Progress, Challenges and the Way Forward on Ballast Water Management in Malaysia

Cheryl Rita Kaur
Centre for Coastal and Marine Environment, Maritime Institute of Malaysia (MIMA),
Unit B-06-08 Megan Avenue II, 12 Jalan Yap Kwan Seng, 50450 Kuala Lumpur, Malaysia
[E-mail: cheryl_rk@mima.gov.my]

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It is generally understood that international shipping is fairly amenable to management strategies aimed at preventing the introduction of non-indigenous aquatic species through the discharge of ballast water. Malaysia’s strategic location along the Straits of Malacca (SOM), one of the world’s busiest waterways, emphasises the need for strategies to manage ballast water issues for both national and international shipping. The International Convention for the Control and Management of Ships’ Ballast Water 2004 (BWM 2004) was ratified by Malaysia in 2010, although it has not yet been enforced for ships operating in her waters. This paper reviews progress on the implementation of the BWM 2004 provisions as well as issues and challenges faced by the various stakeholders in its implementation at the national level. Current and planned actions and programmes by Malaysia to comply with the provisions of BWM 2004 to address local concerns are also discussed.

[Keywords: Ballast Water Convention, implementation, progress, issues, challenges]

Introduction

Ballast water is essential for ships to maintain balance, stability and structural integrity, especially when unladen. Since the late 19th century, ships have used ballast water, which is pumped from the surrounding water into clean tanks and potentially dirty cargo holds (Carlton, 1985). The International Maritime Organisation (IMO) defines ballast water as ‘water with its suspended matter taken on board a ship to control trim, draught, stability, or stresses of a ship’. Generally, ballast water is taken aboard when cargo is unloaded and is discharged at the port of destination before loading new cargo. Ballast also helps ferry, military and fishing vessels to manoeuvre, facilitate control during loading conditions and maintain stability. For tankers and dry bulk carriers, ballast water is used in larger quantities to make up for weight loss after cargo is discharged.

Ballast water is also considered one of the major vectors for the transport of planktonic organisms. A wide diversity of organisms is known to exist in ballast water and associated sediments. The subsequent discharge of ballast water results in their release at ports-of-call and/or in transit, creating numerous opportunities to establish non-native populations. According to the World Conservation Union (IUCN) 2002, marine bio-invasion through ballast water is the second greatest threat to marine biodiversity after over-exploitation. Together with land-sourced pollution, over-fishing and climate change, it has been identified as among the greatest threats to the world’s oceans. This concern is also recognised by the World Health Organisation (WHO) that fears not only the detrimental ecological impacts on the marine ecosystems and its economical repercussions, but also the threats posed to human health.

The problem of invasive species is largely due to the expanded maritime trade and traffic volumes around the world. More than 80 percent of the world trade is seaborne and its volume continues to increase. The development of faster and larger ships has enabled larger quantities of ballast water to be carried more quickly and frequently to a greater number of destinations, allowing for greater numbers of species the opportunity to invade new areas. Catastrophic introductions of species have been documented worldwide with most of them having irreversible effects. Among them are Cercopagis pengoi, Eiocheir sinensis, Vibrio cholera, Neogobius melanostomus, Mnemiopsis leidyi, Asterias amurensis, Undaria pinnatifida, Carcinus maenas, and harmful algal blooms (HABs). The introduction of marine organisms that are alien to local ecosystems has serious consequences to native biota, fishery and ecosystem as a whole.
Materials and methods

Malaysia was the 27th state and among the first in the region to accede to BWM 2004 on 27th September 2010. In tandem with the ratification, Malaysia would be obliged to enforce effective ballast water management in her waters upon coming into force of the convention. This paper as such focuses on the importance of BWM 2004 for Malaysia by analysing the current status, issues and concerns involved in ships’ ballast water control and management in the country. For this purpose, various stakeholders were consulted including government agencies, shipping companies and port authorities as well as focusing on current international practices pertaining to the issue and the implications on ship operators.

This paper is organised into two parts. The first part provides a brief explanation on the international responses and initiatives taken to address the matter while the second part focuses on the progress, challenges and way forward for Malaysia towards effective implementation of ballast water control and management.

International approach

It has been more than 20 years since Canada drew the attention of the international maritime community, through the IMO, to the problems it was experiencing with the infestation of the European zebra mussel in the Great Lakes. Since then, there has been an increasing awareness on the issue. However, considerable harm has already been done around the world worth billions of dollars and the situation could worsen without effective action. Several major international conventions and forums such as the United Nations Convention on the Law of the Sea (UNCLOS), the International Convention on Biological Diversity (CBD), and the World Summit on Sustainable Development (WSSD) have highlighted the significance of the marine invasive species issue and called upon governments and industries to act accordingly, even before the IMO convention was introduced.

