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The Impact of Implementation of Verified Gross Mass (VGM)

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Abstract

Every year, a large number of containers are damaged or lost overboard as a result of stow collapse due to overweight containers. Incorrectly declared container weights make it difficult to plan the safe stowage of a ship, endanger a ship's stability and place pressure on the ship's structure. The International Maritime Organization (IMO) in collaboration with industry representatives has therefore adopted specific rules as part of the Safety of Life at Sea (SOLAS) Convention. On 1st July 2016, the SOLAS amendment becomes law rendering it illegal to ship a container without a valid Verified Gross Mass (VGM).

The purpose of the (VGM) requirement is to obtain an accurate gross weight of packed containers to reduce accidents caused by wrongly declared container weights. The regulation is globally binding for all signatories of the SOLAS convention (in total 171 countries). Main reason for the change of the SOLAS Convention is that there is currently no rule or process to ensure that the weight being provided for loading is accurate, leading to huge risks to workforce, vessels, terminals and equipment.

This paper discusses the importance of the VGM requirement to avoid accidents caused by mis-declared weights. The Egyptian port authorities should take steps toward implementing the SOLAS Convention amendments due to the existence of important ports such as Port Said and El Sokhna. They should be provided with the necessary equipment for weighing containers before loading.

Keywords: Mis-declared container weight, container loss, shipping, weight verification, SOLAS amendments, IMO guidelines, marine safety, marine accidents, weighing methods, weighing equipment, ecological impacts, marine environment.

1. Introduction

Shippers (senders of goods, not shipping lines) declare the contents of and weight of containers in shipping documents. Mis-declarations occur when the actual weight differs from this. Loading a container with more than the declared weight can reduce shippers' costs. As well, the weight may simply be estimated, or may not include the tare weight of the container or the weight of dunnage. A ship's master is responsible for stowage so the ship's capacity is not exceeded, and it is properly balanced (trimmed).

If masters do not know the actual weight of each container they cannot trim correctly. (King, 2014)

Moreover, SOLAS is an international maritime safety treaty designed to ensure that ships comply with minimum safety standards in construction, equipment and operation. (ICHCA)

After that date, it would be a violation of SOLAS to load a packed container onto a vessel if the vessel operator and marine terminal operator do not have a verified container weight. (WSC, 2015)

The Verified Gross Mass (VGM) refers to the verified weight of the packed container including:

- The weight of all packages and cargo items
- The empty weight of the container itself (tare weight). The tare weight is clearly mentioned on the door of the container.

The requirement to verify the gross mass of packed containers applies to all containers subject to the Convention for Safe Containers (CSC). This includes standard sea freight containers, tank containers, flat racks and bulk containers.

In 2011, work started at IMO on the development of measures to prevent loss of containers. In view of marine casualties and incidents in which mis-declared container mass had been a contributing factor, one strand of the work was the possible establishment of a requirement that packed containers be weighed to obtain their actual gross mass prior to vessel loading. The work culminated in the approval of the guidelines regarding the verified gross mass of a container carrying cargo and the adoption of amendment to SOLAS regulation to require the mandatory verification of the gross mass of packed containers.

The container ship sector has been complaining about under-declared container weights for years. It has prepared and distributed to shippers guidance on how to determine the weight of containers, either by actually weighing stuffed containers or by exercising more care in calculating the weight of cargo placed into a container. These efforts have been unsuccessful. In recent years, the sector (with assistance and support from other, larger carrier groups) has taken the problem to the IMO. After several years of study, a correspondence group of the IMO Subcommittee on Dangerous Goods,

, Solid Cargoes and Containers (DSC) in 2013 recommended that the International Convention for the Safety of Life at Sea (SOLAS Convention) be amended to include provision for mandatory verification of the gross mass of packed containers. After deliberation, DSC approved the recommendation and forwarded it to the Maritime Safety Committee (MSC) for consideration. (Bryant, 2016)

On 30 May 2014, the 93rd Session of the MSC approved a proposed amendment to the SOLAS Convention to make verification of the gross mass of containers mandatory prior to loading of the containers on ships engaged on international voyages subject to the Convention. This was followed shortly by the issuance on 9 June 2014 of guidelines regarding the determination of the verified gross mass of a container carrying cargo. On 21 November 2014, the 94th Session of the MSC formally adopted the SOLAS amendment and, under the tacit approval process, provided for an effective date of 1 July 2016 so as to give all stakeholders sufficient time for implementation. (Bryant, 2016)

Major accidents resulting from overweight containers have prompted the international shipping community to take action in order to prevent incorrect weight declarations.

