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WORLD MARITIME UNIVERSITY

Malmö, Sweden

THE IMPLEMENTATION OF THE BALLAST WATER MANAGEMENT CONVENTION IN TIMOR-LESTE

DOMINGOS XIMENES NUNES

Timor-Leste

A dissertation submitted to the World Maritime University in partial fulfilment of the requirements for the reward of the degree of

MASTER OF SCIENCE

in

MARITIME AFFAIRS

(MARITIME SAFETY AND ENVIRONMENTAL ADMINISTRATION)

2021

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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): **20/09/2021**

Supervised by: Capt./Dr. Raphael Baumler
Professor
World Maritime University

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Abstract

Title of Dissertation:

The implementation of the Ballast Water Management Convention in Timor-Leste.

Degree: **Master of Science**

Carrying ballast water (BW) on board vessels is crucial for the seaworthy condition. At the same time, there is risk associated with BW discharge which may affect the marine environment, human health, and economy of coastal states as well as Timor-Leste.

In that regard, this study examine the exposure level of the Timorese ports engage on international trade, the vulnerability of the marine environment, and the potential consequences to Timor-Leste if Hazardous Aquatic Organisms and Pathogens (HAOP) is introduced.
After such risk assessment, the risk level of Timor-Leste to the HAOP is estimated and followed by proposing the risk mitigation measures which is to implement the BWM Convention in Timor-Leste to mitigate the risk to acceptable levels.

However, there are several challenges faced by Timor-Leste for the ratification and implementation of the convention from technical to political matters. Therefore, to address the challenges in order to effectively implement and enforce the BWM Convention, numerous recommendations are formulated such as the development of the National Ballast Water Management Strategy (NBWMS) and the establishment of the National Task Force (NTF), the investment for technical skill to the Timorese seafarers and the staff of the National Directorate of Maritime Transport (DNTM), and the adoption of a domestic laws regulate BW discharge if the ratification of the convention takes time.

Keywords: BWM, HAOP, Native Species, Marine lives, Timor-Leste, Marine biodiversity, Vulnerable.

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LIST OF ABREVIATIONS

ATMI	Advisory and Training for the Maritime Sector in Timor-Leste
APORTIL	Timorese Port Authority
ADB	Asian Development Bank
ANPM	National Petroleum Authority
AUSAID	Australian Aid
BW	Ballast Water
BWM	Ballast Water Management
BWMC	Ballast Water Management Convention
BWE	Ballast Water Exchange
BWP	Ballast Water Plan
BWMS	Ballast Water Management System
BWT	Ballast Water Treatment
BWMP	Ballast Water Management Plan
BWRB	Ballast Water Record Book
CCCB	Centre for Climate Change and Biodiversity
CT	Coral Triangle
CTC	Coral Triangle Centre
CT-CFF	Coral Triangle Initiative on Coral Reefs, Fisheries, and Food Security
CBD	Convention on Biological Diversity
DNTM	National Directorate of the Maritime Transport
DAFF	Department of Agriculture, Fisheries and Forestry
ETO	Esperanca Timor Oan
EEZ	Exclusive Economic Zone
FAO	Food and Agriculture Organization
FDCH	Human Capital Development Fund
GVA	Gross Added Value
HAOP	Hazardous Aquatic Organisms and Pathogens
IMO	International Maritime Organization
IBWMC	International Ballast Water Management Certificate
ITC	International Trade Centre
IFC	International Finance Cooperation
JICA	Japan International Cooperation Agency
LNG	Liquefied Natural Gas

MEPC	Marine Environment Protection Committee
MTC	Ministry of Transport and Communication
MAF	Ministry of Agriculture and Fisheries
MoU	Memorandum of Understanding
MARPOL	International Prevention for the Prevention of Pollution from Ships
NBWMS	National Ballast Water Management Strategy
NTF	National Task Force
NGOs	Non-Governmental Organizations
NM	Nautical Mile
NTT	Nusa Tengara Timur
OEC	Observatory of Economic Complexity
PBBS	Port Biological Baseline Surveys
PSC	Port State Control
PSCO	Port State Control Officer
PNG	Papua New Guinea
PM	Prime Minister
RO	Recognised Organisation
SOLAS	Safety of Life at Sea
SSE	The Secretary of State of the Environment
TEUs	Twenty Equivalent Units
TGMTU	Timorese German Maritime Training Unit
UNTL	National University of Timor-Leste
UNCED	United Nations Conference on the Human Environment and Development
UNCLOS	United Nations Convention on the Law of the Sea
UV	Ultraviolet
USA	United State of America
USAID	United State Aid
WMU	World Maritime University

Chapter 1

Introduction

1.1 Research background and Problem statement

Maritime transport carries more than 80% of global trade goods, and about 12 billion tons of ballast water is transferred around the world per year (Ibrahim & El-Naggar, 2012). Ballast water is used to control draught, list, trim, stability, or stresses of a ship (IMO, 2009). Hence, ships require ballast water to maintain seaworthy conditions when they sail without cargo, less cargo, or not equally loaded (David et al., 2015).

Ballast water is the uptake from one environment and discharged to another with different organisms and pathogens. Globally approximately 10 billion tonnes of ballast water is carried by ships from the port of donor to the port of recipient around the world annually, and thousands of organisms and pathogens are carried around in ballast water (Tamelander et al., 2010; Gollasch & David, 2011; David et al., 2015; Liu et al., 2019).

Some organisms and pathogens are considered as Harmful Aquatic Organisms and Pathogens (HAOP). When HAOP survive within the ballast water tank during the voyage and released into a new biogeographic region, they will create a hazard (GEF-UNDP-IMO GloBallast Partnerships Programme & WMU, 2013). In that regard, the marine environment, human health, and economy of marine resource users will be affected after the introduction of HAOP (David et al., 2015). For example, the introduction of the north-west Pacific predatory sea star *Asterias amurensis* in Australia has caused dramatic changes to deep sea species (Ross et al., 2003). Further, the introduction of dinoflagellate *Alexandrium tamarense* has caused red tides in Australia, New Zealand, and the United States (GEF-UNDP-IMO GloBallast Partnerships Programme & WMU, 2013).

Timor-Leste is an island nation where shipping activities are crucial. Several vessels from Australia, Indonesia and Singapore are weekly called at Dili Port which is the main port in the country until the present time. Accordingly, the exposure of Dili Port to the introduction of HAOP is significantly high due to the frequent release of ballast water within the port area.

In addition, Tibar Bay Port which will be the biggest port in Timor-Leste, is under construction and will be in operation at the beginning of 2022 (Timor-Leste News Agency, 2021). This port is considered as a hub for the secondary ports in the country and it will also be able do transhipment to the secondary port of small islands of the east of Indonesia, Australia, and Papua New Guinea. From this point of view, the release of ballast water into the port will be increased and therefore the exposure of Tibar Bay Port to the introduction of HAOP will be extremely high.
Moreover, as more than 90% of total exports is composed of oil and gas (ITC, 2014), Timor-Leste has been developing a Liquefied Natural Gas (LNG) terminal in Beacu, Viqueque, the south-eastern part of the country. Once this construction is concluded and ready to be used, LNG carriers will regularly call at the terminal to carry the LNG cargoes and supply them to other countries. Thereupon, the exposure level of Beacu LNG terminal to the release of HAOP will be high as the discharge of ballast water within the area will definitely be increased.

Most vessels calling at Dili Port, Tibar Bay Port, and Beacu LNG terminal, come from countries sharing similar environmental condition regarding the temperature and salinity (Webb, 2019). In this regard, the HAOP which originated from such countries may survive and spread to the surrounding environments, which are rich in marine living and non-living resources. As an example, HAOP such as the Australian spotted jellyfish have spreading potential (Battle, 2009).
Henceforth, the environments of Dili Port, Tibar Bay Port, and Beacu LNG terminal are highly vulnerable to the presence of HAOP.

Additionally, Timor-Leste's marine ecosystem is part of the Coral Triangle area, often called the Amazon of the Seas, with rich marine biodiversity. The Coral Triangle covers approximately 30% of coral reefs globally, and over 3,000 species of fish live in the area (Burke et al., 2012).
Further, more than 70% of the Timorese population relies on fisheries or agriculture for their livelihoods and nutrition needs (NSD, 2010). In addition, investment in coastal and marine tourism is continuously growing.
In short, the Timorese livelihood depends on healthy marine environment. Consequently, the introduction of HAOP may have disastrous impacts on the population and their activities.
Therefore, the introduction of HAOP is considered a high Risk for Timor-Leste.

To protect the Timorese marine environment from the threat of HAOP, there is a need to establish mitigation measures available in the BWM Convention. Implementing the BWM Convention is the only feasible barrier for Timor-Leste to reduce or eliminate the Risk of biohazards related to ballast water discharge.

1.2 Research objective

This research aims to:

i. identify the benefit of implementing the BWM Convention in Timor-Leste,
ii. identify the challenges of the ratification and the implementation of the BWM Convention,
iii. provide the potential solutions to the National Directorate of Maritime Transport of Timor-Leste (DNTM) to address the challenges faced for the ratification, implementation, and enforcement of the BWM Convention.

1.3 Research questions

The following are the questions which considered vital and will be addressed to develop this dissertation:

i. What are the advantages of the implementation of the BWM Convention to Timor-Leste and its people?
ii. What could be done to address the challenges of the ratification and the implementation of the BWM Convention in Timor-Leste?
iii. What are the steps which are required to assist the DNTM in implementing and enforcing the convention successfully?

1.4 Research Methodology

The research methodology is stated detailed in the following:

- Data regarding the statistic on maritime traffic of ships going in and out of Dili Port, Tibar Bay Port, and the Beaçu oil terminal were collected to assess the exposure level of such ports to the introduction of HAOP. These data were collected from the Port Authority of Timor-Leste (APORTIL) for Dili Port, Timor Port for Tibar Bay Port, and Timor gap for Beaçu oil terminal.
- To examine the vulnerability of the country's marine environment and estimate the potential consequences for the risk assessment level, data regarding Invasive Aquatic Species in the tropical region was collected through a literature review. In addition to that, interviews were carried out with the Centre for Climate Change and Biodiversity (CCCB) of the National

University of Timor-Leste (UNTL), the Secretary of State of the Environment, Ministry of Agriculture and Fisheries, and Ministry of Tourism. Concluded that if the risk shows up to be high, a recommendation will be proposed regarding the need to implement risk mitigation measures to protect Timor-Leste from the introduction of HAOP.

- To address challenges faced for the ratification, implementation, and enforcement of the BWM Convention in Timor-Leste, interviews were conducted online with DNTM and APORTIL to assess the country's current condition regarding the level of preparedness.

1.5. Expected Outcomes

Timor-Leste has not yet ratified the BWM Convention due to a lack of awareness and resources.

The study may support awareness raising about the vulnerability of the country to HAOP.

Therefore, the ratification of the BWM Convention should be investigated by the authorities in order to protect the country from the introduction of HAOP.

1.6. Limitation of the study

In this research, the data were collected from different sources such as the DNTM, APORTIL, Timor Port, Timor gap, the Centre for Climate Change and Biodiversity (CCCB) of the National University of Timor-Leste (UNTL), the Department of Biodiversity of Secretary of State of the Environment, Ministry of Agriculture and Fisheries, and Ministry of Tourism. However, there was a lack of data from such institutions due to the covid-19 pandemic as most of the staff worked from home, which caused difficulty in providing necessary data for this research. Moreover, despite the importance of getting data from the port area, which relies on the Port Biological Baseline Survey (PBBS), especially in the Tibar Bay Port, the Dili Port, and the Suai Port (Beacu LNG terminal) until the present time, there has not yet any PBBS activity due to the lack of available resources such as expertise, funding, facilities, and others related matters. Therefore, no specific data was available regarding the PBBS for such ports.

Chapter 2

Literature Review

Different studies and research articles have been reported in the literature the transfer of HAOP and its impact on the marine environment, human health, and the economy.

Furthermore, few studies focused on the practical implementation of the BWM Convention.

Ineffective implementation of the BWM Convention due to the lack of awareness of the impacts of HAOP by the maritime administration and the port authority can potentially cause the transfer of HAOP within the coastal water of any country and harm the marine environment.

Therefore, this literature review will analyse the risk from exposure and vulnerability point of view. Besides, the consequences and mitigation measure are also analysed in this literature review.

When a port is frequently visited by many vessels from different regions for the export of commodities, the exposure of such port is high to the introduction of HAOP due to the intensive release of ballast water within the port areas.

For instance, in Australia, which supplies grain to Middle East and China, the exposure of their ports is very high to the introduction of HAOP from Middle Eastern countries and China. Besides, as Central West Africa exports oil to North America, Latin America, and Europe, the exposures of their ports are extremely high to the introduction of HAOP from countries of the three regions (GEF-UNDP-IMO GloBallast Partnerships & IOI, 2009).

Approximately 3,000 to 4,000 species are carried around the world every day in Ballast water (Carlton & Geller; Gollasch, as cited by David et al., 2015). Besides, some recent study showed that around 7,000 species are transported in ballast water around the world each day (Carlton, 2001;Tamelander et al., 2010).

Most of species that are carried in ballast water do not survive during the voyage (Tsolaki & Diamadopoulos, 2010; Tamelander et al., 2010; Ibrahim & El-Naggar, 2012). However, some organisms can survive within the ballast tanks for more than three months (David et al., 2015).

