8-23-2015

Research on the prospect analysis and countermeasures if China joins the BWM Convention

Qinghua Gu

WORLD MARITIME UNIVERSITY

Dalian, China

RESEARCH ON THE PROSPECT ANALYSIS AND COUNTERMEASURES IF CHINA JOINS THE BMW CONVENTION

By

GU QINGHUA

China

A research paper submitted to the World Maritime University in partial Fulfillment of the requirements for the award of the degree of

MASTER OF SCIENCE

(MARITIME SAFETY AND ENVIRONMENTAL MANAGEMENT)

2015

DECLARATION

I certify that all the material in this research paper 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 research paper reflect my own personal views, and are not necessarily endorsed by the University

Signature: Gu Qinghua

Date: 2nd July, 2015

Supervisor: Wu Wanqing

Professor, Dalian Maritime University

Assessor:

Co-assessor:

ACKNOWLEDGEMENTS

This research paper was developed as part of my studies at Dalian Maritime University for the master's degree of World Maritime University in Maritime Safety and Environmental Management. I would like to express my heartfelt gratitude to a number of people, if without them, my studies would not succeed.

The first one I want to thank is my dissertation supervisor, Professor Wu Wanqing, Dalian Maritime University, for his strict requirement and scientific guidance through this work. I will benefit from his rigorous research attitude and solid theoretical foundation in my future work.

I would also give my sincerely grateful to all the professors attending this MSEM program, whose professional teaching have substantially improved my knowledge and benefit this research paper. My special thanks also goes to the staff of this program in Dalian Maritime University for their attentive help. The same gratitude goes to my classmates.

I am also willing to deliver my appreciation to Huang Fengfei, the head of Qinhuangdao ATON Administration and other colleagues, for offering me such a good opportunity to attend this off-job studying.

Lastly, I want to express my everlasting respect to my family, especially my wife Zhang Ying who was pregnant and gave birth to my angel-my daughter during my studies, they are the origin of my power and inspiration.

Thank you all very much!

ABSTRACT

Title of Research paper: **Research on the Prospect Analysis and Countermeasures If China Joins the BWM Convention**

Degree: **MSC**

90 percent of the global cargo traffic is achieved through the transport mode of ship. While promoting the development of world trade, the impact of biological invasion caused by the ship carrying ballast water becomes increasingly severe, bringing great harm to the environment, human health, and marine resources. In February 2004, IMO formulated and adopted the “2004 International Ships' Ballast Water and Sediments Control and Management Convention” (BWM Convention), provides a solution to this problem.

Currently, the Convention has not yet entered into force, and China has not acceded to the Convention, but from a development point of view, we believe that for the near future the Convention will take into effect. In order to protect their environment and interests, many countries have also developed a unilateral claim, thus ships sailing to these countries must be observed according to relevant ballast water regulations. China itself is IMO A council member; meanwhile, China is a big shipping country. Whether from the perspective of strengthening international influence or protecting our environment, China should take the lead on the ballast water performance. So the study of the prospects and countermeasures of China's accession Ballast Water Convention has a very important practical significance.

This dissertation is based on this purpose, take the BWM Convention as the study object, according to the relevant requirements of the Convention, conducted a survey on the status of ballast water management at home and abroad, and analyze the impact and prospects of China's accession to the Convention, in line with the situation of analysis, propose strategies and measures that should be taken to fulfill the Convention.

Key Words: BWM Convention, Management, Status, Prospect, Countermeasures

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

BWM	Ballast Water Management
IMO	International Maritime Organization
UNCTAD	United Nations Conference on Trade and Development
IUCN	International Union for Conservation of Nature
UNCDE	United Nations Conference on Environment and Development
WSSD	World Summit on Sustainable Development
MEPC	Maritime Environment Protection Committee
PRC	the People's Republic of China
WHO	World Health Organization
CCS	China Classification Society
USCG	United States Coast Guard
AQIS	Australian Quarantine and Inspection Service
SEPA	State Environmental Protection Administration of PRC
CMSA	China Maritime Safety Administration
SOA	State Oceanic Administration
AQSIQ	General Administration of quality supervision and inspection and Quarantine
GEF	Global Environment Facility
UNDP	United Nations Development Program
BWMS	ballast water management system
VLCC	very large crude carrier
BWRS	ballast water reporting system
PSC	Port State Control
EU	European Union

Chapter 1 Introduction

1.1 Background of research

“Ballast Water” means water with its suspended matter taken on board a ship to control trim, list, draught, stability or stresses of the ship (BWM Convention (2004)). In order to ensure balance and stability, sailing ships are required to load ballast water. When ships are loading ballast water, at the same time, local aquatic lives are loaded in the ballast tanks. Harmful aquatic organisms in the ballast water sail with the ships, until the end of the flight, portion of them will still survive and are discharged with the ballast water at the port of destination.

According to statistics, 90 percent of the global cargo traffic is completed through the transport mode of ship (International Maritime Organization[IMO], 2012, p.4), the number of ocean-going vessels reaches to approximately 90,000 (United Nations Conference on Trade and Development[UNCTAD], 2014, p.7); About 12 billion tons of ballast water per year transfers in the world through vessels; There are as many as 7,000 kinds of creatures daily presence in the ship's ballast water onboard travel around the world and 110 million kinds of plankton per cubic meter of ballast water. Up to 2000, there have been about 500 species identified to be spread by ship’s ballast water (Gregory, M.R., 2000).

These exotic species invasive spreading destructed local marine biodiversity and ecological environment both coastal and offshore, threatened the survival of native species, and even endangered the health of local residents. Such examples are a common occurrence:

In the 1970s, North American jellyfish spread to the Black Sea, and the mass propagation and predation of plankton, eggs, juvenile fish brought crowning calamity to local farming of anchovies and herring; The west coast of San Francisco Bay of USA is the world's largest biological invasion zone, where 212 alien species have been found; European zebra mussels in the Great Lakes region of the United States madness breeding, blocked the underground pipeline in this region; Since 1989 the US government has spent more than 100 million US dollars per year to take control measures for this. In the late 1980s a kind of algae called toxic dinoflagellates intruded into Australian waters and polluted local aquatic shellfish. Residents eating contaminated shellfish became paralysis or even dead. In 1997, Australian Quarantine Bureau estimated that more than 172 kinds of biological species had invaded Australia, including perch from Asia, invertebrate aquatic beetle from Chile, starfish from Alaska and so on. Studies have pointed out that, every year around the world tens to hundreds of billions of dollars need to be spent to cope with the destruction caused by alien invaders (Song, D., 2012, pp.46-49). Chinese Liaodong Bay, the Changjiang River estuary of the East China Sea, Pearl River estuary of the South China Sea have been ranked among the most polluted areas of the country by the government. At present, there are 16 kinds of alien red tide have been identified that intruded Chinese waters caused by ballast water. Similar examples are too numerous to enumerate. The International Union for Conservation of Nature (IUCN) research shows that, biological invasion has caused extinction of 39% species of the

world in the last 400 years and the economic loss of more than $400 billion all over the world each year (International Union for Conservation of Nature [IUCN], 2013, p.12). The marine invasion is one of the main reasons.

With the trend of global economic integration, international trade is increasing rapidly. The number of worldwide ballast water transfer is also increasing swiftly. The harm to the environment is getting more serious. Therefore, the study of solution to ballast water problem is urgent, BWM Convention entering in force is imminent, China's accession to the Convention is imperative.

1.2 Objectives of research

The main purpose of this paper is to discuss the necessity of Chinese ratification of the BWM Convention. This paper will analyze the possible impact of BWM Convention on domestic legislation, management mechanism, ballast water treatment technology, shipbuilding, port state control and other related aspects. In view of the ballast water convention requirements, put forward countermeasures for China, thereby in favor of China for making relevant preparations for entering into force of the BWM Convention, to ensure ulteriorly the sustainable development of China’s marine environment and economy.

1.3 Methodology

Firstly we widely reviewed the relevant literature beforehand, including IMO documents and circulars, international conventions, articles from books, journals, and information from websites. Secondly, I visited various departments such as

Maritime Safety Administration, port authority, Environmental Protection Agency (EPA), shipping company and so on to acquire information and suggestion. Furthermore, the secondary resources and statistical figures provided the necessary datasets to carry out a qualitative research, which is mainly used in addressing the main points of this dissertation. According to tutor's guidance and practical experience, combined above method, ultimately complete the research paper.

1.4 Structure of dissertation

This dissertation consists of six chapters. The second chapter mainly introduces the engender process, the development status and main content of the BWM Convention. The third chapter lists the situation of the ballast water management work of some the world's other countries and regions. The fourth chapter, based on the investigation on the China’s ballast water management status, analyzes the advantages and disadvantages of China joining BWM Convention, explores the possible effect on China. The fifth chapter highlights suggestions for the related parties involved in BWM Convention. Finally, the last chapter discourses the overall summaries and conclusions.

