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The impact of Ballast Water Management Convention on combating invasive species in Turkey (Black Sea)

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The Impact of Ballast Water Management Convention on Combating Invasive Species in Turkey (Black Sea)

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Declaration

I certify that all the material in this dissertation that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views, and are not necessarily endorsed by the University.

(Signature): ....

(Date): **24th September 2019**

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Abstract

Title of Dissertation: The Impact of Ballast Water Management Convention on Combating Invasive Species in Turkey (Black Sea)

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The impact of globalization on the world economy has a positive influence on maritime transport, which is ranked first in terms of international trading of goods. Shipping is the mainspring of invasion by aquatic marine species since it has contributed a significant part of invasive alien species in the Black Sea. In other words, roughly 80% of the foreign species being introduced to the Black Sea is through the ballast waters of the vessels.

Therefore, as an International response, the International Maritime Organization (IMO) adopted Ballast Water Management Convention (BWMC). This convention entered into force on 08 September 2017 to deal with alien invasive species problem through regulations for common interest of States authority.

The purpose of this study is to examine and observe the implementation of the Ballast Water Management Convention in Turkey (Black Sea) and to determine the challenges in terms of flag state and port state. During the study, technical, economical and legal challenges were addressed, and suggested solutions were put forward. The core reason why the Black Sea was chosen as a study area is that it is a closed system. The Black sea has the largest anoxic volume in the world and it is exposed to many human-induced threats and ship-based pollution contributed through marine accident, oils spill, ballast water. Its only connection to the Atlantic Ocean through the Mediterranean Sea is through the Bosporus. This particular situation makes the Black Sea ecosystem much more vulnerable. In this regard, author attended five ships for inspections with the port state controller to observe the implementation of Convention during the study.

KEYWORLDS: Ballast water, Black Sea, Alien Invasive species, Shipping, Ballast Water Management Convention, D-2 Standards, Challenges, Flag State, Port State.

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LIST OF ABBREVIATIONS

BIMCO	Baltic and International Maritime Council
BWE	Ballast Water Exchange
BWM	Ballast Water Management
BWMC	Ballast Water Management Convention
BWMP	Ballast Water Management Plan
BWMS	Ballast Water Management System
BWMS	Ballast Water Management System
BWPS	Ballast Water Performance Standard
BWPS	Ballast Water Performance Standard
BWTS	Ballast Water Treatment
CCC	Sub-Committee on Carriage of Cargoes and Containers
Cfu	Colony-forming unit
DBP	Disinfection byproducts
DTO	Deniz Ticaret Odasi (Chamber of Shipping-Turkey)
DWT	Deadweight Tonnage
FAL	Facilitation Committee
FPOs	Floating Production and Offloading Unit
FSUs	Floating Storage Units
GEF	Global Environment Facility
GloBallast	Global Ballast Partnerships Programme
GT	Gross Tonnage
HTW	Sub-Committee on Human Element, Training and Watchkeeping
IAS	Invasive Alien Species
ICS	International Chamber of Shipping
III	Sub-Committee on Implementation of IMO Instruments
IMO	International Maritime Organization
IOPP	International Oil Pollution Prevention
IOPPC	International Oil Pollution Prevention Certificate

ISTFIX	Istanbul Freight Market
LEG	Legal Committee
MARPOL	International Convention for the Prevention of Pollution from Ships
MEPC	Marine Environmental Protection Committee
MSC	Maritime Safety Committee
NCSR	Sub-Committee on Navigation, Communications and Search and Rescue
NIS	Non-Indigenous Species
PBBS	Port Biological Baseline Surveys
PPR	Sub-Committee on Pollution Prevention and Response
PSC	Port State Control
SDC	Sub-Committee on Ship Design and Construction
SDG	Sustainable Development Goals
SOLAS	Safety of Life at Sea
SRA	Same Risk Area
STCW	Standards of Training, Certification and Watchkeeping Convention
TC	Technical Cooperation Committee
THM	Trihalomethanes (Chemical Compound)
TL	Turk Loydu (Turkish Class Society)
TUBITAK	Scientific and Technological Research Council of Turkey
TUDAV	Turkish Marine Research Foundation
UNCLOS	United Nation Convention on the Law of the Sea
UNCTAD	United Nations Conference on Trade & Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Program
WWF	World Wide Fund for Nature

CHAPTER I
INTRODUCTION

1.1. Background

The shipping sector, which provides 90% of the international transport of all trade goods, has an important place in world trade. Ballast water is an important factor that has been used since the construction of steel vessels about 120 years ago, and which ensures the balance of the unloaded ship during the navigation. Especially, in cases where cargo is empty on cargo ships, seawater is taken into the vessel's ballast tanks in order to ensure stability and structural integrity on board (TUDAV, 2018).

Aquatic organisms carried by water in ship ballast tanks are recognized as one of the serious global environmental hazards facing humanity today. The species of invasive marine organisms transported by ballast waters to a new marine environment are defined as one of the biggest threats to the world. In this period, where human being has a negative impact on the environment, the losses of marine species with high economic value are seen faster than in previous periods. This situation threatens our environmental and economic values in relation to marine living resources (IMO, 2018):

Approximately 7,000 marine and coastal species travel unnoticed across the world's oceans, silently stowed away in ships' ballast water tanks every day and every hour. These unwanted travelers become invasive when released in a new environment by outcompeting and changing native flora and fauna, which results in an irreversible ecological variation and economic loss (WWF, 2009).

The transfer of invasive species to new habitats was first demonstrated in 1903 by the presence of high amounts of Odontella (Biddulphia sinensis), phytoplankton algae of Asian origin, in the North Sea. Detailed scientific studies on this issue began in the 1970s. In the late 1980s, Canada and Australia took first place among the countries with problems that are invasive in nature. The quantitative data on the problem of transport of invasive species by ballast water shows that bio-infestation rates continue to increase, and that new areas are being invaded by alien species every day (TUDAV, 2018).

The transported ballast water carries 30-35% of the ship's carrying capacity (deadweight tonnage). Ballast water and sediments of ships are the main vector for the transport and propagation of planktonic organisms, poisonous dinoflagellates, fish and other unicellular organisms of fish eggs / larvae. It is estimated that between 7,000 and 10,000 different species are transported by ships in the world every day. Discharging the ballast water from a marine ecosystem into another marine ecosystem can lead to the transport of undesirable organisms, threatening the ecological balance and spreading outbreaks. Invasive species are considered one of the four greatest threats to the world's oceans. The other three threats are land-based marine pollution, over-consumption of living marine resources and physical destruction / destruction of marine habitats (marinedealnews, 2018).

The International Maritime Organization's (IMO) Ballast Water Management Convention was widely accepted by countries in 2004. This is the only international instrument that helps prevent the spreading of harmful invasive species from the global shipping industry. Although many ship-owners and fleet managers want to prevent the transmission of harmful species from port to port, they cannot compete with this because the crew and ship's safety will be compromised if ballast water is not used (WWF 2009).

In addition, the International Maritime Organization (IMO) has been working on ballast water and sediment problems for many years. In 1997, IMO published guidelines for the control and management of transfer of harmful aquatic organisms and pathogens.

On 13 February 2004, the *International Convention on the Control and Management of Ballast Water and Sediments of Ships* was opened for signature in order to prevent harm to the environment, human health, goods and resources from uncontrolled discharge of ballast waters and sediments, which caused the transport of harmful aquatic organisms and pathogens. As of September 8, 2017, the contract has entered into force and ballast water discharge standards have been implemented with this contract.

The number of countries, which are parties to the agreement with Turkey, has reached 79 and 80.94% in terms of world tonnage. With the entry into force of the Convention, regional cooperation has been established in the sea areas determined as critical in order to solve the problem of ship ballast water. In this context, it is important to note that within the scope of the IMO Globallast Partnership Project was hosted by Turkey in various training courses and workshops. Turkey led the project as the leader country of the Regional Task Force together with Croatia, which was established with the Mediterranean countries.

Within this framework, the main objectives of the GloBallast Partnerships Program are for developing countries; in ballast management, coordination, communication, training, awareness-raising, ballast water risk assessment, ballast water management measures, compliance with contracts, implementation and monitoring, regional cooperation, resource and financing are determined as targets.

Considering the transportation data between 2002 and 2006, it has been estimated that an average of 23 million tons of ballast water is discharged in and around our coasts (Coast of Black Sea, Aegean Sea and Mediterranean Sea). 12 million tons of this ballast water comes from the ports in Mediterranean countries and 6 million tons from the ports in Black Sea countries (Korcak, 2011). In addition, the amount of ballast water coming from the northern Atlantic ports to our country is approximately 1.5 million tons with a share of 6%. When the amount of ballast water coming to our seas is proportioned, Marmara Sea ranks first with the largest share. The second place is the Eastern Mediterranean coast and the third one is the Aegean Sea (Korcak, 2011).

1.2. Research Questions

In order to achieve the objectives of research, the following questions need to be addressed:

a. Why are invasive species a problem in the Black Sea, with a particular focus on the Turkish Straits and the Sea of Marmara?
b. Which invasive species are affecting the Black Sea and what is the cost of invasive species to the Black Sea coast of Turkey?
c. What are the objectives and the mechanisms of the Ballast Water Management Convention for addressing invasive species?
d. What are the main challenges and opportunities associated with the implementation of the Ballast Water Management Convention in Turkey?

1.3. Research Objectives

Based on the aforementioned, the thesis study will examine the correct and successful ways/methods of prevention of invasive species in ballast water and threatening marine ecosystem based on the methods specified in the Convention. Furthermore, the study is to provide environmental and bio-economic benefits such as biodiversity conservation, reducing the negative impacts of ship ballast water in tourism areas, especially in swimming areas and preventing epidemics and one of the research objectives is to improve the implementation of the Convention.

1.4. Research Methodology

In order to reach an effective conclusion, this research will be accomplished in 3 steps. The first step is the literature survey that intends to review both primary and secondary sources (written in both English and Turkish language) in order to gain valuable knowledge from books, articles, publications and internet resources about current situation in terms of implementation of Conventions and invasive species in Black Sea.

The second step is data collection that covers more specific information including alien invasive species threatening the Black Sea and governance of Ballast Water Management Plan of Turkey. This step includes obtaining information from government (Ministry of Transport and Infrastructure and The TÜBİTAK Marmara Research Centre), Turkish chamber of shipping and universities.

The third step is to analyze all materials that will give an opportunity to the author to understand the main principles of the topic and give applicable solutions to deal with weaknesses and threats. After analyzing all collected literature materials and data, it will be possible to look at ways to enhance awareness in relation to alien invasive species that pose a danger to Black Sea Coast of Turkey and facilitate the implementation of Ballast Water Management Convention in terms of port state control.

1.5. A Key Assumption and Potential Limitations

1.5.1. Key assumption: A key assumption of this research is that Ballast Water Management Convention is one of the most important and new Conventions in the world. At the same time, since the Convention entered into force very recently, there are some uncertainties with respect to implementation by port state controllers. On the other hand, it is important to enhance awareness of invasive species carried by ship transportation in order to handle this issue more seriously in terms of port state control's ship inspection perspective.

1.5.2. The potential limitation: The potential limitation of the research is that in order to determine whether ballast treatment device works properly, it is important to get sample from tank or pipes line and analyze the samples at lab. However, this cannot be done given time constraints. Moreover, it is observed that there are limited references of applicability of the Convention in order to compare and contrast with other states since the Convention entered into force on September 2017.

