National Economic Assessment for Ballast Water Management In Jordan

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Contents

1- Introduction

1 .1 Shipping and Marine invasive alien species

Shipping moves over 80% of the world's commodities and transfers approximately 3 to 5 billion tones of ballast water internationally each year. A similar volume may also be transferred domestically within countries and regions each year and that 7,000 species are carried around in ballast water every day. Ballast water is absolutely essential to the safe and efficient operation of modern shipping, providing balance and stability to un-loaded ships. However, it may also pose a serious ecological, economic and health threat. Ballast is any material used to weight and/or balance an object. Ballast water is therefore water carried by ships to ensure stability, trim and structural integrity. Ships have carried solid ballast, in the form of rocks, sand or metal, for thousands of years. In modern times, ships use water as ballast.

It is much easier to load on and off a ship, and is therefore more efficient and economical than solid ballast. When a ship is empty of cargo, it fills with ballast water. When it loads cargo, the ballast water is discharged.

It recognized that the uncontrolled discharge of ballast water and sediment from ships has led to the transfer of harmful aquatic organisms and pathogens, causing injury to public health and damage to property and the environment.The introduction of invasive marine species into new environments by ships' ballast water attached to ships' hulls and via other vectors has been identified as one of the four greatest threats to the world's oceans. The other three are land-based sources of marine pollution, overexploitation of living marine resources and physical alteration/ destruction of marine habitat. Organisms are transported much beyond their normal range and into new area, where they may find suitable environmental conditions and become established. The increasing volumes of shipping as well as the increasing speed in adding to the risk that species are moved as well as the risk that they survive. Most of species introduction result in no or little noticeable change in local ecosystem diversity and productivity, some introduced species may under suitable conditions become established and in the absence of natural controls such as predators, parasites or diseases, drastically change the ecosystem (Invasive Alien Species, IAS). This will cause a

significant ecological and economic impact; the famous two examples on IAS are the zebra mussel and comb jelly fish.

coral reef ecosystem of Jordanian coast is one of the most sensitive area, we recording a 3 aline species of fish were origialy from Meditteranean sea and other biota still needs scientific survay.

1 .2 The Aim of the Economic assessment

In general, the objective of the economic assessment is to provide an understanding of the economic value of resources that may be under threat of a potential bio-invasion, as well as estimation of the costs related to pre-cautionary action toward the implementation of the BWM convention.

This report is prepared in order to assess the economical overhead of ballast water management activities to existing maritime operational system of Jordan. Also it is aimed to make a comparison between the impacts of the aquatic invasive species and the cost of the national ballast water management system.

This economic assessment study demonstrates and quantifies the economic values of an ecosystem and the potential impacts to these values by introduction of an invasive species.

This assessment study is primarily aimed to serve as a practical tool to support the actions on the national ballast water management strategy.

The results of this report are supporting the national decision on ratification the Ballast Water Convention.

1 .3 Source of information

This report is prepared by using the formal (actual and estimated) available statistical from concern bodies of Jordan. These bodies are Aqaba special economic zone Authority, Jordan maritime Authority and Marine Science Station.

There are three principle sources for the formal national information and statistical data on Jordan. They are the reports of Aqaba special Economic zone Authority, Reports of Jordan Maritime Authority and the annual reports and the scientific publications of the researchers in Marine Science Station.

A number of agencies have input into the management and control of fisheries in Jordan. These include the Ministry of Agriculture, which is responsible for basic policy, extension services and data collection, the General Corporation for Environmental Protection of the Ministry of Municipal and Rural Affairs and the Environment and the Jordan Valley Authority, which promotes aquaculture development and water use in its area of responsibility. Co-ordination between these authorities in fisheries matters is more informal than through any formal co-ordination structures.

Marine Fisheries sector of Jordan is not highly significant, because the limitation of Jordanian coast, it is totally about 26 Km, the area which is open for fishing is very narrow, also due to the low primary production of Aqaba seas. In addition to the Ministry of Agriculture, the Aqaba special economic zone Authority (ASEZA) is the responsible for fisheries management and preparing annual reports on Fisheries statistics, such these reports which were prepared by (MSS) give the basic statistical information on the economic assessment of fisheries sector.