Chapter 2 Brief Introduction of BWM Convention

2.1 The creation of BWM Convention

The serious harm to the environment caused by ballast water problem has already aroused the attention of the international community. In 1992, United Nations Conference on Environment and Development (UNCDE) request International Maritime Organization (IMO), to consider and pass the appropriate rule of ballast water emission, in order to prevent the spread of alien aquatic organisms. Held in South Africa in 2002, the World Sustainable Development Summit (WSSD) again called for accelerating the control of invasive species in ballast water, urge IMO as soon as possible to complete the work to control and manage the ship ballast water and sediment convention, in order to solve problem of biological water introduced by the ship (Stephan, G., 2007, pp.586-600).

As a specialized organization in charge of the maritime environmental protection, IMO also starts paying attention to this problem very early. The IMO assembly of 1973, ballast water problems especially related with harmful pathogens and migration were highlighter and, the General Assembly adopted a resolution, which pointed out that the “ship ballast water may contain epidemic pathogen, the

emission of the ballast water in its country may lead to spread in other countries. The resolution required that IMO and the World Health Organization (WHO) collect relevant evidence and advice provided by the governments to settle the problem. In 1990, Maritime Environment Protection Committee (MEPC) at its 31st session established a ballast water working group, drafting a guide on invasive species issues. In 1991, MEPC adopted the MEPC.50 (31) "Guideline on prevention from ship's ballast water and sediments of the introduction of harmful species and pathogen". In 1993, the IMO assembly discussed the ballast water survey report that Australia submitted to the MEPC34 session performed by the 13 countries. The results is that it passed A.774 (8) resolution based on the guide in 1991 "the guide preventing introduction of pests and pathogens via ship ballast water and sediments". In 1997, IMO passed the ballast water control scheme with first mandatory meaning resolution A.868 (20), control and manage the ship's ballast water to limit the transfer of harmful aquatic organisms and pathogens within a minimum extent guide (Dang, K., 2001, p.59)

Although IMO has adopted a series of resolutions and guidelines, all are recommended and have no force of law. In 2003, in the 49th session of MEPC, ship ballast water control and management issues were widely discussed and the draft convention of the ballast water and sediment control and management was accepted (Liu, F.S., & Wang, M., 2004, p.67). After the difficult investigation and consultation, in February 2004, IMO finally adopted the BWM Convention, it marking the substantial progress of ship's ballast water management problem.

2.2 The development of BWM Convention

Since MEPC 53 in July 2005, as of the MEPC 58 in October 2008, IMO had

passed 14 Guidelines for the uniform implementation of the BWM Convention, see table 2.1.

Table 2.1 List of Guidelines for the uniform implementation of the BWM Convention

No	Title	Resolution	Date	Status
G1	Guidelines for sediment reception facilities	MEPC.152(55)	2006.10	
G2	Guidelines for ballast water sampling	MEPC.173(58)	2008.10	
G3	Guidelines for ballast water management equivalent compliance	MEPC.123(53)	2005.7	
G4	Guidelines for ballast water management and development of ballast water management plans	MEPC.127(53)	2005.7	
G5	Guidelines for ballast water reception facilities	MEPC.153(55)	2006.10	
G6	Guidelines for ballast water exchange	MEPC.124(53)	2005.7	
G7	Guidelines for risk assessment under regulation A-4 of the BWM convention	MEPC.162(56)	2007.7	
G8	Guidelines for approval of BWMSs	MEPC.174(58)	2008.10	Revokes MEPC.125(53)

G9	Procedure for approval of BWMSs that make use of active substances	MEPC.169(57)	2008.4	Revokes MEPC.126(53)
G10	Guidelines for approval and oversight of prototype ballast water treatment technology programmes	MEPC.140(54)	2006.3	
G11	Guidelines for ballast water exchange design and construction standards	MEPC.149(55)	2006.10	
G12	2012 Guidelines on design and construction to facilitate sediment control on ships	MEPC.209(63)	2006.10	Revokes MEPC.150(55
G13	Guidelines for additional measures regarding ballast water management including emergency situations	MEPC.161(56)	2007.7	
G14	Guidelines on designation of areas for ballast water	MEPC.151(55)	2006.10	

Source: IMO. (2015a).

There are still some other guidelines and resolutions related to the implementation of BWM Convention, See table 2.2

Table 2.2 List of other resolutions and guidelines related to the implementation of the BWM Convention

Resolution	Title	Status
MEPC.252(67)	Guidelines for port State control under the BWM Convention	
MEPC.253(67)	Measures to be taken to facilitate entry into force of the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004	
MEPC.228(65)	Information reporting on type approved BWMSs	Revokes MEPC.175(58)
MEPC.206(62)	Procedure for approving other methods of ballast water management in accordance with regulation B3.7 of the BWM Convention	
MEPC.188(60)	Installation of BWMSs on new ships in accordance with the application dates contained in the BWM Convention	
MEPC.175(58)	Information reporting on type approved BWMSs	Revoked by MEPC.228(65)
MEPC.163(56)	Guidelines for ballast water exchange in the Antarctic treaty area	
A.1088(28)	Application of the international convention for the control and management of ships' ballast water and sediments, 2004	Revokes A.1005(25)

Source: IMO. (2015a). Guidelines and guidance documents related to the implementation of

the BWM Convention.

2.3 The entering into force of BWM Convention

According to Article 18 of the BWM Convention , the conditions for entering into force: “ This Convention shall enter into force twelve months after the date on which not less than thirty States, the combined merchant fleets of which constitute not less than thirty-five percent of the gross tonnage of the world’s merchant shipping, have either signed it without reservation as to ratification, acceptance or approval, or have deposited the requisite instrument of ratification, acceptance, approval or accession in accordance with Article 17 (BWM Convention (2004)).

The latest information show that on June 18, 2014, Japan ratified to join the BWM convention, total merchant shipping gross tonnage reached 32.01% (http://www.Chinaports.com, 2014). On January 12, 2015, Georgia has submitted documents to the IMO to join the BWM Convention (http://www.IMOship.com, 2015). As of May 1, 2015, a total of 44 countries had joined the BWM Convention and the rate of the world merchant tonnage had been up to 32.57%. (See table 2.3, 2.4, 2.5). But it still does not meet the conditions for the effective of BWM Convention. Optimistic estimates, by the end of 2015, the requirement of 35% of the world’s total merchant shipping gross tonnage will be meet. Some developed countries like Germany, Japan, France, Canada, Denmark, the Netherlands, Spain, Norway, South Korea and others have joined to the Convention, while other developed countries like the United States, Britain are not yet. It is noteworthy that the developed countries not joining the BWM Convention doesn't mean they have no requirement to

control and manage the ballast water; on the contrary, more strictly. Take the United States for example, management and control for the ballast water is undoubtedly the world's strictest, and there are many different versions, currently, including American coast guard standards, California standard and New York standard. These standards are hundred times stricter than the BWM convention index, and even some areas require 0 emissions.

In July 2011, held in London, the headquarters of the International Maritime Organization, MEPC 62, IMO reiterated the necessity of the BWM Convention, in order to make it come into force as soon as possible.

Table 2.3 Signatories of the BWM Convention

No	Countries	Status
1	Argentina	Subject to ratification
2	Australia	Subject to ratification
3	Brazil	Subject to ratification
4	Finland	Subject to acceptance
5	Maldives	Subject to ratification
6	Netherlands	Subject to approval
7	Spain	Subject to ratification
8	Syrian Arab Republic	Subject to ratification

Table 2.4 Contracting States of the BWM Convention

No	Countries	Status	Date of deposit instrument
1	Albania	accession	15 January 2009
2	Antigua and Barbuda	accession	19 December 2008
3	Barbados	accession	11 May 2007
4	Brazil	ratification	14 April 2010
5	Canada	accession	8 April 2010
6	Congo	accession	19 May 2014
7	Cook Islands	accession	2 February 2010
8	Croatia	accession	29 June 2010
9	Denmark	accession	11 September 2012
10	Egypt	accession	18 May 2007
11	France	accession	24 September 2008
12	Germany	accession	20 June 2013
13	Georgia	accession	12 January 2015
14	Iran	accession	6 April 2011
15	Japan	accession	10 October 2014
16	Jordan	accession	9 September 2014
17	Kenya	accession	14 January 2008
18	Kiribati	accession	5 February 2007
19	Lebanon	accession	15 December 2011
20	Liberia	accession	18 September 2008
21	Malaysia	accession	27 September 2010
22	Maldives	ratification	22 June 2005

23	Marshall Islands	accession	26 November 2009
24	Mexico	accession	18 March 2008
25	Mongolia	accession	28 September 2011
26	Montenegro	accession	29 November 2011
27	Netherlands	approval	10 May 2010
28	Nigeria	accession	13 October 2005
29	Niue	accession	18 May 2012
30	Norway	accession	29 March 2007
31	Palau	accession	28 September 2011
32	Republic of Korea	accession	10 December 2009
33	Russian Federation	accession	24 May 2012
34	Saint Kitts and Nevis	accession	30 August 2005
35	Sierra Leone	accession	21 November 2007
36	South Africa	accession	15 April 2008
37	Spain	ratification	14 September 2005
38	Sweden	accession	24 November 2009
39	Switzerland	accession	24 September 2013
40	Syrian Arab Republic	ratification	2 September 2005
41	Tonga	accession	16 April 2014
42	Turkey	accession	14 October 2014
43	Trinidad and Tobago	accession	3 January 2012 .
44	Tuvalu	accession	2 December 2005

