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Ballast Water Management Infrastructure Investment Guidance

Prepared on behalf of EBRD

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Executive Summary

This document provides guidance to investment teams on Ballast Water Management (BWM) infrastructure and its assessment for potential inclusion in a broader financial product.

Key elements of the International Convention for the Control and Management of Ships' Ballast Water and Sediments (the BWM Convention) are highlighted, including the specific requirements for Port and Shipping Operators.

The guidance also identifies whether, and how, a given project will be subject to the requirements of the BWM Convention.

Within the geographic risk matrix, the key regional risks associated with the six defined maritime regions are identified. The maritime regions analysed are: Mediterranean Sea, Black Sea, Baltic Sea, Arctic Coast, Pacific Coast and Caspian Sea.

Global best practice for Ballast Water Management is also identified and a set of common best practice characteristics are presented.

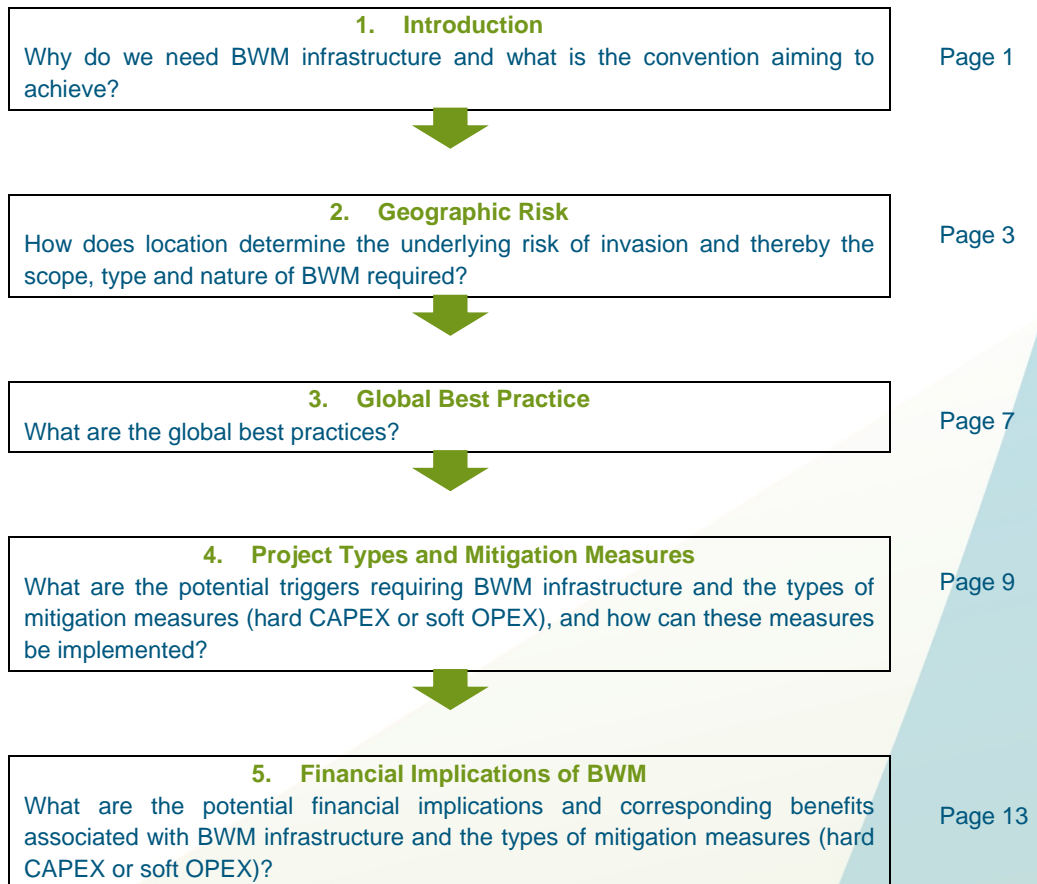
This document enables investment teams to identify and appraise practical and viable BWM implementation measures to be incorporated into an overall Financial Investment Decision (FID).

This document was prepared by Royal HaskoningDHV for the European Bank for Reconstruction and Development. Information contained herein is based on existing data as of September 2013.

This report was revised and updated to reflect 2014 data.

Contents/Process Flow Chart

The diagram below provides the structure of this guidance document and an overview of the stages required in an assessment of BWM infrastructure for a financial product.



Supporting information can be found in the accompanying appendices;

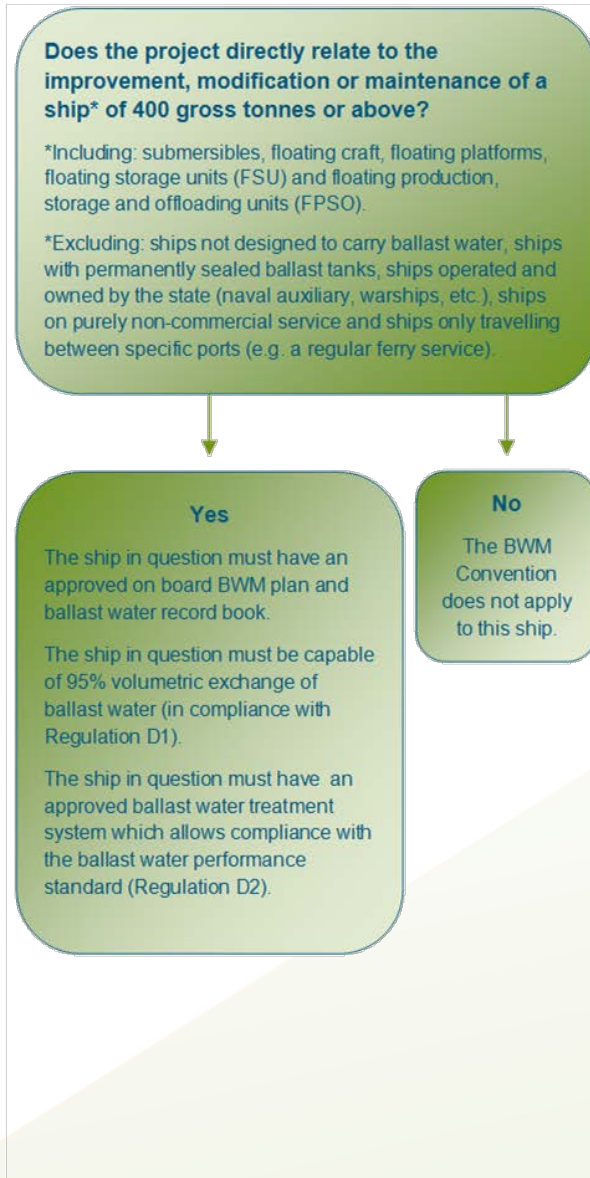
- APPENDIX A International resources**
- APPENDIX B Maritime regions overview**
- APPENDIX C Case study: Port of Split, Croatia**



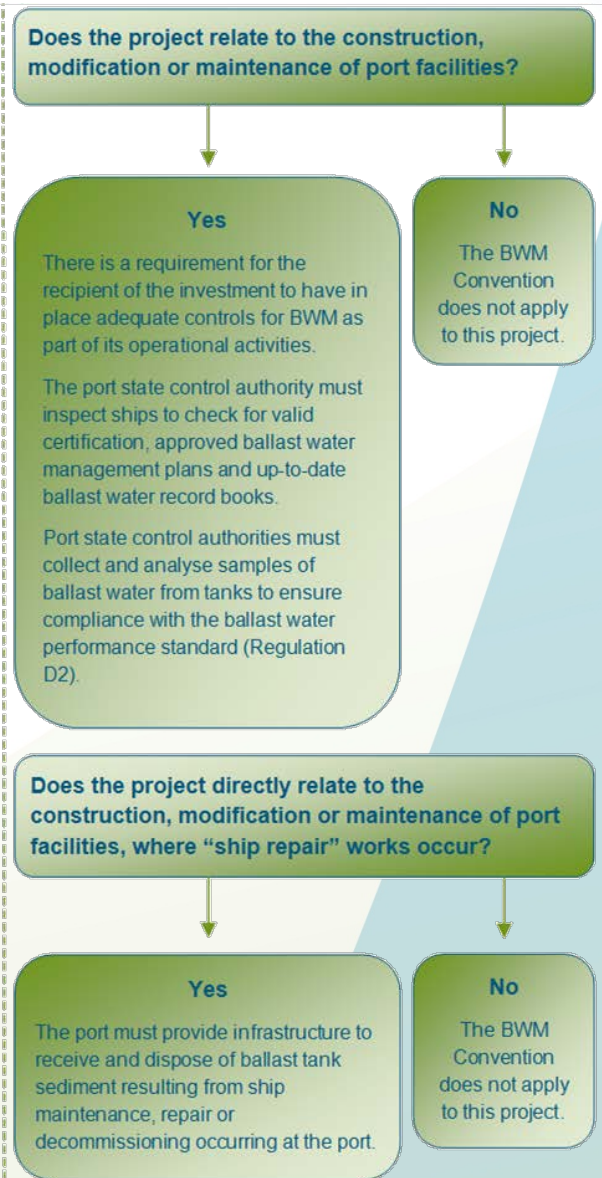
BWM Convention compliance checklist

The checklists below allow investment teams to identify if the International Convention for the Control and Management of Ships' Ballast Water and Sediments (the BWM Convention) applies to a potential investment project. These can be either ship-based or port-based projects. The flow charts allow investment teams to identify if the ship or port in question is compliant with the BWM Convention.

Ship-based investment



Port-based investment



Using the potential impacts and mitigation tables within the report

In order to identify the potential impacts of the project, refer to **Table 4.1 in Section 4: Project types and mitigation measures**. Once the potential impacts have been identified, refer to **Table 4.2 in Section 4: Project types and mitigation measures** to identify the appropriate mitigation options for the level of impact identified.



1 Introduction

“Water with its suspended matter taken on board a ship to control trim, list, draught, stability or stresses of the ship”

The shipping industry transports over 90% of internationally traded goods (600million gross metric tonnes). Ballast water is an essential component for the structural integrity and stability of modern ships when emptied or partially emptied of their load. It is defined by the International Maritime Organization (IMO) as “water with its suspended matter taken on board a ship to control trim, list, draught, stability or stresses of the ship”.

While the use of ballast water is critical to maintaining the operational safety of ships, especially when unladen, its discharges can cause significant economic, environmental and health implications. Ballast water is usually taken on at ports or within coastal waters, however this can also happen at sea. As sea water is drawn into a ship’s ballast tanks, organisms living in that water are also taken on board. This water therefore becomes “biotic”; the larvae and spores of marine animals can survive the long journeys taken by cargo ships. Many of these organisms remain alive inside the ballast tanks and are subsequently returned back to the sea when ballast water is discharged for stabilisation purposes. Ballast is often discharged in exchange for cargo at the port of destination. Any sediment which settles within the ballast tanks is removed manually, and returned to the sea over the side of the ship, or disposed of in shipyards and repair facilities during cleaning of the ballast tanks. Through this activity organisms are transported and released by ships into new environments where they are not indigenous. These organisms are referred to as alien species.

“The BWM Convention will come in to force 12 months after ratification by 30 states, which represent 35 % of world merchant shipping tonnage”

Depending on the environmental conditions into which they are discharged, organisms may not only survive but establish themselves and become dominant. These organisms are referred to as invasive alien species (IAS), and are now globally recognised as one of the greatest threats to biodiversity. IAS have the potential to sufficiently affect ecosystems to the extent that serious economic, environmental and health implications occur. They include fish, crustaceans, molluscs, polychaetes and algae.