The requirement will protect vessel and terminal operators' people and assets, as well as shippers' cargo. Changes to the Safety of Life at Sea (SOLAS) Convention require that all containers have a verified weight certificate before being loaded on to a ship so that vessel and terminal operators can prepare vessel stowage plans prior to loading cargo on ships. The primary objective of the SOLAS amendments is to enhance the safety of international container shipping.

Mis-declared container weights have serious safety consequences throughout the supply chain. In the context of international shipping, mis-declared container weights can result in unsafe stowage plans, (of which the declared weight is an important component). This may result in the failure of the container stack, instability and excessive stress on the ship's structure, often with catastrophic consequences. (Maritime New Zealand, 2015)

2. The Influence of Overweight Containers on the Safety of Ships

Incorrect weights mean that the weight distribution onboard is often different to that in the stowage plan, with heavier boxes placed higher in stacks and lighter boxes bearing the loads. This causes the stacks to become unstable resulting in lost containers, collapsed stacks and damage to the ship. It may also result in the uneven distribution of weight across the ship causing instability and even damage to the ship. (Maritime New Zealand, 2015)

Unstable container stacks or poorly distributed loads may expose the ship to stresses beyond its design capacity. This may result in a ship buckling or breaking in two. Structural failure on a ship is also likely to be cumulative with repeated overloads. (King, 2014)

As containers are stacked higher to keep up with the growth of world trade, overweight and miss-declared weights can:

- Lead to vessels being improperly stowed, which can adversely affect vessel stability;
- Produce collapsing of container stacks on board ships;
- Damage the ship's structure;
- Cause containers damage since the cargo weight in container exceeds the declared weight. (Cristian, 2011)

Problems relating to mis-declared container mass also include:

- Incorrect vessel stowage decisions;
- Re-stowage of containers (and resulting delays and costs), if the overweight condition is ascertained;
- Collapsed container stacks;
- Containers lost overboard (both those overweight and containers that are not overweight);
- Cargo liability claims;
- Chassis damage;
- Damage to ships;
- Stability and stress risks for ships;
- Risk of personal injury or death to seafarers and shore-side workers;
- Impairment of service schedule integrity;
- Supply chain service delays for shippers of properly declared containers;
- Last minute shut-outs of confirmed, booked and available loads when the actual mass on board exceeds what is declared or the total cargo mass exceeds the vessel limit;
- Liability for accidents and fines for overweight containers on roads, and resulting time and administrative efforts and costs to seek reimbursement from responsible parties (IMO, 2015)

3. Accidents Caused by Overweight Containers

On 27 January 2006, during heavy weather in the North Atlantic, the container ship P&O NEDLLOYD GENOA incurred the loss of 27 containers overboard and the collapse of 28 other containers. Subsequent investigation revealed that two of the damaged containers were significantly over their declared weight. The UK Marine Accident Investigation Branch (MAIB)) noted that no mechanism existed for verifying declared container

weights. (Bryant, 2016)

On 18 January 2007, during heavy weather in the English Channel, the container ship MSC NAPOLI broke its back. Taken under tow, the ship was intentionally grounded in Branscombe Bay, Devon, UK. During the complex salvage operation that followed, 660 containers that had been stowed on deck and remained dry were weighted. The weights of 137 of those containers (20.8%) were each more than three tonnes greater than their declared weights. The largest single difference was 20 tonnes and the total weight of the 137 mis-declared containers was 312 tonnes heavier than on the cargo manifest. (Bryant, 2016)

In February 2007, the 868 TEU vessel Annabella experienced a collapse of seven containers whilst sailing in the Baltic Sea. As the vessel was under the UK flag, an accident report was subsequently prepared by the UK Marine Accident Investigation Branch (MAIB). Various failings were identified and recommendations made which were directed at the ship's manager and the charterer; but terminal operators and software suppliers were also found lacking in certain respects. (FTA, 2011)

On 11 June 2011, the container ship DENEK, while loading containers at the port of Algeciras, listed heavily to port, coming to rest at an angle of 50° against the pier. Investigation by the Spanish Standing Commission for Marine Accident and Incident Investigations found that the excessive listing and near-capsizing of the vessel was due in part to the fact that the weights declared for many of the containers were much lower than the actual weights. (Bryant, 2016)