CHAPTER II
ALIEN INVASIVE SPECIES

It is not a native of a particular ecosystem, but in unpredictable forms and times, new species involuntarily coming to a region from outside are called invasive (exotic) species (Ozdemir & Ceylan, 2007).

The invasion of invasive species occurs as a result of displacement of species due to changes in the ecosystem, ballast waters of ships and man-made activities. Humanity's increasing mobility has radically increased the rate at which various living things move from one ecosystem to another. As exotic species invade natural communities (bio-invasion), indigenous species that are unable to cope with this expansion are in danger of extinction (Ozdemir & Ceylan, 2007).

The worldwide displacement of ship ballast water causes problems on the marine environment whereby ballast water essentially serves to stabilize the ship when it is empty and is discharged into the sea during the load taking process. According to the estimates, approximately 3-5 billion tons of ballast water is transferred worldwide each year. The invasive sea creatures transported in this way have become a serious problem for the marine environment. With this transfer, it is estimated that around 7,000 to 10,000 different marine microbes, plant and animal species are transported worldwide each day (Globallast, 2017).

Turkey, which ratified the Ballast Water Management Convention on 2014, has liabilities with respect to marine environment pollution and these responsibilities stem from not only international conventions, but also come from regional conventions, (Barcelona Convention 1976, Bucharest Convention 1992) bilateral agreements and domestic law (Kubilay, 2014). Ship-source pollution problem, remain on the agenda due to workshops carried out as a national level and participating to International platforms which fulfilling by Turkey (Kutluk, 2018).

2.1. Assessment of Invasion Progress

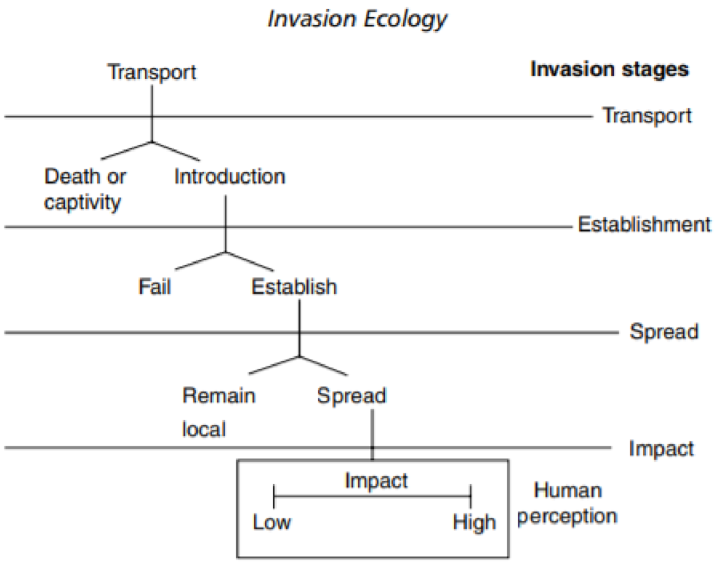
The whole lifetime of the species should be considered related to possible types of shipping transport, even though species might be transferred in their adult form. Several species have planktonic larval stages of diversifying period. Possible of long-distance dissemination of organism by ship ballast water can base on length of period in the water column or larval stage of organism.

In addition, some characteristics which are related to organisms directly influence the potential of transferring organisms by ballast water, such as, salinity tolerance, size, mobility, tolerance to air exposure (Carlton, 2003).

An integrated framework-defining invasion as a step-by-step process has been widely accepted (Pereyra, 2016). Questions such as what is an invasive species and are invasive species an inherent conservation problem are still unresolved since invasion science has not been technologically advanced without controversies. Therefore, these questions have headed to considerations about special effects versus origins.

Usually the non-native species are selected up from their native environment and introduced to a new environment, which is also wild ecosystem (Transport in Fig. 1). The introduced species either start a self-sustaining population within their new non-native environment (Establishment in Fig. 1.1) or they become extinct. The rapid growth of that non-native population in large quantity will create expansion in its geographic range (Spread in Fig. 1) and this will cause relevant economic and ecological disturbance and thus earning the name “invasive.” (Lockwood et. Al., 2013)

Figure 1: Invasion process model



Sources: (Lockwood et. Al., 2013)

The threat of invasion at any given location has been shown to increase with the rate at which invasive alien species (IAS) are introduced and the degree of disturbances that promote IAS establishment since alien invasive species are threat to human livelihoods and biodiversity globally. IAS is considered as the primary threat to global biodiversity, economies and human health. IAS growth is facilitated by the environmental changes, increase in globalization facilitates and the effects of climate change.

The leading invasion vectors fluctuate between low-income countries (air travel) and high-income countries. However, uniting data on the causes of introduction and establishment can develop early warning and eradication schemes since most countries have limited capacity to act against invasions. It is also known that 1/6 of the global land surface is highly vulnerable to invasion, including significant areas in developing economies and biodiversity hotspots. (Levine & D'Antonio (2003), Theoharides & Dukes (2007), Early et. Al., 2016).

The intensities and global patterns of introduction and disturbance are changing more rapidly today than at any time during human history. The highest numbers of IAS in the world are found in economically developed countries with the strongest IAS management determinations and the greatest knowledge about the extent of invasions. However, the geographical patterns of future invasions is likely to be significantly different from that of today. (Seebens at. Al., 2015 & McGeoch et. Al., 2010).

2.1. How Species can be Invasive in a New Environment

Invasive alien marine species jeopardize biodiversity, fishing, tourism and human health, and over time, the situation worsens unlike oil spills. Due to ships ballast water, 10,000 species are estimated to be in transit around the world and there is no effective way to solve this problem immediately. IAS is considered as dangerous species because of their persistent nature for settling into new marine environments. It will network with existing communities and, gradually adapt to natural habitats. Several alien invasive species are able to change their new environment. Accordingly, it creates pressure onto indigenous species such as the comb jelly made it to anchovies in the Black Sea (UNEP, 2010).

Invasive species, which usually occupy areas that are poor in diversity, compete with local species in the regions, causing changes in ecosystems. Intense industrial fishing in the Black Sea, water extraction, deterioration in the structure of deltas and pollution caused invasive species to prefer these regions. Either especially in cases where species diversity undergoes significant erosion for reasons such as pollution, a significant increase in the number of individuals living in the environment increases, or they can be easily dispersed as competition is lost and there are no enemies. In the past, the Black Sea has experienced this situation with creatures such as sea snails (Rapana thomasiana) or bell jellyfish (Mnemiopsis leidyi). (Sağlam, Kesici & Akdoğan, 2011).

2.2. Invasive Species in the Black Sea Carried by Ship Ballast Water

Although ship-related pollution mostly comes to agenda in marine accidents, illegal discharge from the ship and other deliberate movements reveal the greatest risk to the marine environment. In order to overcome this global problem internationally, due to The International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978 MARPOL 73/78 which was signed under the leadership of IMO, the Contracting Parties have important responsibilities in order to effectively handle, store and send to the final disposal any waste produced on ships arriving at their ports (Köseoğlu, Töz & Şakar, 2016).

The most important reasons of marine pollution are discharging bilge, ballast or tank washing waters to the sea, discharging of waste and similar household wastes into the sea, the oil and wastes produced as a result of the washing of decks (Özdemir, 2012).

The number of alien species in the Mediterranean is exceeding 1000 while Turkey is approaching 500 the number of foreign species in the sea. While 74% of the alien species coming to the Mediterranean Sea come through the Suez Canal, 80% of the foreign species coming to the Black Sea come with the ballast waters of the ships (UNDP, 2018).

In the last decade, shipping has progressively contributed to the increase of pollution and spread of invasive species in the Black Sea (UNEP, 2010).

Table 1: Invasive Species in the Black Sea

Species (involuntary arrived)	Year	Origins
Balanus improvisus, B. eburneus	19.yy	North America
Blackfordia virginica	1925	North America
Mercirella enigmatica	1929	India
Bourgainvillia megas	1933	Atlantic
Rhithropanopeus harisi tridenta (yengeç)	1932	Pacific
Rapana thomasiana (deniz salyangozu)	1953	Japan Sea
Mya arenaria (tarak)	1966	North Sea
Callinectes sapidus (Mavi yengeç)	1967	Atlantic Coast of North America
Doridella obscura (Nudi branchiate)	1980	Pacific
Anadara cornea (Ak midye)	1982	Adriatic
Mnemiopsis leidyi (taraklı medüz)	1982	Atlantic Coast of North America
Desmarestia viridis (alg)	1990	North Europe

Source: (Ozdemir & Ceylan, 2007)

2.3. Cost of Invasive Species to the Coast of Black Sea

Alien species carry parasites in marine ecosystems, marine biodiversity, marine species and habitats, infect disease and they cause genetic degradation, create competition and endanger generations by consuming indigenous species. These species also pose a threat to human health and can lead to illness and poisoning. In addition, invasive species, which have negative impacts on the country's economy, adversely affect fishing and tourism (UNDP, 2018).

The damages that invasive species can survive and establish colonies by coming to the ecosystem to which they do not belong can be classified into three main sections:

Ecological: Invasive species affect and reduce the biodiversity and ecological distribution of natural species in these situations. Studies show that invasive species occupy a region in the world every week, sometimes every day;

Economic: Fish resources, coastal industry, tourism and other commercial activities to be interrupted by the invading species. For example, the “mnemiopsis” a type of jellyfish, which came to the Black Sea by ship, caused approximately 1 billion dollars of damage to Turkey’s fisheries.

Human Health: Toxic organisms, disease microbes and pathogens spreading with ballast water causes disease and even death in humans (Ozdemir & Ceylan, 2007). In addition to that, an invasive species called Mnemiopsis leidyi, has been accused for the depletion of coastal fisheries and it has been causing to spend many millions of dollars annually (UNEP, 2010). In addition, the BS benthic ecosystem has been under high predation pressure by the invasive sea nail Rapana Venosa (Knudsen et al., 2010).

As a result of the deterioration of the ecological balance in the Black Sea due to various reasons, there has been a significant decrease in the fish stocks living in the region and some species have been lost in the ecosystem. In the same period, the opportunistic gelshy Mnemiopsis leidy, which has recently entered the Black Sea, benefiting from the space in the environment, reached a high population size and became the dominant species in the pelagic ecosystem (Kideys et al., 2005, Mutlu, 2009). At the end of the 1980s, the sudden collapse of the Black Sea anchovy intensified to the attention of the importance of gelshy organisms in the pelagic ecosystem. Geliform organisms can reach high population density in coastal regions in a short time and easily adapt to the environmental conditions. Bloom organisms adversely affect fish and fishing activities (especially pelagic fishing) and thus economic fishing as well (Özdemir et al., 2014).

Anchovy (Engraulis encrasicolus ponticus) has a very important role in the pelagic ecosystem of the Black Sea, and anchovy possess as a commercial value for Turkey. In the late 1980s and early 1990s, anchovy stocks decreased both by pollution and by the invasive Mnemiopsis leidyi species consuming food zooplankton in the Black Sea (Orhan, 2010).

CHAPTER III
OVERVIEW OF THE BALLAST WATER MANAGEMENT CONVENTION

3.1. Introduction to International Maritime Organization

International Maritime Organization (IMO) is the global standard-setting authority for the safety, security and environmental performance of international shipping as a dedicated organization of the United Nations. The core role of the IMO is to produce a guiding framework for the shipping trade, which is unbiased and operative, entirely approved and universally fulfilled (IMO, 2019a).