1.1 Ballast Water Management Convention

The International Maritime Organization (IMO) is a specialised agency of the United Nations responsible for the international regulation of

ship’s safety and security in conjunction with prevention of marine pollution from ships. In 2004, the IMO adopted the International Convention for the Control and Management of Ships’ Ballast Water and Sediments (the BWM Convention). The BWM Convention and its supporting Technical Guidelines can be accessed at www.imo.org.

The BWM Convention will come into force 12 months after ratification by 30 states, which represent 35 percent of the world merchant shipping tonnage. At the time of writing this document (June 2014) the BWM Convention is ratified by 40 states, which represent 30.25 percent of the world merchant shipping tonnage.

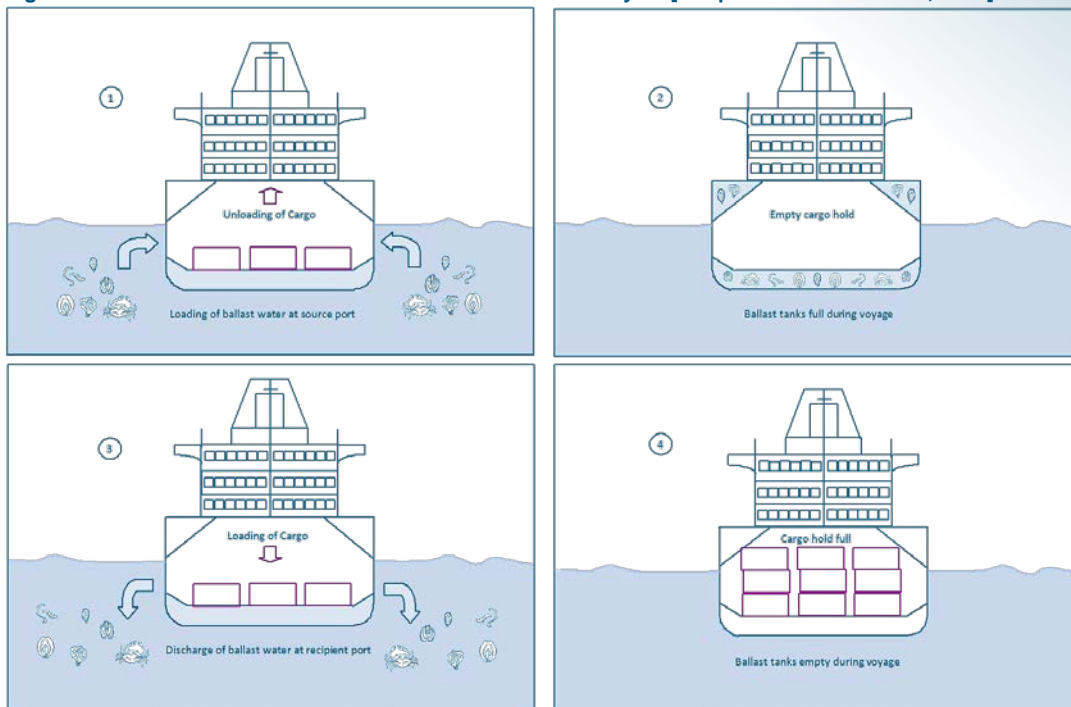
Once the BWM Convention comes into force, member states will undertake to “prevent, minimise and ultimately eliminate the transfer of Harmful Aquatic Organisms and Pathogens (HAOP) through the control and management of ships ballast water and sediment”. Member states have the right to take more stringent measures consistent with international law, ensuring practices do not cause greater harm than they prevent, to their environment, human health, property or resource, or those of other states.

1.1.1 Ship requirements

The BWM Convention requires all ships to be subject to a range of measures to address the potential impacts associated with ballast water operations. The Convention allows for some exceptions; ships that do not use ballast water; ships with permanent ballast water in sealed tanks; and naval ships. Exemptions may also be granted to ships sailing between specified ports (such as a ferry operating a dedicated service between two ports), provided the ship does not mix ballast water or ballast tank sediment other than between the ports specified in the exemption, and that it is in accordance with all IMO member states.

In addition, all ships must have an approved Ballast Water Management Plan (BWMP) and a Ballast Water Record Book. The BWMP sets out the standard operational guidance for the planning and management of a ship’s ballast water and sediments. The Ballast Water Record Book logs ballast water operations such as uptake, treatment, exchange, circulation and discharge.

Figure 1.1 Cross sections of ballast tanks and ballast water cycle [Adapted from GloBallast, 2013]



The BWM Convention requires ballast water management on board ships in accordance with the following standards:

- The Ballast Water Exchange Standard (Regulation D1), which requires an efficiency of 95% volumetric exchange of ballast water with marine water at a location at least 200 nautical miles from the nearest land and in water at least 200 metres in depth; or
- The Ballast Water Performance Standard (Regulation D2), which concerns water quality for discharge, related to specified maximum concentrations of micro-organisms.

The BWM Convention sets out timelines for the implementation of these standards based on a ship's year of construction and ballast water capacity. In summary, the Ballast Water Exchange Standard (Regulation D1) will be replaced by the Ballast Water Performance Standard (Regulation D2) in 2016.

All ships in service or under construction when the BWM Convention enters into force are considered to be existing ships. By their first International Oil Pollution Prevention (IOPP) renewal survey, after the convention enters into force, all ships will have to use an approved Ballast Water Treatment System (BWTS) to treat ballast water prior to discharging it.

1.1.2 Port requirements

The BWM Convention requires that ports¹, where ship repair occurs, provide infrastructure to receive and dispose of ballast tank sediment resulting from ship maintenance, repair and/or decommissioning at that port. However, it does not require that ports provide infrastructure to receive and dispose of ballast water associated with ships sailing to and from them.

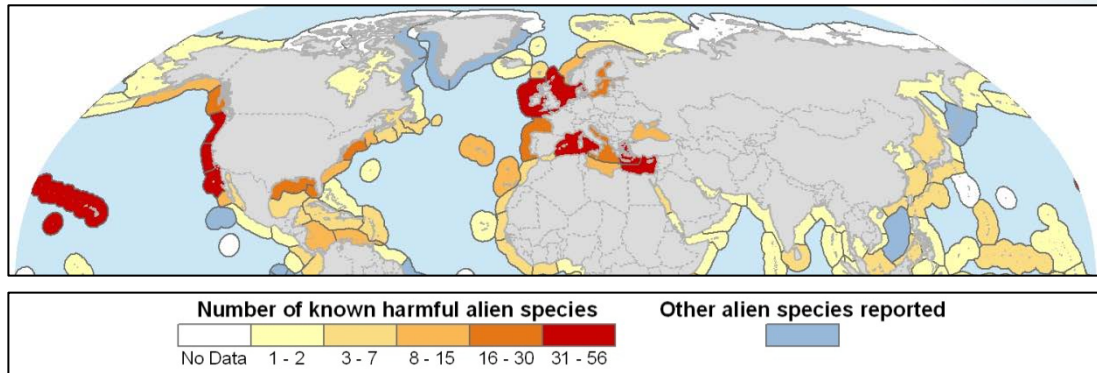
In addition, the BWM Convention requires port state control authorities to inspect ships and check for a valid Certificate/Statement and an approved BWMP, to inspect the Ballast Water Record Book, and/or to sample ballast water. The principal purpose of inspections is to check the ship's operations against the prescribed Ballast Water Exchange Standard and/or the Ballast Water Performance Standard. The BWM Convention requires authorities to undertake inspections and associated administrative tasks quickly and efficiently - balancing the needs of the inspection process with the time-sensitive nature of commercial shipping operations - to avoid undue delays to ships.

Finally, the BWM Convention also requires port state control authorities to promote and facilitate scientific and technical research on BWM. This includes monitoring the effects of BWM in the waters under their jurisdiction.

¹ The BWM Convention refers to Port's which refers to the responsibility of the 'port authority' rather than the publicly or privately owned container terminal or general cargo facility where the ship berths.

2 Geographic Risk

Figure 2.1 IAS by coastal eco-region [source: Adapted from Molnar *et al*, 2008]



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The level of environmental similarity between ‘donor’ port and ‘recipient’ port is a key factor in determining the risk of IAS introduction by way of ballast water

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Shipping and BWM activities at individual ports, and particularly regional hub ports, pose the highest risk of introducing and spreading IAS

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2.1 Maritime Regions

Section 2 identifies for investment teams how IAS risks relate to the transfer and discharge of ballast water between different ports, and particularly between different ports in different maritime regions.

Figure 2.1 illustrates the known levels of IAS across the global coastal eco-regions. The figure clearly identifies a correlation and causal link between socio-economic development and high shipping levels; with higher numbers of known IAS indicated by the darker red shading. Shipping and BWM activities at individual ports, and particularly regional hub ports, pose the highest risk of introducing and spreading IAS (vectors of dispersion).

Maritime regions, the countries considered within those regions, and the corresponding co-ordinating bodies relevant to the EBRD’s investment locations are outlined in **Table 2.1**. **Figure 2.2** shows the locations of the maritime regions detailed in **Table 2.1**.

The level of environmental similarity between ‘donor’ port and ‘recipient’ port is a key factor in determining the risk of IAS introduction by way of ballast water. Water temperature and salinity are two of the most critical elements for determining environmental similarity between

ports; and particularly between ports that are located in different maritime regions.

Table 2.2 shows the likelihood, based on matching environments/climate types, of IAS colonising a maritime region depending on the relative locations of donor and recipient ports.

However, the climatic element is only one of the many factors influencing the risk of IAS. For all maritime regions, the risk of IAS increases if the following conditions occur and make the receiving environment more vulnerable:

- Vacant niches – i.e. a community within the habitat lacks certain species, which ought to be present under normal conditions;
- Habitat disturbance, due to natural or anthropogenic factors including previous species introduction causing a disturbance effect; and
- Increased modification and increased traffic from new shipping trade or expansion of receiving facilities.

Table 2.1 Maritime regions

Maritime region	Co-ordinating body/authority	Countries considered within the maritime region (member states who have ratified the BWM Convention are shown in bold*)
Mediterranean Sea	Regional Marine Pollution Emergency Response Centre for the Mediterranean Sea (REMPEC)	Albania , Bosnia and Herzegovina, Croatia , Montenegro , Slovenia, Turkey , Morocco, Tunisia, Egypt , Algeria, Cyprus, France , Gibraltar, Greece, Israel, Italy, Lebanon , Libya, Malta, Monaco, Spain , and Syrian Arab Republic .
Black Sea	Commission on the Protection of the Black Sea Against Pollution (Black Sea Commission/BSC) Black Sea Environment Programme - (Bulgaria, Georgia, Romania, Russian Federation, Turkey, Ukraine) GloBallast Programme - Port of Odessa in Ukraine	Bulgaria, Georgia, Romania, Turkey , Russian Federation and Ukraine.
Baltic Sea	Helsinki Commission (HELCOM) - the Baltic Marine Environment Protection Commission	Estonia, Latvia, Lithuania, Poland, Denmark , Germany , Russian Federation , Finland and Sweden .
Arctic Coast	Arctic Council	Russian Federation , Greenland, Norway , Canada and USA (state of Alaska).
Pacific Coast [Bering Sea and the Sea of Okhotsk]*	N/A	Russian Federation , Japan and USA (State of Alaska).
Caspian Sea	Caspian Environment Programme (CEP)	Turkmenistan, Kazakhstan, Azerbaijan, Iran and Russian Federation .

*This information was correct at the time of writing, for the latest BWM ratification information please visit www.imo.org.

**The Pacific Ocean is the world's largest body of water, covering about one third of the Earth's surface, and bordering 41 countries. For the purpose of this guidance document, the areas considered for the Pacific Coast maritime region are limited to the Sea of Okhotsk and the Bering Sea, with a focus on the east coast of the Russian Federation, the north coast of Japan and the west coast of Alaska, USA.

