

THE CADETS' UNDERSTANDING OF THE BALLAST WATER MANAGEMENT CONVENTION

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ABSTRACT. The International Maritime Organization (IMO) since September 8, 2017, has **implemented** the Ballast Water Management (BWM) Convention as an effort to protect the maritime environment from ballast water pollution. The ballast water is water used by ships to maintain stability when the ship is unloaded to sail safely. This study aims to determine to what extent the understanding of PIP Semarang cadets in the 7th and 8th semesters of Post Sea Project to the BWM Convention. The research method used is an analytic description with a cross-sectional approach using questionnaires and in-depth interviews. The sample consisted of 49 cadets majoring in the Deck and Engine departments. The study results indicated that most of the respondents do not understand the BWM Convention correctly. On the question of when BWM was enacted, the correct answer was 2.04%. On the question of when Indonesia ratified the BWM, the correct answer was 0%. On the question of how the implementation of BWM for the D-1 standard (ballast exchange) was 2.04% and the D-2 standard (ballast treatment) is 4.08%. However, on the question about the importance of handling ballast water 34.69% answered correctly, which means that they know the dangers of ballast water and it is very important to handle it so as not to impact health and environment. The suggestion is to disseminate the information to cadets through seminars, including marine pollution courses or special training on ballast water.

1 INTRODUCTION

Indonesia as the World Maritime Axis has been known since the Majapahit era [1]. With a coastline of 95,161 km², Indonesia ranks as the second longest coastline in the world after Canada [2]. Three-quarters of Indonesia's territory is the sea, with 17,504 islands. Transportation by sea by ship is essential to connect between islands.

Since 2015, the Asean Economic Community (MEA) has been established as a forum for free trade for ASEAN member countries. With the MEA, the Indonesian economy is more enthusiastic about the increase in exports of manufactured goods. Thus, more and more ships are entering and leaving ports in Indonesia carrying manufactured goods. Therefore, sea transportation is the most ideal and preferred mode to support international trade. According to Fugazza et al. (2017), sea transportation transports more than 80% of the primary world trade commodities. The large carrying capacity of the ship makes it the primary choice for import-export activities.

The ballast water carried by ships and discharged at the port of arrival when the ship is about to load commodities comes from the water of the departure port, which is not known to be clean [4]. When the ship is empty without cargo, it will carry a certain amount of ballast water as a counterweight so that the vessel can sail in a stable condition and not float. Gollasch et al. (2018) and Kurniawan et al. (2022) state that ballast water has caused losses, both in the inner sphere of ballast water which has the potential to contain food and is also a living medium for specific biota that can collect high pollutant elements and as a place for biota to develop. Attachments are destructive to shipbuilding construction and externally (ballast water can potentially cause pollution in the marine environment).

Irreversible and economic loss. Xue et al. (2021), in their paper, states that every day 3,000-7,000 alien species (microorganisms) are brought to all the world's oceans through ballast water and then disposed of in a new environment; this will cause invasiveness and change the ecosystem structure of native flora and fauna and will cause ecological changes in a whole. Naik et al. (2021) estimate that more than 12 billion tons of ballast water move worldwide each year. Dobbs et al. (2013) conducted research in the waters of Singapore, Mexico, and Virginia, United States of America, regarding the operation of ballast water on ships that can potentially spread *Vibrio cholerae* bacteria to all ports in the world. The study also assessed antibiotic resistance in *Vibrio cholerae* bacteria found in ballast water. In 2012 (Rivera et al.) studied organisms in ballast water tanks and found that living bacteria were 32% freer than plankton which was only 18%. Bacteria that increased 26 times from ballast water were found in coastal waters, then the density of VLP (virus-like particles) was 88 times as well as the

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abundance of microbes in the biofilm. In addition, *Vibrio cholerae* bacteria were found in BOB (ballast organic biofilm) from waters that were twice as much as BOB from the high seas. Altug et al. (2012) examined the Turkish Marmara Sea from 2009 to 2010; the study aimed to study foreign species that entered the Turkish Marmara Sea from ballast water output. This study found at least 38 species of bacteria, 27 of which are pathogenic. El-Husna et al. (2017) assessed the impact of the presence of microbes from ballast water on environmental health. It was found that there was a relationship between the presence of microbes (*Vibrio cholerae*, *Escherichia coli*, and *Enterococcus intestinal*) in ballast water and the coastal environment of Cilacap. In 2022 (El-Husna et al.) found 9 (nine) types of pathogenic bacteria from ballast water discharged at the port of Tanjung Emas Semarang, with the content of *V. cholerae*, *E. coli*, and *E. intestinal* exceeding the threshold allowed by the Standard D-2 Ballast Water Management (BWM) Convention [13,14].