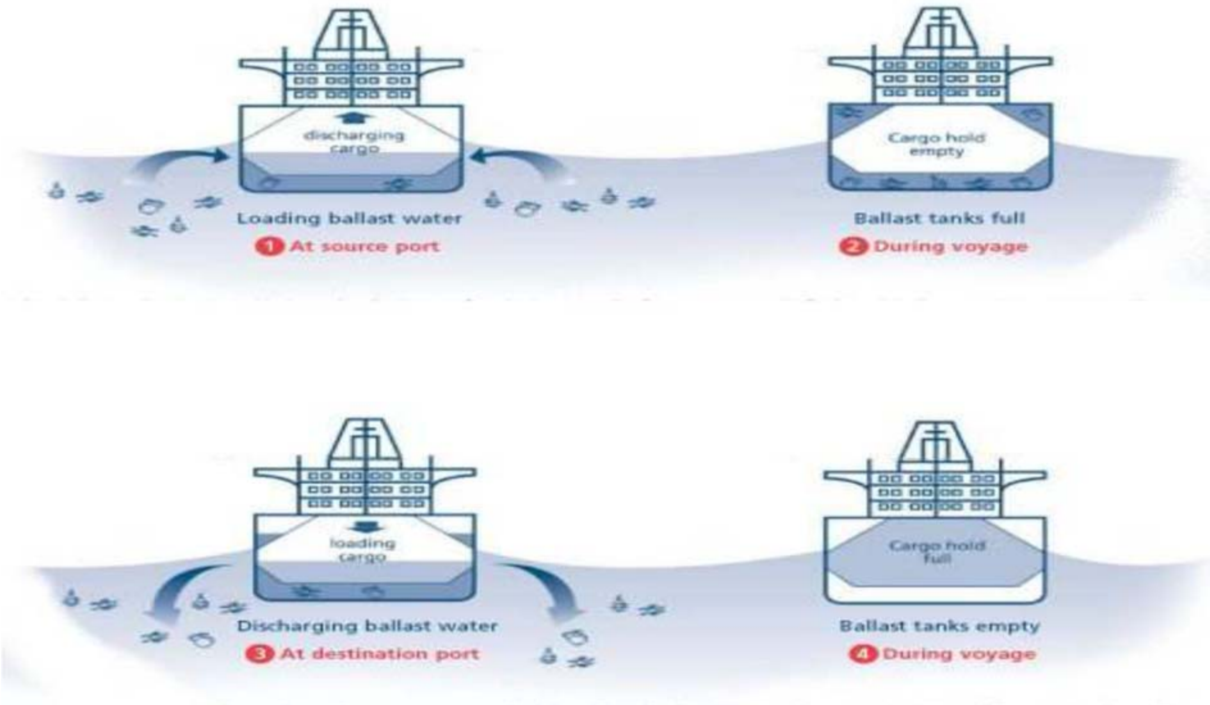
IMO is vigorously working towards the 2030 Agenda for Sustainable Development and the associated Sustainable Development Goals (SDGs) as part of one of the organizations of the United Nations (IMO, 2019a). Without a doubt, most of the essentials of the 2030 Agenda are expected to realize with a sustainable transport sector facilitating global economy bearing in mind that shipping is subsidiary of the world trade. IMO's Technical Cooperation Committee has officially approved connections between the Organization's technical assistance work and the SDGs. While the oceans goal, SDG 14, is central to IMO, aspects of the Organization's effort can be associated to all individual of the SDGs (IMO, 2019a).

According to Ayan & Baykal (2010), IMO's missions can be summarized as taking the necessary technical measures in terms of navigational safety in international seas and to encourage the regulation of the relevant international norms, to encourage the adoption of the most effective rules to ensure the efficiency of maritime business and to ensure cooperation between countries in order to prevent the pollution of seas by ships.

3.2. Dealing with Ballast Water

Ballast water is very important for the ships in terms of stability and safe navigation as a structural integrity. Nevertheless, once a ship takes ballast water into its tanks, it is carried to every part of the ocean. Therefore, it is a main problem for marine environment, which is possible to contain several microbial organism, algae, invasive species and discharged into ecosystem where they are non-indigenous.

Figure 2: Ships ballast operation cycle



Source: (Globallast, 2013)

Unprocessed ballast water discharge at a ship's route could possibly introduce new invasive aquatic species to the environment. Over the last few decades, international trade and ship traffic volume has raised the likelihood of invasive species being released. Hundreds of invasions have already occurred, sometimes with deleterious results for the native ecosystem, economy and infrastructure.

Ships, which are engaged in international trade, should operate their ballast water and sediments, in line with a ship-specific ballast water management plan under the umbrella of The Ballast Water Management Convention. According to the Convention, all ships shall carry an International Ballast Water Management Certificate and a ballast water record book (IMO, 2017).

All ships tied up to international trade are under an obligation to treat their ballast water in order to avoid the introduction of alien species into new environment, including exchanging their ballast water or treating it using an approved ballast water management system (IMO, 2017).

To begin with, there are two different standards matching these two options. Firstly, the D-1 standard requires ships to exchange their ballast water in open seas, away from coastal waters (IMO, 2017). Preferably, this means at least 200 nautical miles from land and in water at least 200 meters deep (IMO, 2017). In doing so, fewer organisms will survive and hence ships will be less likely to introduce potentially harmful species when they discharge the ballast water. As a second, D-2 standard is related to performance, which specifies the maximum amount of viable organisms allowed to be released, including specified indicator viruses harmful to human health (IMO, 2017).

The crucial point between D-1 and D-2 is the fact that new ships must meet the D-2 standard from today while existing ships must primarily meet the D-1 standard (IMO, 2017). An execution timetable for the D-2 standard has been approved, based on the date of the ship's International Oil Pollution Prevention Certificate (IOPPC) renewal survey, which must be carried out at least every five years. In the end, all ships will have to obey to the D-2 standard. For majority of ships, this involves installing special equipment (IMO, 2017).

3.3 Background of the Ballast Water Management Convention

At the end of 14 years of tough negotiations between IMO Member States, the International Convention for the Control and Management of Ships' Ballast Water and Sediments (Ballast Water Management Convention) was adopted at a Diplomatic Conference held at IMO Headquarters in London on 13 February 2004 (IMO, 2019).

Several guidelines have been established to simplify the execution of the Contract. Member States to the Contract are given the option to take additional measures that are subject to principles set out in the Contract and to IMO guidelines (IMO, 2019). The Convention consists of Articles and Annexes including technical criteria and requirements in the Regulations for the control and management of ship’s ballast water and sediments (IMO, 2019).

Ships, navigating in international waters for international trade and using ballast water, are subject to the BWM convention but there are the following exceptions:

- The uptake and discharge of ballast water necessary for ensuring the safety of the ship in emergency situations;
- The accidental discharge or ingress of ballast water as a result of damage to the ship or its equipment;
- The uptake or discharge of ballast water for the purpose of avoiding or minimizing pollution incidents from the ship;
- The uptake and subsequent discharge on the high seas of the same ballast water; or
- The discharge of ballast water from a ship at the same location where the whole of the ballast water originated and provided no mixing of unmanaged ballast water from other areas has occurred. If mixing occurs, the ballast water is subject to management in accordance with the Convention.
- Ships which are not designed or constructed to carry ballast water
- Ships that only operate in the local waters of a single authority or in local waters of a single authority combined with single voyages to and from international waters. Exceptional single voyages to and from international waters can be granted by the local authority and the vessel’s Flag Administration.
- War ships, naval auxiliary, or ship owned, operated by a State, and used only on Government, non-commercial service, as stated in Article 3.2(d) of the Convention.

- Ships with sealed or permanent ballast water tanks (DNVGL, 2019 & GOVUK, 2018)

After the dates of 8 September 2017, all ships shall have and implement a BWM plan and record all ballast water operations in the BWM record book. The BWM plan shall be approved by the administration.

Vessels above 400 GT (excluding floating platforms, FSUs and FPSOs) are subject to a BWM survey and are required to hold a BWM certificate.

3.3.1 Requirements for vessels below 400 GT and floating platforms, FSUs and FPSOs.

As per regulation E-2 of the Convention, the government of the coastal State (for floating platforms, FSUs and FPSOs) or the flag administration (for vessels below 400GT) will determine whether or not the vessel must comply with D-1 (exchange) or D-2 (treatment) regulations (DNVGL, 2019).

We understand that according to the Convention, such vessels shall be required to have approved BWMP and Record Book (DNVGL, 2019). However, if they are permanently positioned, BWMP and Record Book, it may be asked of the Administration (Shelf State) if the BWMP or Record Book is required (DNVGL, 2019). The Flag Administration will determine the D-2 compliance date for vessels that do not have an IOPP certificate. The compliance date should not be later than 2022 (DNVGL, 2019).

3.3. IMO Globallast Partnership Programme Project

The International Maritime Organization (IMO), Global Environment Facility (GEF) and the United Nations Development Program (UNDP) has been working collectively since the year 2000 to eliminate the impacts of harmful aquatic species present in the ballast water management area (IMO, 2019e). The merging of these three organizations known as GloBallast became one of the longest serving event under the GEF, spreading in two phases between the years 2000 to 2017 respectively (IMO, 2019e). The initial stage of the Global Ballast Water Management Programme was to ensure active ways of controlling the introduction of invasive marine species in countries like Iran, India, Brazil, Ukraine, China and South Africa (IMO, 2019e).

Engagement of stakeholders helped the GloBallast in generating a successful global effort in developing an international regulatory framework in order to address the concern regarding the aquatic intrusive species in vessels ballast. The initial phase of this discussion concluded in 2004 whereby an important milestone was achieved when the adoption of the Ballast Water Management (BWM) was done by the IMO member states (IMO, 2019e).

The primary objective of the GloBallast in general was to support the developing countries, as stated earlier to ease the threat of introduction of marine invasive species by vessels ballast water while the second phase of the project focused on developing tools and strategies for sustainability, driving local coordination and co-operation, expanding the government and port management capacities and initiating the legal, policy and institutional reforms at the national level for partnering countries such as Colombia, Croatia, Egypt, Ghana, Jamaica, Argentina, Bahamas, Chile, Jordan, Nigeria, Panama, Trinidad and Tobago, Turkey, Venezuela and Yemen (IMO, 2019e).

The International Maritime Organization (IMO) implemented the GEF-UNDP-IMO GloBallast Partnership Programme (2008 - 2017) after the accomplishment of the initial 'Global Ballast Water Management' Project (IMO, 2019e). The implementation by IMO was done to withstand the pressure globally in tackling the ballast water problem and to speed up the state-of-the-art global partnerships to further develop possible solutions (IMO, 2019e).

Accordingly, the Project also focused on developing technological solutions, exchange of information and enhancing knowledge globally in order to support marine biosecurity enterprises (IMO, 2019e). Some of the noteworthy achievements of this project were the establishing of the GloBal TestNet, a network of organizations involved in testing for the type approval and certification of ballast water systems, organizing of the international R&D Forums and Conferences that were considered as one of the most important specialized gatherings in this area of knowledge, having 30 technical publications on different aspects of BWM and producing 6 demonstrations sites for PBBS (Port Biological Baseline Surveys).

IMO is currently implementing the GEF-UNDP-IMO GloBallast Partnerships Programme (2008-2016) to sustain the global momentum in tackling the ballast water problem and to enhance the innovative global partnerships to develop possible solutions following the achievement of the initial 'Global Ballast Water Management' Project (IMO, 2019e).