The costs of legal, policy and institutional reforms are estimated by using the costs of the similar work packages of the national ballast water management project of Jordan.
In most cases there were some complications in defining the cost of different services / benefits because the tariffs changes due to many parameters. On this kind of situations, some calculations made including approximations like as mean values.

2-Methodology

In this report the below mentioned basic economical assessment methods were used.

2 .1 Market price analysis

Market prices can be used for any ecosystem good or service that can be bought or sold, and can be applied to e.g. loss of income, loss of employment, loss of marketable goods, costs ,etc. This is a comparatively inexpensive method, and requires less data intensive analysis to arrive at a value. In addition, this technique is flexible enough so that it can be used e.g., where an invasive alien species has replaced or diminish directly consumable species, when invasive alien species affect the production of marketable goods, or when invasive species themselves become marketable goods.

This means that market price analysis often is recommended when a valuation study is to be conducted for an invasive alien species impact, whereas many other techniques, while valid and valuable in their own right, require much longer time periods for data collection, analysis and reporting. An added benefit is that many countries already collect the data necessary through the collection of national statistics, making this an easy technique to carry out "in-house."

There are a few caveats foresting the information. If the market for goods and services is distorted by subsides or other market externalities, the results may not reflect the true economic and social costs of an invasive alien species impact. However, awareness of such factors can be sufficient to recognize that the market prices may under or over estimate the true costs, and make necessary corrections. Lastly, while this methodology determines the value of products derived from an ecosystem, it can miss the true (complete) value of the ecosystem due to only examining the market for goods, while excluding other non marketable services.

2 .2 Travel cost method

Travel costs valuation is particularly useful for ecosystem level valuation of recreational or leisure destinations, e.g. the value of a given water body for fishing activity.

The method is frequently used, but it does depend on a large data set and complex statistical skills, and is gathering information from visitors to recreational sites is very labor intensive.

3- Assessing economic value of resources at risk from IAS impacts

The possible impacts of IAS are manifold, and can affect human health, infrastructure, trade and ecosystems. In all cases this may have economic implications. The spread of IAS is associated with ballast water and also fisheries and aquaculture, that have led to human poisoning, closures of shellfish farms and bans on gathering wild shellfish.

Assessing and valuating impacts of species introduction is thus important both for managing IAS incursions as well as for supporting preventive action. However, assessing the economic impacts of an IAS requires a structured process for evaluating the specific attributes of the ecosystems, economies, and cultures affected.

This chapter provides an overview of the used approaches to economic assessment of ecosystem values, and outlines a simple framework for economic value assessment of sectors and resources at risk that can make an estimate of the possible costs to society and industry arising from ballast water mediated species introductions.

3 .1 The value of Ecosystems

Mainstream economics postulates that human well-being (economic welfare) is functionally linked to the consumption of goods and services. The benefits that human beings receive from ecosystem processes are referred to as ecosystem services, and the economic value of an ecosystem is the measure of the welfare provided by the flow of its goods and services.

Ecosystems provide valuable services to human production and consumption. The Millennium Ecosystem Assessment classifies these services into:

- Provisioning services such as food and water.
- Regulating services such as flood and disease control.
- Cultural services such as spiritual, recreational, and cultural benefits

- Supporting services, such as nutrient cycling, that maintains the conditions for life on earth.

Ecosystem valuation must encompass a wide range of goods and services provided by nature, not just the direct market values (Emerton and Bos, 2004). The value of the ecosystem should be given in terms of the total economic value (TEV), which includes direct use, indirect use and non-use values (Turner and others 2000).

There are a number of well-known techniques that may be used to calculate components of TEV: market prices, production function approaches, surrogate market approaches, cost-based approaches, and stated preference approaches (Emerton and Bos, 2004). In cases where it is possible to calculate the TEV, the complex approach for BW economic.