Several individual countries such as Argentina, Australia, Brazil, California, Canada, Chile, Egypt, Israel, New Zealand, Panama, Peru, Russia, United Kingdom, United States, Ukraine, Michigan, and Oregon, took proactive measures in enforcing stringent unilateral rules on voluntary and mandatory reporting and regulations on ships calling at their ports. These countries have the authority to stop ships from entering their ports if they do not conform to their established standards. An illustration is provided below:

(i) The Australian Quarantine and Inspection Service (AQIS) for instance in July 2001, introduced mandatory ballast water management requirements that prohibit the discharge of ‘high-risk’ ballast water from ships anywhere inside Australia’s territorial seas (12 nm limit). Vessels must also retain all ballast water records and any relevant logbooks, and make these available to quarantine officers on request. In addition, all ships from international waters are required to submit a Quarantine Pre-Arrival Report (QPAR) to AQIS. This report includes the reporting of ballast water management procedures undertaken. The ship’s master is required to send the QPAR to AQIS between 12-48 hours prior to arrival in Australia, usually through the ship’s local agents. Additional requirements apply to Victoria State’s coastal traffic that stipulates ballast water must be exchanged at a minimum of 3 nm offshore.

(ii) Canada introduced a regulation in June 2006 which requires vessels carrying ballast water to be taken outside Canadian waters to either - exchange ballast water more than 200 nm from land in a water depth greater than 2000 m, or if during its voyage they have not navigated to an area more than 200 nm from shore with a water depth of 2000 m; to exchange ballast in an area at least 50 nm from land with a water depth at least 500 m. If a ship is unable to exchange ballast water due to stability or safety concerns, then the authorities must be notified at least 96 hours before entering Canadian waters, or as soon as it is practical. Besides that, when a ship is destined for a Canadian port, the master of the vessel must submit a fully completed Ballast Water Report Form by an approved method detailing whether the vessel has a
Ballast Water Management Plan (BWMP) appropriate to that ship.\textsuperscript{ii}

(iii) As for New Zealand, effective 1\textsuperscript{st} April 2004, legislation requires mid-ocean ballast water exchange (>200 nm offshore) and prohibiting the discharge of sediments into their territorial waters (12 nm territorial limit). Any sediment must be disposed off by the use of an approved landfill. Vessels discharging ballast must record in their logs where the ballast water was loaded together with the volumes, location and dates of all exchanges undertaken. Before arriving in New Zealand, vessels must complete a ballast water declaration form; and a quarantine officer’s permission to discharge ballast must also be obtained prior to any discharge at the port.

(iv) In the United States, the federal legislation proposed in the Congress conforms to the IMO convention requirements, except that the regulation D-2 biological efficacy standard is some 100x more stringent. However, it may be anticipated that this proposed regulation will be subjected to further amendment prior to a final acceptance.

The International Convention for the Control and Management of Ships’ Ballast Water and Sediments 2004

Due to the complexity and transboundary nature of ballast water control and management issues, the IMO proposed the International Convention for the Control and Management of Ships’ Ballast Water and Sediments which was adopted by consensus at a Diplomatic Conference in February 2004\textsuperscript{9}. The convention builds on the complementary roles of coastal, port and flag states as well as the shipping industry in protecting the marine environment by embracing effective ballast water management measures (IMO, 2005)\textsuperscript{10}. The convention will come into force once it is ratified by 30 countries representing 35 percent of the world’s merchant shipping tonnage (as on 10 February 2014, there were 38 contracting states representing 30.38 percent of world tonnage). Several other countries have announced their preparedness to ratify the convention soon (communication with IMO representatives).

Among the challenges faced in ratification are the different sets of international laws and regulations which make it difficult and complex for ship operators to comply with requirements at different parts of a voyage. The IMO requires states to adopt international standards in reducing or eliminating problems caused by ballast water and has introduced several initiatives for that purpose:

- Six pilot countries (India, South Africa, Ukraine, Iran, China, and Brazil) have been successfully involved in a demonstration port survey and management plan to minimize the risk of transfer of alien species in ballast water through the IMO-GloBallast Programme (2000-2004)\textsuperscript{11}. Through this programme, technical assistance is extended to these countries to prepare them for the coming into force of the convention. These include education and awareness building, port baseline surveys, ballast water sampling to assess high risk ships calling to their ports, training of port and shipping personnel in ballast water management practices, and assistance with local laws and regulations.

