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# Practical impediments to the effective utilization of Ballast Water Management Plan from Port facilities and Shipping practice

**BOVIATSIS M.[1] , POLEMIS D.[2] and TSELENTIS V.[3]**

[1]PhD Candidate, University of Piraeus, Department of Maritime Studies
[2]Assistant Professor, University of Piraeus, Department of Maritime Studies
[3]Professor, University of Piraeus, Department of Maritime Studies

*corresponding author: Boviatsis Michael
e-mail: mboviatsis@gmail.com

**Abstract:** Since the new Ballast Water Management Convention entered into force in 2017, the ballast water should be cleansed of any harmful aquatic organisms, pathogens, wastes or even bacteria, before being released into a new aquatic environment. For this purpose, the ships are required to carry i) a ballast water management plan with detailed descriptions upon the implementation of the Convention's requirements, ii) a ballast water record book, clearly stating the release spots and stations of ballast water and iii) an International Water management certificate, stating if the ship should abide the D-1 or D-2 standards. The research questions of this paper are, i) should these standards apply when ballast water is released into more aggressive aquatic environments than the one that the outgoing ballast was collected? ii) how a port authority will be able to enforce the Convention's rules when the water release happens in open waters and how a vessel can be criminalized? iii) Are the Port Facilities prepared and equipped in a global spectrum with the necessary tools to handle the ships' demand on waste water unloading? iv) is the creation of an aquatic map stating the level of threat the local organisms pose to other aquatic environments viable and how this will help with the decrease of ballast water management processes.

**Keywords: BWM Convention, Ballast Water Management Plan, BWM Record Book, BWM aquatic(bio) map**

## 1. Introduction

Since the introduction of steel ships, water has been used as a ballast to stabilize ships at sea. Ballast water is used to maintain safe operating conditions during a trip. This practice reduces pressure on the hull, provides transverse stability, improves propulsion and flexibility, and compensates for weight changes at various cargos, including fuel and water consumption (Gerharda et al., 2019).

While ballast water is essential for safe and efficient modern shipping operations, it can inflict serious ecological, economic and health damages due to the large number of marine species carried on ship ballast tanks. These include bacteria, germs, small invertebrates, eggs, cysts and larvae of various kinds (Bax et al., 2003). Transferable species can survive to create a breeding population in the host environment, making them invasive, competing other species and multiplying in proportions of pests. In the picture bellow, it is presented how the BWM system operates in practice (Chen et al., 2021).

## 2. The Root Cause of the Phenomenon

Scientists first recognized the signs of the introduction of alien species after the mass appearance of Odontella algae (Biddulphia sinensis) in the North Sea in 1903. But by the 1970s the scientific community began to analyze the problem in detail. In the late 1980s, Canada and Australia were among the countries with particular problems with invasive species and raised their concerns with the IMO Marine Environment Protection Committee (MEPC).

The problem of invasive species in the ballast water of ships is largely due to the increased volume of trade and traffic in recent decades and, as maritime trade volumes continue to grow, the problem may not yet have reached its peak. The consequences in many parts of the world have been devastating. Quantitative data show that the rate of bio-invasions continues to grow at an alarming rate and new areas are constantly being introduced (David et al., 2019).

The spread of invasive species is now recognized as one of the greatest threats to the ecological and economic well-being of the planet. These species cause enormous damage to the biodiversity and precious natural wealth of the land on which it depends. The direct and indirect effects on health are becoming increasingly serious and the damage to the environment is often irreversible.

Preventing the transfer of invasive species and coordinating a timely and effective response to invasions requires cooperation and collaboration between governments, the economic sector, non-governmental organizations and international treaty organizations. The United Nations Convention on the Law of the Sea (Article 196) provides the global

framework by requiring States to work together to prevent, reduce and control marine pollution, including the deliberate or accidental introduction of a specific part of the marine environment, which can cause significant and harmful changes in it.

The International Maritime Organization (IMO) has been at the forefront of the international effort, committing itself to tackling the transport of infiltrating aquatic species (IAS) via shipping. In 1991, the MEPC adopted international guidelines for the prevention of the introduction of unwanted aquatic organisms and pathogens from ship ballast water and sediment discharges (MEPC resolution.50 (31)). While the United Nations Conference on Environment and Development (UNCED), held in Rio de Janeiro in 1992, recognized the issue as a major international concern.

In November 1993, the IMO Assembly adopted Resolution A.774 (18) on the basis of the 1991 Guidelines, requesting the MEPC and the MSC to review the Guidelines with a view to developing legally binding provisions. The organization adopted Resolution A.868 in November 1997 (20) - Guidelines for the control and management of ballast water in ships to minimize the transport of harmful aquatic organisms and pathogens, calling on its Member States to use these new guidelines when addressing the issue of IAS.