In East Asia, for example the port of Tanjung Priok, Jakarta Bay, is the busiest port of Indonesia, where vessels from Singapore, Malaysia, Australia, and New Zealand

are regularly called at this port, and therefore, the port is highly exposed to the introduction of HAOP due to the continual discharge of ballast water within the port area (Azmi et al., 2015).
When the marine environment conditions are favourable, non-indigenous species can survive. It is estimated that more than 850 species have been successfully introduced into new biogeographic regions globally (Hayes & Sliwa, 2003). In Great Lakes alone, more than 145 non-indigenous species have become introduced since 1800 (Horan & Lupi, as cited by Lovell et al., 2006).

Organisms which survived the voyage and released successfully into a new biogeographic region might become invasive species and compete with native species for foods, places and even prey upon native species (David et al., 2015; Carlton, 2001; GEF-UNDP-IMO GloBallast Partnerships & WMU, 2013).
HAOP is considered the most recent seaborne threat (David et al., 2015).
Therefore, when it is introduced to a new biogeographic region, the marine environment, human health and wellbeing, and the economy of such a region will be seriously affected (Tamelander et al., 2010; David et al., 2015; Lakshmi et al., 2021).
When the environment and surrounding are rich in biodiversity, they may be highly vulnerable to the introduction of HAOP (Boudouresque et al., 2017).
For example: the Mediterranean mussel (*Mytilus galloprovincialis*) is spread via ballast water and by fouling ship hulls, and has displaced various South African native mussel species (Tamelander et al., 2010). Besides, the invasive comb-jelly *(Mnemiopsis leidyi)* which was introduced to the Black Sea from the eastern coast of the Americas has severely preyed upon zooplankton and the larval stages of fishes (GESAMP; Vinogradov et el, as cited by David et al., 2015).
Additionally, studies consider that spreading HAOP globally might cost around tens of billions of US dollars every year (Marbuah et al., 2014; David et al., 2015).
Interwies and Khuchua (2017) estimated the potential economic loss of several countries worldwide if HAOP is introduced due to the ineffective implementation of the BWM Convention. These countries are the Bahamas - a cost estimated is US$ 1.6 billion per year; Trinidad and Tobago - a cost estimated is US$ 134.2 million per year; and Turkey which has a cost estimated at US$ 8.16 billion.
Furthermore, HAOP has serious economic and health impacts, such as the cholera outbreak in Peru in 1991, which cost US$ 770 million (Interwies & Khuchua, 2017).
The spreading of North American comb jellyfish in the Black Sea, which caused the

drop in commercial catches of fish and cost about US$ 240 million per year (Tamelander et al., 2010).

In United State of America (USA) alone, HAOP has caused economic loss of the country for more than US$ 14 billion per year (Pimentel, as cited by David et al., 2019). In Europe, about €12 billion is spending annually on repair, management, and mitigation of impacts of HAOP (Shine et al., 2010). Furthermore, the introduction of the Chinese mitten crab *(Eriocheir sinensis)* has caused economic loss for Germany about €80 million (Battle, 2009; Gollasch, 2011).

In terms of human health, the outbreak of toxic dinoflagellate (*Gymnodinium catenatum*) on the Mexican Pacific coast caused Paralytic Shellfish Poisoning (PSP), resulting in over 30 deaths and around 500 people hospitalized (Tamelander et al., 2010; Global Invasive Species, 2021). Further, thousands of people were affected by the cholera outbreak (*Vibrio Cholera*) in Peru in 1991 (Tamelander et al., 2010).

Consequently, to prevent, minimize, and ultimately eradicate the potential effects of HAOP, the International Maritime Organization (IMO) adopted the BWM Convention in 2004 (Tamelander et al., 2010; GEF-UNDP-IMO GloBallast Partnerships Programme & WMU, 2013; Grob & Pollet, 2016; Olenin et al., 2016; Rey et al., 2018; IMO, 2017).

To prevent the release of HAOP, the BWM Convention has approved different management methods such as ballast water exchange, ballast water treatment, and other alternative offering the same level of protection such as ballast water to port reception facilities (IMO, 2009; Lakshmi et al., 2021).

2.1. Ballast water exchange (D-1 ballast water exchange standard)

The most widely practiced of the ballast water management method up to the present time is the exchange of ballast water in the mid-ocean due to the cost efficiency and less complexity (Lakshmi et al., 2021).

Regulation D-1 BWE standard requires all vessels engaged on international voyage to perform their ballast water exchange in high sea with a minimum of 95% of the volumetric exchange of ballast water before entering ports of a party (IMO, 2009).

The BWE can be performed in three different methods as shown in Figure 1, such as the sequential method, the flow-through method, and the dilution method. The

flow-through method and the dilution method are recognised as pump through method (IMO, 2009).

The three BWE methods are described for further detail in the following according to ballast water exchange requirements, paragraph 4.4:

- **Sequential method:** in this method, firstly the ballast tank is emptied and followed by refilling with the replacement of ballast water to reach the 95% of minimum of volumetric exchange.
- **Flow-through method:** in this method, the replacement ballast water is pumped into a ballast tank and then it allows water to flow through overflow.
- **Dilution:** in this method, the replacement ballast water is filled from the top of a ballast tank and discharging from the bottom at the same time.

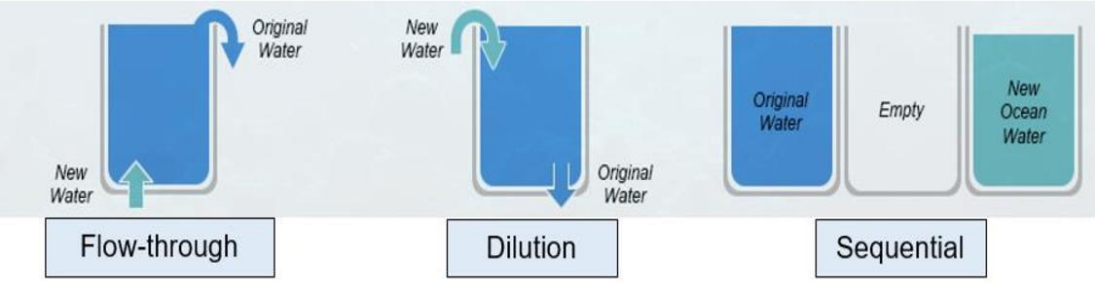

Figure1. Ballast water exchange methods
Source: Globallast, 2014-2017c.

When exchanging ballast water by the pumping through method, pumping through three times the volume of each ballast tank is required to comply with the standard. Nevertheless, pumping through less than three times might be acceptable since the 95% volumetric exchange of the minimum is met (Tamelander et al., 2010).

According to the Regulation B-4.1, the ship shall perform the BWE on the high sea with the minimum 200 nm from the nearest land, and in water at least 200 meters in depth. Due to some serious problem that the vessels face such as stability issue, the ballast water should be exchanged at least 50 nm from the nearest land, and in water at least 200 meters in depth.

However, the ballast water exchange (BWE) has various limitations. Thus, it could jeopardize the safety of ships (e.g. overstress, loss of stability, decrease in the capability of manoeuvring, etc.) (Gerhard et al., 2019). Other limitations are fuel cost

regarding the pumping and time consuming when conducting the BWE on the high sea (Barry et al., 2008).

Moreover, the standard of BWE in the mid-ocean requires of a minimum 95% volumetric exchange (IMO, 2009). Furthermore, after exchanging three tank volumes, around 4% of original water still remains and 5% of dead plankton of the port of donor was in the ballast tank (Lakshmi et al., 2021). Hence, after conducting BWE in the open sea, there is still possibilities to release organism and pathogens from port of origin to the port of recipient.

2.2. Ballast Water Treatment (D-2 ballast water performance standards)

To overcome the limitation of BWE, the ballast water performance standard (D-2) establishes goals designed to achieve an acceptable levels of biological risks (GEF-UNDP-IMO GloBallast Partnerships Programme & WMU, 2013).

After September 2024, all vessels engage on international voyages will have to comply with D-2 standards (MEPC.278 (71), as cited by (Gerard et al., 2019).

Regulation D-2 BWP standard requires all vessels that discharge ballast water shall contain viable organisms inferior to the specified limits (IMO, 2009; Werschkun et al., 2014).

The D-2 standard is summarized in Table 1.

Table 1
Performance standard (regulation D-2)

Organism category	Performance standard
Organisms, size ≥ 50 µm[a]	< 10 viable organisms/m^3
Organisms, size ≥ 10 and < 50 µm[a]	< 10 viable organisms/mL
Toxicogenic *Vibrio cholerae*	< 1 cfu[b] / 100 mL
Escherichia coli	< 250 cfu[b] / 100 mL
Intestinal Enterococci	< 100 cfu[b] / 100 mL

Source: IMO, 2017

To meet the D-2 standard, the installation of the BWMS on board vessels is the most common approach. Additionally, ships ballast water can be treated through three different types as shown in Figure 2, such as mechanical, physical, and chemical (IMO, 2017).

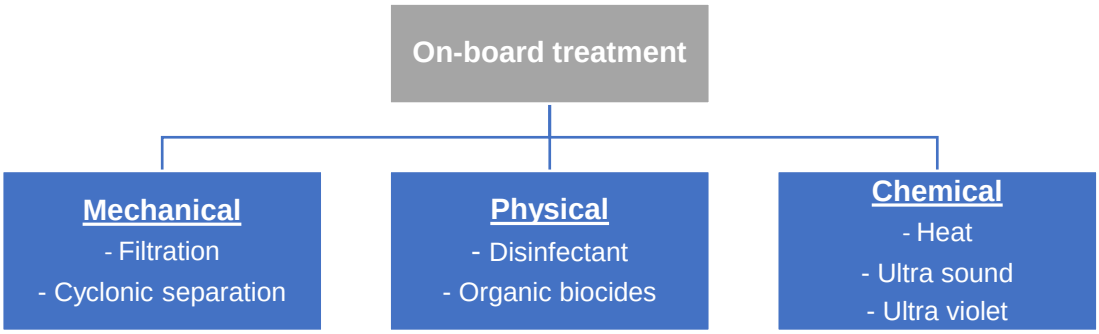

Figure 2. Types of on-board ballast water treatment
Source: GEF-UNDP-IMO GloBallast Partnership Programme & WMU, 2013.

To meet the D-2 standard, there are several ballast water treatment methods which have been on trial such as filtration, chlorination, cavitation, UV radiation, deoxygenation, hydrocyclone, and etc. (David et al., 2015; Lakshmi et al., 2021).

In particular, the most energy efficient, cost effective, low power consuming, and capable of inactivating 100% of organism has been discovered to a filtering step followed by hydroxyl radical treatment (Lakshmi et al., 2021).
On the other hand, different studies have been conducted and then figured out that none of the ballast water treatment (BWT) method or combination of the primary and the secondary methods could eradicate 100% of HAOP but only reach an acceptable level (Tsolaki & Diamadopoulos, 2010; Veldhuis et al., 2010; Ibrahim & El-Naggar, 2012).

In addition, some study highlighted that, after ballast water is treated with the BWT methods, some HAOP can still regrow inside the ballast water tank within specific intervals (e.g. 18 hours for bacteria and 20 days for phytoplankton) (Grob & Pollet, 2016).

Moreover, the ballast water treatment system on-board is not the only way to meet the D-2 standard. The D-2 standard might be met with other ballast water management measures such as the improvement of BWE or ballast water discharge to port reception facilities for treatment (David et al., 2013).

2.3. Port Reception Facilities

When ships do not conduct the BWE due to safety issue or there is technical problem with the BWT system on board vessels, ships could discharge their BW into BW reception facilities if available as it is not obliged to be provided by port states. To assist the implementation of such facilities, the parties can use the Guidelines for Ballast Water reception facilities (G5).

Discharging to the port reception facility is one of the option that ships can choose to manage their BW to prevent organisms and pathogens transported in BW release into the new bio-geographic region (Tamelander et al., 2010). Furthermore, the BW reception facilities can be installed at port as it does not require a major infrastructure cost (GEF-UNDP-IMO GloBallast Partnership Programme & IUCN, 2010).

However, in small island developing countries such as Timor-Leste where there is no shipyard, discharging the BW into the reception facilities might not be an option. In that regard, several countries have been committed to implement the BWM requirements. Indeed, most the of these national requirements are based on the BWE, the BWT on board vessels, and only a few addresses the BW reception facilities (David et al., 2015).

Moreover, the option of the BW reception facilities could be a difficult choice as it requires a complete new logistic service in ports (Veldhuis et al., 2010).

2.4. Conclusion

This literature review analysed the risk from exposure level of the ports to the vulnerability of the marine environment, the potential consequences and the recommended mitigation measures.

When ports are engaged on the international trade for a continuous export of goods, the exposure level of such port will be high to the introduction of HAOPs.

Further, if the marine environment is favourable to HAOPs to live after they are introduced via BW discharge, they might spread and become a serious threat to such environment. Indeed, the transfer of HAOPs from one place to a new bio-geographic region via ballast water has caused disastrous impacts on the marine environment, human health, and economy of several countries worldwide.

Therefore, IMO adopted the BWM Convention to mitigate and ultimately eliminate the risk associated with the transfer of HAOPs. Furthermore, several options are required by the convention, such as the BWE (D-1 standard), BWT (D-2 standard), and BW reception facilities.