- The IMO-GloBallast Partnership Initiative (2007) was further aimed at expanding government and port management capacities, investigating legal, policy and institutional reforms at country level, developing mechanisms for sustainability, and driving global and regional coordination and cooperation.

- The IMO has also developed ballast water guidelines [Assembly Resolution A.868 (20)] which, among others, stipulate that ships should carry out ballast water exchange at sea. The purpose of this is to minimise the transfer of non-indigenous species and reduce the risk of exotic species invasions. However, ballast...
water exchange is limited by safety considerations, making a ship especially vulnerable to rough conditions, posing serious threat to the crew and cargo. As such, ballast water treatment is now one of the main focuses of the IMO convention and a number of countries are currently carrying in-depth research on ballast water treatment technologies based on the IMO guidelines. Due to the transboundary nature of the issue, it is argued that successful ballast water control and management would only be possible through global and regional cooperation and uniform enforcement. This is definitely a challenge, but it is also important to acknowledge the consequences of not doing so. An anticipated impact is on trade which uses national commercial vessels to ports overseas where strict rules and regulations on ballast water discharge apply. Furthermore, if ports or countries act in isolation, there arises the danger of unfair economic competition especially from ports that have less stringent management systems. In addition, actions taken at national level sometimes only temporarily reduce the risk of species introductions in the respective country’s ports as they might lead to the establishment of alien species in some of the neighbouring countries due to lacking of enforcement and lower level of environmental protection practiced.

To add further, the proliferation of different sets of laws and regulations governing shipping makes compliance extremely difficult and complex for ship operators. Uncoordinated country-specific management complicates the conduct of worldwide trade. States could stop ships from entering their ports if vessels do not conform to their established standards, leading to undue delay and financial implications to ship operators. It is as such envisaged that the shipping industry would be able to wholly benefit from the IMO convention which provides greater international consistency regarding to ballast water requirements.

Situation in Malaysia: Understanding the threats imposed
Ports and shipping magnitude

As one of the world’s top twenty trading nations, the importance of the maritime sector to Malaysia cannot be underestimated. Almost 90 percent of the country’s traded goods are transported by sea. There are more than 100 landing facilities in the country, ranging from major ports to small jetties either under federal or state control (Figure 1). An estimated 80 minor ports or jetties are under the control of Marine Department of Malaysia while some of the world’s major ports, maritime hubs and trans-shipment harbours operate in Malaysia.

Malaysia is also strategically located along the Straits of Malacca (SOM), which is one of the busiest shipping lanes in the world. This Strait is a maritime superhighway that hosts a tremendous amount of maritime activities and seaborne trade that facilitates a high volume of vessel traffic (Figure 2). These range from small boats owned by fishermen earning subsistence living off its resources and barter traders, to giant container ships owned by major shipping lines as well as super tankers carrying crude oil. In 2013, over 77,000 movements of ships were reported in the SOM, making it the world’s busiest shipping lane for merchant shipping traffic. In addition, a boost in the number and sizes of ships calling at Malaysian ports has also been recorded over the years. For instance, total number of ships calling by some of the major ports in Malaysia, which stood at just 57,156 ships in 1996, increased to 65,499 ships in 2006 and more recently recorded a total of 147,447 ships in 2013. It has been projected that annual traffic in the strait will increase to above 100,000 vessels by 2020

Such growing numbers and volumes would add to the challenge for appropriate and effective ballast water management to protect the marine environment and natural resources.

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iii Estimate made by the Chairman of the Nippon Foundation, Mr. Yohei Sasakawa, in his speech at the 'Symposium on the Enhancement of Safety of Navigation and the Environmental Protection of the Straits of Malacca and Singapore' held in Kuala Lumpur, Malaysia on the 13-14 March 2007.
Fig. 1 - Major ports in Malaysia.

Fig. 2 - Number/type of ships reporting under the STRAITREP in the SOM (2009-2013), and total number of ships for the respective periods (right scale).

Type and total number of vessels reported to the STRAITREP, a mandatory ship reporting system used in the SOM. The system provides active monitoring and navigational advice for vessels in particularly confined and busy waterways. The service is implemented by the Marine Department of Malaysia designed to improve the safety and efficiency of navigation, safety of life at sea and the protection of the marine environment. The system captures vessels of 300 GRT and more of size passing through the Straits.

Source: Data from Marine Department of Malaysia
All these factors represent a huge challenge for Malaysia to manage the ballast water issue. Moreover, the problem could be further compounded as any introductions of exotic species could be spread domestically by coastal vessels passing the area. It has been well-documented that domestic movement of ballast water has the potential to move marine invasive species outside their normal ranges and expand the range of established transoceanic invaders².