After more than 14 years of complex negotiations between the IMO Member States, an international convention on the control and management of ballast water and sediment (BWM) was adopted by consensus during a diplomatic conference held at the IMO headquarters in London. On 13 February 2004, the Secretary-General of the International Maritime Organization stated that the new Convention would be an important step in protecting the marine environment for this and future generations. "Our duty to our children and their children cannot be exceeded. I am sure we would all like them to inherit a world of clean, productive, safe and secure seas - and the outcome of this conference, by eliminating an increasingly and more serious threat, will be necessary to ensure this".

## 3. The Ballast Water Management Convention

The BWM Convention entered into force on September 8, 2017. The Convention requires all ships to implement a ballast water management plan. All vessels must carry a ballast water logbook and are required to perform ballast management procedures to a given standard. The contracting parties to the contract have the possibility to take additional measures which are subject to the criteria set out in the contract and the IMO guidelines.

Several articles (such as 2 and 9) and the Annex (Section B and D) of the BWM Convention refer to guidelines to be developed in Resolution 1 of the Organization and the Conference, called on the IMO to urgently develop these guidelines and to adopt them as soon as possible and, in any case, before entry into force of the Convention, with a view to facilitating the universal and uniform application of the instrument.

Initially, MEPC, at its fifty-first meeting in April 2004, approved a program to develop guidelines and procedures for the uniform implementation of the BWM Convention listed in Resolution 1 of the Conference, including additional instructions required but not included in the resolution. The program was further extended to the fifty-third session of the MEPC in July 2005 to develop and adopt 14 sets of guidelines, the last of which was adopted by MEPC Resolution.173 (58) in October 2008. The guidelines, some of which have been revised since their initial approval and have access to various other relevant guidance documents (Outinen et al., 2021).

During the development process of the Convention, significant efforts were made to develop appropriate standards for ballast water management (Annex, Section D). These are the ballast water exchange standard and the ballast water performance standard. Vessels performing ballast water exchanges must do so with a ballast volume efficiency of 95% and vessels using a ballast management system (BWMS) must meet a performance standard based on agreed organisms per unit volume (Chen et al., 2021).

According to Regulation D-3 of the BWM Convention, ballast water management systems used to comply with the Convention must be approved by management taking into account the guidelines for the approval of ballast water management systems (G8). The guidelines (G8) were revised in 2016 and became mandatory code for the approval of ballast water management systems (BWMS code).

Regulation D-3 also stipulates that ballast management systems using active substances to comply with the Convention must be approved by the IMO in accordance with the approval procedure for ballast water management systems using active substances (G9). Procedure (G9) consists of a two-step process - basic and final approval - to ensure that the ballast water management system does not pose excessive risks to the environment, human health, property or resources.

A technical team of experts has been set up under the auspices of GESAMP to review the proposals submitted for the approval of ballast management systems using Active Substances. The GASAMP Working Water Group (GESAMP-BWWG) reports to the Agency on whether such a proposal poses excessive risks in accordance with the criteria set out in Procedure (G9).

The contract requires review to determine if there are appropriate technologies to achieve the standard. The MEPC conducted a series of such revisions and agreed that appropriate technologies were in place to meet the standard contained in Regulation D-2 of the BWM Convention (Outinen et al., 2021).

The adoption of all the necessary guidelines for the uniform implementation of the BWM Convention and the approval and certification of modern ballast water treatment technologies have posed serious obstacles to the ratification of the instrument and some other countries have stated their intention to accede to this Convention in the near future (Wang et al., 2020).

## 4. The extend of the Impact of Ballast Water to a Region

Ballast water does not affect only the maritime sector or the environment in general, but also the everyday lives of the habitants near the affected areas. The outcome of this phenomenon is that the affected ecosystem is drastically changed, with severe environmental, health and even economic consequences. In several countries, introduced, microscopic, 'red-tide' algae have been absorbed by filter-feeding shellfish, such as oysters. When eaten by humans, these contaminated shellfish can cause paralysis and even death (Gollasch et al., 2020). Studies revealed that in North America, the introduced European Zebra Mussel has infested over 40% of internal waterways and over US$5 billion has been spent on control measures since 1989. The list goes on, hundreds of examples of major ecological, economic and human health impacts across the globe. It is even feared that cholera may be transported in ballast water. There are hundreds of other organisms carried in ballast water that cause problematic ecological effects outside of their natural range around the world (David et al., 2019).