At that period, Turkey carried out some issues in order to align with GloBallast project. First of all, the Decision of the Council of Ministers on the date of 8 April 2014 and numbered 6531 of our country is a party to the Convention and entered into force after being published in the Official Gazette dated 28 August 2014 (DTO, 2014). It reached 83 countries and 81% of the GRT in terms of tonnage worldwide (IMO, 2019g).

With the entry into force of the Convention, regional cooperation was established in the critical areas of the sea to solve the ship ballast water problem. In this context, within the scope of the IMO Globallast Partnership Project Turkey hosted various training and workshops. In the Regional Task Force established with the Mediterranean countries, Turkey carried out the project as the leading country together with Croatia.

Within this scope, the main objectives of the GloBallast Partnership Program are determining aims for developing countries likewise; coordination, communication and training regards to ballast water management, awareness raising, ballast water risk assessment, ballast water management measures, compliance with contracts, implementation and monitoring, regional cooperation, resource and financing (IMO, 2019e).

3.4. Orientation Period for BWM Convention in Turkey

The BWM Convention entered into force on 8 September 2017 and preparations have been initiated by the Ministry of Transport and Infrastructure. Under the aforementioned Convention, the Turkish Flag vessels have been delegated authority to Class Organizations for the survey and certification of Ballast Water Management and for the preparation of Ballast Water Management Plans (DTO, 2017).

The ships with Turkish flags must have a type approval certificate of the ballast water treatment devices to be equipped.

In the approval process of the type approval certificates of the ballast water treatment devices to be applied by the Administration to Turkish Flag vessels;

1. An application for type approval by the Ship Equipment / Operator or ballast water treatment device manufacturer to the Authorized Class Bodies for the device it has produced,

2. Submission of the documents and reports prepared by the Authorized Classes Institution in accordance with the decision of MEPC.174 (58) to the General Directorate of Coastal Structures and Shipyards, together with the appropriate opinion report of the Authorized Classes Organization for the mentioned device,

3. The General Directorate of Coastal Structures and Shipyards shall inform the General Directorate of Marine and Inland Waters of the Ministry of Transport and Infrastructure and Class Organizations whether the documents and equipment in question are eligible,

4. As a result of the controls to be carried out, the procedures for issuing a Type Approval Certificate by the Administration to the Ballast Water Treatment Devices which are considered to meet the requirements of the (G8) Guideline entered into force by the IMO decision MEPC.174 (58), will be followed,

5. Since the Convention entered into force on 08.09.2017, it was stated that the certification applications to be made within the scope of the implementation of the Convention, and application should be made immediately, in order to avoid any delays (DTO, 2017).

3.5. Ballast Water Management Plan

According to a report published by DNVGL in 2019, regulation D-1 (exchange), regulation D-2 (treatment) and regulation B-5 (sediment management) of the ballast water management plan (BWMP) elaborates on the process for discharge of the ballast water and handling of sediment. Regulation D-1 or D-2, and B-5 further ensures that cleaning of sediments and conducting ballast water discharge are in accordance with the BWMP. The author further elaborates that each vessel should be approved by the states administration in ensuring that the vessel is equipment specific. If the vessel secures both the methods, then both the procedures D-1 and D-2 could be included in the vessels plan (DNVGL 2019).

It is very important to consider the factors such as ensuring that the ballast water intake is avoided *inter alia* in shallow water and places where the propellers can stir up sediment, ensuring that the ballast water intake is avoided near sewage and industrial waste outfalls, ensuring that the ballast water intake is avoided in the dark or at night time as the bottom dwelling organisms rise to the top during these time, ensuring ballast water intake is avoided when and where phytoplankton bloom occurs, ensuring that ballast water over one hundred days old is in a low risk category, ensuring new emerging methods like thermal methods, filtration, disinfection, and ultra violet treatment is considered, ensuring chemical treatment is done to kill organisms in ballast water therefore (Sanguri, 2010).

3.6. Ballast Water Management Standards

There are significant challenges faced by the states willing to protect their seas from the introduction of harmful organisms. Thus, it has generated two significant approaches in order to meet the IMO D-2 Ballast Water Performance Standard (BWPS). These two significant approaches are ballast water exchange (BWE) and ballast water treatment. Different shipping conditions, patterns and local conditions add more complex challenges to BWE requirements (David et al., 2007), which result in the variation influence on international trade patterns and competitiveness among ports (David & Gollasch, 2008).

3.6.1. Ballast Water Exchange Standards (D-1)

Mid-ocean Ballast Water Exchange is usually recommended for decreasing the risk of introducing of unwanted species by transferring them in ballast water as its relatively inexpensive and involves ballast water management plans and increased pumping and fuel cost. *Ballast water exchange* is an operational method used to remove nonindigenous species (NIS) from ballast tanks by replacing seawater taken on in port and near-shore areas with deep, open-ocean seawater (Rabotnova, 2012). As the matter of fact, organisms from coastal waters pose little contamination risk to the deeper ocean water as in most cases these organisms are not able to survive in the open ocean. In turn, the ballast water, loaded in the deep ocean areas does not pose a big risk for a coastal area after being discharged there.

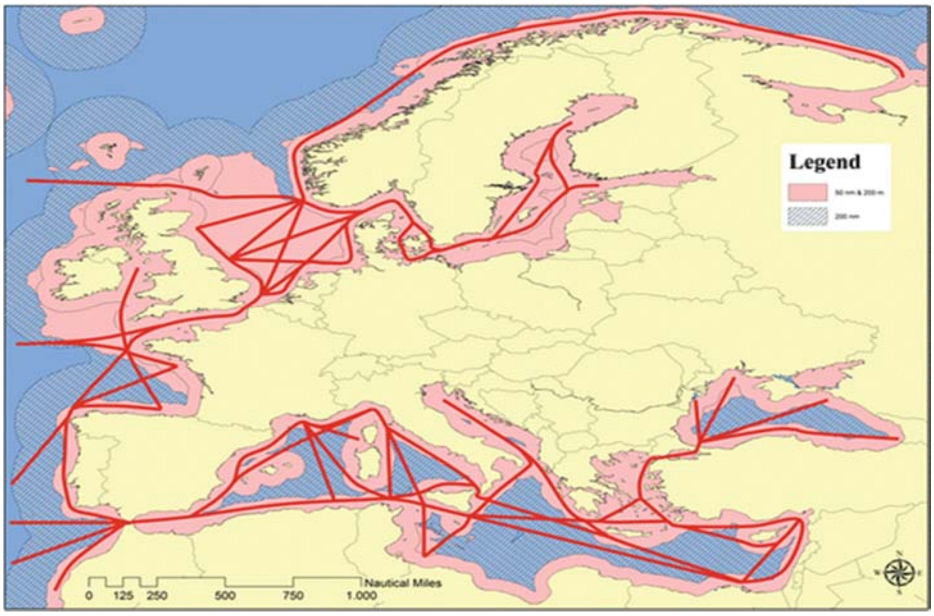
Organisms near the shore (including port and river mouths) do not usually survive in the middle of the ocean and when ocean organisms are released in coastal waters. When replacing ballast water at sea, the safety procedures for the ship and crew must be observed. In addition, the following applications are recommended:

- Wherever possible, ships should carry out ballast water exchange in deep waters, in the open ocean and as far from the shore as possible. Where practicable, the ballast water change shall be carried out at least 200 nautical miles away from the nearest land and at a depth of 200 m as taking into account guidelines developed by the organization

- Where ballast water exchange is not possible according to the above paragraph, ballast water exchange should be carried out as far as possible from the nearest shore and in any case at least 50 nautical miles from the nearest shore and at a depth of 200 meters.

- When flow through the open ocean is used by pumping ballast water into the tank or warehouse and allowing water to overflow, at least three times the tank volume must be pumped from the tank;
- If ballast replacement methods are not feasible in the open ocean, ballast replacement may be acceptable in the areas specified by the port state (TurkLoydu, 2019).

Figure 3: Appropriate sea areas for D1 standards

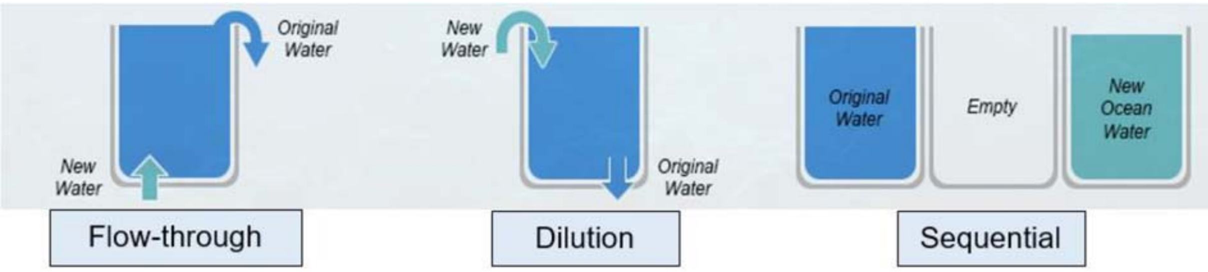


Sources: David et al., 2015.

The three different ballast water exchange method involves;

Sequential: whereby, this method ensures that the ballast tanks is emptied until the ballast pumps lose the suction and then the tanks are further stripped by eductor systems. Taking fresh ballast into the tank follows this process, **Flow through method** follows, in this method, the water is pumped into the tank and then it is allowed to overflow through the air vent or dedicated overflow vents. This is three times the volume of the tank that is to be pumped through to get a 95 percent efficiency of exchange and the final method is using the **Dilution Method**, in this method the tank has two openings whereby the water is pumped in from one opening and flows out through the other (Sanguri, 2010).

Figure 4: Ballast Water Exchange Methods



Source: (Globallast, 2014-2017c)

3.6.2. Ballast Water Treatments Standarts (D-2)

D-2 determines the maximum amount of living organisms that can be discharged into the sea, including indicator microbes that are harmful to human health.

The D-2 standard specifies that ships can only discharge ballast water that meets the following criteria:

• less than 10 viable organisms per cubic meter which are greater than or equal to 50 micrometers in minimum dimension;

- less than 10 viable organisms per milliliter which are between 10 micrometers and 50 micrometers in minimum dimension;
- less than 1 colony-forming unit (cfu) per 100 milliliters of Toxicogenic Vibrio cholera;
- less than 250 cfu per 100 milliliters of Escherichia coli; and
- less than 100 cfu per 100 milliliters of Intestinal Enterococci (IMO, 2019f).

Many different ballast water treatment methods have been developed to meet the D2 standards published by IMO. Developed and developing ballast water treatment methods can be examined under three main headings as mechanical methods, physical methods and chemical methods (Vural & Yonsel 2016).