Number of Contracting States: 44

(The combined merchant fleets of which constitute approximately 32.86 % of the gross tonnage of the world's merchant fleet)

Source: (IMO, 2015b, pp.488-490)

Table 2.5 Ownership of the world fleet (as of 1 January 2014)

Countires	Nubmer of ships	DWT (thousand)	% world total
Argentina	66	888	0.053
Australia	123	2587	0.154
Brazil	346	19510	1.164
Finland	152	2039	0.122
Malta	33	585	0.035
Netherlands	1234	17203	1.026
Spain	217	2206	0.132
Syrian Arab Republic	154	1237	0.074
Albania	34	140	0.008
Antigua & Babuda	1	1	0.000
Barbados	1	2	0.000
Canada	358	9209	0.549
Congo	4	9	0.001
Cook Islands	2	6	0.000
Croatia	112	3304	0.197
Denmark	955	40504	2.415
Egypt	220	3536	0.211
France	442	11798	0.704
Germany	3699	127238	7.588
Georgia	3	8	0.000
Iran	229	18257	1.089

Japan	4022	228553	13.630
Jordan	18	177	0.011
Kenya	6	19	0.001
Kiribati	1	1	0.000
Lebanon	159	1474	0.088
Liberia	7	38	0.002
Malaysia	602	16797	1.002
Marshall Islands	34	615	0.037
Mexico	149	1365	0.081
Mongolia			
Montenegro	4	74	0.004
Nigeria	241	4893	0.292
Niue			
Norway	1864	42972	2.563
Palau			
Republic of Korea	1568	78240	4.666
Russian Federation	1734	18883	1.126
Saint Kittsand Nevis	3	16	0.001
Sierra Leone	1	3	0.000
Sweden	339	6685	0.399
Switzerland	350	17012	1.015
Tonga	1	1	0.000
Turkey	1547	29266	1.745
Trinidad and Tobago	5	7	0.000
Tuvalu			

Source: (UNCTAD (2014), review of maritime transport 2014, p37)

2.4 The main contents of BWM Convention

2.4.1 Overview of BWM Convention

The BWM Convention is composed of the body, a technical annex and two appendices. The main body includes 22 articles. It gives definitions, general obligations, application, control of the transfer of harmful aquatic organisms and pathogens through ships' ballast water and sediments, sediment reception facilities, survey and certification, detection of violations and control of ships, inspection of ships, co-operation, dispute settlement, signature, ratification, acceptance, approval and accession, entry into Force etc. The Technical Annex is called "Ships' Ballast Water and Sediments Control and Management Regulations". It consists of 5 parts, makes specific provisions respectively for application and exceptions, management and control requirements for ships, special requirements in certain areas, standards for ballast water management, survey and certification requirements for ballast water management. Appendix 1 is the form of international ballast water management certificate and appendix 2 is the form of ballast water record book (BWM Convention (2004)). In addition, in order to refine the requirements of the Convention so that the Convention can be applied uniformly, MEPC starting from the 53rd meeting have passed 14 Guidelines and 8 resolutions (see tables 2.1, 2.2), and these resolutions (Guidelines) and the Convention together constitute an integral system.

2.4.2 Main contents

1. Application of the Convention

According to article 3, this Convention shall apply to: ships entitled to fly the flag of a Party; and ships that are not entitled to fly the flag of a Party but which operate under the authority of a Party (BWM Convention (2004)). It is noteworthy that, although the Convention is not applicable to government non-commercial purpose ships and any warships, it requires that the ships follow the spirit of the Convention as much as possible (Xu, X.M., 2008, p.18).

2. Responsibility of Parties

In accordance with the requirements of Article 4, the responsibility of Parties includes two sides: First, each Party shall take effective measures to ensure that those ships comply with those requirements; Second, each Party shall develop national policies, strategies or programmes for the attainment of the objectives of this Convention (BWM Convention (2004)).

3. Port reception facilities

Involved onshore reception facilities, Convention and Guidelines made provisions on ballast water and sediment respectively.

Article 5 of the Convention prescribes that adequate facilities shall be provided for the reception of Sediments in ports and terminals to ensure that such Sediments do not impair or damage their environment, human health, property or resources or those of other States. Correspondingly, G1 has made specific provisions on sediments reception facilities in terms of planning, disposition, capacity and personnel training.

Regulations B-3.6 of Annex and G5 prescribe ballast water receiving facilities ashore. Similar to G1, G5 provides that the ballast water received shall be carried out the necessary handling to ensure the safety of the environment, and shall notify the specific capacity of the reception facilities to the ships. It should be noted that, according to the regulations, the port is not necessary to build ballast water receiving facilities.

4. The ship's certificate and instruments

Section B of Annex and Part A of G4 make specific provisions on relevant certificates and documents. As a rule, the ship is required to hold "International Ballast Water Management Certificate", equip "Ballast Water Management Plan" and fill out the "Ballast Water Record Book". Section E of Annex sets out detailed procedures for inspection and certification, Part B of G4 details requirements for the preparation of "Ballast Water Management Plan", In accordance with B-2 of Annex and A-2 of G4, each operation of ballast water, including accidental emissions, shall timely and accurately fill in G4's "Ballast Water Record Book" and shall be subject to inspection (BWM Convention (2004)).

5. Inspection of ships and detection of violations

The provisions of Article 9 of the Convention: a ship should be subject to inspection by officers duly authorized by that Party for the purpose of determining whether the ship is in compliance with this Convention, including: (a) Verifying that there is onboard a valid Certificate, which, if valid shall be

accepted; and (b) Inspection of the Ballast Water record book, and/or (c) A sampling of the ship's Ballast Water if necessary. Article 10 of the Convention prescribes detection and sanctions on ships. If a ship takes any violation of the requirements of this Convention, the Party shall take steps to warn, detain, or exclude the ship (BWM Convention (2004)).

6. Standards for ballast water management

Ship ballast water management and control requires achieving a certain standard. The Section D of Annex makes specific provisions.

(1) D-1, Ballast water exchange standard. Ships performing Ballast Water exchange in accordance with this regulation shall do so with an efficiency of at least 95 percent volumetric exchange of Ballast Water or pumping through three times the volume of each Ballast Water tank.

(2) D-2, Ballast water performance standard. Ships conducting Ballast Water Management in accordance with this regulation shall discharge less than 10 viable organisms per cubic metre greater than or equal to 50 micrometers in minimum dimension and less than 10 viable organisms per milliliters less than 50 micrometers.

(3) D-3, Approval requirements for BWMS. BWMS used to comply with this Convention must be approved by the Administration taking into account Guidelines developed by the Organization (G8).

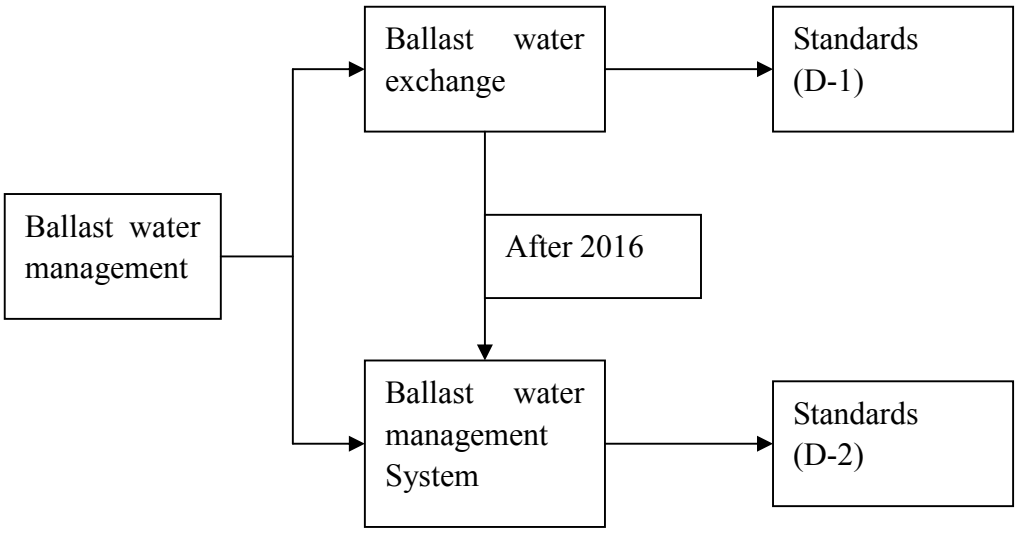
(4) D-4, Prototype ballast water treatment technologies. For any ship that, prior

to the date that the standard in regulation D-2 would otherwise become effective for it participates in a programme approved by the Administration to test and evaluate promising Ballast Water treatment technologies, the standard in regulation D-2 shall cease to apply to that ship for five years from the date of installation of such technology (BWM Convention (2004)).