Assessment is used: TEV= VEcosystem = V Direct-use + V Indirect-use + V Non-use.
Nevertheless, it is often not possible to calculate the full TEV.

Ascribing values in economic or monetary terms can be done with relative ease for some of these services such as the revenue generated by a fishery in the marketplace. For other services that are not traded in markets, however, it is much more difficult to ascribe value. For example, a coastal ecosystem acting as a fish nursery habitat is valuable because it provides a safe environment for fish to grow in before moving into other areas where they are caught.

There is no direct market for the coastal ecosystem, but the price of fish can give a 'shadow value' for the habitat. This is an example of a so-called indirect use value.

Importantly, TEV helps us to understand that ecosystems provide values beyond ecosystem goods and services traded in the marketplace. Further, some of these values may be critical to community livelihoods. Using the TEV framework to capture the full value of the ecosystem services avoids the pitfalls of industrial studies that may only capture marketable values.

However, establishing quantitative values for indirect and non-use values of ecosystems can require detailed studies by trained environmental economists and the use of large data sets and advanced statistical analyses. Quantification may be a costly and time-consuming exercise.

Hence, in some instances, qualitative analyses to identify the categories of values and the flow of benefits and costs to various stakeholder groups may in itself provide critical information for decision makers.

3 .2 Categories of economic value

The Total Economic Value (TEV) of an area/ecosystem is a function its use values and non-use values (Table 1).

Direct use values, derived from direct use or interaction with environmental resources and services, can involve commercial, subsistence, leisure or other activities, such as fisheries and tourism.

Indirect use values, which relate to the indirect support and protection provided to economic activity by the ecosystems natural functions, can include flood control and protection against storm surges as well as spawning or nursery areas for commercially caught fish.

Non-use values, on the other hand, are derived from people's happiness based on the knowledge of the existence of an ecosystem or species from which they derive no real use but that they want to know is preserved. It is the value that national and international populations derive without necessarily visiting the site, but just from knowing the reefs and other national resources there continue to exist in good condition. This can also include a bequest value, e.g. the satisfaction one gets from knowing a resource will be passed on to future generations.

3 .3 Economic evaluations and calculations for key sectors

There have been some notable changes in the proportional share of GDP output accounted for Jordan's different economic sectors since 2000. Overall industry has been its share of GPD increase from just under 26% in 2000 to 40% in 2002.

This section provides limited economic review and assessment of Jordan including a commentary the key sectors within the economy as well as outlines a framework for assessing the value of resources at risk from bio-invasion and thus the potential economic implications of IAS introduction.

3.3.1. Key Sectors:

Many marine ecosystems and resources are not traded in markets and so do not have an obvious price. There is a risk from IAS, therefore, that the effects of BW activity on the natural habitats will be ignored. Though environmental impacts do not have a price that does not mean they do not have value. This is the difference between financial analysis, which is concerned only with goods and services traded in markets, and economic analysis which is concerned with society's well being welfare. If we are concerned with people's welfare, we fully consider environmental impact.

There are numerous sectors, stakeholders and processes that may be impacted by an IAS incursion in some way, a few stands to be directly affected and /or are more vulnerable. These sectors are thus of particular importance when considering the economic impacts of IAS. Frequently, these are also the sectors for which economic value can be most easily assessed.

3.3.1.1 Fisheries:

Jordan is almost entirely land-locked and only has a small (27 km) marine coast to the Red Sea, centered on the port of Aqaba. All marine activities in Jordan are made into this port.

The main objective of Jordan's fishery policy is to protect the marine environment of the Red Sea area (particularly the coral reef areas), which is an important component of Jordan's tourist industry. This overall marine protection policy includes ensuring the sustainable productivity of local fish stocks, both commercial and non-commercial.

Since shipping traffic in the northern Gulf of Aqaba is projected to double during the next decade due in part to the economic growth associated with dramatic increases in population over the last 20 years, environmental pressure on the marine coral reefs and resources will increase, particularly in Aqaba city.