Figure 2.2 Maritime regions and respective nation states

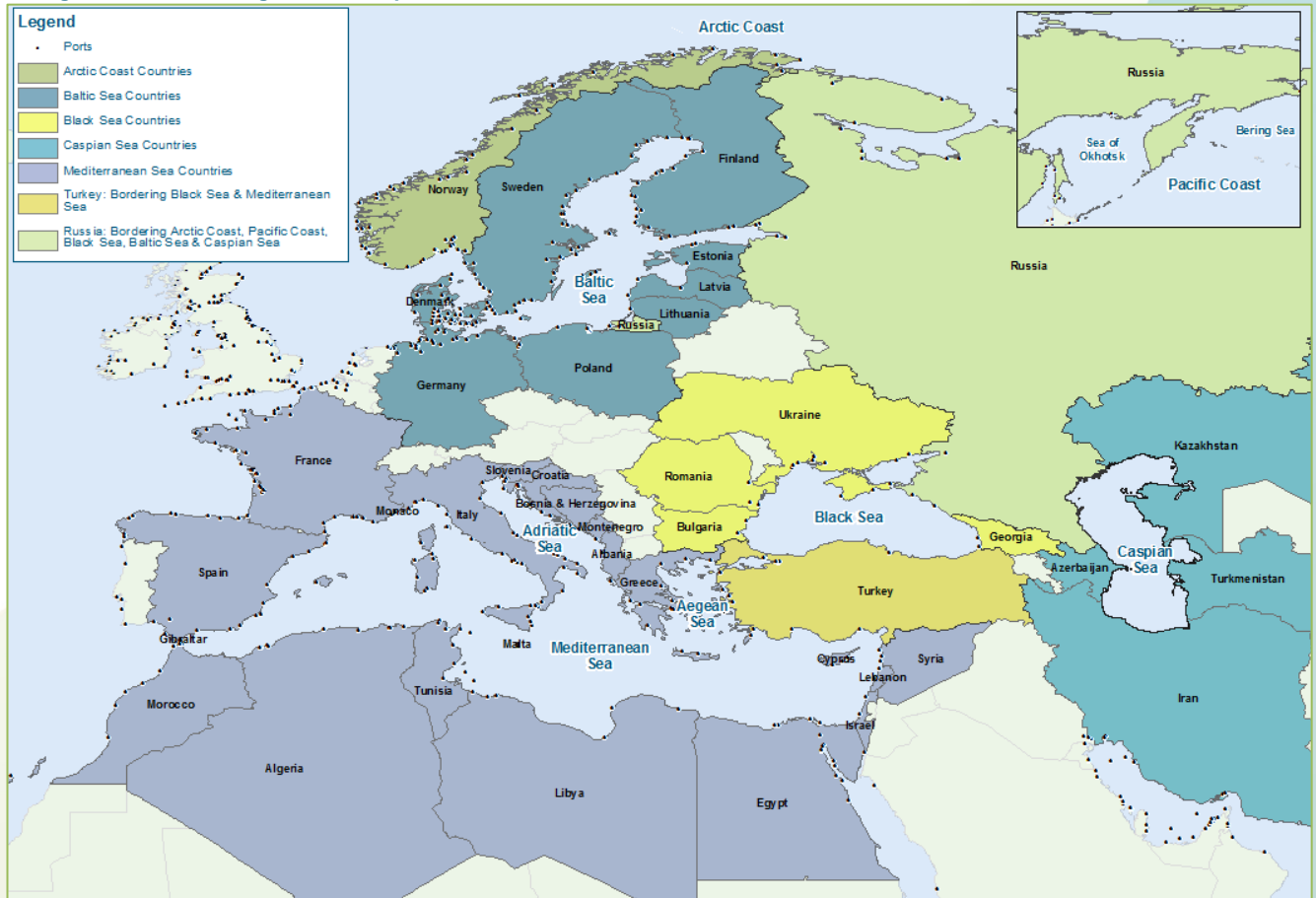


Table 2.2 Likelihood of colonisation of IAS, according to matching environment in donor and recipient region [Adapted from Leppäkoski & Gollasch, 2006]

Recipient region	Donor region			
	Arctic & Antarctic [Arctic Coast]	Cold-temperate [Baltic Sea, Pacific Coast]	Warm-temperate [Mediterranean Sea, Black Sea, Caspian Sea]	Tropics [no regions identified within GD]
Arctic & Antarctic [Arctic Coast]	High	Medium	Low	Low
Cold-temperate [Baltic Sea, Pacific Coast]	Medium	High	Medium	Low
Warm-temperate [Mediterranean Sea, Black Sea, Caspian Sea]	Low	Medium	High	Medium
Tropics [no regions identified within GD]	Low	Low	Medium	High

*The Table illustrates the environmental similarities between origin and destination maritime regions/ports of origin. It shows that a ship taking on ballast water from a cold temperate maritime region (e.g. the Pacific Coast), and deballasting into another cold temperate maritime region (e.g. Baltic Sea), the likelihood of an alien species surviving and colonising is high. However, if a ship takes on ballast water in a warm-temperate maritime region (e.g. Black Sea), and deballasts into an Arctic/Antarctic maritime region (e.g. Arctic Coast), the likelihood of an alien species surviving and colonising is low.

“ Each criteria is given a score of one to three, with one being the lowest risk and three being the highest risk ”

2.2 Geographic Risk Matrix

Geographic Risk Analysis has been undertaken to calculate which regions are most vulnerable and at risk to IAS. The Geographic Risk Matrix, **Table 2.3**, assesses each maritime region, based on six criteria. For each criterion, a score of one to three is given, with one being the lowest risk and three being the highest risk.

The first five criterion are then added together to give a sub total which is multiplied by the volume of shipping score. The end result gives an overall risk rating of Low (5-17), Medium (18-19) and High (20-45). The six criteria and the corresponding ranking system qualification are;

Percentage of countries within region that have ratified the BWM Convention (policy/regulation)

- Risk level 1 – More than 30% of countries
- Risk level 2 – Between 20% and 30% of countries
- Risk level 3 – Less than 20% of countries

Effectiveness and extent of current BWM in place within each maritime region (infrastructure)

- Risk level 1 – Compulsory implementation of BWM strategies within more than 2/3 of region
- Risk level 2 – Voluntary implementation of BWM strategies within more than 1/3 of region
- Risk level 3 – No enforcement of BWM strategies in place/limited partial strategy in less than 1/3 of region

Productivity of ecosystems (level of modification and diversity of existing ecosystems)

- Risk level 1 – Highly modified ecosystems with low uniqueness
- Risk level 2 – Moderate modification of ecosystems with intermediate levels of biodiversity sub-regions
- Risk level 3 – Unique or high in biodiversity with moderate modification

Number of ports within each maritime region (capacity of each region)

- Risk level 1 – Less than 40
- Risk level 2 – Between 40 and 100
- Risk level 3 – More than 100

Origin of shipping, based on the distance and therefore likelihood of a different ecosystem at origin when compared to destination (change)

- Risk level 1 – Less than 50% long haul and or less than 50% short haul
- Risk level 2 – (there is no risk level 2)
- Risk level 3 – More than 50% medium haul and less than 50% short haul

Volume of annual shipping (throughput), by cargo tonnage

- Risk level 1 – Less than 100m tonnes
- Risk level 2 – Between 100m and 400m tonnes
- Risk level 3 – More than 400m tonnes



Table 2.3 Geographic risk matrix

Maritime region	% Ratified	Effective-ness of current BWM	Productivity of ecosystem	No. of ports	Origin of shipping	Sub total	Shipping volume (multiplicati on factor)	Summary risk rating	
Mediterranean Sea	1 (41%)	1	1	3	3	9	3	27	High
Black Sea	1 (33%)	2	3	1	1	8	2	16	Low
Baltic Sea	1 (44%)	2	2	3	1	9	2	18	Medium
Arctic Coast	1 (40%)	3	3	1	1	9	1	9	Low
Pacific Coast	2 (N/A)	2	3	1	1	9	1	9	Low
Caspian Sea	1 (40%)	3	3	1	1	9	2	18	Medium

The key issues faced within each of the maritime regions in **Table 2.1** have been identified in the risk profiles below.

Risk Profile: Mediterranean Sea

- High shipping volumes;
- High numbers of fish and shellfish farms in lagoons and bays;
- Marine habitats and biodiversity threatened by overfishing and coastal development leading to water pollution and coastal habitat reduction; and
- Water quality degradation is on-going with principal sources being surface runoff of nutrients and discharge of inadequately treated sewage.

Risk Profile: Black Sea

- Highly productive ecosystem with low salinity;
- Marine mammals are critically endangered and the monk seal is virtually extinct;
- Fishery of the indigenous Black Sea Oyster decimated by the introduction of IAS via ballast water;
- Severely impacted in terms of overfishing and destructive fishing practices;
- Highly sensitive to the introduction of IAS via ballast water due to its low salinity, environmental degradation and a low "biological immunity";
- Huge drainage basin;
- Is a major industrial and agricultural region, with uncontrolled urban development; and
- Uncontrolled fisheries and eutrophication is causing important alterations in the structure and dynamics of the Black Sea.

Risk Profile: Baltic Sea

- Largest brackish water body in the world;
- Ecologically unique with limited biodiversity;
- Suffers from oxygen depletion;
- Intensive fishing and eutrophication are the two main threats affecting this environment;
- Young and relatively simple ecosystem, it is particularly sensitive to invasion and ecological change;
- Eutrophic conditions and rapid expansion in shipping increase vulnerability; and
- High shipping volumes which are steadily increasing.

Risk Profile: Arctic Coast

- Arctic and subarctic oceans, such as the Barents, Bering and Labrador Seas, are among the most productive in the world;
- Considerable uncertainty about the impacts of alien species moving into the Arctic region;
- Climate change is likely to increase the rate and extent of IAS by influencing the dispersal and survival of both indigenous and alien species; and
- Marine navigation and transport are likely to increase in volume and duration in response to both economic development and as the ice-free season extends as a result of climate change, with the consequent infrastructure developments.

Risk Profile: Pacific Coast (Bering Sea and Sea of Okhotsk)

- Some of the world's richest fishery resources, with approximately 340 species;
- Supports many endangered whale and seabird species, along with commercially valuable fisheries such as salmon and king crab;
- The key sensitivities of the region are; pollution, habitat destruction, over-exploitation of resources and climate change;
- Ecosystems and habitats that have been degraded by human activities and are stressed, will be more vulnerable to introductions of IAS via ballast water; and
- Despite its global importance, the Pacific Ocean is not being managed sustainably.

Risk Profile: Caspian Sea

- High biodiversity, low salinity;
- Unique brackish habitat, an extremely important and special ecosystem in terms of global biodiversity;
- In 2000 there was a mass mortality of Caspian Seals and in 2001 a mass loss of the Caspian sprat occurred;
- Increasingly vulnerable to the introduction of IAS via ballast water due to the degree of environmental degradation and the on-going rapid expansion of new developments, such as oil and gas extraction and shipping; and
- Caspian littoral States rely heavily on the sea for fisheries production.

3 Global Best Practice

3.1 Global Best Practice

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Conducting
BWM activities
whenever
practical and at
every
opportunity
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Section 3 provides a review of current global practices and approaches to BWM. The characteristics of best global practice are identified as:

- Recognising the importance of ballast water discharge as a principle vector for the introduction and spread of IAS;
- Recognising the role of ship owners and ship operators in reducing the risk of the introduction and spread of IAS;
- Conducting BWM activities whenever practical and at every opportunity;
- Striving toward global, integrated ballast water management strategies;
- Supporting scientific research sampling programs and analysis;
- Inspecting ballast tanks and removing sediment if necessary;
- Recording of all ballast water exchange and discharge, and make this available for inspection upon request;
- Minimising ballasting during presence of targeted species;
- Minimising ballasting at night;
- Disposing of accumulated sediments appropriately;
- Investing in BWTS and facilities; and
- Integrating involvement, including agreement amongst fisheries, ports and governmental bodies.