7. Ballast water management requirements

Section A of Annex prescribes that, the discharge of Ballast Water shall only be conducted through Ballast Water Management, Ballast water management includes two ways: dealing with the BWMS and ballast water exchange (see Figure 2.1).

Figure 2.1 The two ways of ballast water management



Regulation B-3 makes provision on the schedule of implementation of D-2, see table 2.6

Table 2.6 Ship implement D-2 standard schedule

Building time	Ballast water tank volume	Time of implementation
<2009	1,500≤V≤5,000	2015
	V<1500 or V> 5000	2017
2009	V<5000	2012
2010-2011	V<5000	Delivery time
	V≥5000	2017
≥2012	All ships	Delivery time

Source: (China Classification Society [CCS], 2014, p.3)

Regulation B-4 makes provision on the condition of ballast water exchange: conduct such Ballast Water exchange at least 200 nautical miles from the nearest land and in water at least 200 meters in depth; If unable, such exchange shall be conducted as far from the nearest land as possible, and in all cases at least 50 nautical miles from the nearest land and in water at least 200 meters in depth; G6 details the requirement of exchange; G14 provides guidelines on designation of areas for ballast water.

In summary, the Ballast Water Convention and relevant guidelines actually constitute a complete system. It makes specific regulations from different angles, different levels for departments and operation related to ballast water management.

Chapter 3 The situation of the development of ballast water management of some other counties

Some countries and regions, especially developed countries give high priority to ship ballast water issues. Before the introduction and entry into force of the Convention, including the United States, Australia and Canada and some other countries, all have developed unilateral ballast water management regulations. The main measures include: Ballast water exchange, ballast water treatment onboard, prohibiting the discharge of ballast water and so on.

3.1 America

The United States suffered the most serious hazard by ballast water pollution. About 2,000,000,000 t of ballast water every year is transferred from the world to the sea areas of United States. The cost that Government spend on ballast water pollution control is about $ 2 billion per year (Qian, Z.S., 2007, p.21).

Affected by "the zebra shellfish incident", to prevent the invasion of alien species from marine ballast water, the United States have issued a series of ship's ballast water exchange area law. On October 29, 1990, US Congress passed "Non-indigenous Aquatic Nuisance Prevention and Control Act of 1990"

(NANPCA) aimed at preventing the introduction of alien aquatic organisms through ballast water, gave the United States Coast Guard (USCG) jurisdiction of ballast water management. August 4, 1993, USCG unveiled the final rule "to enter the Great Lakes ship's ballast water management," in the "Federal Gazette", required each ship entering the Great Lakes region from the United States and Canada along the coast 200 miles away to implement ballast water management. (Zhang, S., 2014).

In October 1996 the US Congress enacted the "National Invasive Species Act of 1996" (NISA), The Act modified NANPCA and reapproved, Compared with the 1990 Act, the Act expand the scope of ballast water management to all waters of the United States. NISA requested to continue the implementation of the Great Lakes mandatory ballast water management program, and instructed the USCG to develop for all US ports, required ship mandatory to submit ballast water management report and voluntary ballast water management program (Zhang S.H., & Tu, J.J., 2008, pp.39-41).

In May 1999, USCG published in the "Federal Gazette" the "Temporary Provisions implementation of the National Invasive Species Act of 1996." which required all ships entering US waters from the United States exclusive economic zone to implement mandatory ballast water management report, record keeping, and proposed to promote the voluntary implementation of ballast water management requirements (including the exchange of ballast water).

3. 2 Canada

The competent authority of ballast water of Canada is Ministry of Transport of

Canada. In 2000, the Canadian Shipping Alliance proposed rules about ballast water management. On June 8, 2001 the revised "Canadian Ballast Water Management Guide" clearly requires the implementation of IMO guidelines. On June 8, 2006, the Government of Canada actualized the new regulations in waters under the jurisdiction (Lu, H.M., 2012, pp.74-77). It requires:

1. Conduct ballast water exchange at least 200 nautical miles from the nearest land and in water at least 2000meters in depth.

2. If unable, such exchange shall be conducted as far from the nearest land as possible, and in all cases at least 50 nautical miles from the nearest land and in water at least 500 meters in depth.

3. If such exchange in waters is less than 50 nautical miles from the shore, salinity should reach at least 30%.

4. If due to the stability and security issues, the ship can not exchange the ballast water, it must report to the competent authorities in the 96 hours before entering Canadian waters.

3. 3 Australia

Australia is one of the earliest countries to take measures to deal with the hazards of biological invasions brought by ship’s ballast water. As early as 1991, Australia united Canada motion for the first time on the control of ballast water at MEPC meeting. Also in 1991, Australia developed a guide which is the world's first enforcement of the ballast water management, and updated in 1999.

The authority of Australia in charge of ballast water management is Australian Quarantine and Inspection Service (AQIS), responsible for ballast water management carried by ships of all entering Australian waters. Australia regards IMO.A868 (20) resolution "on the control and management of ships' ballast water, to reduce the spread of harmful aquatic organisms and pathogens Guide" as their international ship ballast water management guidelines (Wang, X.L., 2013, pp.6-7).

3. 4 Other counties and regions

Other countries and regions, such as Brazil, Argentina, Chile, Norway, New Zealand, Lithuania, Russia etc all have developed unilateral measures, to implement the ballast water mandatory requirements. Also some of the adjacent countries have developed bilateral， multilateral and regional cooperation memorandum or agreement, such as Western and Northern Europe, the Black Sea region, the Gulf, East Asia and Eastern Baltic Sea region have also developed a regional resolution or strategic action program (Wei, Y., 2014, pp.78-83).

Chapter 4 Analysis of prospect of China joining the BWM Convention

4.1 Current status of ballast water management in China

China is a Class A council member of the IMO, and is also contracting party of great majority international maritime conventions. China has been keeping close track of relevant international conventions, and actively promoting the entry into force and implementation of the Convention to some extent. BWM Convention is among the first biotechnology-related conventions. As a pre-emptive environmental protection convention, it has been given close attention of all concerned.

4.1.1 The legislation of ballast water management in China

At present, in China laws and regulations about ships' ballast water management mainly contain “the law of Marine Environmental Protection of the People's Republic of China (PRC)”, “the Law of Management Regulations on Preventing Vessels from Polluting the Sea Area of PRC”, “the Law of Frontier Health and Quarantine of PRC”,” the Law of the Entry and Exit for Animal and Plant quarantine of PRC” (Kuang, H., 2010).

1. “The law of Marine Environmental Protection of the People's Republic of China (PRC)”. The latest amendment “the law on the protection of the marine environment of PRC” since April 1, 2000 has come into effect. The law makes clear “the state administrative department take charge of the supervision and management of the non fishery, marine pollution caused by military vessels of the non military vessels and port outside the waters within the jurisdiction” the chapter 8 (preventing the pollution damage of the ship and the relevant operations to the marine environment).

Article 62 provides that: “in the sea areas under the jurisdiction of PRC, any ship and related operations shall not violate the regulations to discharge the pollutants, waste and ballast water, garbage from ships and other harmful substances into the oceans”. But because it is the law in charge of the marine environmental protection, with the purpose and general characteristics, it is impossible to provide the specific requirements of the ship's ballast water control and management in reducing harmful aquatic organisms and pathogens ship.

The ninth chapter of Article 97th stipulates: PRC establish or participate international convention related with marine environmental protection which have different provision from this law, the provision of the international convention will apply (not this law).

2. “The Law of Management Regulations on Preventing Vessels from Polluting the Sea Area of PRC”. The latest has taken effect since 2010 March 1, whose emphasis is on the marine pollution management of the harmful goods, such as the oil by the ship and the dangerous goods. Without special requirement for the

control and management of the ship ballast water, only in the 15th article: “the ship garbage, sewage, oily sewage, toxic and harmful substances sewage, waste and other pollutants and ballast water discharged by the ship in PRC, should comply with the laws and administrative regulations, the international convention and relevant standard requirements of PRC has concluded or participated in.”

3. “The frontier health and Quarantine Law of PRC”. The act comes into force on May 1, 1987, and the current version is based on the thirty first session of the Tenth National People's Congress Standing Committee in December 29th 2007, “on the decision of the revision” the frontier health and Quarantine Law of PRC” is modified. The article 18 refers to the ballast water management, but the content is very limited: “Frontier health inspection authority supervises the health status of the frontier port and the health status of the means of transport which stop in the frontier port for entry and exit according to the health standards provided by the state”, including “the supervision and inspection of the treatment of garbage, waste water, sewage, manure and ballast water”.

On 2010 April 19th, “State Council on the decision of the revision “ Implementation Rules of PRC frontier health and Quarantine Law” passed by the State Council's 108th executive meeting further make clear: “with the sanitization unauthorized by the health and quarantine organ ,discharge of ballast water, remove garbage, dirt, etc. control items” shall accept the administrative punishment of the health and quarantine organ; “ the ballast water setup from the cholera epidemic area ,have not disinfected, are not allowed to be discharged and shift”.