The BWM Convention is a convention regarding the management of ballast water management, mechanically, physically, chemically, and biologically, which can be used singly or in combination to remove, kill harmful organisms or prevent the entry of harmful aquatic organisms and pathogens from sediment and ballast water [13]. In the BWM Convention, there are several standards. Such as, the D-1 standard regulates how to reduce and eliminate harmful organisms from ballast water by exchanging ballast water on the high seas (with a distance of 200 NM (nautical mile) from the outermost land) with a depth of 200 meters. If it cannot do it on the high seas, it can be done near land with a distance of 50 NM and a depth of 200 meters. While the D-2 standard regulates the performance standards for the content of microorganisms in ballast water which will be discharged into the waters when the ship is docked and loading goods. In the Standard D-2 BWM Convention, that ballast water released at the port must meet the standards for *Vibrio cholerae* content of 0 CFU/100 ml of the water sample, *Escherichia coli* 250 CFU/ 100 ml of the water sample, and *Enterococcus intestinal* 100 CFU/100 ml water samples [14].

The Cadets are prospective seafarers going through education and training as a means of initial formation [15]. In the education and training process, they will introduce various process activities they will experience while working at sea. For the ship to sail safely, it must use ballast water as a counterweight, the process of ballasting and deballasting. The impact of ballast water discharge on the ecosystem at the ship's arrival point, Etc. Including regulations governing the use of ballast water, namely the Ballast Water Management (BWM) Convention.

2 METHOD

This study uses an analytical description method with a cross-sectional approach. The study was conducted on 49 cadets from the Nautika and Teknika study programs in semesters seven and eight who already had work experience at sea when they did Sea Project for one year. The researchers used questionnaires and in-depth interviews to obtain data.

3 RESULTS AND DISCUSSION

The study's results on whether the respondents agreed with the promulgation of the BWM Convention by IMO Indonesia ratified it 49 people (100%) strongly agreed. On the question of whether they decide if the Indonesian government makes laws and regulations as a derivative of the BWM Convention to protect Indonesian waters, 49 people (100%) answered agree. When asked whether it was decided for ships that did not exchange ballast water, nine people (18.387%) replied they did not agree, and 40 people (81.63) agreed. On whether it is agreeable for ships that do not treat ballast water before being discharged, five people (10.20) answered disagree, and 44 (89.80) answered agree. On whether they agree to meet the requirements of the D-2 standard, ballast water treatment facilities are provided at the port, and 49 people (100%) agree. Regulations

Seeing the answers given by respondents, they are pretty optimistic that the cadets, as prospective seafarers, understand the importance of rules governing shipping activities to protect the maritime environment from the invasion of foreign microorganisms that pose a risk to the environment and health.

When asked about when the BWM Convention was promulgated, one person (2.04%) answered correctly, eight people (16.33%) answered incorrectly, 39 people (79.59%) answered they did not know, and 1 (2.04%) people say forget. On the question of when Indonesia ratified the BWM Convention, 0 people answered correctly, 37 people answered they didn't know (75.51%), one person answered forgot (2.04), and 11 people responded incorrectly (22.45%). For the question of the number and year of the laws and regulations which are derivatives of the BWM Convention, one person (2.04%) answered correctly, 38 people (77.55%) answered they did not know, nine people (18.37 %) answered incorrectly, and one person (2.04%) answered they forgot. On the question of what is known about the D-1 BWM Convention standard, there were two people (4.08 %) who answered correctly, 38 people (77.55%) answered they did not know, eight people (16.33 %) answered incorrectly, and one person (2.04%) answered forgot. Regarding knowledge about the standard D-2, the results are that 37 people (75.51%) do not know, and 12 people (24.49%) answered incorrectly. On the question how far is the ballast water discharge from the outermost land, one person (2.04%) responded correctly, did not know as many as 22 people (44.90%), 25 people answered incorrectly (51.02%), and answered forgot one person (2.04%) On the question of how many meters the depth of ballast water discharge is, 14 people (28.57%) answered correctly, 20 people answered don't know (40.82%) and responded wrongly 15 people (30.61). On the question of how many kinds of ballast water treatment on the ship before being discharged, 38 people (77.55%) answered they did not know, and 11 people (22.45%) answered incorrectly. On the question

of what chemical compounds are used for ballast water treatment, 38 people (77.55%) answered they did not know, and 11 people (22.45%) answered incorrectly. And for the question of whether ballast water treatment before being discharged is urgent, 17 people (34.69%) answered correctly, 20 people (40.82%) answered they did not know, and 12 (24.49%) answered incorrectly.

4 CONCLUSION

From the results of the cadets' answers, their level of knowledge varies depending on their experience while sailing. The cadets sailing in international waters usually have experience in ballast water management on board. Because many countries have enforced the provisions of the BWM Convention, requiring ships to meet the D-1 standard and the D-2 standard. For the question about the urgency of ballast water management before being discharged, 17 people (34.69%) answered correctly, meaning that there was concern from the cadets as prospective seafarers to treat ballast water before it was disposed of so as not to pollute the environment.

The cadets need further socialization and education about the dangers of ballast water and its management, as well as an understanding of the BWM Convention.

Socialization can be through seminars, workshops, or entry into marine pollution lecture materials. The cadets' understanding of ballast water and the BWM Convention increases and ultimately increases awareness of ship ballast water management when they work as seafarers.

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