The D-1 standard requires all vessels to exchange their BW in the mid-ocean with a minimum 95% of volumetric exchange of BW before calling at the ports. In addition, there are three methods that can be used by ships when conducting the BWE such as sequential method, throw-flow method, and dilution.

Besides, the D-2 standard requires all vessels to treat their BW by using physical, mechanical, and chemical methods before entering the ports. To comply with the D-2 standard, the treatment should contain viable organism inferior to the specified limit.

Moreover, when ships could not comply with the D-2 and D-2 standards, the ports could provide the BW reception facilities if available.

CHAPTER 3

Overview of Rights and Obligations of Flag State, Port State and Coastal State for the protection of marine environment from HAOPs

The BWM Convention was adopted in 2004 at IMO's Headquarters in London after a long process of negotiations among IMO member states to prevent, mitigate, and ultimately eradicate the risk of HAOP to the marine environment, human health and wellbeing, property and resources of any country (IMO, 2017).
The BWM Convention entered into force in September 2017 (IMO, 2019). Since then, the parties are required to enhance the rights and obligations of flag state, port state, and coastal state for the protection of marine environment, human health, and the properties and resources from the threat of HAOP according to the provision of the BWM Convention. In addition, Numerous technical guidelines have been adopted to facilitate the implementation of the convention but are not mandatory (Tamelander et al., 2010).
Up to the present time, the BWM Convention has been ratified and accessed by 86 countries which represent 91.19% of the world total shipping tonnage (IMO, 2021). All contracting parties of the BWM Convention are required to provide the protection to the marine environment, implement the regulations according to the BWM Convention on their fleet, and participate in global implementations of regulations (Baumler, 2021).

The BWM Convention requires all vessels which engage on international voyage to control their ballast water and sediment in accordance with a ship's specific ballast water management plan which is required in the Regulation B-1 (IMO, 2009). Furthermore, the Ballast Water Management Plan (BWMP), Ballast Water Record Book (BWRB), and the International Ballast Water Management Certificate (IBWMC) are required to be carried on board of all vessels in international trade according to the BWM Convention.
To ensure no more favourable treatment is given to any vessel, all vessels are subject to port state control in the port of a party to the BWM Convention (IMO, 2019).

Beside the BWM Convention, the rights and obligations of flag state, port state, and coastal state are guaranteed and required by UNCLOS articles 192 and 94 which recall that “States have the obligation to protect and preserve the marine environment” and “Every State shall effectively exercise its jurisdiction and control in administrative, technical and social matters over ships flying its flag”.
The right and obligations of Flag state, Port State, and Coastal State for the protection of marine environment from the threat of HAOP are discussed in further detail in the following:

3.1 Flag State Right and Obligations

Flag state is the state where ships are registered. Therefore, an effective implementation of the BWM Convention by the flag state is vital as it plays a critical role for the risk mitigation because it is primarily responsible for controlling and regulating vessels, their equipment and crews (GEF-UNDP-IMO GloBallast Partnerships Program & WMU, 2013). For instance: crews training regarding the operation of the Ballast Water Management Systems (BWMS), investigating accidents or incidents, survey and certification for ships and their equipment, conducting approval process for the ballast water management system, applying penalty in case of any violation, etc.
The right and obligations of flag state regarding the protection of marine environment are required by several international conventions such as UNCLOS and others which are adopted by IMO.
It is widely known that, many ship-owners do not fully agree to implement the BWM Convention on board vessels due to the cost of operation. Hence, the flag state is required to develop mandatory regulations to enforce ships flying its flag to manage their ballast water in order to comply with the provisions of the BWM Convention as stated in article 4 of the convention.

To address the risk arising from ballast water, the Figure 3 shows how the rights and responsibilities of the flag state work.

Figure 3. Flag state rights and obligations to address ballast water risks

Source: Baumler, 2021

3.2 Port state rights and obligations

As a party of the BWM Convention, the port state has right and obligations according to the provisions of the convention which are detail outlined in the Article 9 (Inspection of Ships), 10 (detection of violation and control of ships), 12 (Undue delay to ships), and 14 (Communication of information).

Under such provisions, the port state can exercise its rights and obligations to enhance the protection of marine environment, human health, property and resources from HAOP within its jurisdiction.

Moreover, the resolution MEPC.252 (67) was developed to facilitate the port state control (PSC) inspection under the BWM Convention.

To address the risk arising from ballast water, the Figure 4 shows how the rights and responsibilities of the port state work.

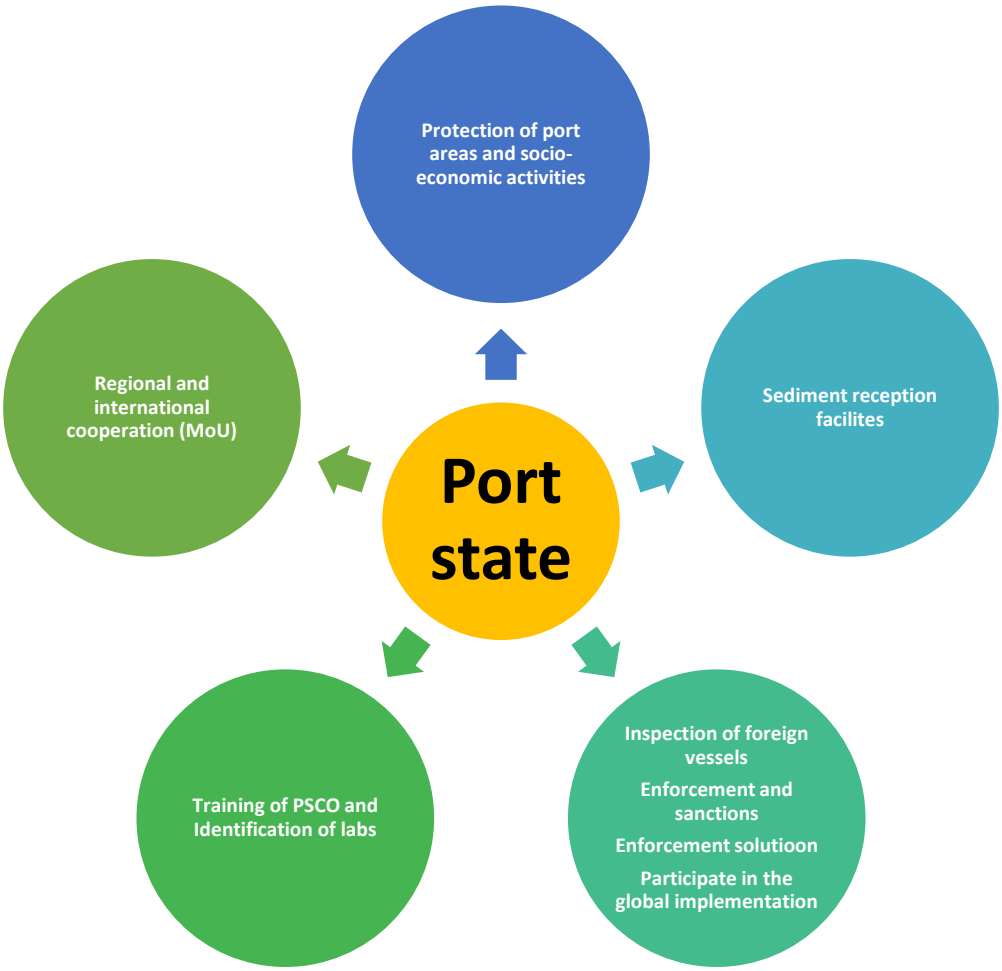

Figure 4. Port state rights and responsibilities to address ballast water risks.
Source: Baumler, 2021

3.3 Coastal state right and obligations

The coastal state has right and obligations to carried out the scientific and technical research and monitoring, design areas of ballast water exchange, detect and investigate if any violation occurs, conduct regional and international cooperation with other states, grant exemptions, establish the contingency plan, and public awareness and preparedness (GEF-UNDP-IMO GloBallast Partnership Programme & WMU, 2013).

To address the risk arising from ballast water, Figure 5 shows how the rights and responsibilities of the coastal state work.

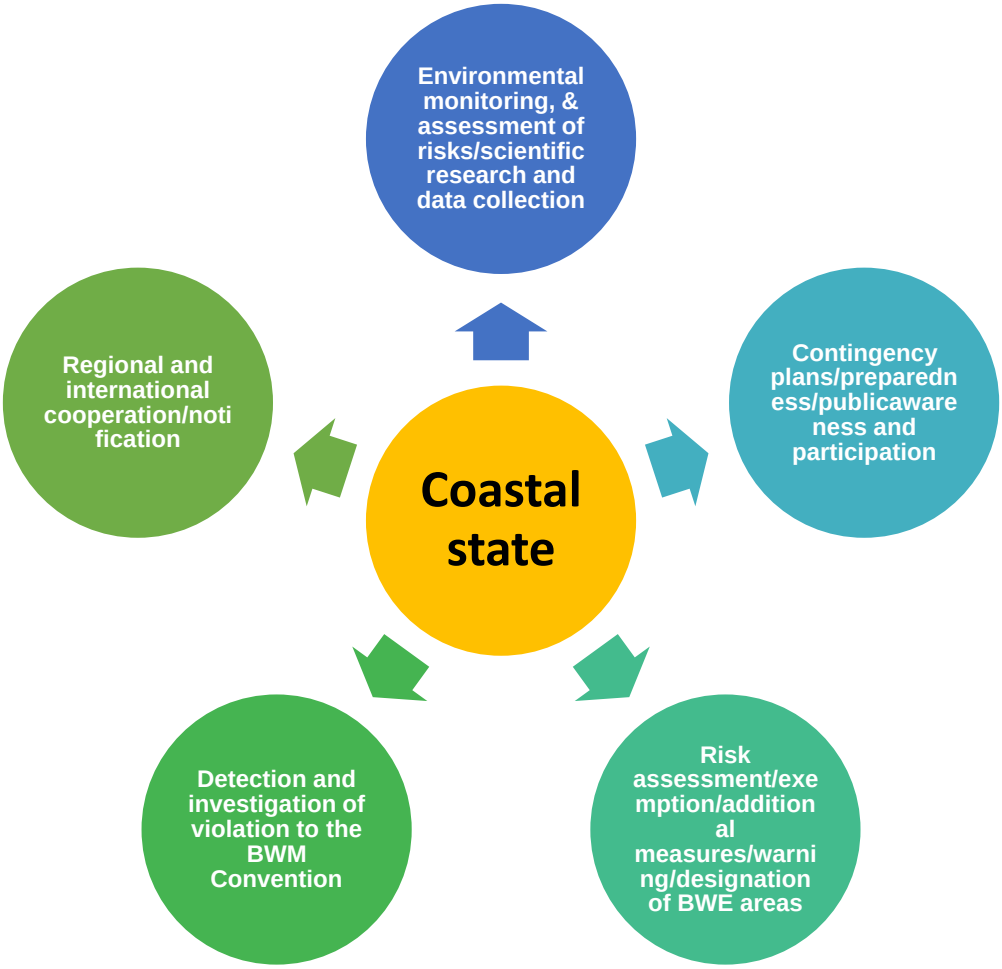

Figure 5. Coastal state rights and responsibilities to address ballast water risks.

Source: Baumler, 2021

3.4. International instruments for the protection of the marine environment from HAOP.

HAOP is a global threat that requires global action for preventing the introduction from one environment to another. Once HAOP is introduced, it is almost impossible to be eradicated, and therefore the impact on the environment, human health, resources, and properties will be continuously increased. In that regard, the issue of HAOP has been alerted the world since the 1980s, when Australia and Canada brought their concerns to the attention of IMO, especially the Marine Environment Protection Committee (MEPC) (IMO, 2019).

In response, the BWM Convention was adopted to prevent the introduction of HAOP via ballast water discharge.

Besides, different international organizations adopted several international instruments that also concern the issue of HAOP, such as the Convention on Biological Diversity (CBD), UNCLOS, the Food and Agriculture Organization (FAO) Code of conduct for Responsible Fisheries, and etc. Moreover, different multilateral agreements related to the BWM Convention were also adopted during the United Nations Conference on the Human Environment and Development (UNCED) in Rio de Janeiro in 1992, such as the Agenda 21 Action Plan and the Rio Declaration on Environment and Development.

3.5. Conclusion

Since the BWM Convention entered into force in 2017, the parties have been required to implement and enforce the convention through performing the rights and obligations of flag state, port state, and the coastal state to mitigate the risk associated with the introduction of HAOPs.

These three key players are entitled by the convention with powers and responsibilities to create effective barriers at all steps of the causation chain.

As a result, the protection of the marine biodiversity from HAOPs is guaranteed if the flag state, port state, and the coastal state rights and obligations are effectively exercised.

Besides the BWM Convention, there are several international instruments which also discuss about the issue of HAOPs such as UNCLOS, CBD, and etc.

CHAPTER 4

The Importance of Accession to the BWM Convention by Timor-Leste

The BWM Convention is vital for Timor-Leste to be acceded and implemented appropriately due to the several factors as mention below:

- The Timorese ports are exposed to the introduction of HAOP.
- The ports and surrounding environments are vulnerable to the introduction of HAOP because of the richness in marine biodiversity.
- The population is dependent on marine resources

This chapter analyses the risk approach of the introduction of HAOP to Timor-Leste.