4. The Law of the Entry and Exit for Animal and Plant quarantine of PRC. It was passed on October 30th, 1991 and implemented in April 1, 1992. The quarantine objects include “animals and plants, its products and other quarantine objects of import and export, its containers, packaging and the transport from animal and plant epidemic areas”. Although the ballast water contain survival of the animals and plants (mainly plant seeds and animal larvae or eggs), but due to the ballast water as a special object keeping the balance for the ship, it is not “container” used for carrying animals and plants, animal and plant products and other quarantine objects, so does not contain in the range of the quarantine.

Thus, the legislation mentioned above for ballast water management is set mainly to prevent ships that carry oil, toxic and harmful substances polluting the marine environment, and prevent the infectious diseases by the introduction or the spread, the legislative point of view focuses on the protection of the marine environment from oil pollution, toxic and harmful substances pollution and the protection of human health, regarding the problem of introducing alien organisms and pathogens by ship's ballast water, there is no specific legislation or more targeted regulations (Shen, Y.Y., 2010). As far as I am concerned, no local regulations have been adopted for the control and management of ballast water by the coastal provinces.

4.1.2 Ballast water management agency in China

According to the relevant laws, the main agencies in terms of the ballast water management include:

1. State Environmental Protection Administration (SEPA)

It is government agency under the State Council that takes charge of national environmental protection and pollution control. Although it is mainly responsible for the terrestrial pollution and the prevention and control of the coastal engineering pollution, according to the law of the marine environment protection, it is also responsible for the coordination, supervision and guidance of national marine environmental protection.

2. China Maritime Safety Administration (CMSA)

Its original name was Port Authority of the PRC. In 1998, Port Authority merged with the China Ship Inspection Bureau and was renamed CMSA, belonging to the Ministry of communications. Its main responsibilities include: ship safety and preventing the ship pollution from water, water transportation management; auditing and approving the authorized institution to make the statutory inspection and certification.

3. The State Oceanic Administration (SOA)

The SOA is the subordinate government agency under the State Council. It is responsible for the development and use of the oceans, to prevent the pollution from the exploitation of the offshore oil and offshore engineering and the dumping of waste by sea. In addition, the SOA is also responsible for marine environmental protection, marine nature reserves and ecological protection and other aspects of scientific research, monitoring and assessment.

4. The General Administration of quality supervision and inspection and Quarantine (AQSIQ)

The subordinate body of the State Council shall be responsible for the quarantine of Chinese frontier health and the import and export of animals and plants, and it is responsible by two major departments. There is the branch in all the opening ports, and is responsible for the treatment of ballast water in quarantine and sanitation. As the first quarantine procedure is the first step when the ship arrives at the port, agencies will obtain the report of the ship's ballast water (http://www.doc88.com, 2012).

4.1.3 Tracking and research of the Convention in China

1. Implementation of the project of the global ballast water management

Before the IMO passed the BWM convention, from 2000 to 2004, China had implemented a global project named "help the developing countries overcome the effective implementation of the ship's ballast water management and the difficulties of controlling implementation" (referred to as GloBallast). The project is that the IMO in order to help the developing countries to implement control measures effectively, avoid invasive aquatic introduced by ship's ballast water, and successfully join into the ballast water convention, combined with Global Environment Facility (GEF) and the United Nations Development Program (UNDP) to set up. China is one of the six implementary countries of the project. Dalian is Chinese exemplary city (http://www.doc88.com, 2012).

2. The track and study of ballast water conventions

After the end of GloBallast, since the end of 2004, the CMSA on the basis of previous work has continued to carry out related work about ballast water management. The specific task includes tracking the ballast water Convention and related guidelines, investigating the influence of the Convention on our fleet, analysis the feasibility for China to join the BWM Convention, research on port, inspection and quarantine, CCS, shipbuilding and Dalian Ocean Shipping CO.LTD and other units; At the end of 2005, China finished “the foreground analysis and Countermeasures Research Report for China join the ballast water convention”. In 2008 China printed "International Convention for the Control and Management of Ships’ Ballast Water and Sediments, 2004" Chinese and English edition. From 2010, CMSA implemented "the implementation of Ballast Water Convention on the strategy and countermeasure research project" for 3 years (Fan, D.S., 2013).

4.1.4 Research and developed status of BWMS in China

Research and production of BWMS is not only the main limiting factor of the acted process of the Convention, but also the key to the implementation of the Convention. Within the international community, BWMS development status, i.e., whether there is a sufficient variety of BWMS available on the market, directly related to a large number of countries to decide whether to join the BWM Convention. At the same time, a statistical study shows that, during 2015-2020 the five years, the market of global ship BWMS installation will come up to about $34 billion (China Market Report Center, 2014). Considering the huge commercial interests, a great many companies around the world have invested in BWMS research and development activities.

Currently, China also has lots of companies engaged in this work, As of July, 2014, there are a total of 11 BWMS manufacturers or research and development units that acquired Type Approval Certificate issued by CCS which is authorized by CMSA (CCS, 2014). It is worth mentioning that, at present, China only has two systems using active substance to clear ballast water organisms, and most others utilize ultraviolet radiation method. Not optimisticly, the ultraviolet light tube used must rely on foreign imports (Xie, C.L., 2010, pp.86-90).

Figure 4.1 Example picture of BWMS

Source: http://www.sunrui.net/cn/cpzx/cbyzscl/yzpb/

4.1.5 The situation of ship/ship company

Since the MSA's propaganda and communication activities in the early stage in the industry, the ship and the ship company has fully mastered the BWM Convention requirements. It is understood that our ocean vessels, especially the container ship, very large crude carrier (VLCC) and bulk carriers almost all

equipped with ballast water management plan, and to deal with the ballast water by the method of ocean exchange.

Considering that the BWM Convention has not yet entered into force, the main measures for the ballast water convention taken by the shipping company are still in the planning and preparation stages, according to the build time of the vessels which belong to the company, arrange the ship's repair time for the installation of ballast water management systems (BWMS), select suitable BWMS. Although the BWM Convention require that 2010 and 2011 vessels under construction should install the BWMS, but because the BWM Convention has not yet entered into force, this requirement does not have the force of law, therefore for most of the newly built ship, the shipping company did not install the BWMS, only set aside sufficient space for future installation of equipment and pipelines.

4.2 Analysis of the opportunity for China access to the BWM Convention

4.2.1 Enhance China's international image and status

As a big maritime state, China has been among the 13 consecutive elected IMO A council members (http://www.shipinall.cn, 2013), Class A members should take the lead on promoting construction and compliance aspects of the Convention. Joining and facilitating the BWM Convention to take effect has positive significance for enhancement of the image position and influence in the IMO and promoting China from the marine big country to the maritime powerful state. As China's economic development, national power increase. The image of big country will be reflected in all areas of the international arena. In

the international maritime sector on ballast water management issues, has the ability to actively respond to changes in international conventions, faster, more active and more effective response to the Convention, Itself is an important manifestation of soft power and the image of a big country.

4.2.2 Protect the environment, human health and the marine economy

From December 2001, the survey of invasive alien species for the first time in China's history was launched nationwide. The survey covers three major ecosystems: terrestrial, aquatic and marine. Survey results show that, invasive alien species per year caused a total of ￥19.859 billion in direct economic losses to China's related national industry. Among them, agriculture, forestry, animal husbandry and fishery ￥16.005 billion, transportation, storage and postal industry￥0.847 billion, water conservancy environment and public facilities management industry ￥87 million, human health ￥2.921 billion. The result that the experts calculated is based on the indirect economic loss assessment model which indicated that, the indirect economic loss caused by the invasive alien species to the ecological system, the species and the genetic resources of China was 100.017 billion annually. The economic losses of the ecosystem, the diversity and the genetic resources were ￥99.825 billion, ￥71 million and ￥121 million respectively. Adding two, the total economic loss caused by the invasive alien species to China is ￥119.876 billion. Among them, the damage of marine ecosystems is the most serious. The biological invasion caused by ballast water is the main reason (Zhao, Y.X., 2008, p.4).

After accession to the Convention, control and management of the ship's ballast and sediment could prevent, reduce and even eliminate the harmful aquatic organisms and pathogens from entering our country, decrease the damage to the

ecological environment of our country, achieve the purpose of protecting the ecological environment and the aquatic safety. And then to protect the economic benefits of marine fishery, salt industry, marine industry, marine biomedical industry, marine electric power industry, seawater utilization industry, coastal tourism industry, etc.

4.2.3 Promote technology development of BWMS in China

A statistical study shows，between the five years 2015-2020，global ship BWMS installed market will be about $ 34 billion. It is estimated that, according to the requirements of the BWM Convention, about 55,000 of the world's vessels before the end of 2016, and 68000 before 2020 should be installed the BWMS (Peng, X.Z., 2012, p.35). China itself is a large shipping country and also a large shipbuilding country, on a conservative estimate, Demand for BWMS in domestic market is about 3,600 units, and the economic benefits may come up to $ 1 billion (Lan, R., 2010, p.424). Join Ballast Water Convention will help promoting China's ballast water management system technology development, occupy a place in the international market.