A list of international BWM resources can be found in **Appendix A**.

3.2 BWM best practice

A selected range of country specific global examples of BWM best practice are identified below.

3.2.1 European Maritime Safety Agency (EMSA)

On behalf of the ESMA, the Institute for Marine Resources & Ecosystem Studies (IMARES) have developed a full standard methodology for testing ballast water

discharges for gross non-compliance of the IMO's BWM Convention. The standard methodology identifies a Gross Non-Compliance (GNC) threshold and includes sampling protocol of ballast water, analysis methodology and confidence limits based on EMSA research.

3.2.2 European (North West) Standards

Vessels travelling from fresh water ports should undertake ballast exchange in appropriate/designated areas. Any vessels arriving from outside the OSPAR maritime area must undertake exchange on route, in waters over 200nm from the shore and in waters at least 200m deep. Should this not be possible vessels must make a minor diversion to identified discharge areas.

3.2.3 Ukraine

On entry to the Black Sea, segregated ballast water must be exchanged for Black Sea ballast water, this should be recorded in the oil record book and logbook of the vessel. The amount of ballast water discharged at the loading berth must be declared to the agent and on berthing, samples of the ballast water will be tested prior to discharge being permitted.

3.2.4 Antarctic

A ballast water management plan is to be prepared for vessels entering Antarctic waters, considering problems associated with ballast water exchange in Antarctic conditions. A record should be kept of all ballast water operations. Ballast water exchange must take place prior to arrival in Antarctic waters, or at least 50nm from the nearest land and in waters at least 200m deep. Any ballast water taken on in Antarctic waters must be exchanged north of the Antarctic Polar Frontal Zone and at least 200nm from the nearest land in water 200m deep. The release of ballast water tank sediments during cleaning should not occur in Antarctic waters.

3.2.5 Egypt

In Alexandria the port authorities require the vessel master to request discharge of ballast

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Integrating
involvement,
including
agreement
amongst
fisheries, ports
and
governmental
bodies
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Recognising the
role of ship
owners and
ship operators
in reducing the
risk of the
introduction and
spread of IAS
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The nature and scale of environmental risk, which drives the requirements for the ultimate combination of hard and/or soft measures is subject to maritime risk of invasion
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water by letter prior to the discharge taking place. The letter must detail the number of ballast tanks, quantity of ballast water in each ballast tank, total quantity of ballast water to be discharged and a statement that the ballast water was exchanged in the Mediterranean Sea.

3.2.6 Israel

It is required that vessel masters provide pilots with a complete ballast water exchange report showing that ballast water taken on in the open ocean has been exchanged in an open ocean beyond any continental shelf or freshwater current. Ships bound to Eilat should carry out exchange outside of the Red Sea, where practical, and ships bound for Mediterranean ports must exchange ballast water in the Atlantic, where practical.

3.2.7 Australia

Australia has applied BWM requirements in its waters since 2001 and signed up to the IMO BWM Convention in 2005. The Department of Agriculture, Fisheries and Forestry (DAFF), the lead BWM agency, is currently drafting legislation and operational procedures to establish national BWM arrangements. The Australian and state/territory governments along with marine industries and marine scientists are implementing the National System for the Prevention and Management of Marine Pest Incursions. The National System aims to prevent new marine IAS species arriving, to guide responses when a new pest is discovered, and to minimise the spread and impact of pests that are already established in Australia. The Australian commercial fishing industry has developed voluntary best practice management biofouling guidelines “National Best Practice for Domestic Commercial Fishing Vessels for Managing Marine Pests” to help prevent the introduction of IAS and protect the marine environment, businesses, fishing grounds and ports from the impacts of marine pest outbreaks.

3.2.8 New Zealand

In New Zealand ballast water introductions are treated as a ‘biosecurity’ issue, rather than a maritime matter. The Biosecurity Act (Public Act 1993 No 95) was introduced in 1993 and requires all ships entering New

Zealand waters to re-ballast at sea, subject to safety considerations and in accordance with the IMO guidelines. The New Zealand Ministry of Fisheries have also completed a proposed management strategy for the introduced of Asian kelp *Undaria pinnatifida*.

3.2.9 Canada

Voluntary provisions for ballast water exchange were first introduced in Canada in 1989 for ships travelling to the Great Lakes. In Canada the responsible authority for BWM is Transport Canada. They have produced the “Guide to Canada’s Ballast Water Control and Management Regulations”, which provides information on the application of the Ballast Water Control and Management Regulations made in accordance with the Canada Shipping Act, 2001.

The Shipping Federation of Canada advises ships to apply a precautionary approach in the uptake of ballast water by minimising ballasting operations under the following conditions:

- In areas identified in connection with toxic algal blooms, outbreaks of known populations of harmful aquatic organisms and pathogens, sewage outfalls and dredging activity;
- In darkness, when bottom dwelling organisms may rise in the water column;
- In very shallow water;
- In areas where a ship’s propellers may stir up sediment;
- In areas with naturally high levels of suspended sediments (e.g. river mouths and delta areas, or in locations that have been affected significantly by soil erosion from inland drainage); and
- In areas where IAS are known to occur.

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Ballast water discharge is prohibited within the Panama Canal
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Limit ballast uptake in areas identified in connection with toxic algal blooms, outbreaks of known populations of harmful aquatic organisms and pathogens, sewage outfalls and dredging activity
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4 Project Types and Mitigation Measures

Section 4 enables investment teams to identify and prioritise project-level ballast water measures and corresponding mitigation required by the BWM Convention for a project investment.

Shipping characteristics and the receiving port environment determine the ballast water operations and management measures undertaken at that location and within the wider maritime region. By providing loans for new and/or improved infrastructure, and particularly port infrastructure, project investments can change shipping characteristics and, thereby, create ballast water impacts should such changes increase

the likelihood of facilitating the transfer and introduction of IAS.

4.1 Project-level Ballast Water Impacts

Ballast water impacts relate to the potential release of wastes (i.e. ballast water and ballast tank sediment) containing IAS and the associated risk of an adverse change to the environment, human health, property and/or resources. Project types and associated ballast water impacts are detailed in **Table 4.1**.

Table 4.1 Project types and associated ballast water impacts

Project type	Associated ballast water impact
Construction of a new port facility	During construction , ships involved in capital works and dredging activities may come from any number of maritime regions. The ships may have the potential to introduce new ballast water sources and IAS to an environment previously not exposed to these influences. During operation , ships using the new port may introduce new ballast water sources and IAS to an environment previously not exposed to these influences.
Introducing new ships/cargo/passengers [e.g. expansion of an existing port]	During construction , ships involved in the construction and dredging activities may come from any number of maritime regions. The ships may have the potential to introduce new ballast water sources and IAS to an environment previously not exposed to these influences. During operation , new types and sizes of ships may be attracted, thereby increasing the environment's exposure to new ballast water sources and IAS.
Increased throughput [e.g. expansion of an existing port by increasing the quantity of cargoes/ships/passengers]	During construction , ships involved in the construction and dredging activities may come from any number of maritime regions. The ships may have the potential to introduce new ballast water sources and IAP to an environment previously not exposed to these influences. During operation , larger sized and/or increased numbers of ships may be attracted, thereby increasing the environment's exposure to more ballast water sources and IAP.
Introducing new types & increasing existing throughput [e.g. expansion of an existing port with new and more cargoes/ships/passengers]	During construction , ships involved in the construction and dredging activities may come from any number of maritime regions. The ships may have the potential to introduce new ballast water sources and IAP to an environment previously not exposed to these influences. During operation , ships sailing to and from new and/or more maritime regions may be attracted, thereby exposing the environment to new and/or more ballast water sources and IAP.
Operational maintenance [e.g. dredging]	During construction , ships involved in the construction and dredging activities may come from any number of maritime regions. The ships may have the potential to introduce new ballast water sources and IAP to an environment previously not exposed to these influences. During operation , larger sized and/or increased numbers/types of ships may be attracted, thereby increasing the environment's exposure to more ballast water sources and IAP.
Modernisation of BWM equipment / retro fitting	Ships with updated BWM equipment will be better enabled to comply with the BWM Convention.

“ Finance for new and/or improved infrastructure, project investments can change shipping characteristics and, thereby, cause ballast water impacts ”

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Ballast water impacts could result from a range of investments in port and shipping projects
”

Ballast water impacts could result from a range of investments in port and shipping projects (as identified in **Table 4.1**). Investments in port infrastructure projects (including dredging works to improve navigation) can increase the risk of IAS due to resultant increases in port capacity to handle new and/or an increased number and volume of cargo and passengers causing a corresponding change to the existing shipping characteristics and associated ballast water activities. In addition, investments in associated port infrastructure and the logistics supply chain (e.g. improved road and rail links) can increase the risk of IAS for the same reason.

Therefore, investment decisions need to consider the potential for an indirect increase in the environment's exposure to ballast water impacts (i.e. the transfer and introduction of IAS) via new and/or more ballast water operations. Investment decisions also need to consider whether a project investment which, wholly or in part, provides investment for ballast water sediment reception and/or disposal facilities at a port, results in a reduction in the environment's exposure to ballast water impacts.

“
Investment for ballast water reception and/or disposal facilities at a port, may result in a reduction in the environment's exposure to ballast water impacts
”

4.2 Mitigation Measures

Project investments need to comply with a range of environmental protection mechanisms including the BWM Convention where relevant. Compliance may require project implementation measures that can be described as hard (i.e. physical infrastructure) and/or soft (i.e. non-physical management) and incur different expenditure levels. Depending on the implementation mechanism, these measures may need to be covenanted into loan agreements.

The particular requirements of the BWM Convention are detailed in **Section 1**, and many of the requirements form appropriate mitigation measures for the individual investments in port and shipping projects.

4.2.1 Expenditure Measures

At a project level, high expenditure measures are likely to relate to the modernisation and/or acquisition of ballast water management equipment (i.e. predominantly hard measures). This will include the purchase and/or installation of equipment, and the subsequent operation and maintenance of such equipment including training.

Medium expenditure measures are likely to relate to new ballast water operations and institutional development necessary to meet the requirements of the BWM Convention, including the prescribed Ballast Water Exchange Standard and/or the Ballast Water Performance Standard (i.e. hard and soft measures).

Low expenditure measures are likely to relate to extensions to on-going ballast water operations and capacity building necessary to meet the requirements of the BWM Convention (i.e. predominantly soft measures).

These measures are identified in **Table 4.2** according to the corresponding value of capital of operational expenditure.

4.3 Implementation

Global best practice informs the identification of appropriate measures proposed for individual investment. **Table 4.2** identifies a series of hard and soft project implementation measures for high, low and medium risk maritime region. The nature and scale of environmental risk, which drives the requirements for the ultimate combination of hard and/or soft measures is subject to maritime risk of invasion. These factors include the scale of the primary investment (equity or debt), the commercial viability of the measures required, and the risk assessment of the project location within the context of **Section 2** (risk profile). **Table 4.5** provides examples of appropriate measures necessary for investment types with associated geographic risk.