The outcome of ballast water can be successfully summarized in the bellow mentioned categories: i) the extermination of the species populating the area before the "new-transferred" via ballast water species emerge, ii) the gradual denaturation of the local and regional biodiversity, leading to the destruction of vast ecosystems, iii) direct impact of public health, with the proliferation of many malicious bacteria and other hostile microorganisms to human health, iv) severe impact on local economies, such as fisheries, tourism attractions and other human coastal activities, v) finally, direct effects on coastal industries that use water extraction and water-based resources as material for their production (Wang et al., 2020).

## 5. Present issues and proposed solutions

As already is discussed above, the BWMS is currently expanding rapidly, but there are many cases where there is an overload internally on shipping companies, upon handling the newly-required processes, or even externally when inspections are carried out or external stakeholders are included as part of the process. In order to extenuate the amount of operation required, an option would be for these standards not to be applied when ballast water is released into more aggressive aquatic environments than the one that the outgoing ballast was collected. In order for this plan to be implemented, we need a global map, describing, analyzing and marking the aggressiveness of biodiversity into a regional level. By utilizing a "bio-map" such as this, we will considerably simplify the operational processes, by creating a filter before the initiation of each BWM process, evaluating if the utilization of the BWM process will be actually impactful (Chen et al, 2021).

Another aspect, regarding how a port authority will be able to enforce the Convention's rules when the water release is implemented, has already been handled initially by US coast guard and gradually by other authorities into similar cases to ballast water. Namely, US Coast Guard has developed a process of notifying a source of pollution, such as oil or other waste, investigating the maritime routes of all passing ships in the area and locating the liable vessel. As it is known, the oil and other wastes have individual characteristics that make them distinct from all other. The same applies for the ballast water, especially when the BWM processes require sampling, as already analyzed above. Even if the illegal spilling of ballast water is implemented in open waters, the same process as with oil spills is utilized, namely when the ballast water carrying malicious microorganisms enters the EEZ of a country, this state can criminalize the act pursuant to the National or International Legislation (eg. UNCLOS Article 204) (David et al., 2015).

To the question if the Port Facilities are prepared and equipped in a global spectrum with the necessary tools to handle the ships' demand on waste water unloading, the answer becomes complicated. The most efficient method for the ports to actually handle this issue is proactiveness and adaptation. Specifically, the ports could actually measure the volume of required actions, before these actually materialize and install the proper quantity of equipment in order to respond to demand and avoid conjunctions. Additionally, the utilization of other equipment, such as secondary tanks, pumps from cargo handling or even installed temporarily to supportive ships, such as tugs, can actually reciprocate to sudden spikes in demand for ballast water treatment.

Finally the abovementioned plan of creating an aquatic map, stating the level of threat that the local microorganisms pose to other aquatic environments, can only be achieved through a coordinated action plan of IMO involving all member states (BWM Convention members and non-members). Specifically, each member state should provide sufficient data from their sovereign areas of the biodiversity. All those data should be collected and evaluated from the same working group, which will compare the aggressiveness of each nation's biodiversity, as depicted by each respective national data gathered. Based on this method, an international "bio-map" evaluating the biodiversity aggressiveness status of each region can be created, adding to the operational efficiency and effectiveness of BWM methods and processes (David et al., 2015).

## 6. Conclusion

Ballast water is essential for safe and efficient modern shipping operations, but it creates at the same time severe ecological problems, due to the multitude of marine species carried in ships' ballast water. The ballast water includes bacteria, microbes, small invertebrates, eggs, cysts and larvae of various species.

When ballast water is loaded many microscopic organisms and sediments are introduced into the ships ballast tanks, with the majority of them being able to survive in those tanks. If suitable conditions exist in the

region where those microorganisms are released, they will start to reproduce, harm the existing biodiversity and become invasive species. Potentially, these microorganisms can i) exterminate the native species, ii) destroy the local and regional biodiversity, iii) harm the public health, iv) inflict damage to regional economies and v) negatively affect coastal industries and endeavors.

The International reaction to this phenomenon was the initiation of the BWM Convention, which regulated the operational processes, required for ballast water handling, and the installment of D-1, D-2 and D-3 standards. But an outcome to the rapid expansion of the BWM Regulation was the lack of equipment and proper organization from port-authorities and other stakeholders in order to satisfy the present demands from ship-owners. Some viable options to limit the present market demand, in order for the port authorities to evaluate and invest in the proper equipment are the modification of the existing supportive equipment in port authorities and the utilization of tugs and other supportive ships. Additionally, with the coordinated effort from all nations, a "biodiversity" map may be drafted, evaluating the biodiversity aggressiveness status of each region, thus providing a filter before the initiation of each BWM process, evaluating if the utilization of the BWM process will be actually impactful.

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