4.2.4 Improving the competitiveness of China's international routes ship

As of January 2014, China (excluding Taiwan) has 5405 vessels which are above 1000GT. The total dwt is 200,179,000 tons, accounting for 11.938% of the world total dwt, It continues to rank third in the world rankings (the first two were Greece, Japan). Among them, flying China flag total dwt tonnage of 73252 tons, accounting for 3.41% of the world total dwt. （UNCTAD，2014）, China's accession to Ballast Water Convention, is bound to promote international voyage

ship flying China's flag gradually equipped with ballast water management system, improve the level of ballast water management awareness, enhance the market competitiveness of the Chinese international voyage ship, thus bring huge economic benefits.

So, despite the requirement of installation of BWMS on board may bring economic burden to ship, but it also guarantee the smooth operation of the international route ships; at the same time, through the development and manufacture of BWMS, it will promote the development of related industries. More importantly, Ratification and implementation of the Convention also maintains our political interests and international image, and would have brought long-term potential protection to the marine environment, the resulting benefits for the marine economy are more considerable.

4.3 Analysis of the main problems of China's accession to BWM Convention

4.3.1 The legal system is not perfect

At present, although there are "The law of Marine Environmental Protection of PRC", "The Law of Management Regulations on Preventing Vessels from Polluting the Sea Area of PRC" and other Acts have involved ballast water management, and also the legislation level is relatively complete, formed a series of legal norms from the laws, the statutes to the regulations. However, the integrity of the legislative level can not represent the enriched content. Existing provisions are relatively empty and abstract, each of the laws / regulations only covers 1-2 of Ships' Ballast Water Management, and the relevant provisions are lack of contact, do not form a complete entirety. In addition, some ballast water

management specifications are appointed norms, take “The Law of Management Regulations on Preventing Vessels from Polluting the Sea Area of PRC” for example, there is no provision for how the ballast water should be discharged, but to perform other laws or international conventions. However the reality is that our country did not join the BWM Convention (Chen, Q., 2012, p.54).

4.3.2 Exist crossover in management mechanism

Ballast water management is related to many stakeholders. Coordination between the parties determines whether ballast water management can achieve tangible results. In accordance with China's existing legislation on ship ballast water management, maritime administrations, health and quarantine authorities, environmental authorities and some other agencies all have the rights and obligations of ships' ballast water management, The overlap of multiple law enforcement agencies and the overlapping of law enforcement authority adds difficulty to ballast water management.

4.3.3 BWMS cost too high, ship’s installation exist difficulties

In order to fulfill the relevant requirements of the ballast water convention, the ship (owner) needs to invest large sums of money for the ship reconstruction and installation of the corresponding BWMS. Depending on the amount of processing, domestic ballast water management systems on the market range in price from ￥1 million to ￥10 million (Liu, G., 2014, p.50). The average price of foreign system as the same size is about 0.5 million dollars or even high (R.rivas-hermann, 2014, pp.1-12). China (excluding Taiwan) has 5405 vessels above 1000GT. The funds need to be invested for installation and reconstruction

will be astronomical. However, at the current period, China's shipping industry is downturn. Ship owners are hard to allocate the money. Furthermore, since the ballast water treatment system installation requires certain space and technical requirements, some small vessels and some special ship, such as chemical tankers, LNG ships, etc. may be unable to install BWMS.

4.3.4 The receiving facilities of port and shipyard can not meet the requirements of the performance of the Convention

The BWM Convention provides that the parties are committed to ensure adequate sediment reception facilities in the port and dock where the country is designated for the cleaning or repair of the ballast tank. Although, the port is not prerequisite to build the ballast water receiving facilities, the reception of the sediment at the shipyard can not completely satisfy the demand.

4.3.5 PSC inspection capacity can not meet the performance requirements

Although China has long started to pay attention to the problem of ballast water management, how to carry out the effective supervision of the ballast water management is still insufficient. On the one hand, there is no national level on the relevant ballast water management regulations and technical standards; On the other hand, the existing capacity and measures of PSC inspectors are not met the demand to survey that whether the ship carries ballast water management and control is in accordance with the requirements of the Convention.

4.3.6 The market competitiveness of ballast water management system is not strong in China

As of October 1, 2014, there are 57 kinds of BWMS obtained the type approval, 55 kinds got IMO basic approval, 37 kinds acquired final approval of IMO. In China, there are only 3 kinds of BWMS acquired basic approval, 2 got final approval and 11 kinds obtained type approval (IMO, 2015b). See table 4.1, 4.2, 4.3. However, as mentioned above, our vast majority of BWMS use ultraviolet radiation method. The ultraviolet light tube used must rely on foreign imports. So the international market competitiveness of domestic BWMS is not optimistic.

Table 4.1 List of China's ballast water management systems that make use of Active Substances which received Basic Approval from IMO

	Name of the system	Name of manufacturer	Date of Basic Approval
1	Sunrui Ballast Water Management System (subsequently changed to BalClor Ballast Water Management System)	Qingdao Sunrui Corrosion and Fouling Control Company	26 March 2010 (MEPC 60)
2	DMU ·OH Ballast Water Management System	Dalian Maritime University	2 March 2012 (MEPC 63)
3	40 OceanDoctor Ballast Water Management System	Jiujiang Precision Measuring Technology Research Institute	5 October 2012 (MEPC 64)

Table 4.2 List of China's ballast water management systems that make use of Active Substances which received Final Approval from IMO

	Name of the system	Name of manufacturer	Date of Basic Approval
1	15 BalClor Ballast Water Management System	Qingdao Sunrui Corrosion and Fouling Control Company	1 October 2010 (MEPC 61)
2	31 OceanDoctor BWMS	Jiujiang Precision Measuring Technology Research Institute and Institute of Marine Materials Science and Engineering of Shanghai Maritime University	17 May 2013 (MEPC 65)

Table 4.3 List of China's ballast water management systems which received Type Approval Certification by their respective Administrations (resolutions MEPC.175(58) and MEPC.228(65))

	Approval Date	Name of the Administration	Name of the BWMS	Copy of Type Approval Certificate	Active Substance employed MEPC report granting	Final Approval
1	28 January 2011	China Maritime Safety Administration	BalClorTM Ballast Water Management System	Provided (MEPC 62/INF.29)	Yes, please refer to MEPC 61/2/15,annex 9	MEPC 61/24,Paragraph 2.7.3
2	16 February 2011	China Maritime Safety Administration	Blue Ocean Shield Ballast Water Management System	Provided (MEPC 62/INF.28)	No Active Substances used	Not Applicable
3	28 March 2011	China Maritime Safety Administration	BSKYTM Ballast Water Management System	Provided (MEPC 62/INF.30)	No Active Substances used	Not Applicable
	12 June 2012	China Maritime Safety	CyecoTM Ballast Water	Provided (MEPC	No Active Substances	Not Applicable

4		Administration	Management System	64/INF.12)	used	
5	5 February 2013	China Maritime Safety Administration	BALWAT Ballast Water Management System	Provided (MEPC 66/INF.15)	No Active Substances used	Not Applicable
6	22 August 2013	China Maritime Safety Administration	HY™-BWMS	Provided (MEPC 66/INF.14)	No Active Substances used	Not Applicable
7	10 October 2013	China Maritime Safety Administration	NiBallast™ Ballast Water Management System	Provided (MEPC 66/INF.12)	No Active Substances used	Not Applicable
8	4 November 2013	China Maritime Safety Administration	Cyeco™ Ballast Water Management System	Provided (MEPC 66/INF.16)	No Active Substances used	Not Applicable
9	2 December 2013	China Maritime Safety Administration	Seascape Ballast Water Management System	Provided (MEPC 66/INF.13)	No Active Substances used	Not applicable
10	11 July 2014	China Maritime Safety Administration	PACT marine™ Ballast Water Management System	Provided (MEPC 68/INF.5)	No Active Substances used	Not applicable
11	17 November 2014	China Maritime Safety Administration	OceanDoctor® Ballast Water Management System	Provided (MEPC 68/INF.4)	Yes, please refer to MEPC 65/2/19, annex 7	MEPC 65/22 paragraph 2.8

Source: IMO. (2015c).

Chapter 5 Countermeasures of China accession into BWM Convention

Based on the above analysis, China’s accession into the Ballast Water Convention will play a good role in promoting marine environmental protection and marine economy and driving the development of related industries which is in line with China's long-term interests. But there are some issues concerning the legal system, management mechanism, performance capabilities and so on. How to proceed with the following work should be taken seriously. Coordinate national parties, MSA, ports, ships, etc. are required to build capacity of ballast water management from different angles, in different aspects. Thus, it is essential to make relevant preparations for the implementation of Conventions in China.

5.1 Improve the legal system of ballast water management

At present, although there are relevant laws and regulations related to ballast water management, however, as mentioned in Chapter 4 analyzes, there are some problems in those laws and regulations. In order to effectively deal with the entry into force of the Convention or proactive ratification and implementation of the Convention, must follow the requirements and standards of the BWM Convention, consult foreign legislative experience and models in

the field, establish and improve ballast water management legal system that should cover the following areas (Wang, W.H., 2011).