Table 4.2 Mitigation measures, categorised as hard, soft, high, medium and low expenditure

Measures	Port	Ships
H Hard Measures	Construction of port treatment facilities €€	Acquisition of ships with BWTS €€
	Implementation of a biodiversity monitoring system (as an option for treatment facilities, according to the BWM Convention) €	Regular clearing/cleaning of ballast water sediment €
	Installation of ballast tank sediment reception and disposal facilities at ports €€	Retrofitting of ships with BWTSs – various options available €€€
	Construction of physical infrastructure that is 'implementation-ready' €€	Acquisition and retrofitting of BWTS on-board ships without BWTS €€€
	Acquisition and installation of ballast tank sediment reception and disposal facilities at ports €€	
S Soft Measures	Management responses/procedures identified in the event of emergency deballasting €	Implementation of a BWMP €
	Institutional strengthening for new port state control authorities to inspect BWMPs and Record Books, and undertake sampling of ballast water €€	Use of an approved Ballast Water Record Book €
	Institutional strengthening for new port state control authorities to undertake scientific and technical research and monitoring of ballast water management €€	Regular inspection of ballast water tanks €
	Training/increased awareness within port facility and those in the supply chain €	Training/Increased awareness for ship operators €
	New requirements for ballast water treatment in accordance with the Ballast Water Performance Standard €€	Extended requirements for ballast water treatment in accordance with the Ballast Water Performance Standard. €
	Regular monitoring of BWM in waters under port's jurisdiction €	New requirements for ballast water exchange in accordance with the Ballast Water Exchange Standard €€
	Regular water sampling within port waters €€	Extended requirements for ballast water exchange in accordance with the Ballast Water Exchange Standard €
	More stringent controls within individual port authorities €	Regular sampling of ballast water €
	Institutional strengthening for new port state control authorities to initially certify and subsequently renew BWMPs €€	<p>Key</p> <p>€€€ High expenditure measures (BWTS) [> €2 million per annum/per purchase]</p> <p>€€ Medium expenditure measures (ballast water exchange) [€500,000 to €2 million per annum/per purchase]</p> <p>€ Low expenditure measures (BWMPs and inspections) [< €500,000 per annum/per purchase]</p>
	Procedure to prohibit disposal at sea €	
	Capacity building (training) for existing port state control authorities to inspect BWMPs and Record Books, and undertake sampling of ballast water €	
	Capacity building (training) for existing port state control authorities to initially certify and subsequently renew BWMPs €	
	Capacity building (training) for existing port state control authorities to undertake scientific and technical research and monitoring of BWM €	
	Ballast water and sediment sampling €	
	Undertake/support scientific research in relation to ballast water treatment and IAS €	
	Use of subcontractors to manage ballast water offsite. €€	

4.4 Indicative mitigation measures

In **Table 4.3**, provides indicative mitigation measures for example project types within maritime regions of high, medium and low risk.

Table 4.3. Indicative mitigation measures

Investment scale	High Risk Maritime Region	Medium Risk Maritime Region	Low Risk Maritime Region
New Infrastructure	<ul style="list-style-type: none"> On site ballast water treatment and/or reception facilities and installation of ballast tank sediment reception and disposal facilities at shipyards/docks; Regular water monitoring within port waters; Undertake/support scientific research in relation to ballast water treatment and IAS; Port state control authorities to inspect BWMPs and Record Books, and undertake sampling of ballast water; BWMP and restricting access from any ships which do not comply with the BWM Convention; On-board ballast water treatment systems; and BWM contingency provisions. 	<ul style="list-style-type: none"> On site ballast water treatment facilities and installation of ballast tank sediment reception and disposal facilities at ports; Regular water sampling within port waters; Port state control authorities to inspect BWMPs and Record Books, and undertake sampling of ballast water; BWMP restricting access from any ships which do not comply with the BWM Convention; On-board ballast water treatment systems; and BWM contingency provisions. 	<ul style="list-style-type: none"> On site ballast water treatment facilities and installation of ballast tank sediment reception and disposal facilities at ports; Port state control authorities to inspect BWMPs and Record Books, and undertake sampling of ballast water; BWMP, restricting access from any ships which do not comply with the BWM Convention; On-board ballast water treatment systems; and BWM contingency provisions.
Retro fit of Existing Infrastructure	<ul style="list-style-type: none"> BWMP, restricting access from any ships which do not comply with the BWM Convention; Port state control authorities to inspect BWMPs and Record Books, and undertake sampling of ballast water; and Regular water sampling within port waters; and Training/Increased awareness within port facility. 	<ul style="list-style-type: none"> BWMP, restricting access from any ships which do not comply with the BWM Convention; Regular water sampling within port waters; and Training/Increased awareness within port facility. 	<ul style="list-style-type: none"> Implementation of a BWMP, restricting access from any ships which do not comply with the BWM Convention; and Compliance with BWM Convention.
Minor/Indirect Investment	<ul style="list-style-type: none"> Implementation of BWMP; and Monitoring of BWM in waters under port's jurisdiction. 	<ul style="list-style-type: none"> Implementation of a BWMP; and Monitoring of BWM in waters under port's jurisdiction. 	<ul style="list-style-type: none"> Compliance with BWM Convention.

5 Financial Implications of BWM

5.1 Overview

International shipping is responsible for moving approximately 3 to 5 billion tonnes of ballast water annually. Incremental costs to each tonne of water, imposed through BWM under the Convention, will have significant net implications for the financial operations of national governments, ship operators and investors. **Section 5** identifies the potential financial implications and corresponding benefits associated with BWM infrastructure and mitigation measures.

Whilst a cost-benefit assessment is necessary for individual BMW projects specific to their geographical location, the local economy and the relationship with the shipping industry, this section draws on some existing case studies to provide a more general consideration of the financial elements that contribute to the potential costs and benefits of BWM.

The following studies were used:

- CIE (2007), Ballast Water Management. A Regulation Impact Statement;
- GloBallast (2010), Economic Assessment for Ballast Water Management: A Guideline;
- Lloyd's Register (2011), Ballast Water Treatment Technology: Current Status;
- UMCES (2013), Economical and Logistical Feasibility of Port-based Ballast Water Treatment;
- Bax, N., et al (2006), Evaluation of National Control Plan management options for the North Pacific Sea-star *Asterias amurensis*, CSIRO, Hobart; and
- Monzingo et al (2011), Ballast Water Treatment System, Evaluation for Small Vessels.

No systematic quantification of the global costs to operators, owners and governments as the result of invasive species is available, but attempts to quantify some specific invasions suggest that the costs can be very high (e.g. Raaymakers IMO, 2002).

5.2 Alternative forms of Ballast Water Management

An investment project in BWM consists of a set of measures that could be invested in at ports and/or on ships. Many opportunities for measures exist that support BWM, as mentioned in **Section 4**. The project type(s) for BWM in a specific marine location (specific country, region, sea, port) define the scope of measures.

5.3 Ship Based BWM

Two ship-based options exist for the control and management of ballast water: ballast water exchange and ballast water treatment. Ballast water exchange takes place at sea and is required by the BWM convention to ensure that a minimum of 95% ballast water is exchanged. On-board treatment was phased in after 2009 due to the convention, under the Ballast Water Performance Standard. This requires specific treatment systems on board the ship to ensure that ballast water is treated during the uptake or release of water, in order to be free of IAS.

For ballast water exchange and treatment, there is a capital expenditure (CAPEX) - operational expenditure (OPEX) trade-off for retrofitting equipment versus purchasing new vessels. To install new equipment, in the ballast water treatment case especially, CAPEX will be a large one-off sum (up to several million for ballast water treatment). OPEX for both options is less predictable but will certainly trend upwards through the effects of BMW on increased fuel, power, necessary manpower and equipment, repairs and maintenance, surveys, and safety and risk (in the form of increased insurance payments).

This is to be weighed against the option of purchasing new vessels, which will require an investment in the area of €76 million but have much lower operation costs.

5.3.1 CAPEX for ballast water exchange

The initial capital expenditure required for ballast water exchange will be a function of

“ A cost-benefit assessment is necessary for individual BMW projects specific to their geographical location, the local economy and the relationship with the shipping industry ”

“ International shipping is responsible for moving approximately 3 to 5 billion tonnes of ballast water annually ”

“ Both pumping costs and delay costs to ships increase, the further offshore ballast water exchange is required ”

whether new air pipework needs to be installed, or existing pipework needs to be modified in order to reach the exchange target. With the mandatory transition from ballast exchange to ballast treatment, the required CAPEX will be much larger due to the necessary installation of treatment systems.

In its regulation impact assessment on the Australian economy, the CIE report identified the following breakdown of costs affected by BWM for mandatory exchange:

- Delay costs;
- Higher ship capital and running costs;
- Exchange costs;
- Treatment costs;
- Depreciation costs;
- Capital costs;
- Long-run flow to other parts of economy; and
- Enforcement costs.

5.4 Direct costs

Because of the one-off relatively low capital costs for ballast water exchange, direct costs arise predominantly from additional pumping costs and costs incurred by deviating from the standard route in order to reach designated exchange zones. Both pumping costs and delay costs to ships increase, the further offshore ballast water exchange is required:

- Pumping costs: the additional fuel, energy and labour requirements and machine maintenance costs associated with running ballast water pumps; and
- The delay cost: the deviation and delay costs associated with having to sail to a designated exchange area or having to slow down ship speed while pumping is conducted.

Pumping Costs

Using the CIE (2007) figure of pumping cost of €0.04 per tonne, a typical ship with a deadweight tonnage of above 10,000 tonnes and a pumping capacity of 3,100 tonnes, would incur an addition €108 for each hour of travel. CIE (2007) provided an estimate of this additional cost at around €481 per voyage.

“ The delay costs associated with ballast water exchange will vary according to the journey and the management plan implemented ”

The amount of time taken to pump ballast water on board, and therefore the additional cost incurred, will also be a function of the ship’s pumping capabilities - whether it uses “flow-through” ballast water tanks, or “empty-fill” ballast water tanks.

Empty-fill exchange requires emptying the ballast tank 100% and then refilling it with ocean water. In the flow-through method of exchange, new ocean water is pumped in from below to replace and force out existing water. A volume of three times the ballast tank capacity (300%) must be pumped out (SERC 2004).

Delay Costs

The delay costs associated with ballast water exchange will vary according to the journey and the management plan implemented. The further off-course a ship has to go to reach an approved exchange zone, the higher the overall delay cost. There are two components to the delay cost:

- Moving off-course will add to the overall cruising time as the ship will have to travel further overall; and
- The further off-course a ship has to go to reach an exchange zone, the lower the time available to exchange once in the zone.

The following additional costs were calculated for reaching necessary exchange zones of 50, 12 and 3 miles, with the majority of the cost attributable to the delay incurred.

Table 5.1 The impact of exchange distance on cost [Data source: CIE (2007)]

The Impact of Exchange Distance on Cost		
Distance (miles)	Additional cost (AU\$m)	Percentage attributable to delay cost
50	32.2	94%
12	16.9	88%
3	13.4	85%

These calculations assume that ships cruise towards the exchange zone at a 45-degree angle, allowing for shipmasters to continue cruising in the general direction of the destination port.



These figures were estimated assuming mandatory exchange for all ships and will be considerably lower if a “high-risk” system, obligating only ships at high risk of carrying IAS to make exchanges, were implemented instead.

5.5 Enforcement Costs

5.5.1 Government and industry enforcement measures and associated costs

In order to ensure that BWM is correctly carried out, legislation will need to be complimented by national government surveillance and monitoring. These measures include:

- Ballast water and logbook inspections; and
- The maintenance of the ballast water risk assessment tables, including inspecting ports for resident pests as required.

In its study of 35 ports, assuming that a survey is undertaken once every two years and the same 35 ports are present each year, CIE (2007) estimated the total survey cost to the Australian government to be €0.91 million per year.

This cost of enforcement would be strongly correlated with the incentives for non-compliance. The easier it is for ships to make ballast water exchanges outside of the required areas, or to falsify claims, the more resources will be required to strengthen surveillance and monitoring.

5.5.2 Industry enforcement measures and related costs

Domestic ships will also incur additional costs under national enforcement legislation, including:

- Development and maintenance of an approved BWM Plan; and
- Regular survey and certification of ballast water equipment.

Estimations by CIE (2007) have quantified the cost of a Management Plan at €3500, to be updated once every five years.

