (Liquefied Natural Gas):** LNG consists mainly of methane occurring naturally in underground deposits, associated with crude oil or gas recovered from coal mines (colliery gas).

**GT (gross tonnage):** Gross tonnage of a vessel in accordance with the provisions of the International Convention on Tonnage Measurement of Ships, 1969.

**Hinterland:** (competitive hinterland); Describes the market areas over which the terminal has to compete with others for business. (natural hinterland); The natural or fundamental hinterland refers to a market area to which a terminal is the nearest.

**MARPOL:** International Convention for the Prevention of Pollution from Ships. Entered into force in 1983 and is divided into 6 Attachments: I - Regulations for the Prevention of Pollution from petroleum products; II - Noxious Liquid Substances in Bulk; III - harmful packaged substances carried by sea; IV - the sewage from vessels; V - the waste produced on board, and; VI - control of atmospheric emissions.

**Passage (of ships):** Navigation through the territorial sea for the purpose of: a) traversing that sea without entering internal waters or calling at a moor or port facility outside internal waters; b) proceeding to internal waters or out of them or call at such moor or port facility.

**Innocent passage:** The passage of vessels is innocent so long as it is not prejudicial to the peace, good order or security of a coastal State. The passage must be conducted in accordance with the UNCLOS and other rules of international law.

**Continental shelf:** Comprises the seabed and subsoil of the submarine areas that extend beyond the territorial sea throughout the natural prolongation of the extension of land territory to the outer edge of the continental margin or to a distance of 200 nautical miles from the baselines from which we measure the breadth of the territorial sea, where the outer edge of the continental margin does not extend up to that distance.

**Port State Control (PSC):** Inspection of foreign ships in national ports by officers (inspectors) in order to ensure that certificates and declarations and the condition of the ship and its equipment comply with the requirements of international conventions and that the ship is manned and operated in accordance with the applicable international laws.

**Refined** (oil products): Includes gasoline, kerosene and liquefied petroleum gas, asphalt, lubricating oils, diesel fuels and residual fuels.

**Slow steaming:** Strategy adopted by ship owners which results in reducing the average speed of the ship. A slowdown of 5 knots can reduce consumption by up to 50%.

**UNCLOS:** United Nations Convention on the Law of the Sea

**EEZ** (Economic Exclusive Zone): It is an area beyond the territorial sea and adjacent to, subject to the specific legal regime, under which the rights and jurisdiction of the coastal State and the rights and freedoms of other States are governed by relevant provisions stated at the UNCLOS Convention.

**Contiguous zone:** 1 - In contiguous to its territorial sea zone, the coastal State may exercise the control necessary to: a) prevent infringement of the laws and customs, fiscal regulations, immigration or health within its territory or territorial sea; b) punish infringement of the laws and regulations within its territory or territorial sea. 2 - The contiguous zone may not extend beyond 24 nautical miles, counted from the baselines used to measure the breadth of the territorial sea.