1. Laws or regulations on comprehensive supervision and management of ships' ballast water, setting out responsibilities of the various departments involved, all aspects of the content and the corresponding penalties;

2. Provisions on ballast water management systems approving, for regulating specific work for the development, test, application, reporting, and other approving and accrediting of type approval of BWMS;

3. Work procedure on PSC inspection and sampling, provide regulations for the maritime law enforcement inspection;

4. Work procedure on ships' ballast water special management in emergency situation, to manage the ballast water transfer of epidemic, some area seawater abnormalities and other special or emergency situations;

5. Work procedure on ships' ballast water management system exemption, for regulating the work for ship application, carrying out risk assessment and ballast water management system exemption;

6. Receiving, processing and disposal of sediments on ship, to regulate onshore sediment management;

7. Regulations on the supervision and management of small boat ballast water, so that small vessels could comply with requirements of the Convention.

8. Establishment socialization mechanism of compensation liability of invasion of alien species triggered by ballast water;

9. Jointly designate ballast water exchange area with neighboring countries, and publish to the public.

5.2 Establish a integral ballast water management mechanism

Currently China ballast water management involves multiple departments. To avoid power overlap and omissions, and more effectively perform the ballast water management, China should develop national operational framework, policies and practices, and clarify the duties and responsibilities of the parties concerned. Complete operational framework should include four elements: Executive team, the lead agency, national strategies and operational arrangements, etc. (Zhou, Z.S., 2011, p.34).

1. Executive team. Members of the executive team, include the lead unit (CMSA), port authorities, environmental authorities, fisheries and marine resources authorities, health and quarantine authorities, marine scientific research institutions and shipping companies, etc. The task of executive team is to enact national strategies. Executive team should analyze all the relevant current information, including the IMO requirements, shipping status and the status of the biological introduction, and on the basis of the above information, determine the appropriate policies, practices, division of responsibilities and operating procedures, proposed the legislation draft of national ballast water and sediment control and management. After wide consultation of the draft, submit it

to the legislature for consideration to adopt.

2. Lead agency. The main responsibility of the lead agency is the implementation and long-term management of the national strategy. To ensure that national laws and regulations are effectively implemented, the lead agency should do the following: lay down relevant laws and regulations, to specific national policy; Develop and implement Concrete plan of ship and port technology, operational and administrative aspects; Through propagate and training to ensure that the relevant units grasp state policy and other relevant information; Assess the effectiveness of national policy, and make the necessary adjustments and optimization.

3. National strategies. National strategy is prerequisite for the effective implementation of national ballast water management architecture. Since the ballast water management issues involve many aspects, a national strategy should fully take into account the requirements of international conventions, national environmental resource protection requirements. In addition it should safeguard the interests of shipping companies, learn from the latest international experience, and combine the characteristics of China's marine environment and biological resources.

4. Operational arrangements. A long-running management process of national strategy includes: Collecting information to provide a reference for decision-making; establishing the port ballast water management plan; implementing ballast water management on board as well as supervision and inspection; dealing with publicity, education and popularization of ballast water management requirements.

5.3 Capacity-building of the competent authority' for compliance and enforcement of the BWM Convention

According to the aforementioned legal system, considering that MSA is the department of implementing supervision and management of ship of China, MSA should be the competent authority to take the responsibility for the fulfillment and execution of ships' ballast water management concretely. In order to fulfill this responsibility effectively, MSA needs to make great efforts in the aspects below: tracking research work of the Convention, drafting relevant laws and administrative documents, survey and certification of BWMS on board, type approval of BWMS, submitting of the active substance, performing of PSC on ship arrival port etc. Taking these factors into account, MSA should enhance the capacity of the PSC of the fulfillment of BWM Convention in China. Additionally, we should further improve the following aspects:

1. Establishment of ballast water reporting system (BWRS). Establishing BWRS is common practice for ballast water management in developed countries, also is the first step in the implementation of ballast water management in Port State (Zhang, S.H., 2008, p.65). The establishment of a reliable BWRS could help the PSC officer to easily and effectively obtain information on the ballast water management of the ship, and can quickly assess the potential environmental damage risks of the ship to take measures to deal with or exemption. The A.868 (20) resolution adopted by IMO provides a sample of BWRS for our reference.

2. Special training for PSC inspectors. Conduct specialized training on highly technical contents of supervision and inspection for the Convention so that PSC inspectors have the inspection capacity of ship's ballast water management

operation, including certificate examination, completed and submitted reports, especially the sampling, storage and analysis of the ballast water sample (Zeng, X.M. & Zhan, Y.L., 2007, pp.39-41).

3. Support and promotion of the research and development of the ballast water sampling and analysis tools. Ballast water sampling and analysis plays a vital role in the whole PSC inspection, and it is the most complex and difficult in the whole process. When the D-2 standard has been widely adopted, ballast water sampling and analysis will become more important. Support and promote the industry to develop appropriate sampling analysis tools, help PSC officer obtaining a representative sample of ballast water within a limited period of time and an accurate analysis result, to ensure that no delays in sailing date are caused by such examination. It is an important prerequisite for the effective implementation of PSC inspection of BWM Convention.

4. Formulation of the provisions or plans for emergency disposal of ballast water. Once the ship ballast water sample does not comply with the relevant standards of the Convention in the PSC inspection, we need to take relevant sanctions, including: carry out ballast water exchange in designated waters, do not allow docking, discharge to shore reception facilities, take disposal measures, etc. (Gao, W.P., 2012, pp.151-153).

5. Development of pre-arranged planning for emergency or additional measures under special circumstances. In some special circumstances, it is required that implement unconventional operations or take appropriate additional measures for ships' ballast water and sediments. These special cases include: there is a higher risk of alien species transfer in the intended installation or discharge of

ballast water, ship accidents resulting in ballast water leakage, etc. Contents of contingency plans should include the main body, risk assessment, level, countermeasures, information notifications and Post Analysis (Zhang, S., 2009, p.35).

6. Supervising and urging port / shipyard to have the receiving ability. Despite the establishment of reception facilities for ballast water and sediments is not a mandatory requirement of BWM Convention, however, considering the Port State governments should try to provide the necessary additional measures for those who can not meet the ballast water management requirements for special reasons ships, especially when the ship repair or clean ballast tank, the sediment must be properly disposed of. Therefore, the appropriate reception facilities should be established in the port when the conditions permit. The competent maritime authorities shall improve the qualification evaluation mechanism of the receiving and disposal departments of the marine pollutants in the port and supervise and urge port / shipyard to establish the reception facilities.

7. Dealing well with propaganda, education and training. According to ship's ballast water accident statistics, the operation of the crew is actually a key factor for the safety (Li, Y.L., 2006, p.35). Correspondingly, I propose that MSA introduce relevant crew ballast water training materials from IMO, conduct training on seafarers to enhance safety awareness and operational capability of the crew.

8. Strengthen international communication and cooperation. The global nature of ship navigation determines the ballast water management is a cross-country and inter-regional issue. Ballast water treatment technology itself is also a

cross-cutting issue. Only by strengthening international and regional communication and cooperation could we more effectively control and prevent the damage caused by the introduction of aquatic organisms and pathogens by ballast water

5.4 Specific actions of the ship / Ship Company

As the main body of performing the BWM Convention, Ships engaged in international routes operation, should actively respond to the challenges brought about by the entry into force of the Convention. For the implementation of the Convention, firstly, the ship needs on the basis of the key factor, such as the construction time and ballast water tank capacity, etc. to determine the concrete actions and time arrangements in line with the requirements of the Convention; Secondly, according to the time schedule to carry out related work, include: equipped with the "International Ballast Water Management Certificate", preparation of "Ballast Water Management Plan", outfit "Ballast Water Record Book" and other certificates and documents. Lastly, take measures to effectively deal with ballast water.

According to requirements of the Convention, the ballast water treatment measures include ballast water exchange, on board processing, and discharging to reception facilities on shore. However, ballast water exchange is a transitional measure, discharged to reception facilities on shore vulnerable restricted by objective conditions, so the best way is to install onboard BWMS.

In addition, shipping company should carry out targeted training to the crew. B-6 of BWM Convention stipulates that officers and crew shall be familiar with

their duties in the implementation of Ballast Water Management particular to the ship on which they serve and shall, appropriate to their duties, be familiar with the ship's Ballast Water Management plan.(BWM Convention (2004)).

5.5 BWMS research and development and manufacturing companies to expand market

The situation of BWMS research and development and manufacturing to some extent determines to some extent the schedule of the country ratified the Convention. The lack of an effective and easy way to popularize techniques to help ship to process ballast water in accordance with D2 standard is one of the main reasons for the member states reluctant to sign for the Convention at the present stage (Bi, Z.X., 2014, p.253).

From February 27 to March 2 2007, at MEPC63 held in London, many countries and ship owners expressed concern for the difficulties of carrying out BWM Convention, such as the insufficient technology and limited shipyard ability. However, some European Union (EU) countries and Korea disagreed, the reason why they think so is that they hold the majority BWMS approved by the IMO, especially South Korea. Up to now, in the 55 basic approval BWMS, Korea has 17 (accounting for 30.9%), among 37 final approval BWMS, Korea has 11 (29.7%), of 57 type approval, Korea has 8 (14.0%). In China, there are only 3 kinds of BWMS acquired basic approval, 2 got final approval and 11 kinds obtained type approval (IMO, 2015c).