Generally, hazard is defined as any source that can harm or damage. Besides, risk is a probability of someone or something that will be damaged or harmed by hazard. Furthermore, any hazard will present some element of risk; however, the level of the risk depends on the exposure to that hazard (GEF-UNDP-IMO GloBallast Partnership Programme & WMU, 2013).

The analysis of the risk approach is demonstrated clearly from hazard to risk, as can be seen in Figure 6.

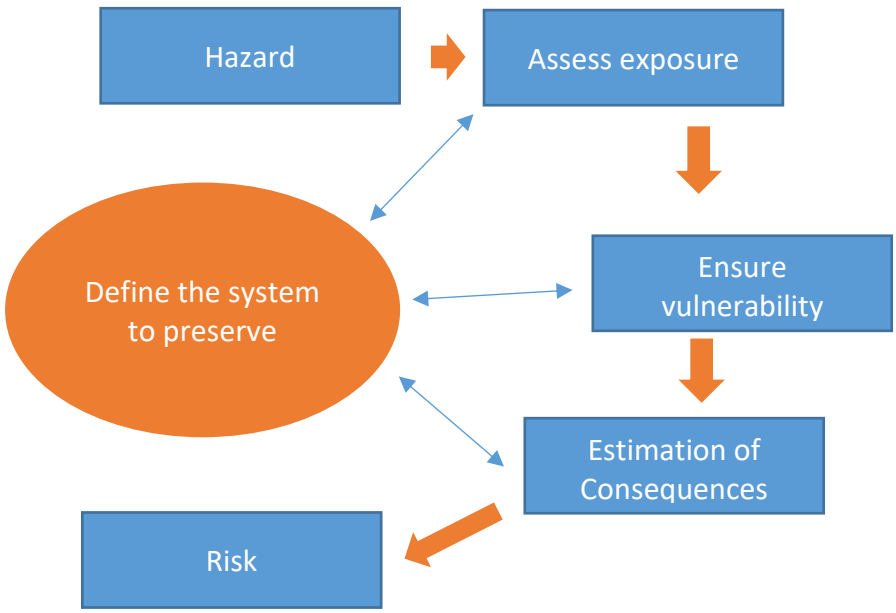

Figure 6. The element to consider in risk evaluation.
Source: King et al., as cited by Baumler, 2021.

4.1. The system to be protected and preserved from HAOP

As an island country, the maritime area of Timor-Leste is estimated four times wider than the land area, as can be seen in Figure 7 (Voyer et al., 2020). Consequently, the marine biodiversity will continuously provide a massive benefit to Timor-Leste and ensure the country's future prosperity.

Figure 7. The maritime boundary of Timor-Leste
Source: Maritime Boundary Office [MBO], 2016.

As a coastal state, Timor-Leste has the right to exploit all its biotic and abiotic resources within its jurisdiction, as stated in Article 193 of UNCLOS, 1982. At the same time, the country shall protect and preserve marine biodiversity to guarantee its sustainability for a long period of exploitation (UNCLOS article 192).
Oceans are sources of food and jobs. Ocean-based industries, particularly ecotourism and fisheries, are known as crucial providers of income and jobs.

Current, Timorese oil and gas exploitation will not last forever, this presumes that as an island country, the marine biodiversity of Timor-Leste will be one of the primary

keys to continuously sustain the economic growth of the country, and it can only be achieved if the marine biodiversity is protected and preserved properly.

Moreover, Timor-Leste belongs to the Coral Triangle (CT) region; therefore, to protect the marine biodiversity, a regional approach is more advantageous as the marine ecosystem is interconnected to one another within the region, as shown in Figure 8. The Coral Triangle Initiative on Coral Reefs, Fisheries, and Food Security (CTI-CFF) has been adopted by six countries including Timor-Leste since 2009. The CTI-CFF possesses a regional plan of action to protect and preserve the marine and coastal biological resources of the region.

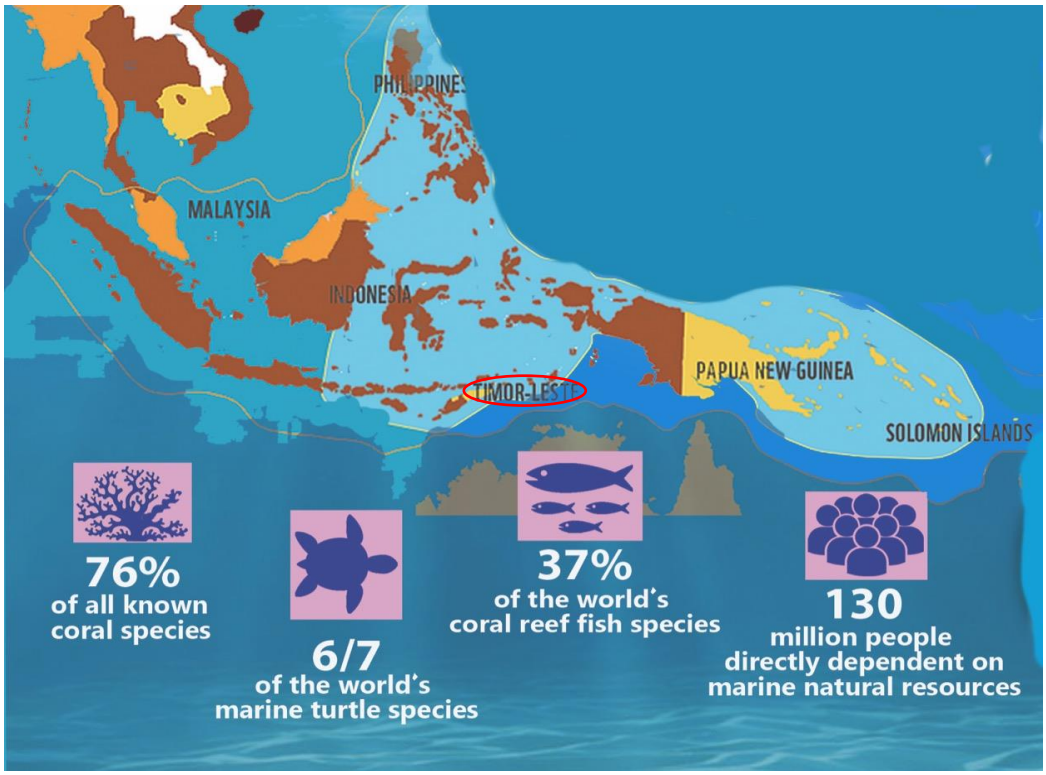

Figure 8. Coral Triangle region
Source: Buddinggeographers, n.d.

4.2. Ballast Water Hazard

For Timor-Leste, hazard which is related to BW discharge is the introduction of HAOP into the country's marine environment. As a trading nation, Timor-Leste is threatened by the introduction of HAOPs. In that regard, the most appropriate approach for the country is to manage the risk of HAOPs to an acceptable level.

4.3. The exposure of Timorese ports to the introduction of HAOP

The country imports and exports goods from many countries, especially with Indonesia, Australia, Japan, Singapore, Malaysia, China, and United States. The maritime sector handles approximately 95% of the Timorese foreign trade volumes (ADB, 2020). Country's main exports are coffee and oil and gas. Oil and gas is mostly exported to refineries in Darwin, Australia. In 2019, Timor-Leste exported a total of around US$ 153.7 million in goods, of which US$ 18.6 million was covered by coffee alone (Statistics Timor-Leste, 2019).

In addition, maritime transport is the only appropriate means to supply goods from Dili the capital of the country to Atauro island and the Autonomous Region of Oecusse. Consequently, maritime transport presents economic benefits for Timor-Leste and an essential link between the parts of the country.

Consequently, Timorese ports are exposed to the introduction of HAOP due to the BW discharges. Indeed, uncontrolled BW discharge may occur but cannot be assessed because there is a lack of available data.

The Timorese ports which will be assessed for the level of exposure to the introduction of HAOP are mentioned in the following:

- the port of Dili,
- the port of Tibar Bay, and
- the future port of Suai.

The exposure level of such ports is assessed owing to their capacities of receiving ships that engage on international voyages.

Port of Dili

Dili port is operated by APORTIL, which is the only port authority of the country. APORTIL is a public institute which is under the Ministry of Transport and Communication (MTC).

Since the independence in 2002, Dili port is the main port of the country. The port accommodates vessels such as general cargo, container, and ferry passengers which engage on national and international voyages. Since the port was used for the international trade, the number of vessels which are called at Dili port is increased continually. For instance, in 2015, there were 840 vessels calling at Dili port and in 2017, 1,376 called at the port (APORTIL, 2017).

For import and export, the port is capable of handling around 120,000 TEUs per year. Notably, the container cargo traffic is increased each year. For instance, the container cargo traffic in the port was 44,094 TEUs in 2019 and then increased to 91.200 TEUs in 2020, as shown in Table 2. It was estimated that the container cargo traffic would surge to 120,589 TEUs in 2023 (APORTIL, 2014).

Dili port is located in the northern part of Dili as can be seen in Figure 9.

Figure 9. The aerial view of Dili port
Source: Google, 2021.

Up to the present time, Timor-Leste has been exporting coffee a lot besides other goods such as locust beans, seaweed, and sugar beet (Observatory of Economic Complexity [OEC], n.d).

Table 2

The evolution of cargo traffic in Dili port from 2019 to 2020.

Year	Containers (TEU)			General Cargo (ton)		
	Import	Export	Total	Import	Export	Total
2018	20,961	20,494	41,455	304,788.88	0,00	304,788.88
2019	22,292	21,809	44,097	349,909.92	0,00	349,909.92
2020	49,914	44,286	91,200	562,887.718	0,00	562,887.718

Source: APORTIL, 2020.

Table 2 demonstrates the evolution of cargo traffic in Dili port from 2018 to 2020, showing that the export rate of containers grew steadily over these years. This indicates that container vessels would have continuously discharged their BW into the port without control and monitoring in the absence of regulations.

In a close future (2022), Dili port will become a ferry terminal. The container and the general cargo terminals will be transferred to Tibar Bay port (APORTIL, 2014) to expand cargo handling capacity.

In short, the international trade exposes the port of Dili to the introduction of HAOP. After 2022, the exposure of the port will significantly decrease with the transfer of cargo handling to Tibar Bay port.

The port of Tibar Bay

Tibar Bay port is a private port in the country that will be operated for 30 years by Bolloré, a French Transportation company. The port is located 10 km west of Dili, and it is constructed with sophisticated port facilities for operation. It will be the country's major port with a length of 630 metres of berth and a draft of 15 meters. The port will be able to accommodate container ships carrying over 7,500 TEUs. Furthermore, the port will be able to handle containers up to 1 million TEU annually (PM Media, 2021).

Figure 10. The artists' visualization of Tibar Bay Port after construction.
Source: International Finance Corporation [IFC], n.d.

Tibar Bay port will be operated as a hub or commonly known as a mini-port of Singapore, making the interconnection of container transport from Australia, Papua New Guinea, West Timor (NTT), and eastern parts of Indonesia, and the Pacific Islands as can be seen in Figure 10.

The evolution of the exports rate of Timor-Leste is shown in Figure 11.

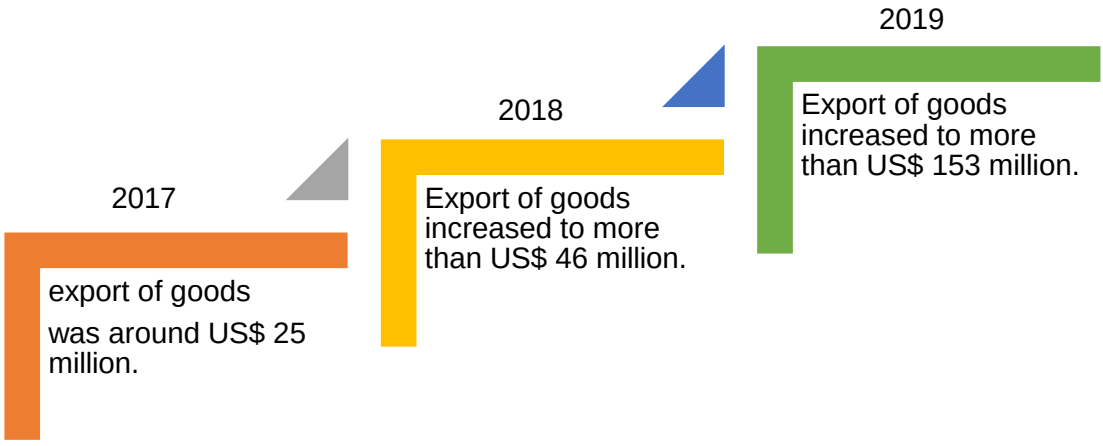

Figure 11. The exports rate of Timor-Leste from 2017 to 2019 in US$.
Source: Statistic Timor-Leste, 2020.

As the export rate and “hub function” will rise, the number of vessels calling at Tibar Bay port will increase as well as BW discharge.

Considering that BWM Convention is not in place, the expected growth in traffic will increase the exposure of the port to the introduction of HAOP.

Port of Suai

Suai port will become the only Timorese port exporting oil and gas. As the second most oil-dependent country in the world after South Sudan (IFC, n.d), Timor-Leste has drafted plans to develop the Tasi Mane Project (TMP) to connect oil and gas fields to mainland for processing and exports. The project includes a Supply Base in Suai, a Refinery in Betano, and an LNG Plant in Beaço, as shown in Figure 12.