Table 2: D-2 Discharging Standards

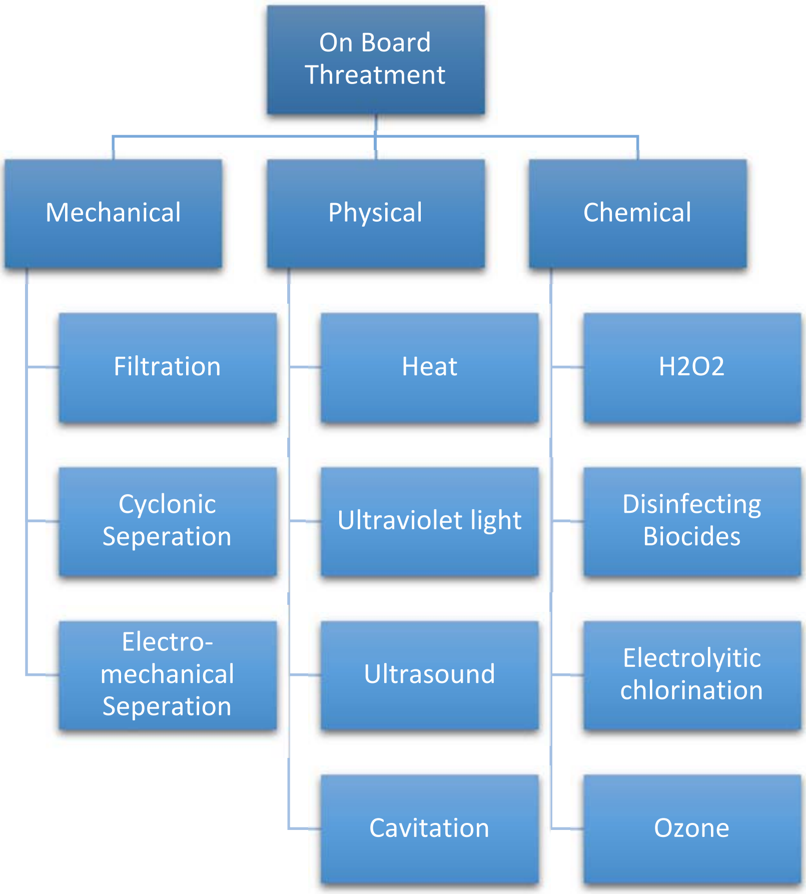
Microorganism category	**Regulation D-2**
Plankton, size > 50 μm	< 10 viable cells / m^3
Plankton, size 10-50 μm	< 10 viable cells / mL
Toxicogenic Vibrio Cholerae	< 10 Colony Forming Unit / 100 mL
Escherichia Coli	< 250 Colony Forming Unit / 100 mL
Intestinal Enterococci	< 100 Colony Forming Unit / 100 mL

Source: (Biosea, 2019).

Due to current ship and technology constraints, no method alone is sufficient for ballast water treatment. For this reason, mixed systems using more than one method are developed and introduced to the market. These systems generally have two different stages. In the first stage, the existing particles and large organisms in the ballast water are retained by mechanical methods and the ballast water is prepared for the methods of the second stage. In the second stage, treatment is carried out by using one or more methods together (Guney, 2018).

So the question is: what is the real difference between the D-1 and D-2 standards? While D-1 is concerned with ballast water exchange, D-2 determines the maximum amount of live organisms that can be discharged into the sea, including indicator microbes that are harmful to human health. The D-1 standard requires ships to carry out a ballast water exchange such that at least 95% of the ballast water is changed offshore. The D-2 standard specifies that vessels meeting the specified organism quantity criteria may discharge ballast water.

Figure 5: On Board Treatment Methods



Source: (Guney, 2018).

3.6.2.1. Mechanical Methods

The basis of the mechanical methods is to reduce the amount of organism and sediment that will reach the tank through a mechanical process before the seawater enters the ballast tank. This prevents many organisms and particles from entering the ballast tank in the first place and the organisms remain in their natural habitats. When mechanical methods are mentioned, the methods that come to mind are cyclonic separation and filtration methods (Vural & Yonsel 2016).

3.6.2.2. Physical Methods

Physical methods used in ballast water treatment include heat, ultrasound, ultra-violet, and cavitation, which purify organisms in ballast water without using a chemical substance.

3.6.2.3. Chemical Methods

Another treatment method specified in IMO standards for ballast water treatment is the use of chemicals. A chemical substance is defined as a substance or organism that has general or specific effects on harmful aquatic organisms and pathogens.

3.6.2.4. Others

Mixed systems are primary and secondary treatment systems. In the primary treatment, large particles and organisms in the ballast water are separated from the ballast water by a mechanical method. Thus, smaller particles and organisms remain in the ballast water for secondary purification (Vural & Yonsel 2016).

Many vessels carry out blended method of ballast water exchange (BWE) with respect to regulation D-1 and ballast water treatment (BWT) and generally in accordance with regulation D-2, this blended method is performing ballast water exchange together with ballast water treatment (BWE+BWT). This method is generally required by code of practice of certain locations in the United States that seek to accomplish more reliable and increased biological effectiveness while in other areas such as in the Amazon River, this method is implemented as a contingency measure in case a treatment system is astounded by local water conditions (IMO, 2019c)

3.6.2.5 Methodology for Addressing Risk Resulting From the Treatment Process

Although, the application of treatment process (D-2) has several advantages to avoid invasive alien species to the oceans, it contains some risks for both the vessel and crew.

In order to ensure the safe handling and storage of chemicals used to treat ballast water and the development of safety procedures to address the risks the following subjects, as appropriate, should be subject to a safety assessment:

- The loading and storage of chemicals or preparations onto the ship;
- The transfer and application of chemicals or preparations from storage to the ballast water management system;
- The position of the ballast water management system and associated piping;
- Operation of the ballast water management system;
- Maintenance of the ballast water management system;
- Spillages from the ballast water management system; and
- Exposure to treated ballast water, chemicals or preparations (IMO, 2009).

In addition, according to BWMC (Regulation B-4-4), the exchange shall not be required “if the master reasonably decides that such exchange would threaten the safety or stability of the ship, its crew or its passengers”.9

3.6.3 Alternative Options

In order to comply with Ballast Water Regulations, some ship-owners are inclined to benefits from port based treatment systems for valid reasons likewise the ships are so old as to make any investment.

To ensure efficient operationS for smaller vessels and in ports, an innovative version of the BawatTM BWMS is already available for use in vessels and ports. The design engages a custom-made 30-foot container (200 m3/h system) with heat exchangers and oil fired boiler system, connectors, power supply and hoses. This innovative system is called "one pass" system and is applicable for other water related treatments such as dealing with water and debris from in-water cleaning of hulls and other water and wastewater disinfection purposes (Baumler, 2019b).

3.7. Ballast Water Convention Annex and Technical Guidelines

The Ballast Water Management Convention is consisted of an Annex with 5 sections and 14 Guidelines which have been constituted to facilitate the missions of port state authorities, ship-owners and seafarers, class societies, manufacturers (such as for ballast water treatment systems) and to promote the coordinated implementation of the different Requirements (Biosea, 2019).

3.7.1. Technical Guidelines

Several technical guidelines have been established and adopted by IMO since MEPC 53 in order to support the uniform and effective implementation of the BWM Convention (GloBallast, 2019).

The available Guidelines, which are contained in a number of MEPC Resolutions, are tabulated in below:

Table 3: BWM Technical Guidelines

G1	Guidelines for Sediment Reception Facilities	Res.MEPC.152(55)
G2	Guidelines for Ballast Water Sampling	Res.MEPC.173(58)
G3	G3 Guidelines for Ballast Water Management Equivalent	Res.MEPC.123(53)
G4	Guidelines for Ballast Water Management and Development of Ballast Water Management Plans	Res.MEPC.127(53)
G5	Guidelines for Ballast Water Reception Facilities	Res.MEPC.153(55)
G6	Guidelines for Ballast water exchange	Res.MEPC.124(53)
G7	Guidelines for Risk Assessment under Regulation A-4	Res.MEPC.162(56)
G8	Guidelines for Approval of Ballast Water Management Systems	Res.MEPC.174(58)
G9	Procedure for Approval of Ballast Water Management Systems that make use of Active Substances	Res.MEPC.169(57)
G10	Guidelines for Approval and Oversight of Prototype Ballast Water Treatment Technology Programmers	Res.MEPC.140(54)
G11	Guidelines for Ballast water exchange Design and Construction Standards	Res.MEPC.149(55)
G12	Guidelines on Design and Construction to Facilitate Sediment Control on Ships	Res.MEPC.150(55)
G13	Guidelines for Additional Measures regarding Ballast Water Management including Emergency Situation	Res.MEPC.161(56)
G14	Guidelines on Designation of Areas for Ballast water exchange	Res.MEPC.151(55) Res.MEPC.163(56)
	Guidelines for Ballast water exchange in the Antarctic Treaty Area	

Source: Tabulated by Author based on IMO, 2004

CHAPTER IV

CAPACITY OF TURKEY & CHALLENGES IN THE IMPLEMENTATION OF THE BALLAST WATER MANAGEMENT CONVENTION

According to the United Nations Convention for the Law of the Seas (UNCLOS), the rights and responsibilities of port States, flag State and the coastal State is defined as improved management of the oceans natural resources. UNCLOS further elaborates that states shall take all actions in order to control the introduction of foreign species whether they are introduced intentionally or unintentionally because these foreign species pose a threat to the marine ecosystems. This control action is also highlighted in Article 196, which clearly states that states should take all measures necessary to prevent, reduce and control the intentional or accidental introductions of alien or new species to the marine environment *(*Ranasinghe, 2016). Under Article 196 in conjunction with BWMC, states should take measures as a port State, flag State and coastal State in order to avoid invasive alien species to the unwanted area of the seas. Although, Turkey is not party to the UNCLOS, some provisions of the agreement, due to the customary law accepted by Turkey.

4.1 The Importance of ratification of Convention by the State

The essential point of the Convention is the political aspiration of a state in terms of accepting, approving, or ratifying the Convention. The Convention provides a framework for regulations oceans and seas including measures related to enforcement considerations. Convention provide Governments may demand to become parties to the Convention owing to:

- Concerns relating to the environment, human health, property and resources;
- Concerns over water quality, which affects the population, or sea areas under their jurisdiction;

- Wish to have uniform enforcement of the Convention;
- Benefits to their ship-owners (worldwide acceptance of ships);
- Benefits to their ports (means of control of pollution); or
- Concern for the worldwide environment (IMO, 2016).

4.1.1 Port State Obligations Resulting from BWMC

The port State is a state that has an authority for the inspection of foreign ships berthing to their national ports, in order to confirm that vessel is operating in conformity with the international rules and regulations. These inspections were initially proposed to be an endorsement to flag State implementation and focus on condition of ship and equipment in terms of IMO requirements. Port State control officers (PSCO) working for the government carry out inspections.