Concerns for Malaysia

There are many different stakeholders involved in or affected by the process of ballast water uptakes and discharges in Malaysia. Among them are the shipping sector, fisheries, mariculture, marine biodiversity, tourism, human health, as well as basic rights to environmental protection. For example, many marine protected areas, tourist spots and resorts are located along the major ports and shipping lanes and are active generators of revenue for the country and tourist destinations along the SOM such as Penang, Langkawi, Pangkor, and Port Dickson support huge economic activities for the country annually. As such, it is feared that any introduction of invasive species would have the potential to not only jeopardise the marine environment but also the national economy¹², ¹³.

The fisheries sector for instance plays a significant role in supporting coastal communities’ livelihood and the development of the national economy¹⁴, ¹⁵. The sector not only contributes to the national Gross Domestic Product (GDP) but also to employment, foreign exchange and protein source for the people. The fisheries sector contributed almost RM 10.6 billion to the national economy in 2011, while food fish sector production which comprises marine capture fisheries, inland fisheries and aquaculture totalled 1.7 million tonnes valued at RM 9.4 billion the same year. The non-food fish sector, seaweeds, ornamental fish and aquatic plants added RM 1.2 billion, a significant increase of 135% in 2011 over 2010 (DoFM, 2011). The bulk of fisheries landings for Malaysia are from the SOM area. Further, aquaculture production (brackish water) in the west coast of Peninsular Malaysia alone (in the SOM area) recorded 71,211 tonnes (49%) from the total production of 138,182 tonnes in Peninsular Malaysia in 2011, valued at RM 378 million.

These are only some of the economic sectors that face potential threats of bio-invasions from ballast water and need to be taken into consideration when addressing the ballast water issue and its potential ecological, economical and human health repercussions on the country.

Issues and challenges of ballast water management in Malaysia

While ballast water is necessary to maintain vessel safety and stability, it also facilitates the translocation of organisms to new areas around the world. As such, some of the main issues that have been identified and are being considered in Malaysia include the following:

- Ballast water is not regarded as a pollutant in Malaysia. As such, its movement within Malaysia are currently unregulated. No specific guidelines have been formulated and rules have been gazetted to specifically address the control of ballast water discharges in Malaysian ports. At present, provisions of the Environmental Quality Act 1974 and the Federation Port Rules 1953 are only applied if ballast water discharged contains oil residue; and are presently with inadequate penalty for unlawful ballast water discharge stipulated in the Merchant Shipping Ordinance 1952.

- The Marine Department of Malaysia has been following the development of this issue under the IMO very closely. However, there is greater recognition of the importance to acknowledge that the problem of harmful organisms and pathogens in ballast water is not a confined problem and hence its solution depends on the initiatives of the government as a whole. A range of ministries and institutions currently have responsibilities that are likely to have relevance to addressing the requirements, issues and gaps towards effective implementation of ballast water control and management measures in Malaysia. In a nutshell, these include at least 14 agencies/organisations and hence a significant degree of inter-agency coordination is required. As such, cooperation from all related agencies is crucial to address the matter.
Although shipping companies in Malaysia are aware of the deleterious effects of ballast water, some of them especially those plying local waters are reluctant to act since global enforcement of the IMO convention has not come into effect and that Malaysia has yet to promulgate legislation on this issue. However, the major national shipping lines currently adhere to the regulation and requirements on ballast water control and management when calling at foreign ports.

One other concern is the lack of local marine biological diversity baseline data and records of possible introductions of species associated with ballast water to the local waters. In many groups of marine organisms, there is also currently insufficient knowledge on the existing native organisms to enable assessment of possible alien species. It is as such difficult to assess the extent of the problem associated with ballast water discharges in Malaysian waters. Lack of continuous monitoring is a major impediment to detect any introduction of invasive alien species. Suitable sampling protocol and measures are therefore considered as a critical element to develop an understanding of the risks posed by ballast water, besides contributing towards establishing a baseline database for species recording at the national level.

Studies have also been undertaken to determine suitable measures towards adopting ballast water exchange mechanism in the national waters prior to coming into force of the BWM 2004. The analysis by Fuad et al. (2011), for example, showed that only the west coast off Sabah in the Malaysian waters would largely comply with the BWM requirements emphasised in paragraph 1.1 and 1.2 of Regulation B-4 with distance of 50 nautical miles from the nearest land with depth of at least 200 meter stipulated for ballast water discharge. The rest of the areas of Malaysia, especially Peninsular Malaysia, do not comply with paragraph 1.1 and paragraph 1.2 Regulation B-4 of the BWM 2004 Convention.