Figure 12. The map of the Tasi Mane Project.
Source: Tsourakis, 2020.

It is expected that the investment will benefit Timorese economy. The Greater Sunrise oil and gas field contains around 8.3 trillion cubic feet of gas and around 300 million barrels of oil (condensate) (La’o Hamutuk, 2008) with an expected revenue of US$ 65 billion (Tsourakis, 2020) and jobs creation for nationals.

Although there is no available data at the moment regarding the port capacity and the estimation of vessels traffic in the port, as the construction of the mega project is

still in progress; it is expected that the Suai port will become one of the country's busiest ports. Numerous oil tankers and LNG carriers will load in its terminals.

Consequently, a significant volume of BW will be discharged in the area. Therefore, it will be highly exposed the marine environment to the introduction of HAOP.

Other ports

Besides these ports, there are also three oil terminals, two secondary ports, and two fishing ports, as mention below:

The three oil terminals (oil terminal of Pertamina, oil terminal of ETO, and oil terminal of Global) were constructed to receive ships that engage on international voyages.

Finally, the secondary ports (Mahata – Oecusse, and Atauro) and the two fishing ports (port of Cairabera and port of Com, Losplaos) are used only for ships that engage on domestic voyages.

Hence, the exposure level to the introduction of HAOPs of such ports and, to a certain extent, the importing oil terminals is considered low.

Assessment of Timor-Leste ports to introduction of HAOP

In summary, the exposure level of the Timorese ports and oil terminals to the introduction of HAOPs is provided in Table 3.

Table 3

The exposure level of Timorese ports to the introduction of HAOPs

Ports	Level of Exposure	Cause
Port of Dili	High – up to 2022 Medium – beyond 2022	The port receives all types of vessels which engage on national and international voyages, but beyond 2022, the port will only receive ferries.
Port of Tibar Bay	High	There will be a frequent discharge of a great volume of BW from container vessels and general cargo vessels in the port.
Port of Suai	High	There will be a frequent discharge of a great volume of BW from oil tankers and LNG carriers in the port.
Port of Mahata - Oecusse	Low	
Port of Atauro	Low	

Port of Com	Low	The same area concept is applicable as the ports do not receive vessels that engage on international voyages.
Port of Cairrabela	Low	
Oil terminal of ETO	Low	There is no frequent BW discharge
Oil terminal of PERTAMINA	Low	
Oil terminal of GLOBAL	Low	

Note: The exposure level is assessed as *Low – Medium – High*

4.4. The vulnerability of the Timorese marine environment to the transfer of HAOPs via ballast water.

Vulnerability is the condition determined by physical, economic, social, and environmental factors or processes that raise the susceptibility of a system to the effect of hazards (United Nations Office for Disaster Risk Reduction, 2020).
Indeed, in the context of the BW, vulnerability is when the marine biodiversity is abundant, consisting of various marine living resources that can easily be harmed by HAOPs. Furthermore, the level of vulnerability can be assessed from low to medium and high depending on the condition of the marine biodiversity.
If the environment is very specific, the level of the vulnerability is high to HAOPs. On the other hand, if the environment consists of several species and more interactive to one another, the system will be more resilient to HAOPs.

The Timorese marine biodiversity will be assessed for its vulnerability to HAOPs due to several causal factors as follows:

- Timor-Leste is abundant in the marine ecosystem as an island country, and it is still unpolluted and unexplored.
- Most of the vessels called at the Timorese ports are coming from countries sharing similar environmental conditions in terms of water salinity and temperatures, such as Australia, Indonesia, Japan, Singapore, and Malaysia. For this reason, the non-indigenous species that originated from such countries can survive in the Timorese marine environment and may harm the native ecosystem and related activities.

4.4.1. The Marine and Coastal Ecosystem of Timor-Leste

Protection of the marine environment is vital to Timor-Leste because, as an island country where around 90% of the population lives on the coast (Voyer et al., 2020), fish products are vital for Timorese's diet even though the government has not seriously invested in the fishing sector up to the present time. The average fish

consumption in Timor-Leste is about 6.1 kg/person/year, which is challenging for the country to reach the global fish consumption projection of 21.3 kg by 2030 (FAO, 2018).

Nevertheless, approximately 41% of the Timorese population lives under the poverty line. Therefore, the government prioritizes combating poverty and malnutrition in which the development of sustainable fishing and aquaculture sectors has been identified for the improvement of food and nutrition security (WorldFish, n.d). So, preservation of current resources and ecosystem is essential.

- **The coral reefs and fishes**

Timor-Leste has a potential exclusive economic zone (EEZ) of around 75,000 km^2 rich in marine biodiversity. Further, the country is part of the CT region, consisting of around 3,000 species of fish (Burke et al., 2012), in which more than 1,200 species of fish live within the Timorese marine biodiversity (Coral Triangle Centre [CTC], 2021). In Dili, around the Atauro island, approximately 642 different reef fish species were found. In addition, each site is estimated to home around 253 reef fish species on average exceeding the record of Raja Ampat Island in Indonesia (Blank, 2016). In addition, the Atauro island is defined as the world's most biodiverse waters (Slezak, 2016; Blank, 2016).

- **Seaweed**

Besides fish products, other seafood such as seaweed (*Budu tasi*) is easy to find around the Timor island, especially in Dili (Atauro island), Manatuto, Baucau, Lospalos, and Bobonaro. Primarily, the Timorese population uses seaweed for salad, which can be found at any party or ceremony in the country. Besides its importance for the Timorese diet, the country also exports seaweed to several countries. For instance, in 2012, around 120 tons of seaweed have been exported to China, Indonesia, and the Philippines with the Ministry of Agriculture and fisheries support (Timorese Business Journal, 2012). In addition, the Timorese seaweed is produced in good quality, therefore, it is important for the international market (Heath et al., as cited by López-Angarita et al., 2019).

Moreover, as Timor-Leste's priority is addressing the issue of poverty and national food security, seaweed plays an important role. Therefore, the country has supported the community in several coastal regions for the development of seaweed.

Figure 13. Collecting seaweed in Atauro island.
Source: López-Angarita et al., 2019.

- **Other marine resources**

There are also other species that are living in the Timorese marine environment, such as dolphins, dugongs, sea turtles, whales, crabs, giant clams, and others (Convention on Biological Diversity [CBD], 2011). However, some species are considered threatened species and require protection measures by the government to prevent their extinction (see annex I).
Moreover, these threatened species are considered vulnerable to HAOPs as they might become extinct once HAOPs are introduced via BW discharge, considering HAOPs could completely modify the marine ecosystem of the country.

- **Coastal and marine tourism**

Beside the marine lives, the coastal areas of Timor-Leste are considerably potential for the development of coastal and marine tourism of the country which could

support the county's blue economy as well as generating employment opportunities for the locals.

- **Current presence of HAOP in Timor-Leste**

Furthermore, the introduction of HAOP into the Timorese marine environment is still little known due to the lack of performing Port Biological Baseline Survey (PBBS) in port areas and limited scientific research.

Considering that Timor-Leste shares similar marine environmental condition with Australia, Indonesia, South Japan, Malaysia, Papua New Guinea (PNG), Singapore, and Solomon Island. Consequently, HAOPs introduced in such countries (important trade partners) could be re-introduced via BW discharge into the Timorese marine environment. Indeed, non-indigenous species coming from such countries via ballast water could survive and affect native species.

The estimated numbers of HAOPs which have been introduced via BW and hull fouling in countries sharing environmental condition with Timor-Leste can be seen in Table 4.

Table 4

The estimated numbers of HAOPs which have been introduced in countries sharing similar environmental condition with Timor-Leste.

Countries	Estimated numbers	Vectors	Habitat description
Australia	26	Ballast water and hull fouling	These species inhabit in coastal waters.
Indonesia	5	Ballast water and hull fouling	These species inhabit in coastal waters.
Japan	21	Ballast water and hull fouling	These species inhabit in seawater with different temperature and salinity ranges.
Malaysia	6	Ballast water and hull fouling	These species inhabit in coastal waters.
Papua New Guinea	1	Ballast water	The specie inhabits in coastal water with a temperature from 22 to 28^{o}C.
Singapore	5	Ballast water and hull fouling	These species inhabit in coastal waters.

Salomon Island	2	Ballast water and hull fouling	These species inhabit in coastal waters.

Source: Iucngisd, (n.d.).

In conclusion, Timor-Leste is rich in marine biodiversity and highly dependent on ocean resources. Therefore, the introduction of non-native species from neighbouring countries or countries sharing similar ecosystem may become a major disaster for coastal communities. In short, Timorese marine environment is highly vulnerable to HAOPs. The resilience of the threatened species and native species to HAOP is still unknown. So, prevention is better than cure.

4.5. The estimation of the consequences to the introduction of HAOP in Timor-Leste

Once HAOPs are introduced into Timor-Leste via BW discharge, there will be consequences to the marine environment, human health, and the economy of the country. Furthermore, the consequences are interconnected to one another.

4.5.1. Environmental impacts

Environmental impacts of HAOPs to Timor-Leste could be the loss of native biodiversity and collapse of ecosystems.

These marine species essential to the sustainability of the population may be threaten once HAOPs are introduced.

For example, invasive species such as the *Caulerpa taxifolia may* cause a serious decrease of native algae and seagrasses which might lead to an extinction, as it happened in other regions of the world (Iucngisd, n.d.) sharing similar environmental conditions with Timor-Leste such as Australia, Indonesia, Malaysia, and Japan.

4.5.2. Human health impacts

Sea food plays a very important role for the diet of the coastal community. Sea food consumption (fish and shellfish) is growing and considered vital to combat malnutrition.

In addition to potential destructive species, some species contain toxins which accumulate in fish and shellfish (e.g., *Gymnodinium catenatum, Perna viridis,*

Alexandrium minutum, *Caulerpa Taxifolia*, and etc). Evidence has shown that such toxins have caused people been hospitalized and even deaths. For example, in Mexico, around 460 people were hospitalized, and 32 deaths caused by *Gymnodium catenatum (*Iucngisd, n.d.*).* These invasive species have been introduced in countries which sharing environmental conditions with Timor-Leste as listed in Table 4, and might be re-introduced into the Timorese marine environment via BW discharge.

4.5.3. Economic impacts

The introduction of HAOPs around the world have caused economic loss in many countries and were estimated to about USD 50 billion in 2009 (Battle, 2009).
For Timor-Leste, the economic impacts of the introduction of HAOPs could be viewed mainly in two aspects such as the declining of fish stock and the destruction of coastal and marine tourism activities.

- **Declining of fish stock**

In Timor-Leste, the richness of marine biodiversity allows sustainable revenues from fishing industry. However, in some countries, the introduction of HAOP has caused near collapse of local fishing sector such as in the Caspian Sea. If the fish resource is affected, fish import to the country will be continuously increased and affect the country's economy and population incomes. Even now where the marine ecosystem of the country is unpolluted and free from serious bio-invasion, fishers have complaint against the growing fish import affecting their incomes (López-Angarita et al., 2019).
The country has around 5000 fishers of which 2000 are from Atauro Island (GOTL & Mills et al., as cited by Tilley et al., 2019) who can be affected by changes in fish market conditions. The fishers also supply fish to several roadside markets for passengers to consume as the main food source when they are travelling from Dili to other districts.
In that regard, not only the income of the fishers but also the income of the local markets and the roadside markets could be affected if HAOPs are introduced into the Timorese marine environment.

- **The impact on coastal and marine tourism activities**

Timor-Leste has potential sites for coastal and marine tourism activities but the sector remains underdeveloped. Stunning beaches and pristine waters are able to

attract national and the international tourists. In addition, whales and dolphins watching, diving, and snorkelling, in the country, especially around the area of Dili, Atauro, Liquica, Manatuto, Baucau and Lospalos are continuously attracting the international tourists. For example, there were 60,000 tourists visited the country in 2014 and increased to around 74,600 tourists in 2019 (Knoema, n.d.).

The tourism industry in the country has supported around 4,300 jobs for the nationals (Chemonics, n.d.) Moreover, the tourism industry, specially the coastal and marine tourism sector generated a revenue of USD 19.6 million in Gross Value Added (GVA) in 2015 (PEMSEA, 2021).

The government has set a goal in the tourism policy that by 2030 and expect the country to earn around USD 150 million in revenues from tourism sectors and create 15,000 direct jobs for the nationals (Capital, 2018).

Consequently, the sector will greatly support national economy in the future. However, the detrimental impacts of HAOPs to coastal and marine tourism can be devastating for the emerging touristic sector.

4.6. The risk level of the introduction of HAOPs to the Timorese marine environment and action to be taken

After analysing the risk assessment from the exposure level and vulnerability to the potential consequences of HAOPs to Timor-Leste.

It is estimated that the risk for the country is very high. In response, there is a need to implement mitigation measures to reduce the risks to acceptable levels.