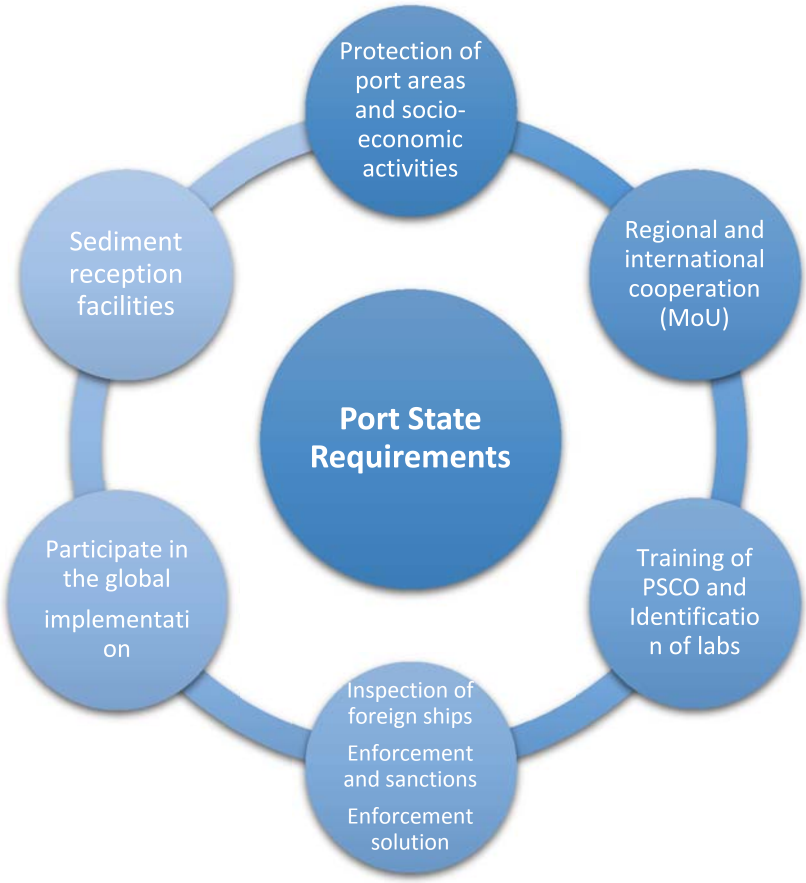
Ships are mandatory to be surveyed and certified (Article 7 Survey and certification) and may be inspected by port State control officers (Article 9 Inspection of Ships) that verify that the vessel has a legal certificate; inspect the Ballast Water Record Book; and/or sample the ballast water. Should they have some concerns, then an elaborated inspection may be carried out and "the Party carrying out the inspection shall take such steps as will ensure that the ship shall not discharge Ballast Water until it can do so without presenting a threat of harm to the environment, human health, property or resources" (IMO, 2019b). In addition to that under the BWMC (Article 12 Undue Delay to Ships), all possible efforts shall be made to avoid a ship being unjustly detained or delayed (IMO, 2019b).

Port State controllers carry out detailed inspection when no valid certificate on board; or doubts on condition of ship/equipment; or Ballast water procedures not known or not implemented. If a violation IS detected by PSCO, sanctions are applied likewise;

- Warning, detention or exclusion of the ship;

- Permission to the ship to leave the port;
- Discharge ballast water or proceed to repair yard or reception facilities; and
- Prohibition to discharge ballast water.

Figure 6: Port State requirements to address BWM

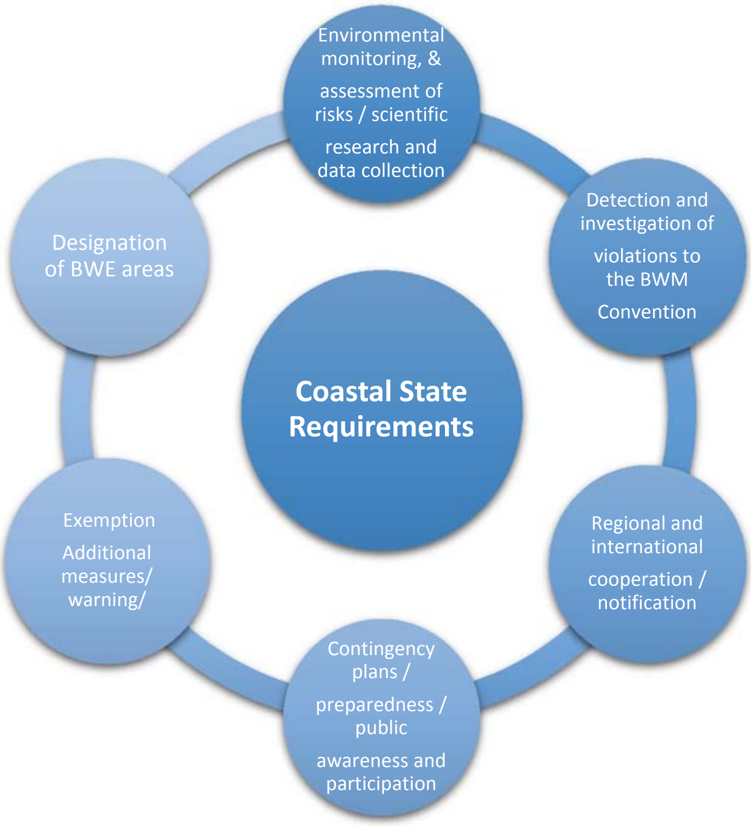


Source: (Baumler, 2019a)

4.1.2 Coastal State Obligations Resulting from BWMC

The Coastal State are responsible for carrying out environmental monitoring program, risk and scientific assessment, collection of data and research, designation of ballast water exchange area, exemptions and to take additional measures, to conduct regional and international cooperation with other states, detection and investigation of violations to the BWM Convention, to prepare contingency plans and the last but not least awareness and preparedness of publics.

Figure 7: Coastal State requirements to address BWM



Source: (Baumler, 2019a)

4.1.3 Flag State Obligations Resulting from BWMC

The flag State is responsible for the training of the crew and transfering of the technology of treatment systems, to detect breach and to apply sanctions, investigation of accidents, to follow regulation and survey, to certificate recognized organization, to carry out the approval process of BWM system and oversight of prototypes and to prepare guidance for national fleets likewise safety of BWM operations, limitation on BW uptake, etc.

The flag States mainly focus on the implementation phase of ships and as doing approval, survey and certification for prevention.

Figure 8: Flag State requirements to address BWM

Source: (Baumler, 2019a)

4.2. Capacity of Turkey in terms of Maritime

4.2.1 IMO Category C

The elections for the membership of the International Maritime Organization (IMO) Council were held on December 1, 2017 within the framework of the 30th General Assembly of IMO in London. In the elections in which 46 countries competed for the membership of the Council, Turkey was re-elected as the Council member after Singapore with 138 votes in the C category.

4.2.2 MARPOL 73/78

It was the most widely accepted and the most comprehensive convention in the international arena and Turkey became a party to MARPOL 73/78 on 24 June 1990. The contract consists of six (6) Annexes. Turkey became a party to all Annexes of the Convention.

4.2.3 STCW Convention

Turkey has been in the “White List” indicating that fulfil literally the requirement of Standards of Training, Certification and Watchkeeping Convention (STCW) and this list issued by International Maritime Organization.

4.2.4 Number of Seafarers

Turkey is one of the world's leading seafarers countries and will play an important role in seafarers' supply in the coming years. Turkey has actively worked 118 539 seafarers and The number of active officers is 47.310 and the number of active crews is 71.229.

4.2.5 White list, amateur seafarers and number of shipyard

As a result of effective and intensive Inspection and Training, Turkish flagged ships were transferred from the Black List to the Grey List in 2006 and to the “White List in 2008 during port audit under the Paris Memorandum. Our country ranks 3rd in yacht construction and 6th in shipbuilding.

Turkey that is surrounded by seas on three sides, has rediscovered the maritime and since 2002, more than 100 thousand people have been granted amateur seaman's certificate. Turkish owned fleet ranks 15th in the world. In 2002, the number of active shipyards increased from 37 to 78. Many investments in the sector have been made or planned to be made with the private sector.

4.2.6 Authorized Institutions

The bodies that are authorized to carry out surveys and certification on behalf of the Ministry of Transportation and Infrastructure on ships with Turkish flags are Türk Loydu (TL), American Bureau of Shipping (ABS), Nippon Kaiji Kyokai (Class NK), Lloyd's Register (LR), Det Norske Veritas - Germanischer Lloyd (DNV-GL), Registro Italiano Navale (RINA), Bureau Veritas (BV), Korean Register of Shipping (KRS).

4.2.7 Antifouling

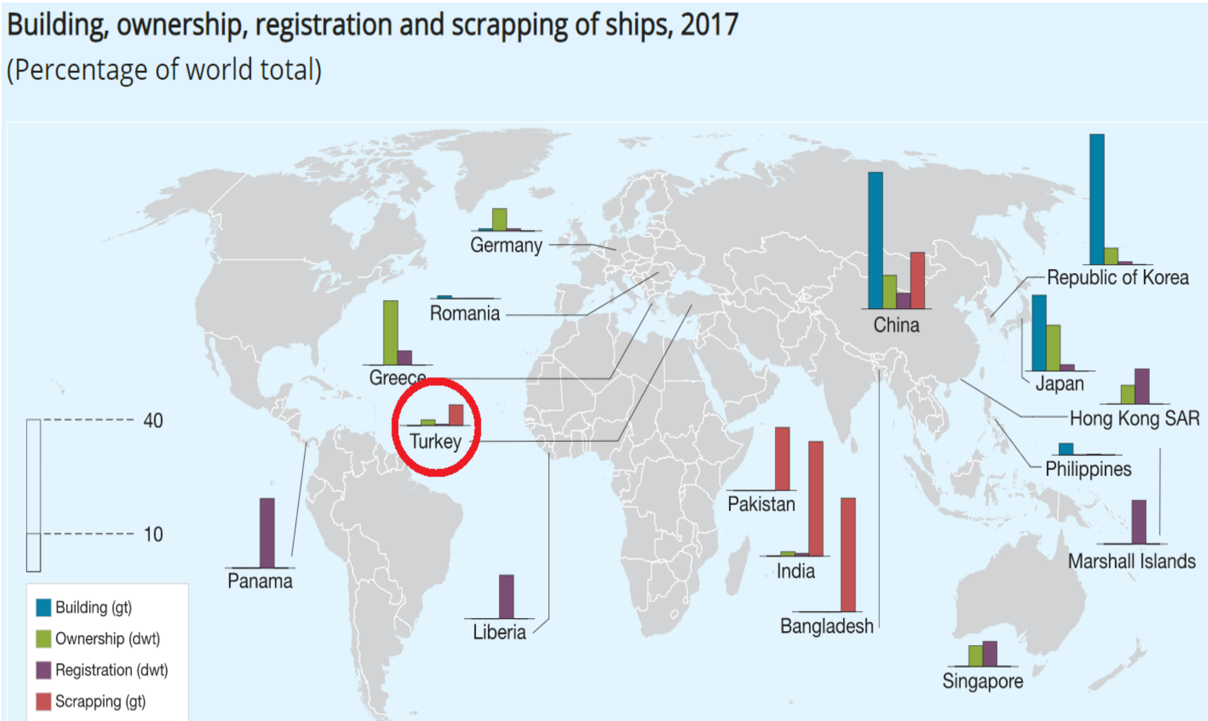
Turkey became a party to the International Convention on the Control of Harmful Anti-fouling Systems on Ships in the year 2018. The Convention aims to prevent damage to human health through the consumption of marine products and the marine environment by the systems used to prevent the attachment, proliferation of unwanted foreign organisms to parts of ships exposed to seawater. For this purpose, the use of tin-containing antifouling paints in these systems is prohibited.

4.2.8 Green Port

In maritime transport, ports, which are one of the most important parts of the logistic chain, generally serve in or near the city center. It is important to increase the environmental sensitivity of the ports to the highest levels by providing energy savings in the port operations and keeping the energy efficiency at the highest level in order to make the ports more compatible with the environment. Therefore, the Port Green Port project was initiated and the first Green Port certificate was granted in July 2015 within the scope of the project carried out by Turkey. As of 2019, 15 ports have a certificate of “Green Port” and one out of 15 is located at Black Sea (UAB, 2019).

Turkish owned maritime trade fleet (1000 GRT and above); As of January 1, 2018, there has been an increase of 165% in terms of number and 228% in terms of tonnage. The World Ranking of the Country Fleets by DWT (1000 GT and Above) (2017) is in the 15th place.