The overall development objectives of the government for the marine environment, including the fisheries sector are:

- To protect the marine environment and resources of Jordan.
- To develop sustainable and responsible fisheries management through stock conservation measures.

- To improve the economic performance of different fishery sectors through better utilization of the marine environment.
- To support the development of aquaculture as an environmentally sustainable fish production method.

3.3.1.2 Coastal aquaculture:

There is no industrial fishery and no significant fish processing capabilities in Jordan however, small fishing boats own by individuals (about 70 fishermen) perform their activities within the Jordanian territorial waters.

Aquaculture development has been undertaken with financial and technical assistance from foreign donors and corporations. No data are available on the value of such assistance.

3.3.1.3 Coastal tourism:

Coastal tourism has recently witnessed a remarkable development, particularly inbound tourism and the coastal tourist establishments where the number of visitors to the recreational areas during holidays. However, it still needs a big concern in order to contribute effectively in supporting the national economy.

Over the past ten years, tourism has considered as one of the most important part of the Jordanian economic sectors in which it was rapid very fast. More than one million foreign visitors travel to the Kingdom. This increase will continue in the future if the proper integrated long-term planning and managements are applied to the tourist and hospitality sector. This will also help supporting the country sustainable development. For Jordan and after the declaration of Aqaba as a special economic zone, this considered as a positive step for the tourism sector. However, ASEZA- Aqaba special economic zone authority is the gate to the Jordan economic development and regional advancement. So, Aqaba should has a capacity to be the regional tourism hub over the other cities around the Gulf of Aqaba such as, Taba and Saudi coastline.

Aqaba therefore, has to play a strategic role in this part of the region and become a success story for Arab tourism and Jordan's economic and social development. The challenge of competition meets the industry of tourism; quality has become a key element in the actions aimed at making tourism more competitive, a problem of variation in tourist seasonality in a particular time of the year should create a appropriate solutions in term of integrated tourist quality management.

3.3.2. Additional costs to society and industry

Besides the potential loss in the revenues and income arising from the effects of alien species invasion to the industrial facilities, there are other sectors and commercial activities, which might be affected, limited, or exposed for a long time to damage. Such damage arises from repair, maintenance or cleaning works of coastal facilities (e.g. ports, power stations, and marine terminals).

The transport sector is one of the important economical resources and a means of commercial transactions with the outside. Export and import activities by sea form a high percentage of the total commercial activities in dealings with the outside. Moreover, Phosphate exportation through the main marine terminals, which contribute with a great share to the state's annual budget.

3.3.2.1 Shipping and coastal infrastructure:

The maritime transport activities relies on the marine environment and resources- (Marine living resources and habitat biology, the ecosystems and coastal beaches, the diverse species of living things)- are put to different and sometimes competing uses by people. They form the ecological processes on which life depends; they provide inputs to the production of goods and services, and the act as sinks for waste and pollution. They have uses which are not obvious or which we do not fully understand. For a more information (see the shipping chapter and additional resources section in the National BW Status Assessment Report).

3.3.2.2 Non-use and use values of the key ecosystem in Jordan:

Many marine ecosystems and resources are not traded in markets and so do not have an obvious price. There is a risk from IAS, therefore, that the effects of BW activity on the natural habitats will be ignored. Though environmental impacts do not have a price that does not mean they do not have value. This is the difference between financial analysis, which is concerned only with goods and services traded in markets, and economic analysis which is concerned with society's well being or welfare. If we are concerned with people's welfare, we must fully consider environmental impacts.

Coral reefs provide a wide array of goods and services to the society. In order to estimate losses in economic value or welfare associated with anthropogenic coral reef deterioration, the impact of IAS on the reefs' flow of goods and services can be converted into economically meaningful measurements.

In Jordan, the corals are used much for recreation & tourism at present, with some associated diving and snorkeling.