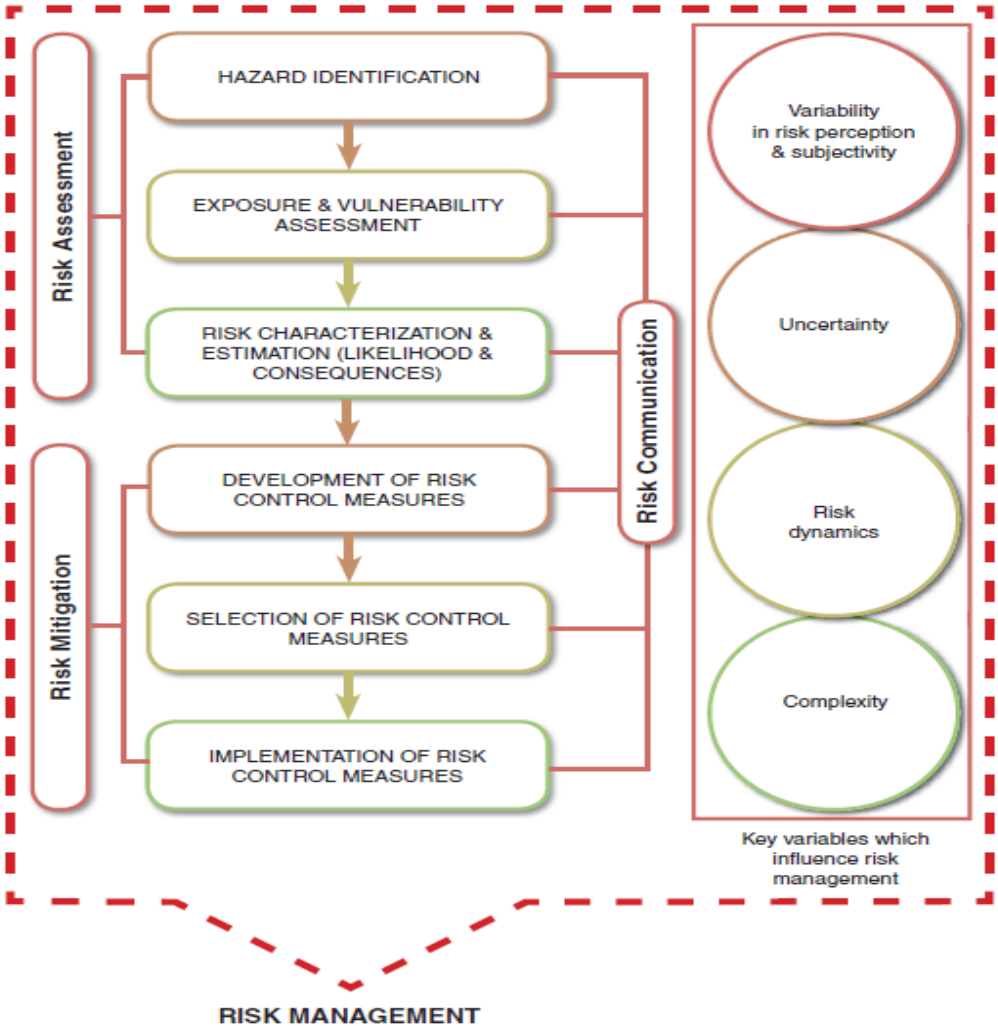

Figure 14. Risk management approach

Source: [GEF-UNDP-IMO GloBallast Partnership Programme & WMU, 2013](#).

As a young country still not affected by serious Bio-invasion, it is much more practical and economically efficient for Timor-Leste to implement the BWM Convention to prevent the introduction of HAOPs into the Timorese marine environment than managing the consequences of the introduction of HAOPs. For this reason, implementing the BWM Convention is the only practical approach for Timor-Leste to mitigate and even eradicate the risk associated with BW discharge.

Need for regional cooperation and coordination

Timor-Leste shares a land border with NTT, an Indonesian province which means that if NTT is affected by HAOPs, then Timor-Leste could be affected after certain period of time. In addition, Timor-Leste belongs to the CT region which consist of

several countries sharing maritime borders close to each other which highlights that if any country in the region is affected by HAOPs, the complete region might be affected.
Hence, the country is recommended to cooperate actively with the Indonesian government which has been party of the BWM Convention and the CT initiatives to take regional action for preventing and mitigating the introduction of HAOPs into the country and the region. In the region, Australia could support the other countries because the country works on BW management for decades.

4.8. Conclusion

The implementation and enforcement of the BWM Convention in Timor-Leste is crucial as most of the Timorese ports which engage on the international trade will be highly exposed to the introduction of HAOPs due to the exports of goods.
Furthermore, the country is rich in marine biodiversity, providing food sources and potential marine and coastal tourism activities.
For this reason, the Timorese marine ecosystem is highly vulnerable to HAOPs.

In addition, vessels that will be called at the Timorese ports are mostly coming from countries sharing similar environmental conditions with Timor-Leste.
Therefore, HAOPs from such countries may survive and become invasive to the Timorese native species and cause their extinction.
Consequently, the introduction of HAOPs into the Timorese marine environment might cause a catastrophic impact to the coastal communities.
Therefore, the risk of HAOPs to Timor-Leste is high. In response, there is a need to implement and enforce the BWM Convention in the country to manage risk associated with BW and sediments to acceptable levels.
Moreover, Timor-Leste need to enhance a regional cooperation and coordination for the protection of marine ecosystem as the country shares land border and maritime borders close to countries belong to the CT region.

CHAPTER 5

Challenges faced by Timor-Leste from the accession to the implementation of the BWM Convention

5.1. Challenges faced by DNTM and MTC for the ratification of the BWM Convention

Established in 2016 with 18 active staff, the DNTM is the only national maritime administration in Timor-Leste. It has five departments and one harbour master controlling Dili, Oecusse, Atauro, Com, Suai, Beaço, and Betano as can be seen in Figure 15.

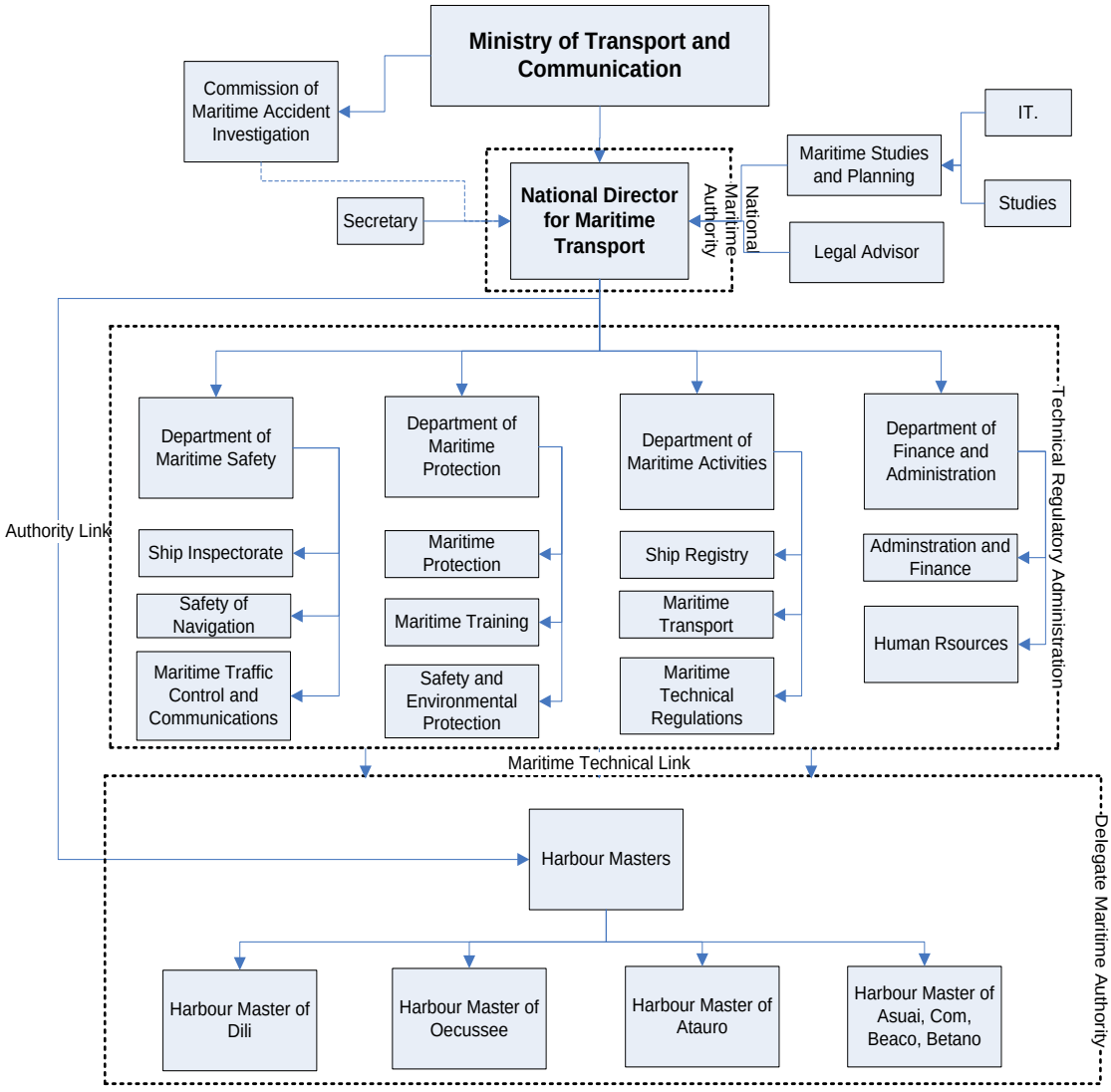

Figure 15. The organizational structure of DNTM

Source: DNTM, 2016.

Up to the present time, none of any IMO convention has been ratified by Timor-Leste due to the lack of technical knowledge and the complex process for the ratification.
The ratification process of the BWM Convention is demonstrated in Figure 16.

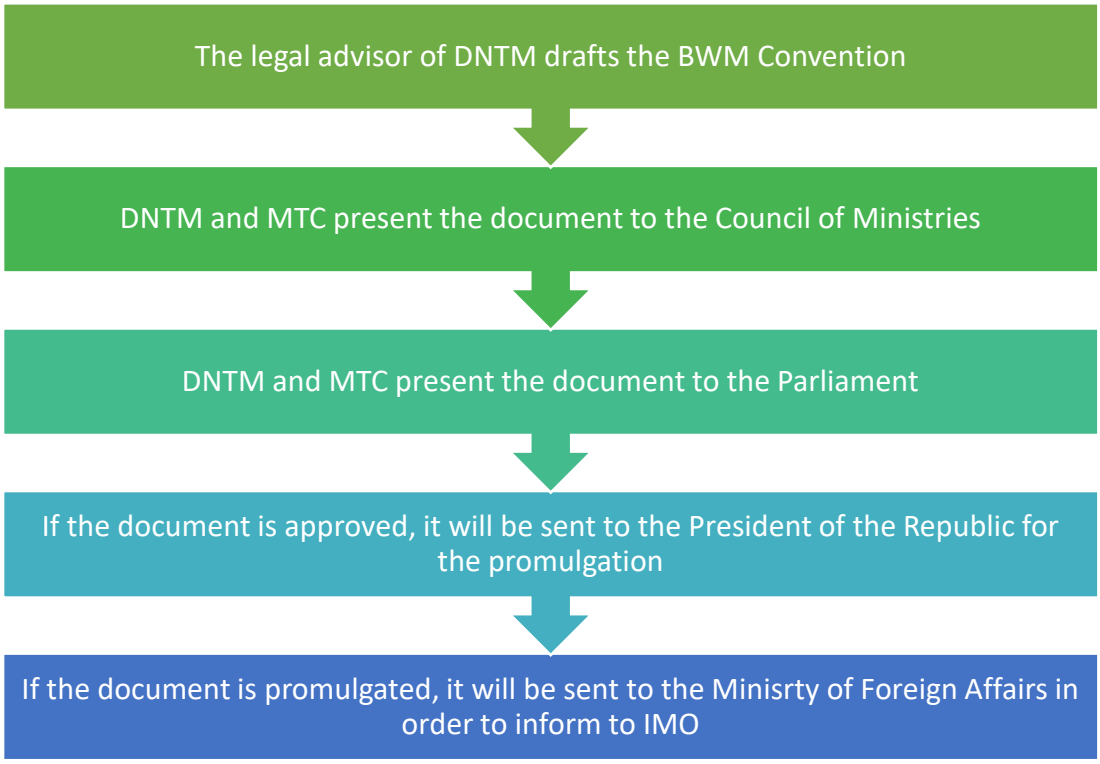

Figure 16. The ratification process of the BWM Convention

Another difficulty before the ratification of BWMC is the political process requiring the formal approval from the Council of Ministries, the Parliament, and Promulgated by the President of the Republic. If the BWM Convention is rejected by any of the sovereign organ demonstrated in Figure 16, the process should be repeated. In addition, the government period is only for four years; hence, if it ends before the BWM Convention is promulgated by the President of the Republic, then the process should be repeated from the beginning.

Furthermore, the importance of the maritime sector to the economy of the country is not widely recognized by nationals and politicians. Therefore, DNTM and MTC should convince all the Ministries, the deputies in the parliament, specially the relevant commission, and the President of the Republic.

Moreover, changes in the government may complicate the process.