Figure 9: Building, registration and scrapping of ships

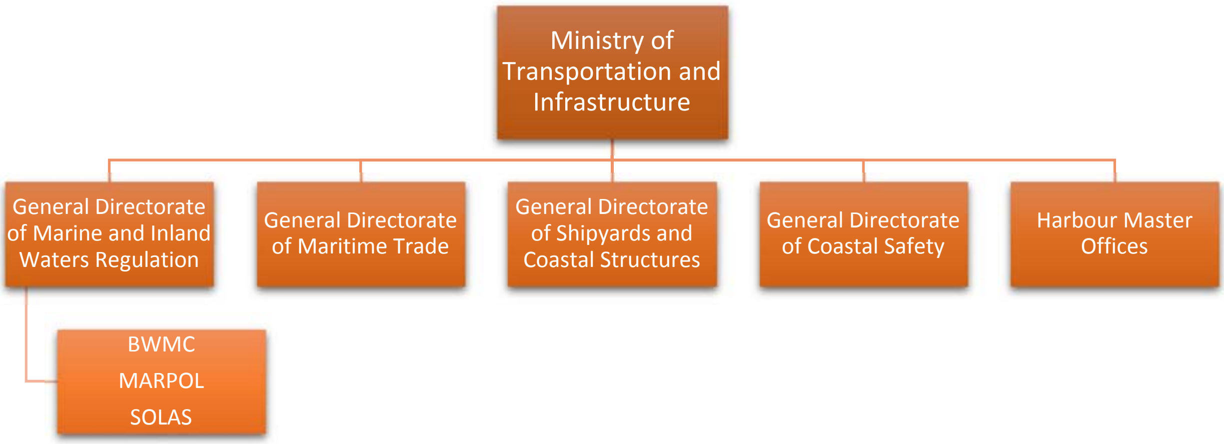


Sources: (UNCTAD, 2018).

4.3 Maritime Administration

The General Directorates and Harbor Master Offices under the Ministry of Transportation and Infrastructure in the Turkey fulfill all activities related to maritime issues. General Directorates related to maritime are shown in figure 10.

Figure 10: Organizational Chart



Source: (UAB, 2019)

4.4 Implementation Challenges Pertaining to BWMC

4.4.1 Technical Challenges

4.4.1.1 D2 Standards

According to the G2 guideline as outlined in (IMO, 2008), the samples used to determine a ship's compliance should represent the whole discharged ballast water. According to (Carney et al., 2013), even though G2 guideline states that samples are compulsory, it does not portray clear guidelines on how to obtain these samples and the representativeness of ballast water samples has not been discussed clearly on this.

When implementing, G2 strategies need sampling regimes in order to provide samples, which represent the whole discharge of ballast water when defining compliance with Regulation D-2. Several major challenges occur such as development of protocols, which precisely assess the compliance with the D-2 standard as operation, and implementation of the Ballast Water Convention is approached. There are also several factors that affects the accuracy of assessments such the number and size of ballast tanks as large volume of ballast water, the heterogeneous dispersal of organisms within tanks and the shape of the tank. These factors generally obstruct efforts in obtaining samples that actually represents the total ballast water onboard a vessel (Carney et al., 2013).

The distribution of marine organisms within the ballast tanks is known as heterogeneous (Murphy et al., 2002; Goulash and David, 2010) and possibility is that this will obstruct and delay the collection of samples, which will naturally represent the entire ship. Other difficulties come across while obtaining these samples from ballast tanks include the presence of sediments and irregular shapes of the tanks, the large volume of ballast water present in vessels and differential locations of ballast water uptake (Murphy et al., 2002) (Carney et al., 2013). The frequency of collecting samples from the tank discharge also affects the accuracy of the data obtained since samples are taken at frequent intervals at a rate of approximately 2 minutes throughout the whole discharge of the tank to obtain an accurate idea of organism distribution in the ballast water tank. Samples generally require analysis, which would be very high, and the time required to do this would causes unnecessary delay to the ships operation, departure or movement (IMO, 2008).

Sampling vessels ballast water for compliance would be realistic by reducing the sampling frequency, which will cause the accuracy of the data to decrease but this required sampling frequency is not finally determined in the G2 requirements (Carney et al., 2013). Ballast water treatment will be required to meet the agreed standards for ballast water discharge.Another challenge is the uncertainty of the equipment’s safety and the performance stability of the products manufactured according to the 2016 Guidelines (G8) or special requirements. Furthermore, the experience on the application and maintenance of the new equipment needs to be précised and developed thus, all these indicates that the products of the new generation are not yet mature in technology and equipment manufacturers globally need more time to optimize and improve their products’ performance.

Delaying the implementation of the D-2 standard for two years also poses a positive challenge for the ship owners and shipping industry as the delay can ease many issues currently faced by ships and will guide ship-owners to use new BWMS manufactured according to the 2016 Guidelines (G8) in a better manner and allow manufacturers of BWMS to carry out research and production in a more rational way.

Another challenge is that the old equipment's, with multiple drawbacks in technology, safety and energy efficiencies being installed and used on a large scale, which is contradictory to IMO's original intention when adopting the 2016 Guidelines (G8), makes the implementation and operation costs uncontrollable for ship owners and these are considered unfair for ship owners and equipment manufacturers.

Finally it is recommended to focus on the long-term goal, instead of the short-term one, and leave sufficient time for the industry to provide BWMS products complying with the 2016 Guidelines (G8) for the market on a large scale by assuring that as many ships as possible are installed with BWMS complying with the 2016 Guidelines (G8), instead of requiring them to install products of the first generation in a hurry, is considered a better way to ensure ballast water discharged complying with the D-2 standard. This approach is also more beneficial to the environment and human health (IMO, 2017a).

4.4.1.2 Environmental Exposure

The international approval procedure of ballast water treatment systems compares the estimated exposure levels of individual substances with their experimental toxicity. While well established in many substance regulations, this approach is also criticized for its simplification, which may disregard critical aspects such as multiple exposures and long-term sub-lethal effects.

International Maritime Organization (IMO) approved the developed systems based on various physical and chemical methods for on-board installation; the most common are the combinations of high-performance filters with oxidizing chemicals or UV radiation. A well-known problem of oxidative water treatment is the formation of disinfection by-products, many of which show long-term toxicity. In natural biota, genetic damages can affect reproductive success and ultimately influence biodiversity. Initiation of genetic damage in natural biota could serve as a sentinel for dangers to human health by environmental pollution and stimulation of genetic damage indicates a possible threat to biodiversity (Werschkun at. Al., 2014).

In most cases, mechanical separation of larger particles by filters or hydro cyclones constitutes the first action step. While these systems have no potential to cause chemical threats to the environment and to the humans, their weaknesses are high-energy consumption and potential performance problems in waters of high turbidity or a high content of dissolved organic matter, which may decrease the penetration of UV light. Therefore, unwanted organism cannot be destroyed by treatment system owing to inadequate UV penetration.

The number of generated disinfection byproducts (DBPs) need to be determined analytically in treated water during BWMS testing due to the quantities of active substances applied in the operational schedule of BWMS, Human and environmental revelation to ballast water related chemicals is first and foremost determined by the quantities of chemicals that may be released by BWMS. (Werschkun at. Al., 2014).

4.4.1.3 Human Exposure

Many details depend on the type of system such as whether it involves frequent cleaning and maintenance procedures or it requires the storage of chemicals on board. Possible exposure to chemicals from BWMS can be anticipated in particular for the ship's crew and for port state inspectors, but also for the public. Work-related disclosure to BWMS related chemicals may occur through dermal contact, which can be barred by appropriate protective clothing and equipment, or through inhalation of volatile substances such as THMs, emitted from treated ballast water into the surrounding atmosphere.

IMO circulated a guidance document detailing the possible exposure situations that should be addressed when setting up a BWTS on board a specific ship in order to help ship owners to protect their crews from chemicals associated with ballast water treatment (IMO, 2009). Non-occupational contact situations also include oral intake of chemicals by swallowing diluted ballast water during swimming or by the consumption of seafood from ballast water discharge areas (Werschkun at. Al., 2014).

4.4.1.4 Alternative Options

Procedures to deal with ballast water discharges from ship repair yards are usually foreseen by the reception amenities for untreated ballast water. Therefore, it is considered as part of contingency measures in ports for discharges that do not meet Port State control requirements with regard to harmful aquatic organisms (IMO, 2019d).

Ship owners are required to comply with new ballast water regulations (installing water treatment systems on boards) while also considering another possibility for those ship owners that may not want to have a treatment system on board because their vessels operates on a non-Exempted permanent routes or their vessels are old to make any further capital investment. Ballast Water Treatment in ports is another alternative solution towards invasive mobile ballast water discharge and also there could be some other possible solutions required for ports that needs to offer back up in case of emergencies when ships on board treatment systems fails. Baumler, 2019b).

The dispute, however, is that systems are not working properly in ports with challenging water quality i.e. muddy water ports. According to the report (MEPC 71/4/21), during ballast uptake of muddy water, systems are blocking or ballasting operations are delayed beyond unexpected limits due to frequent start/stop back-flushing.

During the operations, when the ship up take ballast water from the muddy water ports and discharge it to the port based treatment systems, system might not work and count organisms properly because of the density of water. At the same time, in the Black Sea region, precipitation and river inputs are at high level so, the water is able to change readily to muddy water and the ship up taking ballast water from the Black Sea ports has a high probability to face problems at the next port based treatment investigation.

4.4.1.5 Flag State Related Problems

Officers and crew must be properly trained and competent to carry out their assigned ballast water management duties and functions once a ballast water system has been selected. For the Flag states should sufficiently train crews to operate, the equipment is one of the biggest concerns about the convention. Procedures for training in and familiarization with BWMC should be incorporated in the company safety management system and should include knowing vessels ballast water management plan and assigned duties within, operation and maintenance of the vessels BWMS, emergency procedure, and how to record entries in the vessel's ballast water record book. Since ship crew's turnover is high, the manufacturer may provide training for the crew using the newly installed system, but there is going to be a need for wider training on maintenance and operation (Baumler, 2019b)

By the nature of maritime shipping sector, changing of crew happens frequently and it could be give rise to lack of training on some specific system i.e. on board ballast treatment. Hence, the system, which is not used properly, invites the spread of invasive specious.

4.4.1.6 Port State Related Problems

According to the IMO, commercial ships transport 3 to 5 billion tons of ballast water and potentially invading micro-organisms from one place to another. This threatens endemic species and biodiversity in some regions. In other words, some living creatures move beyond the borders into the tanks of ships, which they cannot naturally cross and move to places they should not be. These examples are ripe in the Black Sea.

At that point, Port State control officers (PSCO) have an important responsibility to prevent that by doing conscious inspection to the vessels.

During the observation phase of this study, author and port State control officer together visited a few different ports and routine inspection was carried out at the ports by PSCO. According to observation, however, it is detected that BWMC is not being known properly and it is because not only the convention got into force recently, but also in terms of frequency, the inadequate training programs carried out at the International level. As a second, in general, PSCOs background are from the maritime sector (i.e. naval architect, maritime transportation and management engineering) and they are not master on invasive species and they have lack of awareness on how those effects might be dangerous both economically and environmentally.

4.4.2 Economical Challenges

Standard vessels must meet the legal standards to release their ballast water since the convention entered into force and crews on any ships are found to violate this could face prosecution, costing port state controls, ship operators, port authorities, ship proprietors and cargo owners millions of dollars (Carney et al., 2013).