The greatest value of the coral reefs will be their non-use value. Indeed, the non-use value is likely to be elevated significantly due to the coral areas of Jordan fairly limited human uses. Non-use value relates to the fact that people both nationally and internationally are generally willing to pay for the continued protection and existence of important habitats such as coral reefs, particularly those in good condition with low levels of use and pressures. Unfortunately few studies have been undertaken to determine non-use values for coral reefs, but it is likely that such values could be considerable.

4- Assessing and evaluating costs of enacting the convention

On this chapter, all the calculations and assessments are introduced in detail in order to define the economical extend of the ballast water management activities. This chapter is divided sub-sections which cover each of the activities.

4.1 Preparatory phase costs

4.1.1 Capacity Building, Coordination and Communication

This section is showing the calculated costs for preparing national and international meetings. The costs are calculated with respect to the national legislation on travel allowances and similar activities done in Jordan within the Globallast Partnership project activities.

4.1.1.1 Introductory training on ballast water management:

Table 4.1.1.1: Coast calculation for training

Calculation	Cost items	Total Amounts
15 x 7 days x $50	**Accommodation**	$5250
In-kind contribution	**Training venue**	In-kind contribution
15 x 7 days x $50	**Daily allowance**	$5250
$500		$500
15x$50	**Travel costs**	$750
In- kind contribution	**Trainers**	In- kind contribution
15x $20x 7 days	**Lunches**	$2100
15x$7 x7 days		$735
$1000	**Social Activities**	$1000
Total		**$15585**

4.1.1.2 Training on legal implementation of the BWM Convention:

Participation : 10 people

Duration : 3 days

Table 4.1.1.2: coast calculation for training

Cost items	Calculation	Total Amounts
Accommodation	10 x 3 days x $50	$1500
Training venue Daily allowance Training documents	In -kind contribution	In- kind contribution
	10 x 3 days x $50	$1500
	500$	$500
Travel costs	10x$50	$500
Trainers	In- kind contribution	In- kind contribution
Lunches Coffee Breaks	10x $20x 3 days	$600
	10x$7 x3 days	$210
Social Activities	$1000	$1000
Total		**$5810**

4.1.1.3: Specialized training to the shipping industry (ship and port side issues)

Participation : 20 people

Duration : 4 days

Table 4.1.1.3: Cost calculation for training

Cost items	Calculation	Total Amounts
Accommodation	20 x 4 days x $50	$4000
Training venue	In- kind contribution	In- kind contribution
Daily allowance	20 x 4 days x $50 (participants may cover their own)	$4000
Training documents	$1000	$1000
Travel costs	20x$50 (participants may cover their own)	$1000
Trainers Lunches	In kind contribution	In kind contribution
Coffee Breaks	20x $20 x 4 days	$1600
	20x $7 x 4 days	$560
Social Activities	$1000	$1000
Total		**13160$**

4.1.1.4 Training of Port State Control officers (compliance monitoring and enforcement);

Participation : 15 people

Duration : 5 days

Table 4.1.1.4: Cost calculation for training

Total Amounts	Calculation	Cost items
Accommodation	15 x5 days x $50	$3750
Training venue	In kind contribution	In kind contribution
Daily allowance	15 x 5 days x $50	$3750
	$500	$500
Travel costs	15x$50	$750
Trainers	In- kind contribution	In- kind contribution
Lunches	15x $20x 5 days	$1500
	15 x $7 x 5 days	$525
Social Activities	$1000	$1000
Total		**$11775**

4.1.1.5 Training on Port Biological Baseline Surveys

Participation : 10 people

Duration : 10 days

4.1.1.5: Cost calculation for training

Total Amounts	Calculation	Cost items
Accommodation	10 x 10 days x $50	$50000
Training venue	In kind contribution	In- kind contribution
Daily allowance	10 x 10 days x $50	$5000
Training documents	$1000	$1000
Travel costs	10x$50	$500
Trainers	In- kind contribution	In- kind contribution
Lunches	10 x $ 20 x10 days	$2000
Coffee Breaks	10x$7 x 10 days	$7000
Social Activities	$1000	$1000
Diving Equipment	$3000	$3000
Laboratory Equipment	$3000	$3000
Total		**$21200**

4.1.1.6 National task force meetings

Participation : 15 people

Duration : 1 day

This would be a day meeting which will be organized 1 per year.