"In general, there is a lack of knowledge in the country regarding the maritime sector. And it's difficult for the government which is only for four years to start the process and ended in their period of government, and what's happened to us is that the most of the time when we are in the process, we convince everyone and everyone knows what is necessary to be done, but after it's approved by the Council of Ministries, it goes to the Parliament and finally, is the end of the government and the Parliament is dissolved that have been the last three times that is the main reason why this was not the most of the international convention have not been ratified". (ATMI Team Leader)

5.2. The political challenges

The lack of the technical knowledge of the Council of Ministries, the Parliament, and the President of the Republic office affect the ratification process. As the convention may not be fully understood, the ratification proposal may be rejected by the Council of Ministries. Furthermore, the same situation may happen at each step because of limited maritime expertise in the country. Therefore, it might be challenging for them to commit for the approval of the convention in a reasonable period of time.

For instance, when the SOLAS, STCW, and MARPOL conventions were presented to the Parliament in 2017, the three conventions were rejected due to the time constraints as they deputies and their advisors were trying to review such conventions to comprehend in a short period of time.

Another example is the legislations on ship inspection and ship registry. After being sent to the President of the Republic for the promulgation in 2018, the legislation was veto. Therefore, up to the present time, the legislations for ship inspection and ship registry have not been implemented in the Timor-Leste.

5.3. Challenges faced by DNTM for the implementation of the BWM Convention.

To perform BWM Convention Flag State, Port State and Coastal State duties, the administrative staff must be familiarized with the convention and its implementation. However, there is a lack of preparation in human resource from DNTM for the implementation of the BWM Convention up to the present time.

Notably, lack of technical knowledge and lack of cooperation among relevant stakeholders might hamper the DNTM when implementing the BWM Convention. In short, DNTM may be unable to properly implement and enforce the convention and apply penalties for any violation.

> *"Human resources and facilities will be an issue, which is faced if not prepared properly".* (Director of DNTM)

Similarly, DNTM designated staff could face some difficulties when performing the duty of the coastal state as follows:

- issuing exemption,
- conducting risk assessment,
- designating the BWE areas for ships called at Tibar Bay port, Suai port and Dili port,
- detecting and investigating any violation of the BWM Convention,
- organizing with relevant stakeholders for conducting the scientific research and data collection, and etc.

In addition, domestic legislation supporting the implementation of the convention may be affected by the lack of technical knowledge.

> *"Regulation is also an important factor that needs to be prepared, such as domestic regulations to support the implementation process".* (Director of DNTM)

After the BWM Convention ratification, stakeholders (Figure 17) may be involved in the implementation of the convention besides DNTM which requires identification and coordination mechanisms.

> *"Regarding the stakeholders, we have the Ministry of Transport and Communication is one of them, including in that the DNTM – the regulatory body and APORTIL. From there, we need to include the new port development, all the terminals which are three terminals, and one bulk terminal in this one plus the new port which is Bollore (Tibar Bay port), the Ministry of Defence, because the Ministry of Defence is in process to establish the National Maritime Authority and they will have harbour masters, they will have harbour masters all around the operational ports".* (ATMI Team Leader)

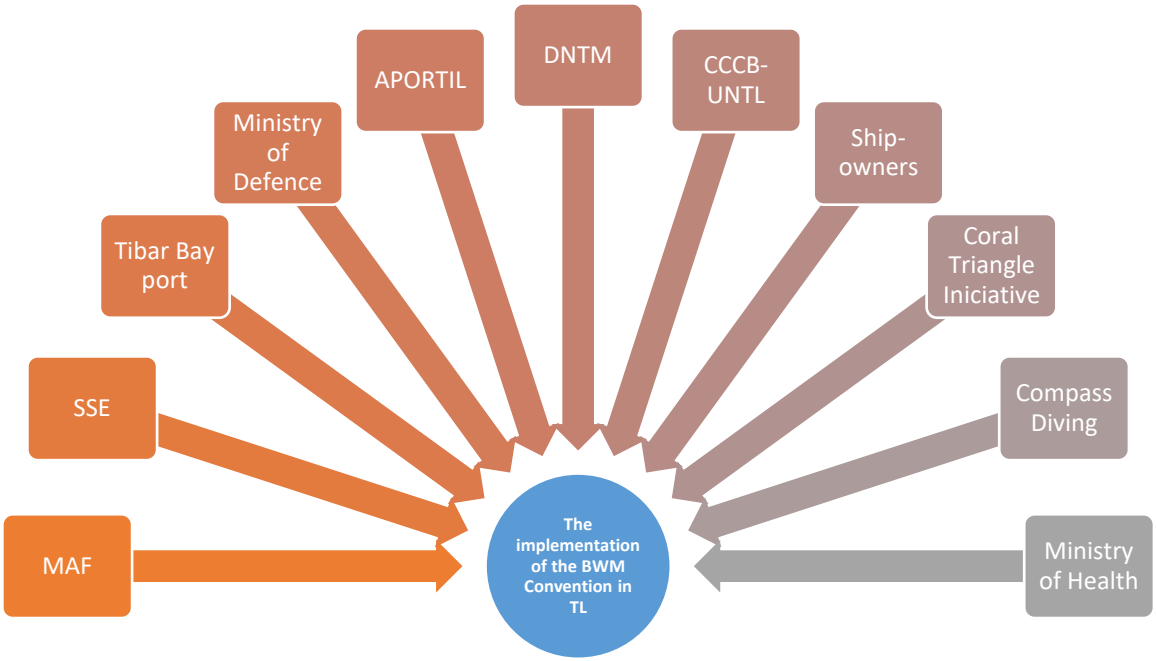

Figure 17. The involvement of some stakeholders for the implementation of the BWM Convention in Timor-Leste.

In that regard, one of the challenges that DNTM will face in the implementation of the BWM Convention might be a lack of cooperation among the stakeholders presented in Figure 17. For example, to conduct a PBBS in the areas of Tibar Bay port, Suai port, and Dili port; there is a need to involve APORTIL and the Tibar Bay port authority for the access to port areas and the detail of shipping activities, Compass Diving for boat and divers, the fisheries department for existing data, the CT initiative for the existing data and technical assistance, health department for bacteria and pathogens data analysis, the CCCB of UNTL for expertise and data analysis.

Consequently, it will be challenging for DNTM to coordinate with such stakeholders to conduct the PBBS effectively if they are not willing to cooperate with each other.

"Another thing that becomes a challenge, if it does not get support from stakeholder". (Director of DNTM)

Furthermore, additional stakeholders such as environmental NGOs, fishers' associations, local communities and seafarers may support the implementation.

5.4. Challenges faced by the Timorese seafarers for the implementation of the BWM Convention.

The Timorese seafarers play a crucial role for the implementation of the BWM Convention as stated in Regulation B-6 of the convention.

Currently, there are 106 Timorese seafarers which are required to be familiarized with the implementation of the BWM Convention on-board vessels. Most of the seafarers were trained and educated in Timor-Leste and some were trained and educated in other countries such as Indonesia, Malaysia, Philippines, Australia and Portugal.

As the BWM Convention was just entry into force in 2017, most of the Timorese seafarers are still unfamiliar with the convention. Therefore, when the convention is ratified, there might be difficult for the seafarers to implement it on board vessels, specifically referring to the BWE and BWT.

"In East Timor, here it is not happening so much for the ballast water, they do not even know how to discharge ballast water in the proper way". (The President of the Timorese Seafarers' Association)

However, seafarers on international voyages will have to comply with the BWM convention and their experience will build expertise.

5.5. Challenges faced by ship-owners for the implementation of the BWM Convention

Implementing the BWM Convention on board vessels will be challenging for the Timorese ship-owners due to the lack of technical knowledge, leading to unawareness of the potential consequences of unmanaged BW discharge. Consequently, the Timorese ship-owners might not be interested in implementing the convention despite the importance of performing the BWE and the BWT for the protection of marine biodiversity.

Furthermore, Timorese flagged vessels engaged on the international voyages will have to invest in expensive treatment system.

However, it is not a serious issue for the country at the moment, as all the Timorese flagged vessels listed in Table 5 do not engage on the international voyage.

Table 5

The list of the Timorese ship-owners

Ship Name	Ship Type	Ship Owner/Agent
Mp. Berlin Nakroma & Mp. Berlin Ramelau	Ferry	APORTIL
Mv. Laju Laju	Roll on/off	Versado
Mt. Dato Siri-Loe	Tanker	Sharalia Agency
TB TJ2	Tug Boat (TB)	Pacific Agency
Mv. Leader 1	LCT	Dili Raio Brilhate
Mp. Atauro Express	Ferry	Autauro Express Agency
TB. Mell Soraya & Mv. Victory 2	TB & LCT	MATO
TB. Gilficac	TB	Gilficac Agency

5.6. Conclusion

The ratification and the implementation of the BWM Convention in Timor-Leste is challenging for all the stakeholders which are involved.

Further, the ratification process of the convention is complex as it requires the approval from the Council of Ministries, the Parliament, and the President of the Republic.

If the convention is rejected by any of such sovereign organs due to the lack of technical knowledge or political commitment, or the government period ends before it is promulgated by the President of the Republic, all the process will be repeated.

Moreover, once the BWM Convention is ratified, its implementation will be challenging for all the relevant stakeholders due to the lack of technical knowledge as it requires competent seafarers to conduct BWE and BWT operation on-board vessels, professional DNTM staff to perform the flag state and coastal rights and obligations, and etc. Besides, the lack of cooperation among relevant stakeholders could cause an ineffective implementation of the convention in the country.

CHAPTER 6

Solutions to fill the existing gaps

6.1 Lessons learned from other parties of the Convention

As Timorese neighboring countries, Australia and Indonesia sharing similar environmental condition with Timor-Leste. Both countries depend on marine resources and intend to preserve biodiversity. Therefore, both ratified BWM Convention.

As a young country geographically located between Australia and Indonesia, it is important for Timor-Leste to enhance the technical cooperation with them regarding the implementation of the BWM convention.

6.1.1. BWM in Australia

Following Canada and the United States, Australia is one of the first countries in the world to regulate discharge from vessels (Lakshmi et al., 2021) before the entry into force of the convention in 2017.

As a major raw material exporter, Australia developed national regulations and ratified the BWM Convention to protect its ports which are exposed to the introduction of HAOPs.

Since the entry into force of the Convention, all vessels calling Australian ports must comply with the BWM Convention requirements and in some areas of the country are subject to additional measures (Victoria State).

Notably, the Australian government decided to attribute compliance monitoring and enforcement to the Department of Agriculture, Fisheries and Forestry (DAFF). Indeed, Australia considers BWM and biofouling as biosecurity concern and consequently managed by a dedicated body independent from maritime administration.

6.1.2. BWM in Indonesia

Indonesia is the largest archipelagic country in the world. So, maritime transport is crucial for the unity of the country. With 141 ports engages on international trade (JICA, n.d.; Nur et al., 2020) the exposure of the Indonesian international ports is very high to the introduction of HAOPs. Hence, the introduction of HAOPs is considered a high risk for Indonesia.

To protect its rich biodiversity (Bali Marine Diving, n.d.) and its fishing sector providing USD 27 billion and providing 7 million jobs for the Indonesians (World Bank, 2021), in 2015, the government of Indonesia through the Ministry of Transportation ratified the BWM Convention.

Before the ratification of the convention, there were several domestic laws and regulations concerning about the protection of marine environment from HAOPs which have been adopted by the Indonesian government as follows:

- The navigation law No. 17/2008 Article 148, 149, 229, and 325.
- The government regulations No. 21/2010 articles 3 paragraph 2g, 5 paragraph 3a, 14 paragraph 1-4, and 15 paragraph 1.
- The regulation of the Ministry of Transport No. 29/2014 articles 3 paragraph 2b, 5, 10, 14, 17, 46, 48 - 50, 52, 58 – 64, 67, and 74.

The country ratified the BWM Convention after been supported by the Globallast project and the IMO – Norwegian Development Cooperation Agency (NORAD) project for technical assistance on ratification and implementation of key IMO conventions.

Although Indonesia ratified the BWM Convention lately, the country immediately includes the BWM regulation to the government regulation (President Regulation No. 132 of 2015), concerning the ratification of the BWM Convention.

Furthermore, Indonesia also has involved in Regional strategies for BWM in East Asian Seas.

6.2 Recommendations to the Timorese government for the ratification and implementation of the BWM Convention

6.2.1. Developing a National BWM Strategy

To manage the risk associated with BW, Timor-Leste should primarily develop a National Ballast Water Management Strategy (NBWMS).

As young country which faces several challenges from technical to the political matters for the ratifications and implementation of the convention, the NBWMS is a practical approach for Timor-Leste as it will include all the national regulatory framework in addition to policies, legislation and institutional arrangement and also programs of work and action plans.

In addition, for Timor-Leste to develop the NBWMS framework, there are five steps in the process as can be seen in Figure 18.