Considering these, it is further argued that perhaps Malaysia would need to consider the option of designating a special area for ballast water exchange in the SOM area; provided Indonesia and Singapore are consulted on the matter of identifying and designating the area. On the contrary, along with the argument that it might be neither practical nor safe to designate a special area for ballast water discharge in the Straits considering the size and depth of the straits, one other option could be for the ships to conduct ballast water exchange outside the Straits, with the distance and depth stipulated by BWM 2004 (e.g., in the Indian Ocean or South China Sea), prior to entering the Straits. These are however immediate options before adopting suitable ballast water treatment technologies onboard ships.

Discussions at national and local levels focusing on ballast water treatment technologies emphasise the availability of a number of options for undertaking a shift from exchange practices to treatment technologies in the near future. It is argued that capital and operating costs would be the major determinants in selecting suitable technologies for the purpose in Malaysia. Balaji and Yaakob stressed that by considering the costs, environmental impacts and the deadlines, a rational review of ballast water management practices ought to be considered concurrently with treatment methods to ensure that optimum shipboard ballast water management is achieved.

Discussions and on-going developments at the national level

The overall strategies on ballast water management identified for Malaysia include the possibility of delineating a suitable area for ballast water exchange, establishing a declaration system for incoming vessels, moves towards identifying suitable ballast water treatment systems, establishing baseline data and determining risk priority for incoming vessels, as well as inspection of ballast water-related parameters by means of the port state control in Malaysia to meet global standards and compliance. To achieve these, a national action plan towards preparing for the coming into force of the BWM 2004 has been established at the national level. This would be mainly through the undertaking of the following three phases by the relevant stakeholders.
Phase 1: To complete the national baseline surveys;
Phase 2: To make a risk assessment of ships calling to Malaysian ports; and
Phase 3: To work towards establishing ballast water exchange based on regional initiative/cooperation.

Progressive achievements have been made through Phase 1 under the national action plan with ballast water sampling activities focusing on ships calling to the Kertih Port, Kuantan Port, Port Klang, Port of Tanjung Pelepas, and the Penang Port undertaken by the Marine Department of Malaysia in cooperation with local scientists from the national academe i.e., University Malaysia Terengganu. Standardised method based on the Australian Centre for Research and Marine Pests (CRIMP) Protocol\(^1\) has been deployed at the national level to ensure standardisation towards building the national baseline data system. Port baseline studies and risks assessment are planned as the next step forward.

**Recommendations on the way forward**

Malaysia is proud to be among the first in the region to ratify the BWM 2004 Convention. Among the advantages to Malaysia are (1) the prevention of the spread of invasive species in the country’s waters and (2) the protection and conservation of Malaysia’s marine biological diversity. This would also be economically expedient as elimination of introduced organisms has proven to be almost impossible. Besides that, this also demonstrates the country’s willingness to discharge her international obligations under international treaties such as MARPOL 73/78, the Convention on Biological Diversity, and Agenda 21. To add on, the measure is also manoeuvred to assist in protecting valuable fisheries resources, tourism, mariculture, marine biodiversity, human health, and the ecosystems as a whole.

The main downside to the ratification is the national readiness in implementing BWM 2004 and cost implication factor which ship-owners and the local authorities would have to bear. To commit to the convention also entails meeting all the obligations that come with it and to some extent increases the burden for related authorities and ship operators. Further, there are several hurdles to overcome in addressing the issues, such as being prepared nationally in terms of policy formulation, management, regulation, research, and information dissemination. Some of the actions that are required and being undertaken in Malaysia include:

- Designating a national task force involving the various related ministries, departments and organisations to coordinate the national response to the issue.
- Addressing the gaps in national laws and regulations.
- Including training and providing information, scientific and technical assistance such as port and ballast water sampling and monitoring programmes, strengthening the ability to enforce the national laws, as well as promoting regional cooperation and information exchange in the establishment of ballast water control measures.
- Replicating the best practices from the pilot countries of the GloBallast Programme to facilitate the local development and implementation of ballast water management.

**Conclusion**

There are still a number of gaps that are being addressed for effective ballast water management in the Malaysian waters. Becoming a party to BWM 2004 was just the first step; with various initiatives and actions planned and currently underway at the national level. Continuous engagements among the stakeholders, moves towards enacting national legislation and implementing proper guidelines and rules, Malaysia will be putting into place one more significant international tool to protect the marine environment from vessel-based pollution. However, the cost implication of putting in the required treatment technology as well as for monitoring activities would be the major undesirable result which the stakeholders should have to bear when the IMO convention comes into force.

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