Table 4.1.1.6: Cost calculation for meeting

Cost items	Calculation	Total Amounts
Accommodation	15 x 1 day x $50	$750
Training venue	In- kind contribution	In- kind contribution
Daily allowance	15 x 1 day x $50	$750
Training documents	$500	$500
Travel costs	15 x $50	$750
Trainers	In- kind contribution	In- kind contribution
Lunches Coffee	15x $20 x 1 day	$300
Breaks	15x$7 x 1 day	$105
Total		**$3155**

4.1.1.7 Regional task force meetings

Regional taskforce meetings are organized under the activities of the Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA).The cost of these meetings is covered under the budget of this organization. Also there are funding sources to tap into, such as the IMO Integrated Technical Cooperation Program. In the below table the cost of these meetings are calculated.

Participation : 25 people

Duration : 2 days

Table 4.1.1.7: Cost calculation for meeting

Cost items	Calculation	Total Amounts
Accommodation	25 x 2 days x $100	$5000
Training venue	$3000	$3000
Daily allowance Training	25 x 2 days x $100	$5000
documents	$1000	$1000
Travel costs	10x$1000	$10000
Lunches	25 x $30 x 2 days	$1500
Coffee Break	25x 10 $ x 2 days	$500
Social Activities	$2000	$2000
Interpretation	$5000	$5000
Total		**$33000**

4.2 Economic assessment

Jordan prepared the economic assessment report with the funds of Globallast Partnership Project. Although the cost is calculated for this activity in the below table in case that national sources were used.

4.2 Cost calculation for consultancy

Relevant Personnel	Time for study	Fee for the expert
Expert on Shipping Industry	1 month	$1500/ month=$1500
Expert on Environmental Economics	45 days	$1500/ month=$2250
Total		**$3750**

4.3 Developing a national BWM Strategy

Jordan prepared the status assessment report with the funds of Globallast Partnership project. Although the cost is calculated or this activity in the below table case that national sources were used.

Table 4.3: Cost calculation for consultancy

Relevant Personnel	Time for study	Fee for the expert
Expert in Legislations	45 days	$1,500/ month=$2,250
Expert on administrative infrastructure	45 days	$1,500/ month=$2,250
	1 month	$1,500/ month=$1,500
Total		**$6000**

4.4 Legislative review and implementation

As part of its planned activities within the national Ballast Water Management Project, Jordan started in reviewing the existing national legislation and as well as to amendment of legislation or drafting of a new act, as necessary. The estimated cost of this activity is calculated in the below table:

Table 4.4: Cost calculation for consultancy

Relevant Personnel	Time for study	Fee for the expert
Expert on Legislations	2 month	$1,,500/ month=$3,000
Expert on administrative infrastructure	2 months	$1,500/ month=$3,000
	2 months	$1,500/ month=$3,000
Expert on Shipping Industry	2 months	$1,500/ month=$3,000
Total		**$12.000**

4.5 Port Biological Baseline Surveys (research and monitoring)

The cost of the (PBBS) Study calculated with an estimation of choosing 1high area on Jordan,

Table 4.5: Cost calculation for service

Cost items	Calculation	Total Amounts
Accommodation	6x$100	$600
Travel expenses	4000$	$4000
Taxonomist	7 days x 5 areas x $500	$17500
Divers	4 days x 2 divers x 5 areas x$500	$20000
Diving Equipment	$5,000	$5000
Laboratory Equipment	$15000	$150000
Total		**$62100**

4.6 Risk Assessments

Jordan is planned to implement a risk assessment study within the national ballast water management project. The estimated cost of implementing this activity is calculated as shown in the following table:

Table 4.6: Cost calculation or consultancy

Relevant Personnel	Time for study	Fee for the expert
Expert on Risk Assessment	3 month	$1,500/ month=$4,500
Expert on Data Bases	3 months	$1,500/ month=$4,500
Expert on Invasive Species	3 months	$1,500/ month=$4,500
Expert on Shipping Industry	3 months	$1,500/ month=$4,500
Software / Hardware		$5,000
		$3,000
Total		**$26.000**

4.7 Compliance-relate cost

4.7.1 Flag state obligations

4.7.1.1 Establishing procedures for issuing BWM Certificate

There are several Personnel are working in Jordan Maritime Authority and ASEZA in order to enhance maritime safety and marine environment protection.

The JMA will be the responsible authority for issuing the ballast water management certificate to the ships

Note: *Authorization may be given to an international classification society that is recognized and authorized by JMA for the issuing the ballast water management certificate to the ships.*

Table 4.7.1.1: Cost calculation for survey

Cost items	Calculation	Total Amounts
Establishing certification requirements	JMA will give the certificates with a service charge $1,500x 25 Jordanian flagged ships.	$37,500
Communication of requirements And procedures to the shipping industry and IMO	JMA will communicate with IMO.	$7500
Total		**$45.000**

4.7.1.2 Approval of ships BWM plans

JMA will be the responsible authority on approval ships` BWM Plans. The cost of this process is going to be reimbursed from ships by the JMA.

Table 4.7.1.2: cost calculation for service

Cost items	Calculation	Total Amounts
Training of staff	JMA will train the staff	4*1500 =6000$
Establishing protocols for getting and approving BWM Plans	Will be responsibility of JMA	25*400= 10000

4.7.1.3: Type approval of BWM systems

As part of its national responsibilities, JMA will give the type of approval to the treatment facilities when established, the cost for this process is going to be reimbursed from companies to the JMA.

Table 4.7.1.3: cost calculation for service

Cost items	Calculation	Total Amounts
Review of the technical reports and test results	JMA will give the certificates with a service charge $15,000	$15,000

4.7.1.4 Surveys (Initial, Renewal, Intermediate, Annual, Additional)

JMA will be the responsible authority on giving type approvals to the ships.

Table 4.7.1.4: Cost calculation for service

Cost items	Calculation	Total Amounts
Initial, Renewal, Intermediate and Annual surveys	JMA will give the certificates with a Service charge Initial: 1500$ Renewal: 1500$ Intermediate: 1000$ Annual: 500$	$112500
Review of the technical reports and test results	Total =4500$x25 Jordanian flagged ships	$15,000

4.7.1.5 Approval of exemption applications

JMA is the responsible authority for approving the exemption applications.

Table 4.7.1.5: Cost calculation for service

Cost items	Calculation	Total Amounts
Exemption application	JMA is responsible	$500

4.7.1.6 Training of crew members

Table 4.7.1.6: Cost calculation for training

Cost items	Calculation	Total Amounts
Training cost	The Seaman takes relevant certificates for education or the company of the ship give the fees for education	The cost of this activity is included to the industry obligations

4.7.2: Port state obligations

4.7.2.1 Compliance monitoring and enforcement (CME)

No additional cost is defined under the CME activities. All the cost of compliance and enforcement activities will be included to the inspection of ships.

4.7.2.2 Inspection of ships

Table 4.7.2.2: Cost calculation for Inspection of ships

Cost items	Calculation	Total Amounts
Salinometer	$I50 x 10	$1,500

4. 7.2.3 Sampling

4.7.2.3.1 Sampling for compliance with D-1standard

Table 4.7.2.3.1: Cost calculation for equipment

Cost items	Calculation	Total Amounts
Port State cost **(inspection of ships)**	About 2300 Calls Jordanian ports annually 25% of the MV surveyed 1 surveyor gets 1000$ per month and surveys 57 ships per month =$17.5 per ship	$40250 per year