Maintenance and structural surveys were estimated to be around €1,750 per survey, to be conducted every two to four years, depending on ship type.

The annual Management Plan and surveying was therefore predicted to lead to an additional cost to the Australian shipping industry of slightly more than €63,000 in total.

It is expected that some of these costs can be passed on to the consumer. For industries unable to pass on the costs however, there is a stronger incentive for non-compliance and hence, potentially a greater need for surveillance and enforcement. However, considering the additional costs are relatively low, in the context of other investment costs, the regulatory bodies and shipping industry has expressed considerable support for regulation, almost 100% compliance is assumed as a viable objective.

5.6 Indirect Costs

In addition to the direct costs imposed by BWM, there may be indirect “knock-on” effects to the rest of the economy, referred to as flow-on costs.

5.6.1 Flow-on costs

Estimates for the flow-on costs encountered will vary depending on the management option implemented. CIE (2007) found that when only high-risk ships were made to exchange, using the closest exchange zone, flow-on costs to the rest of the economy could be as low as €0.98 million a year. Implementing the most costly option of mandatory ballast water exchange for all ships, with an exchange zone of fifty miles could lead to flow-on costs of over €18.2 million.

The fundamental driver behind these costs is the impact of BWM on the value of the shipping, road, rail and air transportation in the domestic economy. The regional impact on these industries varied greatly within Australia itself, so a more specific cost assessment would need to be made for each specific country.

5.7 Summary of Results

To summarize CIE’s (2007) findings for mandatory ballast water exchange, **Table 5.2** lists the above considered costs accumulating over an 18 year period (2007-2025). These figures represent the net present value (NPV) using a discount rate of 7.5% per year.



In addition to the direct costs imposed by BWM, there may be indirect “knock-on” effects to the rest of the economy, referred to as flow-on costs



In the context of other investment costs, the regulatory bodies and shipping industry has expressed considerable support for regulation, almost 100% compliance is assumed as a viable objective



Table 5.2 NPV for Ballast Water Exchange [Data source: CIE (2007)]

The Costs of Mandatory Ballast Water Exchange			
€	Distance from exchange zone (miles)		
	50	12	3
Exchange costs	146	76	61.2
Treatment costs	2.3	2.3	2.3
Capital costs	22.2	22.2	22.2
Depreciation costs	29	29	29
Inspection & Monitoring	1.9	1.9	1.9
Flow-on costs	116	76	67
Total cost	318	208	183

“ An increase in power demand will lead to cleaner seas but it will also lead to an increase of CO₂, NO_x and SO_x particle emissions ”

Bax *et al* (2006) found that a “risk-based” approach to BWM would cost €2.8 million a year for the management of a single foreign species. The savings from using a risk-based approach rapidly diminish as the number of species managed increases.

Assessing the impact of a risk-based approach, using the same exchange distances, CIE (2007) found much lower costs than for those of mandatory exchange, of €162m, €118 and €108m respectively.

5.8 Ballast Water Management Treatment

The majority of OPEX for treatment systems would stem from the increased power requirements (UV, electrolysis or ozonation) of ballast water treatment. All ships have a large power demand but bigger ships have the largest challenge for retrofitting because they may have to install new generators. Ships operating only from shaft generators in ports will need to run additional auxiliary generators because of ballast water treatment requirements. For chemical dosing systems, required power is very low and chemical costs become the major factors.

Ballast water treatment requires a much larger injection of capital through the necessary installation of a treatment system. The treatment options on the market include filtration, hydrocyclones (injecting the water at high velocity), UV irradiation and chemical dosing systems.

GloBallast (2010) estimate that installing treatment systems will require a much larger capital injection ranging from US\$100,000 to 1,000,000 per vessel (US\$0.01-0.2 per ton of

“ Ballast water treatment requires a much larger injection of capital through the necessary installation of a treatment system ”

treated BW). Added to this will be the costs of additional time and energy devoted to searching and testing for the best systems.

Lloyds Register (2011) researched 19 treatment suppliers and found that a system of 200m³/h would require a CAPEX of between €14,000 to €420,000. For a 2000m³/h plants, CAPEX would be between €35,000 to €1.4m.

The operating costs of the systems, on the other hand, varied between no cost (when waste heat is used) and €140 per 1000m³ treated water, giving a mean OPEX of €27 per 1000m³. Although, 11 out of the 19 suppliers quoted an OPEX of under €14 per 1000 m³.

Table 5.3 CAPEX-OPEX for BWMT Systems [Data source: Lloyd's Register (2010)]

CAPEX-OPEX for BWMT Systems					
	Height m	Capex €m		Opex €/ 1000 m ³	Power Kw / 1000m ³
		200 m ³ /h	2000 m ³ /h		
Mean	3	197	604	27	69
Min	37	14	15	13	33
Data point	1	14	35	0	0
Max	20	420	1400	140	220

An increase in power demand will lead to cleaner seas but it will also lead to an increase of CO₂, NO_x and SO_x particle emissions. This could have further cost implications for ships that fall under IMO, and now EU, greenhouse gas legislation.

It is much more difficult for smaller vessels that operate exclusively in fresh water to find an appropriate treatment solution. They are disadvantaged in several ways, including limitations in physical size, short voyage durations, and operation in low salinity water (Monzingo *et al* 2011).

5.8.1 Port based/dedicated treatment ships

“ The largest obstacle, however, is how to co-ordinate the necessary global investments, trust and risk-sharing between ship-owners, ship operators and marine insurers for these operations to be carried out ”

Ballast water regulations issued by the US Coast Guard (USCG) in 2012 state that ships unable to meet the requirements for on board ballast water treatment may be allowed to discharge ballast water at a “port-based facility”, which includes shore-based and barge-based ballast water treatment (BBBWT). It is likely that International Maritime Organization (IMO) regulations will include a similar “contingency” port-based treatment option. Barge-based facilities have also been encouraged elsewhere. One approach, for example, proposed that the Port of Rotterdam export irrigation-quality fresh ballast water to areas such as the Middle East and Western Australia, sources of commodities such as oil, iron, and coal and are also in great need of fresh water.

A study by UMCES (2013) estimates that a BBBWT with the capacity to service 50-60 ships a year would need to generate roughly €700,000 annually. To break even, the service charge for each ship would therefore need to be around €16,720 per ship (or volume based charge of €0.47). In addition to these costs, the ship would need to pay for retrofitting the equipment necessary for using these facilities.

This option may prove attractive to some ships, for example oil tankers that already possess the necessary infrastructure to handle “dirty ballast water” in shore based treatment plants but for others, there would be significant costs including:

- Investing in the correct infrastructure;
- The opportunity costs of time lost in using the facility; and
- Liability and potentially expensive insurance requirements for owners and operators of the port facility.

The largest obstacle, however, is how to co-ordinate the necessary global investments, trust and risk-sharing between ship-owners, ship operators and marine insurers for these operations to be carried out (UMSEC 2013).

5.9 Financial Benefits from BWM

The significant benefits to be gained from BWM stem from the impact of IAS prevention on the local economy and therefore apply to the use of exchange and treatment options.

“ Direct benefits from BWM are derived from the direct use or interaction with environmental resources and services. ”

5.9.1 Avoided cost through prevention

Direct benefits from BWM are derived from the direct use or interaction with environmental resources and services. These can include reducing liabilities to the shipping industry, as well as commercial and recreational activities, such as:

- Fisheries;
- Aquaculture;
- Coastal tourism;
- Reduced environmental liabilities if an emergency event occurs; and
- Increased port activity/trade.

Indirect benefits are related to the indirect support and protection provided to economic activity by the ecosystem’s natural functions, including:

- Flood control and shore protection against storm surges;
- Spawning or nursery areas for commercially caught fish; and
- Avoidance of future costs through IAS in the built environment (such as blocked pipes and clean-up operations).

Benefits of prevention were estimated by CIE (2007) to be at around €21 million a year. Only €1.68 million of this figure is from savings to the fishing industry and aquaculture, which remains relatively untouched by the risk of invasion. The remainder comes from feed-on effects, such as tourism (€3.9- €18.9 million annually).

Table 5.4 Benefits of BWM Systems [Data source: CIE (2007)]

The Benefits of Ballast Water Management	
	Potential cost benefit (€m)
Fisheries	1.75
Tourism & Amenities	18.9
Non-use values	7
Total	€28 million

Non-use values include knock-on effects from things like people’s satisfaction in knowing that the ecosystem is preserved.

“ Because the benefits are mostly derived from the impact of prevention measures to the domestic economy, cost savings will take some time to materialise and will undoubtedly appear in the much longer term compared to initial outgoing costs ”

The benefits above cannot be easily added, partly due to the fact that some benefits tend to overlap but CIE (2007) makes a plausible case that the expected benefits to the Australian economy of preventing further incursions via ballast water could be more than €21 million a year.

To err on the side of caution, however, CIE (2007) chose the more reserved figure of €21 million, to allow for the potentially overstated probabilities of incursions that have been given for the high-risk species concerned.

Other considerations that may also cause this figure to drop include:

- The compliance rate: 100% compliance cannot be guaranteed;
- The addition of IAS beyond the eight known species included in the study;
- Marine survivors: organisms can survive in sediments in the bottom of tank and reballasting can resupply dying organisms with nutrients and oxygen to promote their survival (Low 2003 in CIE 2007).

5.9.2 Time horizon

Because the benefits are mostly derived from the impact of prevention measures to the domestic economy, cost savings will take some time to materialise and will undoubtedly appear in the much longer term compared to initial outgoing costs.

5.9.3 Benefit to Cost Ratio

Using the estimation of €21 million per year in benefits to the Australian economy in conjunction with the cost data above, it is clear that for BW exchange the benefit-cost ratio will be higher for options using closer exchange zones, and higher for risk-based approach over mandatory approaches.

Table 5.5 summarises the above findings to arrive at a benefit-cost ratio for each option, as derived by CIE (2007).

Table 5.5 identifies that mandatory BW exchange imposes high costs and thus yields negative accumulated benefits, a benefit-cost ration of 0.7:1. The most economically attractive option is a risk-based exchange method using closer exchange distances of either 12 or 3 miles.