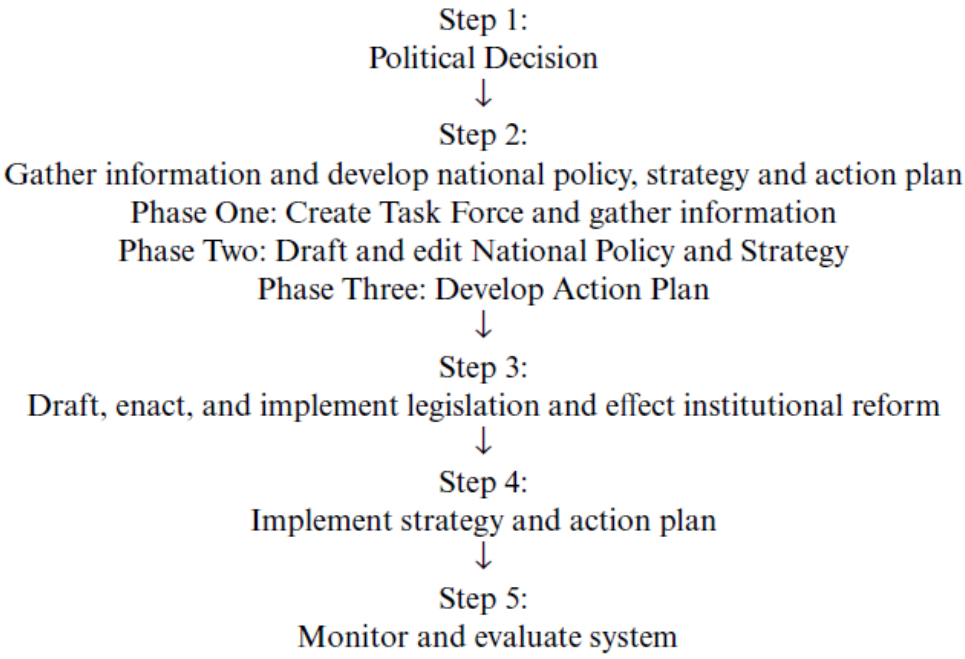

Figure 18. The steps in the development process of NBWMS
Source: Tamelander et al., 2010.

The NBWMS will include all the relevant stakeholders either public or private from the earliest stage through the establishment of a National Task Force (NTF). The NTF aims to support and advice the development process of the NBWMS.
After the NTF is established, a lead agency will be identified. It could be the DNTM and the SSE or other governmental entity, as long as it is decided collectively, transparently, and reasonably.
As a result, there will be more collective action from all the key players for the ratification and the implementation of the convention.
The recommended relevant stakeholders to be included in the NBWMS for Timor-Leste along with their responsibilities are listed in Table 6.

Table 6

The list of recommended stakeholders for NBWMS of Timor-Leste

Organization	Roles & Responsibilities
Recommended Lead Agency **(**DNTM & SSE)	Coordinating and overseeing the implementation of the NBWMS, and etc.
APORTIL	Elaborating and implementing port BWM Plans and provision of relevant infrastructure. e.g. port reception facilities if needed.

Fisheries department (MAP)	Regulating and overseeing fisheries and aquaculture.
Quarantine Authority	Enforcing regulations to prevent the introduction of disease and pathogens.
Ministry of Health	Evaluating and supervising the sanitary control activities in Tibar Bay port, Dili port, and Suai port.
Ship owners & port users	Enhancing the procedures and activities on-board vessels. Supporting information to ship masters regarding the requirements of the ports to be visited.
Fishing and Aquaculture industry	Supporting data as their activities are considered as part of introduction vectors of HAOPs.
Timor Gap & ANPM	Developing and regulating the exploitation of Timorese oil and gas. The oil and gas exploitation activities could be pathways for the introduction of HAOPs.
CCCB - UNTL	Conducting the taxonomy analysis to determine if the species are native or non-native.
Environmental NGOs	Supporting the monitoring task as they could detect the introduction of HAOPs in the earliest stage.

To develop the NBWMS, Timor-Leste needs to request technical assistance from parties of the convention, mainly Australia as one of the best BWM countries in the world.

In addition, the country may allocate fund from the Human Capital Development Fund (FDCH). On the other hand, Timor-Leste may request donor to the Australian Aid (AUSAID), German Cooperation (GIZ), Japan International Cooperation Agency (JICA), United State Aid (USAID), European Union, Asian Development Bank (ADB), and etc.

These donors have supported Timor-Leste since the independence in 2002 up to the present time. In particular, the GIZ – AMBERO and JICA have supported the DNTM and APORTIL with several maritime projects.

6.2.2. Conducting the PBBS

Up to now, there has not been conducted any PBBS in the Timorese ports. Therefore, the government needs to conduct a PBBS in Tibar Bay port, Suai port, and Dili port before implementing the BWM Convention.

The government needs to conduct the PBBS in the three ports to:

- determine the status of NIS or HAOPs within the ports and surrounding areas,
- to prepare an inventory of animal and aquatic plants living in the ports and surrounding areas,
- guide the development of NBWMS and measures to the ports and visiting vessels, and
- establish a biological baseline data so that future change in aquatic communities including the presence of NIS and HAOPs could be measured.

To conduct the PBBS, the government could use the CRIMP Port Baseline Survey Protocol. This technical protocol was developed by the Australian government which has been successfully used in several regions around the world (Hewitt & Martin, as cited by Awad et al., 2014).
Moreover, data from PBBS could be used for risk assessment if there is a need for DNTM to grant exemptions to some vessels under Regulation A-4 of the convention.

Conducting Risk Assessment for grating exemption
The Suai port and Oecusse port are closer to Indonesia (NTT). Therefore, DNTM needs to conduct a risk assessment between these two ports and Tibar Bay port, and Dili port to decide if vessels from such ports will be exempted.
In addition, Timor-Leste and Indonesia (NTT) need to conduct a joint risk assessment as both countries sharing close maritime borders.
Consequently, the two governments could grant exemptions to ships operating specifically within NTT and Timor-Leste if the Regulation A-4 of the convention is met.

6.2.3. Capacity building for DNTM
The DNTM staffs need to be knowledgeable in performing the flag state, port state, and coastal state rights and obligations regarding the BWM Convention.
Therefore, DNTM needs to invest its staffs to have sufficient knowledge on the implementation of the convention before it is ratified.
In that regard, DNTM needs to send its staff to attend BWM training courses in the Timorese-German Maritime Training Unit (TGMTU).

6.2.4. Capacity building for Timorese seafarers

The government through the FDCH needs to send more Timorese seafarers to study in developed countries such as Australia (Tasmania), Portugal, Malaysia, and Indonesia.
In addition, the government needs to upgrade the TGMTU from rating to officer level to produce more Timorese qualified ratings and officers.
Moreover, the TGMTU needs to provide specific training course for seafarers regarding the operation of the BWM on board vessels.

6.2.5. Recommendation to the government for the adoption of the domestic law

The ratification of the BWM Convention could take time, even though the three Timorese ports, mainly the Tibar Bay port will operate in the mid of 2022.
In response, the government needs to adopt a domestic law to provisionally regulate and control BW discharge from all vessels engage on international voyages when calling at the Timorese ports until the BWM Convention is ratified.

6.3. Conclusion

Regarding the challenges faced by Timor-Leste for the ratification and implementation of the BWM Convention, there are several actions needed be taken by the government as well as the DNTM and the Timorese seafarers.

Furthermore, Timor-Leste needs to learn regarding the implementation of the convention from countries which have been parties such as Australia and Indonesia.
In addition, for an effective implementation, the country needs to develop a NBWMS before the ratification. In the initial stage of developing the NBWMS, a NTF consisting of all relevant stakeholders is required to be stablished to support and advice the development of the NBWMS.
Besides, the country needs to conduct the PBBS in all the Timorese ports engage on international voyage to prepare an inventory of all marine lives in the ports areas and the surrounding environments.

The Timorese seafarers and DNTM play a crucial role for the implementation of the convention. Therefore, these two institutions need to be invested for the relevant technical skills development.

Moreover, the government needs to adopt a domestic law to control BW discharge within the Timorese jurisdiction from vessels engage on international voyages before the ratification of the convention.

CHAPTER 7

Conclusion

Carrying BW on board vessels is crucial as it maintains ships' seaworthy conditions when they sail without cargoes or with less cargoes. However, the use of BW may present threats to marine environment, human health, and economy of several countries around the world include Timor-Leste.

As a trading nation, the BW issue for Timor-Leste is considered of utmost importance as all the Timorese ports engage on the international trade are exposed to the introduction of HAOP.
Furthermore, the country is vulnerable to HAOP due to the richness in marine biodiversity. Consequently, there might be disastrous impacts on the Timorese Blue economy and the coastal population if HAOP is introduced into the Timorese marine environment.

To protect the Timorese marine biodiversity from HAOPs, there is a need for Timor-Leste to ratify and implement the BWM Convention.
Nevertheless, several challenges are faced by the country to ratify and implement the convention due to the lack of technical knowledge, lack of cooperation among the relevant stakeholders, and etc.
Addressing challenges to ratify and implement the BWM Convention effectively requires numerous recommendations to be taken by all the key players. In that regard, learning from the convention's parties are needed and the development of the NBWMS and the NTF are recommended to be established before ratifying the convention.
Besides, the development of human resources is crucial for the implementation and enforcement of the convention.

The protection of the Timorese marine biodiversity is an urgent need. However, to ratify and implement the BWM Convention might take time as several stages are required to be done in advance.
Therefore, the country is recommended to adopt a national law similarly to the BWM Convention to provisionally regulate BW discharge until the convention is ratified.

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Annexes

Annex I

The list of threatened species in Timor-Leste

	Species Name	Scientific Name	Group
1.	Bigeye Tuna	*Thunnus obesus*	Fishes
2.	Blackspot Tuskfih	*Choerodon schoenleinii*	Fishes
3.	Black-blotched Stingray	*Taeniura meyeni*	Fishes
4.	Giant Wrasse	*Cheilinus undulatus*	Fishes
5.	Southern giant clam	*Tridacna derasa*	Fishes
6.	Giant clam	*Tridacna gigas*	Fishes
7.	Small giant clam	*Tridacna maxima*	Fishes
8.	Fluted giant clam	*Tridacna squamosa*	Fishes
9.	Bear paw clam	*Hippopus hippopus*	Fishes
10.	China clam	*Hippopus porcellanus*	Fishes
11.	Giant coconut clam	*Birgua latro*	Fishes
12.	Highfin Coral Grouper	*Plectropomus oligacanthus*	Fishes
13.	Polkadot Cod	*Plectropopmus areolatus*	Fishes
14.	Spotted Eagle Ray	*Aetobatus narinari*	Fishes
15.	Basking shark	*Rhincodon typus*	Fishes
16.	Green turtle	*Chelonia mydas*	Mammals
17.	Leatherback turtle	*Dermochlys coriacea*	Mammals
18.	Hawksbill turtle	*Eretmochelys imbricata*	Mammals
19.	Loggerhead turtle	*Caretta caretta*	Mammals
20.	Olive ridley turtle	*Lepidochelys olivacea*	Mammals
21.	Sperm whale	*Physeter catodon*	Mammals
22.	Killer whale	*Orcinusu orca*	Mammals
23.	Spinner dolphin	*Stenella longirostris*	Mammals
24.	Bottlenose dolphin	*Tursiops truncatus*	Mammals
25.	Indo-pacific Hump-backed Dolphin	*Sousa chinensis*	Mammals

Annex II

Questionnaires used for the Interviews

Dear Sir / Madam,

I am Domingos Ximenes Nunes, an MSc student from the World Maritime University (WMU) in Malmo, Sweden. I am currently doing my dissertation for the implementation of the Ballast Water Management (BWM) Convention in Timor-Leste. In that regard, I am interested in collecting data regarding the advantages of implementing the BWM Convention in Timor-Leste, the challenges of the ratification, implementation, and enforcement of the convention, and actions to be taken to address the challenges. Therefore, I am inviting your participation in this research by interviewing with the following questions and kindly let me know your reasonable time for the interview with zoom or other platforms.
Many thanks in advance for your kind support.

Contact Information
This research has been reviewed and approved by the World Maritime University Research Ethics Committee. If you have any additional questions or concerns about this research, please contact:
Student's name: Domingos Ximenes Nunes
Specialization: Maritime Safety and Environmental Administration (MSEA)
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You can also contact my research supervisor.
Supervisor's name: Capt./Dr. Raphael Baumler
Position: Head of Maritime Safety and Environmental Administration
E-mail: rb@wmu.se

Part I.

Ballast water supervision

1. Could you please provide the number of vessels which are called to the ports every month?
2. Do you monitor the BW discharges in ports?
3. Are there any BW requirement/restrictions in ports?
4. Are ships required to submit a Ballast Water Reporting Form before discharging BW?
5. Is there any BW inspection by port authority on arrival?

Part II.

Ballast Water Ratification

6. Could you please explain, why until the present time, the country has not ratified the BWM Convention yet?
7. What are the challenges faced by DNTM to ratify the BWM Convention?
8. When the BWM Convention is ratified, what are the challenges that DNTM will face to implement and enforce the convention?
9. As the seafarers will also implement the BWM Convention, how often are the Timorese seafarers familiarized with implementing the BWM Convention on board vessels?
10. How many stakeholders could be involved in the implementation of the BWM Convention?
11. Do you plan to prepare the ratification and organize a National task force on BW?
12. Besides the BWM Convention, do you have any additional suggestions for the protection of the Timorese marine environment from the threat of invasive aquatic species?

Part III.

Marine Environment

13. As Timor-Leste is rich in marine biodiversity, could you indicate if biological baseline survey (in ports and coastal areas) have been done?
14. Are there any native species that are endangered for extinction?
15. Have there any non-indigenous species been found within the Timorese marine environment?
16. Please indicate the percentages of Timor-Leste GDP which are covered by the fishing sector?

17. As many Timorese are directly beneficiated by the coastal tourism activity, how many are they?