With the entry into force of the Convention, we will face the situation that a large number of ships need to install BWMS. In so doing, China should

accelerate the development of BWMS, improve the technological level of products and enhance product reliability and operability. Thus, China will have a certain price advantage to win the domestic market, and occupy a place in the global BWMS market. China’s government should further increase the support of BWMS development and manufacturing to break the "green trade barriers” in ship's ballast water management formatted by developed countries, thereby protecting the interests of China's shipping industry.

Moreover, taking the huge potential of international market into account, China’s relevant companies, in addition to obtaining type approval certificate issued by the CMSA, can also considering apply for type approval from other countries or classifications to expand the market and achieve greater economic benefits.

Chapter 6 Conclusion

The implementation of BWM Convention is a significant achievement of global environmental protection. With the approaching date of entry into force of the Convention, as a big marine, shipping, shipbuilding and maritime country, China should and must give enough concern and attention.

In this research paper, on the basis of qualitative analysis of the situation of fulfilling BWM Convention in China, combined with the consultation and research of the competent authorities, research institutions, relevant business, do a more comprehensive and detailed analysis on the prospects and issues of China's accession to the Convention. This dissertation argues that, we should exert superiority that China has the foundation of keeping track and study of the Convention and some preparation for Convention, fully grasp and use the historical opportunity of building the maritime power in China, actively promote all stakeholders to be prepared for fulfilling the BWM Convention to enable China to perform BWM Convention effectively, thereby, achieve the purpose of reduction and eventual elimination of the damage to the environment, human health, property and resources in China caused by the harmful aquatic organisms and pathogens transfers. At the same time, promote the development of ballast water control and management related knowledge and technology.

For how to effectively fulfill the BWM Convention, this dissertation also gives a certain amount of countermeasures and suggestions on such aspects: Establishing a management mechanism, improving the legal system, and enterprise behaviors, etc. In particular, we do a more detailed in-depth analysis on how to strengthen the executive ability construction of competent authority. It is hoped that the research results can provide reference for the decision-making of the competent authorities. The implementation of the Convention can be effectively performed.

Reference

Bi, Z.X., (2014). Analysis the reason of delay in entry into force of BWM Convention. *Marine Technology, 7,* 253.

Chen, Q., (2012). Legislative issues about invasion of alien species from ship's ballast water. *World Shipping, 35(2),* 54.

China Classification Society. (2014). Guidelines on Ballast Water Convention Implementation (p.3). Beijing: Author.

China Market Report Center. (2014). 2015-2020 Annual research and consultation report of survey and investment strategy on China' s BWMS industry. Retried November 19, 2014 from World Wide Web: http://wenku.baidu.com/view/05a817ff33d4b14e8524684b.html

Chinaports. (2014). Japan became the 41st member of the IMO to ratify the BWM Convention. Retried June 18, 2014 from the World Wide Web: http://www.port.org.cn/info/201406/175098.htm

Dang, K. (2001). Review of ship's ballast water. *Marine Technology, 4,* 59.

Fan, D.S., (2013). *China's entering "BWM convention" Strategy Research.* Unpublished master's thesis. Dalian Maritime University, Dalian, China.

Gao, W.P., (2012). Treatment methods and suggestion of ship's ballast water pollution. *Science & Technology Vision, 6,* 151-153.

Global ballast water project and Chinese ballast water management agency and Laws. Retried February 19, 2012 from World Wide Web: http://www.doc88.com/p-813687500062.html

Gregory M R. (2000). Global spread of microorganisms by ships. *Nature, 408*, 49-50

IMOship. (2015). Georgia has joined the BWM Convention Retried January 27, 2015 from the World Wide Web: http://www.imoship.com.cn/newsdetail.jsp?id=735

International Convention for the Control and Management of Ships' Ballast Water and Sediments 2004, IMO, (2004).

International Maritime Organization. (2012). International shipping facts and figures – information resources on trade, safety, security, environment (p.4). London: Author.

International Maritime Organization. (2015a). Guidelines and guidance documents related to the implementation of the BWM Convention. Retried June 10, 2015 from the World Wide Web: http://www.imo.org/OurWork/Environment/BallastWaterManagement/Documents/Compilation%20of%20relevant%20Guidelines%20and%20guidance%20documents%20-%20January%202015.pdf.

International Maritime Organization. (2015b). Status of multilateral Conventions and instruments in respect of which the International Maritime Organization or its Secretary-General performs depositary or other functions as at 5 June 2015 (pp.488-490). Retried June 10, 2015 from the World Wide Web: http://www.imo.org/About/Conventions/StatusOfConventions/Documents/Status%20-%202015.pdf

International Maritime Organization. (2015c). List of water management systems that received approval from IMO. Retried June 10, 2015 from the World Wide Web: http://www.imo.org/OurWork/Environment/BallastWaterManagement/Documents/Table%20of%20BA%20FA%20TA%20updated%20May%202015.pdf

Kuang, H., (2010). *The comparative study on laws preventing the invasion of oceanic alien species by ships' ballast water-legislation, tendency and countermeasures.* Unpublished master's thesis. Dalian Maritime University, Dalian, China.

Lan, R., (2010). Investigation and analysis of Ballast water management system market. *Proceedings of 2010 Annual Academic Conference of Marine Pollution Prevention,* 424.

Li, Y.L., (2006). Analysis of polluted accident of ballast water. *Water Transportation Management, 28(10),* 35.

Liu, F.S., Wang, M. (2004). Trends and countermeasures of BWM Convention, *Marine Technology, 1,* 67.

Liu, G., (2014). Analysis and comparison of several mainstream ballast water management system. *World Shipping, 37(5),* 50.

Lu, H.M., (2012). Investigations about status of control and management of ship ballast treatment. *Ship & Ocean Engineering, 41(6),* 74-77.

Peng, X.Z., (2012). Current status and trend of ballast water management system. *Shipping Materials and Markets, 6,* 35.

Qian, Z.S., (2007). New regulations of U.S. California's ballast water management. *Navigation of China, 2,* 21.

R.rivas-hermann, (2014). Innovation in product and services in the shipping retrofit industry: a case study of ballast water treatment systems. *Journal of Cleaner Production,* 1-12.

S. Gollasch et al. (2007). Critical review of the IMO international convention on the management of ships' ballast water and sediments. *Harmful Algae 6 (2007),* 585–600.

Shen, Y.Y., (2010). *Study on the legal mechanism of preventing the invasion of alien species from ships' ballast water.* Unpublished master's thesis. Dalian Maritime University, Dalian, China.

Shipinall, (2013). China has been 13 consecutive elected IMO A council members. Retried December 10, 2015 from the World Wide Web: http://www.shipinall.cn/news/54898.html

Song, D. (2012). Hazards and treatment of ship's ballast water. *Technology Wind, 3,* 46-49.

The International Union for Conservation of Nature. (2013). 2013 IUCN Annual Report (p.12). Gland: Author.

United Nations Conference on Trade and Development. (2014). Review of Maritime Transport 2014 (p.37). Geneva: United Nations.

United Nations Conference on Trade and Development. (2014). Review of Maritime Transport 2014 (p.7). Geneva: United Nations.

Wang, W.H., (2011). *A study on legal mechanisms on supervision of the port state to the shipboard ballast water.* Unpublished master's thesis. Dalian Maritime University, Dalian, China.

Wang, X.L., (2013). The introduction of ballast water management in National Counties. *Shipbuilding Technology, 5,* 6-7.

Wei, Y., (2014). Investigation and analysis of ships' ballast water management status. *Ocean Development and Management, 2,* 78-83.

Xie, C.L., (2010). Review of the application and development of ballast water treatment technology in ship. *Ship & Ocean Engineering, 39(6),* 86-90.

http://www.sunrui.net/cn/cpzx/cbyzscl/yzpb/

Xu, X.M., (2008). Analysis and understanding of the IMO BWM Convention. *China Maritime, 3,* 17.

Zeng, X.M., Zhan, Y.L., (2007). Discussion on Port State Control of ballast water. *World Shipping, 42(7),* 39-41.

Zhang, S. (2009). A general discussion on the emergency response to the treatment of ship ballast water and its sediments. *China Maritime Safety, 12,* 35.

Zhang, S., (2014). *Research on legal regulation of marine invasive species prevention in the U.S.*. Unpublished master's thesis, Ocean University of China, Qingdao, China.

Zhang, S.H, Tu, J.J., (). Ballast water legislation to prohibit alien invasive species in USA. *World Shipping, 31(4),* 39-41.

Zhang, S.H., (2008). Port State Control under the BWM Convention. *China Maritime Safety, 1,* 65.

Zhao, Y.X., (2008, June 3). Invasive alien species eat 120 billion Yuan a year. *People's Daily,* p.4

Zhou, Z.S. (2011). Research on the policy concerning implementation of the BWM Convention. *China Maritime Safety, 1*, 35.