Table 5.5 CBA Worked Example [Data source: CIE 2007]

A Cost-Benefit Analysis (CBA) on Mandatory and Risk-based Ballast Water Exchange							
	Potential Annual Benefit (\$m)	Initial Effectiveness (%)	Permanent Effectiveness (%)	Accumulated Benefits, NPV to 2025 (€m)	Accumulated Cost, NPV to 2025 (€m)	Accumulated net benefit (€m)	Benefit to cost ratio
Mandatory Exchange Zones							
50 miles	21	90	95	208	318	-110	0.7:1
12	21	82	95	201	208	-7	1.0:1
3	21	57	95	177	183	-6	1.0:1
Risk-based Exchange							
50 miles	21	90	95	208	162	47	1.3:1
12 miles	21	82	95	201	118	83	1.7:1
3 miles	21	57	95	177	108	69	1.6:1




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Appendix A: International resources

Links to relevant resources for country specific information

A live version of this list can be found at: <http://globallast.imo.org/index.asp?page=links.htm&menu=true>

Shipping/Port Industry

International Association of Independent Tanker Owners (INTERTANKO) - <http://www.intertanko.com>
International Cargo Handling Coordination Association (ICHCA) - <http://www.ichcainternational.co.uk/>
Det Norske Veritas (DNV) - <http://www.dnv.com>
Lloyd's Register of Shipping - <http://www.lr.org>

International

The International Maritime Organization – Ballast Water Management
<http://www.imo.org/ourwork/environment/ballastwatermanagement>
GloBallast Partnerships <http://globallast.imo.org/>
Convention Biological Diversity - <http://www.cbd.int/>
Database on Introductions of Aquatic Species (DIAS) (FAO) - <http://www.fao.org/fishery/dias>
Global Invasive Species Programme (GISP) - <http://www.gisp.org/>
IUCN Species Survival Commission: Invasive Species Specialist Group - <http://www.issg.org>
Ocean Science and Stewardship - <http://dels-old.nas.edu/oceans/index.shtml>
UNEP Marine Invaders - <http://www.unep.ch/regionalseas/main/hinvade.html>

Africa

ASCLME - <http://www.asclme.org/>
Nigeria - <http://www.niomr.org/>
South Africa IOI-SA - <http://www.ioisa.org.za/>

Asia/Pacific

Australia Quarantine & Inspection Service - <http://www.aqis.gov.au/shipping/>
Australian Centre for Research on Introduced Marine Pests (CRIMP) - <http://adl.brs.gov.au/marinepests/>
Cawthron Institute, New Zealand - www.cawthron.org.nz
Global Ballast Water Management Programme - India <http://www.globallastwaterindia.com>
India NIO - <http://www.nio.org/>
New Zealand - National Centre for Biodiversity and Biosecurity Research - <http://www.niwa.co.nz/our-science/aquatic-biodiversity-and-biosecurity>
New Zealand Ministry of Fisheries - www.fish.govt.nz
The Australian Marine Environmental Protection Association (AUSMEPA) - <http://www.ausmepa.org.au>
The Royal Society of New Zealand - <http://www.rsnz.govt.nz>

Europe

Baltic Research Network on Invasions and Introductions (NEMO) - <http://www.corpi.ku.lt/nemo/mainnemo.html>
Caspian sea - <http://www.caspianenvironment.org/newsite/index.htm>
CIESM Atlas of Exotic Species (Mediterranean) - <http://www.ciesm.org/atlas/index.html>
Directory of Non-native Species in UK waters - <http://www.jncc.gov.uk/page-2597>
DNV - Det Norske Veritas - <http://www.dnv.com>
EU and the Environment -Towards an EU strategy on Invasive Species - http://ec.europa.eu/environment/nature/invasivealien/index_en.htm
European Maritime Safety Agency - <http://www.emsa.europa.eu/>
Global Ballast Water Management Programme - Ukraine <http://www.globallast.od.ua/>
ICES Code of Practice on the Introductions and Transfers of Marine Organisms 1994 - www.ices.dk/pubs/itmo.pdf
IMARES - <http://www.imares.wur.nl/UK/>
INTERREG North Sea Ballast Water project - www.NorthSeaBallast.eu
NIOZ - http://www.nioz.nl/nioz_nl/nioz_nl_homepage.php
NIVA - <http://www.niva.org/home/>
On Board Treatment of Ballast Water and Application of Low-sulphur Marine Fuel (MARTOB) - <http://martob.ncl.ac.uk/Home.htm>

Turkey - <http://www.tubitak.gov.tr/en/ot/10/>

UK Marine SAC project - http://www.ukmarinesac.org.uk/activities/ports/ph6_3_4.htm

North America

100th Meridian Initiative - <http://100thmeridian.org/>

Aquatic Nuisance Species Task Force - <http://www.anstaskforce.gov>

Canadian Department of Fisheries and Oceans - <http://www.dfo-mpo.gc.ca/science/enviro/ais-eae/index-eng.htm>

International Joint Commission - http://www.ijc.org/en/home/main_accueil.htm

Maritime Environmental Resource Centre (MERC) - <http://www.maritime-enviro.org/index.php>

Massachusetts Institute of Technology Exotic Species - <http://massbay.mit.edu/exoticspecies/>

Monterey Bay National Marine Sanctuary - <http://montereybay.noaa.gov/>

National Aquatic Nuisance Species Clearinghouse (Seagrant Program) - http://www.aquaticinvaders.org/nan_ld.cfm

National Biological Information Infrastructure (NBII): Invasive Species - <http://www.invasivespecies.gov/>

Non-indigenous Aquatic Species (US Geological Service) - <http://nas.er.usgs.gov>

North East Midwest Institute - <http://www.nemw.org/index.php/policy-areas/trade-environment-invasive-species>

Protect Your Waters - <http://protectyourwaters.net/>

Providence College: Ballast Water & Exotic Species -

http://encore.uri.edu/iii/encore/search/C__Sballast+water__Orighresult?lang=eng&suite=cobalt

Sea Grant Great Lakes Network - Zebra Mussels & and other Non-Indigenous Species -

<http://www.miseagrant.umich.edu/greatlakes/ais.html>

Sea Grant Invasive Species Team - <http://seagrant.oregonstate.edu/>

Seagrant Nonindigenous Species - <http://seagrant.wisc.edu/home/Topics/InvasiveSpecies.aspx>

Smithsonian Institute: Marine Invasions Research Lab - http://www.serc.si.edu/labs/marine_invasions/

U.S. Naval Research Laboratory - <http://www.nrl.navy.mil/>

US Coast Guard Ballast Water Management - <http://www.uscg.mil/hq/cg5/cg522/cg5224/bwm.asp>

US Fish and Wildlife Service: Invasive Species Program - <http://invasives.fws.gov>

US West Coast Ballast Outreach Project - <http://ballast-outreach-ucsgep.ucdavis.edu/>

South America

Argentina - <http://www.prefectura naval.gov.ar/web/es/html/portada.php>

Brasil - Água de Lastro Brasil - www.aguadelastrobrasil.org.br

Brasil - Prevention and Control of Invasive Bivalves - <http://zoo.bio.ufpr.br/invasores/sitesinternacionais.htm>

Chile - <http://www.mma.gob.cl/biodiversidad/1313/w3-channel.html>

Colombia - <http://www.invemar.org.co/index.jsp>

Venezuela - Instituto Nacional de los Espacios Acuáticos, Venezuela - <http://www.inea.gob.ve/>

Appendix B: Maritime regions overview

Maritime Region	Ratified by	Current implementation status	Ecological considerations	Physical and Geomorphological Considerations
Mediterranean Sea	9 out of 23 countries considered (Albania, Croatia, Montenegro, Turkey, Egypt, France, Lebanon, Spain, Syrian Arab Republic.)	Voluntary	<p>Existing</p> <ul style="list-style-type: none"> • Low productivity ecosystem*; • More than 1000 species of macro-flora; • Important plant communities include; Neptune Grass (<i>Posidonia oceanica</i>), and Zostera Sea Grass meadows systems (<i>Zostera</i> sp.); and • Home to 19 species of dolphins, porpoises and whales (cetaceans), marine turtles (all 5 species) and pinnipeds, including the Mediterranean monk seal. <p>Sensitivity</p> <ul style="list-style-type: none"> • Marine habitats and biodiversity threatened by overfishing and coastal development leading to water pollution and coastal habitat reduction; and • Water quality degradation is on-going with chief sources being surface runoff of nutrients, and discharge of inadequately treated sewage. <p>Invasive Alien Species (IAS) The Red Sea jellyfish (<i>Rhopilema nomadica</i>)</p>	<p>Length: 4,350km Width (north-south): 1,600km Total area: 2.5 million km² Total volume: 3,750km³ Average depth: 1,500m Maximum depth: 5,267m Coastline: 46,000km</p> <ul style="list-style-type: none"> • A shallow inland sea which is nearly landlocked; • Numerous islands; • Limited inflow from rivers which is exceeded by evaporation in the Mediterranean basin, resulting in a water deficit that requires additional inflows to maintain sea levels; • Higher salinity than the connecting Atlantic Ocean; • Hub of commercial shipping lines and encircled by major ports; • Geographic location, the volume of maritime shipping, and the density of fish and shellfish farms in its lagoons and bays; and • Increased risk after opening of the Suez Canal in 1869.
Black Sea	2 out of 6 countries considered (Turkey, Russian Federation)	Georgia: Mandatory	<p>Existing</p> <ul style="list-style-type: none"> • Highly productive ecosystem*; and • Low salinity in comparison to the ocean. 	<p>Inland sea – world's largest inland water basin Maximum depth: 2,212m Surface area (exc. Sea of Azov): 436,400km² Total volume: 547,000km³</p>

Maritime Region	Ratified by	Current implementation status	Ecological considerations	Physical and Geomorphological Considerations
			<p>Sensitivity</p> <ul style="list-style-type: none"> • Marine mammals are critically endangered and the monk seal is virtually extinct; • The productive fishery of the indigenous Black Sea Oyster, to the area, was decimated by the introduction of IAS via ballast water; • Severely impacted in terms of overfishing and destructive fishing practices; • Slowly recovering; • 87% of the sea water is naturally anoxic, the Black Sea is highly sensitive to anthropogenic impacts due to its huge catchment area and almost landlocked nature; and • Highly sensitive to the introduction of IAS via ballast water due to its low salinity, environmental degradation and a low "biological immunity". <p>Invasive Alien Species (IAS)</p> <ul style="list-style-type: none"> • North American comb jelly (<i>Mnemiopsis leidyi</i>); • More than two thirds (68%) of the Black Sea IAS originated from the boreal North Atlantic Ocean and 21% from the Pacific Ocean, mainly the boreal Pacific; and • 41 introduced alien species, 34% were imported for aquaculture and 66% entered the Black Sea as pelagic larvae in ballast waters and/or fouling organisms on ship hulls. 	<p>Length (west – east): 1,149km Coastline: 4,340km</p> <ul style="list-style-type: none"> • Mediterranean water flows into the Black Sea as part of a two-way hydrological exchange; • Temperate climate; • Huge drainage basin and is a major industrial and agricultural region, with uncontrolled urban development; and • Uncontrolled fisheries and eutrophication is causing important alterations in the structure and dynamics of the Black Sea.

Maritime Region	Ratified by	Current implementation status	Ecological considerations	Physical and Geomorphological Considerations
Baltic Sea	4 out of 9 countries considered (Denmark, Germany, Russian Federation, Sweden)	Voluntary	<p>Existing</p> <ul style="list-style-type: none"> • Largest brackish water bodies in the world, - ecologically unique; • Low salinity; • Limited biodiversity, unique mix of marine and freshwater species adapted to the brackish conditions, as well as a few true brackish water species; and • Relatively few animal and plant species live in the brackish ecosystems. <p>Sensitivity</p> <ul style="list-style-type: none"> • Oxygen depletion; • Intensive fishing and eutrophication are the two main threats affecting this environment; • As the Baltic Sea is a young and relatively simple ecosystem, it's particularly sensitive to invasion and ecological change, as Invasive Alien Species can relatively easily find unoccupied ecological niches; and • Current eutrophic conditions and rapid expansion in shipping increase the vulnerability of the Baltic Sea to the introduction of IAS via ballast water. <p>Invasive Alien Species (IAS)</p> <ul style="list-style-type: none"> • Over 120 non-native aquatic species have been recorded in the Baltic Sea to date; • Most of the introductions have arrived from freshwater or brackish-water environments in the Ponto-Caspian 	<p>Occupies a glacially eroded basin (fjord) Length: 1,600km Surface area: 415,266km² Average width: 230km Average Depth: 55m Maximum depth: 459m Coastline: 8,000km</p> <ul style="list-style-type: none"> • Due to its special geographical, climatological, and oceanographic characteristics, the Baltic Sea is highly sensitive to the environmental impacts of human activities in its sea and catchment areas; • Shallow and narrow connection with the North Sea means that water is retained in this Sea for about 30 years; • Semi-enclosed sea, it's enriched by human-induced eutrophication, river runoff and a lack of rapid exchange with the adjacent ocean temperate climate; • Shipping activity to, from and within the Baltic Sea has steadily increased over the past 20 years, reflecting increasing international trade, co-operation and economic prosperity; and • Busiest shipping lanes in the world, with 2,000 sizeable ships operating at any one time.