Bearing in mind that the United States (US) still has not given type approval to a certain type of ballast water treatment system. Accordingly, from the point of ship-owners, alternative systems, which the US has allowed for 5 years until it approves a treatment system, also have a cost, and demanded a clarification by pointing out the difficulties that the investment will cause again after 5 years.

On the other hand, the cost of ballast water treatment systems can range from $200,000 to several million USD, depending on technology, capacity and ship. In addition, additional costs such as the creation of ballast water management plan, shipyard costs and cost for lost time are waiting for the ship-owners According to sources, this system needs to be installed on about 50,000 ships around the world, and only the cost of the systems reaches $ 50 billion for world shipping (DenizHaber, 2016).

Turkey is also one of the countries that signed the convention whereby the Turkish-owned fleet of about 1,500 vessels will be affected in some way by this convention. Since all ships of 500 gross tons and above will be subject to this contract, the cost is expected to be around 200,000 to 400,000 US dollars per ship at the lowest levels. In terms of price, the physical condition of the ship, the frequency of the voyage, and the number of times it changes the sea play a role. Prices may increase exponentially in a short time due to necessity and order density. On the other hand, it is expected that ballast water reception facilities will be established in the ports and systems are being developed in order to provide ballast treatment services to ships that do not have a ballast water treatment system for a fee.

This may have a serious impact on general cargo and dry cargo ships between 1,000-12,000 dwt, which are referred to as coaster. There are already a large number of aged ships, especially in the Eastern Mediterranean and the Black Sea. In the region, approximately 4.3 million DWT of the 10 million DWT coaster fleet is over 20 years old and 3.3 million DWT is over 25 years old. Ships under the age of 25 and over 6,000 dwt are around 2.2 million DWT. The above-mentioned costs for these vessels will be able to find the ship's own cost for 2,000-3,000 dwt vessels, aged 25 years and older under the current market conditions. For ships aged 25 and above and around 5,000-6,000 dwt will be able to reach at least 50% of the ship's value (DenizHaber, 2016).

In this case, it can be thought that many active coastal States in the Black Sea and Mediterranean basin will be scrapped or withdrawn from international trade. According to ISTFIX (Istanbul Freight Market) statistics, the segments likely to be most affected by the BWM Convention, namely the entire coaster fleet over the age of 30, plus a fleet of ships over 6,000 dwt and less than 25 years, account for 25 to 28 percent of the total coaster fleet. Although the situation in the current maritime market is not bright for the ship-owners of the younger ships, it is estimated that the ship-owners of the old ships will have a more serious crossroads. Considering the total of over 1,500 vessels, which constitute the Turkish-owned maritime fleet over 1,000 GT, the invoice in front of the Turkish ship-owner is expected to be at least half a billion dollars (DenizHaber, 2016).

The Marine Environment Protection Committee considered the document MEPC 72/4/8 (Turkey) related to the challenges on ballast water management systems (BWMS) for rescue tugboats in terms of implementation. Tugboats are not meant to be designed to make regular ballast intake and discharge operations as the merchant vessels.

Tugs operating in Turkey have various ballast water tank capacities with respect to their main dimensions and about 14% of tugs operating in Turkey have ballast water tanks in their tank arrangement (IHS Sea-web database), which were assembled between the years 1996 to 2019, with overall length less of than 50 meters. Tugs that are and will be delivered in 2019 and 2020 have been analysed and concluded that some tugboats continue to have ballast water tanks. It was understood that tugs still have ballast water transferring requirements when communicating with both tug operators and shipyards. However, this was abled in some cases by swelling the freshwater tank or oil recovery tank capacities (IMO, 2019h).

Tugs operating around the world were determined and a correlation study has been performed in order to recognize the interrelation of the ballast water tank capacity with tugs main dimensions and parameters as a second approach. There is no such characteristic pattern, which can be easily identified since tugs have different ballast water tank requirements owing to their specialized design (IMO, 2019h).

In conclusion, some ship types do not need to install BWTs to the board despite BWMC has some deficiencies in terms of installation of ballast water treatments system (BWTs). Therefore, installation of the systems to the ships will be a burden to the ship owners or the state authorities.4.4.3 Legal Challenges

4.4.3.1 Exemptions

Within a few years, some ship-owners will need to decide whether to get exempted from ballast water management or to install ballast water management systems in their respective vessels upon BWM Convention entering into force. Therefore, it is necessary to analyse the viability of ballast water management exemptions for maritime authorities and ship-owners in order to improve the assessment guidance for Same Risk Area (SRA).

1 There is a non-existence of methodological control on risk assessment employing the SRA approach, as there is no integrated assessment guidance. Currently the three risk assessment methods in Guidelines (G7) are only related to the principles, while no systematic assessment guidance for each method is provided in Guidelines (G7).

2 Considering the extensive range of marine organisms that can be disseminated by natural factors, following matters need to be considered when relating to the SRA approach since the criteria for quantity assessment and selection of species still remain unclear:

1. The number of target species selected for each ballast water recipient port needs to be further clarified following the identification of species to be assessed.
2. Selection of proper species to be assessed as it is essential for risk assessments In terms of waters under assessment. Lack of criteria for population establishment, introduction and dispersal of target species.

3 Assessment criteria need to be established to determine the invasive species ability to establish populations and disperse upon arrival of target species

4 The assessment period is preferably set not too short or too long, since it will leave a major impact on the assessment results as the assessment period is unclear (IMO.2019i).

4.4.3.2 Case Study: Uncertainty at U.S.A Territorial Sea

According to the Convention, each ship will maintain and implement the ballast water management plan. In addition, each ship will manage ballast water by keeping a ballast water record book and changing ballast water at every navigation (or by using an approved ballast water treatment system). One of the biggest challenges in this regard is that the US (make sure you use the acronym after first usage) still has not given type approval to a certain type of ballast water treatment system, while the US Coast Guard states that treatment by ultraviolet light is insufficient by its own standards. Although the manufacturers of this system argue that the US has imposed false test conditions, the investment of those who have already applied this system to their ships that will sail to the US is now in vain. On the other hand, those who have not yet invested in their ships only know what system they will not install. BIMCO expressed concern about the issue and urged the US to make a quick decision and to clearly identify which systems would be given full approval by updating IMO's Ballast Water Treatment Systems Approval Guide.

Regulation A-3 of the BWM Convention offers an exception to management for vessels that uptake and discharge ballast water at the same location so long as it does not mix with unmanaged ballast water from a different area (Verna & Harris, 2016). IMO also permits vessels to forego managing ballast water under unique geographical circumstances but this exception may be open to broad understanding until clarified to its intended, limited scope, or areas are subject to recognized risk assessment protocols. The accompanying G7 Guidelines include three risk assessment methods to determine if an exemption may be granted: environmental matching, species' biogeographically, and species-specific. The BWM Convention will consider exemptions to management provided that results of a risk assessment identifying the likelihood and consequences of species introduction and survival indicate an acceptable low risk (Regulation A-4). These risk assessments will challenge in the implementation due to their specificity, which may actually promote augmented survey and monitoring effort in areas where exemptions are granted.

Vessel exemptions from ballast water management activities are often based on geographic designations, with the assumption that vessels traveling exclusively within these regions pose a reasonably low risk of transporting non-indigenous species. However, the risk of coastwise, secondary transfer of aquatic non-indigenous species is well documented, even among ports in relatively close proximity. The United States still provides a BWM exemption for vessels traveling within one USCG Zone and vessels on “short-distance voyages”. However, these areas are not biogeographically distinguished and do not therefore inherently reduce risk of invasion. (Verna & Harris, 2016)

In the past, Ship-owners had high expectations for the BWMS that will comply with the 2016 Guidelines (G8), which created a confusion initiated by the installation and operation of the BWMS. Following the necessities of the recent MEPC session, which was encouraged by the "non-penalization" principle, many ship-owners have installed the BWMS that comply with the superseded Guidelines (G8) on their ships (IMO, 2017a).

The Major Challenge these ship owners face now is the complications brought by the technological, safety and economic issues of the BWMS in the whole life cycle of the vessel. The doubt about the implementation of the Convention further adds to the ambiguity of implementation for ship-owners. More time is required by the ship owners to absorb, accept and select suitable BWMS, which in turn will aid to enhance the operations and authority of the BWM Convention without a clear implementation target.

According to the facts provided by the ICS, 39700 ships (IACS-classed ships included) are in need of installing ballast water treatment equipment globally in the next few years’ time. In general it is a major risk to the shipping industry since only 9.9% of ships are installed with BWMS because ship owners not only have doubts about "non-penalization for early movers". Therefore, they are hesitant to install the Ballast Water Management Equipment’s that will comply with the 2016 Guidelines (G8), which are expected to offer better performance and pose a smaller amount of risks (IMO, 2017a).

CHAPTER V
CONCLUSION AND RECOMMENDATION

5.1 Conclusion

The Black Sea, which has a direct connection with the Bosporus and the Marmara Sea, has a geopolitical importance as the Black Sea countries are the only way out to the Mediterranean and Aegean Sea. Furthermore, due to the high amount of river inputs, it is high in nutritional value, and due to the lack of an offshore, it is sensitive and in need of protection at an advanced level. This sensitivity of the Black Sea brings many problems such as the struggle against invasive alien species.

Several scientists agree that invasion is not an abrupt event; it is a kind of a process and hence, has a variety of phase. For the sake of clarity, just as a cancerous cell does not give any signal or very difficult to realize it in the first phase when it encapsulates the human body, invasive species does not give any indication when it enters a new environment. However, the effect increases exponentially over time and the damage is done when it is noticed. Preventive measures is therefore, a first and foremost step in the battle against alien invasive species.

In order to create preventive measures and to act jointly on an international scale, IMO have introduced the ballast water management agreement to the member states. With the entry into force of the Convention in 2017, various innovations have been introduced to the existing standards of change, and the ballast water treatment systems are installed in ships, taking into consideration the construction year of the vessels. Thus, ballast water will be discharged after being purified by treatment systems as various methods on board.

However, with the entry into force of the Convention, different problems and uncertain situations have emerged in terms of environment, human health, technical, economic and legal basis.

5.2 Recommendations

For the effective implementation of the Convention, which came into force in 2017, the PSCO must be trained and educated for to be approach more sensitively to the invasive species problem. Therefore, the IMO should make it more frequent by increasing the training program of PSCOs. In addition, in order to fulfil more capacity building in Turkey, recommended requirement should undertake.

5.2.1 Technical Operational Recommendations

Instead of traditional laboratory methods for the analysis of ballast water samples taken from ships, the eDNA methodology, which provides much more accurate and faster results, should be applied, and therefore, it can be planned to avoid analysis-oriented delay in ship operations.

The production of BWTS, which has become a new industry, has brought a substantial burden on ship-owners while providing substantial gains to the producers. In the future decisions for the BWMC, the IMO should balance the relationship between the manufacturers and the ship-owners and should take steps that are more careful in decisions that will affect the small scales ship-owners in particular.

The last but not least, the needs of ballast water for the ships stability can be minimized and the problems encountered both economically and environmentally can be solved. For this purpose, instead of BWTS, the focus should be on the manufacture of ships that require a minimum of ballast water. Fortunately, Japan Marine United Cooperation have been pioneers in this regard and they have built vessels that designed to operate with minimum ballast water at loading conditions, owing to the superior stability and hull strength. Recommendations are based on the analysis undertaken in section 4.4.

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