4.7.2.3.2 Sampling to ensure D-2 compliance.

Table 4.7.2.3.2: Cost calculation for service

Cost items	Calculation	Total Amounts
Equipment	US $3,000x3 port corporations	$9,000
Taxonomist	US $3,000 per month x 12	$36,000
Laboratory cost	$2,000 per month x 12	$24,000
Total		**$69.000**

4.7.2.3.3 Designation of area as for Ballast Water Exchange

Table 4.7.2.3.3 Cost calculation for consultancy

Cost items	Calculation	Total Amounts
Expert on Risk Assessment	1 month	$3,000/ month=$3,000
Expert on Hydrodynamics of Sea Water	1 months	$3,000/ month=$3,000
Expert on Invasive Species	1 months	$3,000/ month=$3,000
Expert on Shipping Industry	1 months	$3,000/ month=$3,000
Total		**$12.000**

4.8 Industry obligations

4.8.1 Training of crew members (IMO model courses, etc)

Table 4.8.1: Cost calculation for training

Cost items	Calculation	Total Amounts
Training of personnel	US $400x500 Jordan seafarers	US $200,000

4.8.2 BWM Plans

Table 4.8.2: Cost calculation for service

Cost items	Calculation	Total Amounts
Service fee of the JMA	$2,500 per ship x25	$62,500

4.9 Other issues not covered by the Convention

4.9.1. Port biological monitoring programmes and Port BWM Plan development

This programme depends upon the result and recommendations of the team that carried out the port biological baseline survey.

Table 4.10.1 : Cost calculation consultancy

Relevant Personnel	Time for study	Fee for the expert
Expert on Ballast Water Implementations	3 month	$3,000 per month x 3 months=$9,000

5-RESULTS AND CONCLUSIONS

This chapter shows clearly the results of the economic assessment as mentioned in this report to enable and support the BWM planning by using the related economic data taking into account the environmental, industrial and all other issues that necessary to the development of national strategies and action plans to manage the risk associated with invasive alien species. Also, the chapter focuses on the benefit of this assessment to draw the necessary conclusions.

The results can be used by relevant components such as strategies, policies and actions through identifying and comparing the ecology and society loss and the operational costs related to BWM

As shown in chapter 3 and chapter 4, the assessment of costs and losses analysis of the value of resources or sectors which may affected the society as a whole. The latter looks for the operational costs of BWM system which are distributed between stakeholders within the maritime sector. The results of this report can be used and compared in several ways to support and facilitate the decision making process, as shown in the tables below.

Table 5.1: Results of the costs of economic marketable values from IAS impacted

%	Cost$ USD	Possible Ecological loss
.843	$1 million	**Fisheries**
None	N/A	**Mari culture/Coastal Aquaculture**
.421	$.5million	**Other living resources**
84.38	$100, million	**Coastal Tourism**
None	N/A	**Additional Industries**(shipping, infrastructures)
1.687	$2 million	**Human/Public Health**
12.658	$15 million	**In-direct use ecological values**
99.989	**$118.5 Million**	**Total**

Table 5.2: Results of operational cost of BWM system

%	Cost $ USD	OPERATIONAL COSTS
12.77	103685	**Capacity building**
1.47	12000	**Legislative, Policy and Institutional Reforms**
10.85	88100	**PBB Studies and Risk assessment**
25.12	204000	**Flag State Obligations**
15.12	122750	**Port State Obligations**
34.64	281250	**Industry obligations**
100	**$811785**	**Total**

The results show that the operational cost of ballast water management system is definitely less than the cost of possible harms of the invasive alien species. Also it has to be mentioned that only the economical lost from invasive alien species was calculated, without including non-marketed ecological services and non-marketable environmental values.

Table 5.3: the comparison between the operating costs and economical lost

Total operating cost of BWM to Jordan	Possible Economical Effect of AIS to Jordan
$811785 USD	$118 .5 Million USD (worst case)

As a conclusion this economical assessment study shows that the ballast water management activities are feasible to be implemented