Maritime Region	Ratified by	Current implementation status	Ecological considerations	Physical and Geomorphological Considerations
			<p>and from North America; and</p> <ul style="list-style-type: none"> • Non-natives with high pollution tolerance have outnumbered or replaced native species, and then have also been replaced by more recent, hardier newcomers. <p>Four Key IAS</p> <ul style="list-style-type: none"> • The fishhook water flea (<i>Cercopagis pengoi</i>); • North American polychaete worm (<i>Marenzelleria viridis</i>); • Dnoflagellate (<i>Prorocentrum minimum</i>); and • North American comb jelly (<i>Mnemiopsis leidy</i>). 	
<p>Arctic Coast</p>	<p>2 out of 5 countries considered (Russian Federation, Norway)</p>		<p>Existing</p> <ul style="list-style-type: none"> • Transition zone between the sea ice and the open water has intense algal growth in spring and summer, and it's the primary production of these phytoplankton that supports the arctic marine food webs; • Arctic and subarctic oceans, like the Barents, Bering, and Labrador Seas, are among the most productive in the world, and so fish populations have been, and are being, heavily exploited; • Collapses in fish populations caused by over-exploitation in years of low productivity have occurred frequently and resulted in negative impacts on other marine species; and • Bottom trawls damage species composition of e.g. the cold water coral community. 	<p>Smallest and shallowest of worlds five major oceans. Surface area: 14,056,000km² Coastline: 45,390km</p> <ul style="list-style-type: none"> • Ice is the dominant feature of Arctic marine ecosystems - major limiting factor to all biological activity; • Arctic Basin marine region is characterised by the year-round presence of sea ice, while the other Arctic sub regions have ice-free periods ranging from less than a month to up to four months; • Marine navigation and transport are likely to increase in response to both economic development and as the ice-free season extends as a result of climate change, with the consequent infrastructure developments; • The projected impacts of climate changes on sea ice, temperature, freshwater, and wind will affect nutrient supply rates through their effects on vertical mixing and upwelling

Maritime Region	Ratified by	Current implementation status	Ecological considerations	Physical and Geomorphological Considerations
			<p>Sensitivity</p> <ul style="list-style-type: none"> • Considerable uncertainty about the impacts of non-native species moving into the Arctic region but there is no doubt that the Arctic Ocean will be increasingly sensitive and vulnerable to the risk of introduction of IAS via ballast water; and • Climate change is likely to increase the rate and extent of IAS invasions by influencing the dispersal and survival of both native and non-indigenous species. <p>Invasive Alien Species (IAS)</p> <ul style="list-style-type: none"> • At least nine IAS have been recorded in Arctic and sub-Arctic waters outside Canada: • soft-shell clam (<i>Mya arenaria</i>), zebra mussel (<i>Dreissena polymorpha</i>), Akartia copepod (<i>Acartia tonsa</i>), red king crab (<i>Paralithodes camtschaticus</i>), marine pill bug (<i>Sphaeroma walkeri</i>), naval shipworm (<i>Teredo navalis</i>), hydroid (<i>Ectopleura crocea</i>), green algae (<i>Cladophora sericea</i>), and dinoflagellate (<i>Alexandrium affine</i>) 	<ul style="list-style-type: none"> • Currently ship traffic to Arctic ports is low compared to temperate locations; and • The increases in northern ice melting is opening Arctic sea routes to practical navigation for longer.
Pacific Coast	Russian Federation		<p>Existing</p> <ul style="list-style-type: none"> • North East Pacific Ocean region: support productive fisheries and are among the most biologically rich and important regions of the Pacific Ocean; • North West Pacific Ocean region: contains some of the most diverse and commercially productive marine ecosystems and seas; • The Sea of Okhotsk, surrounded by Russia and northern Japan, contains some of the world's richest 	<p>Area: 165.25million km² Widest: 19,800km (Indonesia – Columbia) Deepest point (Mariana Trench): 10,911m Average depth: 4,100m Approximately 25,000 islands</p> <ul style="list-style-type: none"> • World's largest body of water, covering about one third of the Earth's surface; • The Pacific basin is divided into East and West Basins, divided by the East Pacific Rise, a large ridge that runs from

Maritime Region	Ratified by	Current implementation status	Ecological considerations	Physical and Geomorphological Considerations
			<p>fishery resources, with approximately 340 fish species; and</p> <ul style="list-style-type: none"> • Meanwhile the two million km² of the Bering Sea support many endangered whale and seabird species, along with commercially valuable fisheries such as salmon and king crab. <p>Sensitivity</p> <ul style="list-style-type: none"> • Pollution; • Habitat destruction; • Over exploitation of resources; • Climate change; • Pacific species haven been transported by ballast water to new locations within the Pacific, as well as to other locations around the world, where their IAS impacts have been significant; and • Ecosystems and habitats that have been degraded by human activities and are stressed will be more vulnerable to introductions of invasive aquatic species (IAS) via ballast water. 	<p>the Gulf of California to the southernmost tip of South America;</p> <ul style="list-style-type: none"> • Vast area, there are huge variations in the properties of salinity and temperature. The Pacific Ocean helps to regulate the Earth's climate, playing a critical role in the planet's carbon and water cycles; • Despite its global importance, the Pacific Ocean is not being managed sustainably; and • An increasing variety and severity of threats affect high value habitats, including shallow lagoons, coral reefs, mangroves and seagrass meadows and increasingly, deep-sea beds and seamounts. Climate change exacerbates these threats and increases the vulnerability of coastal and ocean ecosystems, their resources, and the people who depend upon them.
<p>Caspian Sea</p>	<p>2 out of 5 countries considered (Iran, Russian Federation.)</p>		<p>Existing</p> <ul style="list-style-type: none"> • High biodiversity; • Largest enclosed body of water; • Low salinity; • Unique brackish habitat, with numerous islands and vast 	<p>Largest enclosed inland body of water, by area. Freshwater lake in the north, saline on Iranian shore. Length (north – south): 1,200km Average width: 320km Total volume: 78,200km³ Average depth: 190m (Caspian shelf – 4-8m, southern Caspian >1,000m) Surface area: 400,000km²</p>

Maritime Region	Ratified by	Current implementation status	Ecological considerations	Physical and Geomorphological Considerations
			<p>coastal areas;</p> <ul style="list-style-type: none"> • 42% of the Caspian's aquatic species are endemic and therefore found nowhere else, with some faunal groups approaching a 100% endemism; • Extremely important and special ecosystem in terms of global biodiversity; • Caspian seal endemic species to Caspian sea and 90% of the world's sturgeon are found here; • Majority of the fish species within the Caspian are freshwater species, adapted to the brackish conditions; and • Several fish are endemic to the Caspian, including the Caspian white fish, Caspian Rutilus, Caspian bream and a Caspian salmonoid, the Caspian salmon (<i>Salmo trutta caspiensis</i>) which is classified as critically endangered. <p>Sensitivity</p> <ul style="list-style-type: none"> • In 2000, there was a mass mortality Caspian Seals and in 2001 a mass loss of the Caspian sprat occurred; and • Increasingly vulnerable to the introduction of IAS via ballast water due to the degree of environmental degradation and the ongoing rapid expansion of new developments, such as oil and gas extraction and shipping. <p>Invasive Alien Species (IAS)</p> <ul style="list-style-type: none"> • Comb jelly (<i>Mnemiopsis leidyi</i>), the New Zealand mud snail (<i>Potamopyrgus antipodum</i>) and the Chinese 	<p>Volume: 78,200km³</p> <ul style="list-style-type: none"> • The Caspian littoral States rely heavily on the sea for fisheries production; and • A significant proportion of the world's highest quality Caviar comes from this region but Sturgeon stocks are bordering on collapse.

Maritime Region	Ratified by	Current implementation status	Ecological considerations	Physical and Geomorphological Considerations
			mitten crab (<i>Eriocheir sinensis</i>).	

Appendix C: Case Study

Port of Split Infrastructure Rehabilitation Project

Port of Split Authority (PSA): statutory authority established to administer and manage operations at Port of Split, Croatia.

Financier: EBRD
 Loan Details: EUR 18.8 million.
 Project Cost: EUR 23.4 million.
 Country: Croatia
 Project number: 42542
 Business sector: Transport
 Public/Private: Public
 Environ category: B
 Board date: 12 Dec 2012
 Status: Signed
 PSD disclosed: 11 May 2012

Project Description: The EBRD is considering providing a €18.8 million loan to PSA in Croatia. The proceeds of the loan will be used for the extension and reconfiguring of the passenger wharves at the port. The extension and rehabilitation of the wharves is required to: increase capacity of existing port area infrastructure, allow for more efficient processing of the island ferry traffic, and entry of medium sized cruise ships into the port area.

The rehabilitation of the Port of Split infrastructure is being implemented as part of the Government's long-term investment strategy to support the expansion of the tourism network in Croatia. The importance of efficient local transport infrastructure is recognised as one of the key factors to ensure the quality of service and expansion of the tourist offer in Croatia outside the limited number of major/well-known tourist hubs such as Dubrovnik and Istria.

Transition Impact:

Frameworks for markets/ Management Strengthening: The Croatian Ministry of Transport acknowledges that there is an urgent need for strengthening the management framework at the level of local port authorities to ensure that their operations are based on commercially beneficial and financially sustainable principles. The Project will provide support for the development of a five year Business Plan for the Port Authority and support for the adoption of a dedicated management information system;

Frameworks for markets/ Environmental Management: Environmental management is of particular significance in Split as the Port Authority's operational area in the Southern Port is located in the centre of the City. The maritime industry-specific Port Environmental Review System (PERS) from Ecoport is fast becoming the recognised standard for port operations in Europe, where 33 ports have already achieved PERS certification. As part of the EBRD loan conditionality environmental management systems are to be developed and adopted by PSA based on the PERS model, where appropriate, to ensure full compliance with the EBRD Environmental Policy as well as the European operational standards.

Private ownership/New private provision of goods and services: The loan agreement will include a covenant requiring the Port Authority to launch the tender for the private sector concession for the passenger terminal by a specified date as currently envisaged in the Pre-Accession Maritime Strategy. By increasing port capacity, the extended berth area will result in a higher commercial value for the envisaged concession.

Environmental Impact:

The Project was categorised as B in accordance with the EBRD Environmental and Social Policy 2008. The extension and reconfiguration of the passenger wharves at the port of Split will result in some adverse environmental and social impacts that are site-specific and readily addressed through mitigation measures.

A review of the site, existing PSA operations and an Environmental and Social Analysis of the proposed investment were undertaken by independent consultants, who also took into account baseline information included in an EIA prepared in 2004 for a similar project in the same location.

Due diligence has confirmed that the project will be structured to meet Croatian regulatory requirements and EBRD Performance Requirements (PRs) and that the PSA is already operating substantially in compliance with the Banks PRs. The most significant environmental and social issues associated with the project are: construction nuisances, traffic management, waste and hazardous materials management. The Project will not require any dredging and is not located adjacent to residential areas. The Project is expected to contribute to the continued development of the tourism industry and improve safety management within the port area.

The construction phase of the Project may include the disposal of asbestos due to the demolition of warehousing units. The ESAP includes requirements for laboratory analysis to confirm the presence of asbestos and safe systems of work for the handling and disposal of this hazardous substance.

An Environmental and Social Action Plan (ESAP) has been prepared for both the construction and operational phases of the project to enable the project to be structured to meet the Bank's PRs. The ESAP includes requirements for: analysis for the detection of asbestos; development of a waste management plan; improvements to health and safety arrangements and the implementation of environmental management system by the Port Authority based on the Eco Port standard.

The Company will be required to carry out the project in compliance with National, EU environmental regulations and standards and the Bank's PR's as well as to provide the Bank with annual environmental and social reports, including updates on the ESAP, and notification on any material accidents or incidents.