Month & Year	Incident
January 2006	Crushing of containers in stack by overweight containers aboard the box-ship P&O Nedlloyd Genoa, which led to a domino-effect of container-stack toppling and collapse.
January 2007	Loss of the MSC Napoli which broke up owing, in part, to overweight boxes. The total weight of 137 overweight containers was 312 tonnes heavier than on the cargo manifest.
February 2007	Collapse of containers in a stack aboard the box-ship Limari, berthed in Damietta, Egypt. Weighing devices on the salvage crane confirmed that the actual weight exceeded the declared weights on at least four containers. They were overweight by 407%; 393%; 362% and 209% respectively.
June 2010	Longoni, Brazil – a reach stacker toppled forward and was damaged beyond repair because the actual weight of the container was 30,220kg, which was far in excess of the declared gross weight of 16,890kg.
January 2011	Beira, Mozambique- lifting mechanism on a ship-to-shore crane fails, causing box to plummet onto containership. Investigation reveals that the box weight, declared at 25,000kg, actually weighs 46,000kg.
February 2011	Overweight container crashes into an Australian wharf; the container was declared at four tonnes but was, according to union sources, actually 28 tonnes which overloaded the crane.
June 2011	Loss of the containership Deneb in Algeciras (Spain), which listed and capsized at the berth owing to one out of every ten boxes being grossly overweight by a factor of 1.9 to 6.7 times the declared figure.
December 2011	Box-ship (identity and location were kept confidential) narrowly avoids grounding by dumping ballast after the master realizes the containers are overweight and have caused his ship to have a deeper draught than calculated.

Source: Submission to the IMO in paper DSC 17/INF.5 by Denmark, the Netherlands, the United States, BIMCO, the international Association of Ports and Harbors, the International Chamber of Shipping, the International Transport Workers Federation and the World Shipping Council.

4. Ecological Impacts

Containers can either sink or drift onto shore. In either case, a container may remain intact or its contents may escape via collisions with other cargo, the vessel, rough seas, reefs, or the shore. A damaged container can thus serve as a source of marine debris. Potential impacts to marine natural resources include falling containers crushing and smothering of benthic organisms, introduction of foreign habitat structure, shifts in local ecology, an expanding benthic footprint over time as the containers degrade and collapse, marine species entrapment and ingestion risks from released container contents, and the deposition of plastics or other oil-based products, hazardous or radioactive materials, and subsequent bioaccumulation. The corrosion-resistant marine coatings used to paint the interiors and exteriors of containers are also a concern, as they have traditionally contained toxic substances such as zinc powder. The risks of some ingredients are described as “very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment”. (Frey & DeVogelaere, 2014)

5. Reasons & Results of Mis-declared weights

When the deck stows are not loaded correctly according to the container weights and as per the ship’s standard instructions, it is a perfect recipe for disaster. Deliberate or not, under declared tonnage in shipping containers has the potential to put lives at risk.

Gantries, fork lifts, trucks and other handling equipment may not be up to the strain and, in worst case scenarios, ships can be incorrectly loaded leading to instability. Thus, correct weights are essential for the ship’s officers to accurately compute the ship’s stability and the various hull stresses and to ensure the ship is within the safe parameters for the voyage. The inaccuracy of weight could lead to loss of lives and loss of vessels. The number of incidents of either small feeder vessels capsizing alongside berths, or on the larger container vessels, deck stows collapsing when in bad weather, all due to miss-declared weights, must be cause for alarm. (Cristian, 2011)

The World Shipping Council estimates that an average of 546 containers are lost at sea each year, excluding containers lost as a result of catastrophic events. The UK Marine Accident Investigation Branch (MAIB) report on the MSC Napoli found that the weights of a large number of the containers had been incorrectly declared. The MAIB advised that the problem of mis-declared weights was prevalent in the industry due to a lack of weighing facilities, and shippers knowingly declaring lower weights to avoid import duties, maximize container use and get around road and rail weight rules. The MAIB has also published reports on three other incidents where inaccurate container weights were identified as a causal factor in ship or container stack failure. (Maritime New Zealand, 2015)

6. Economic Consequences of Mis-declared Weights

There are also significant economic consequences associated with mis-declared container weights. The insurance bill for the MSC Napoli was in the region of £120 million. The sinking of the MOL *Comfort* which has also been associated with mis-declared

container weights is expected to cost insurers US\$523 million. The economic consequences of a failure to provide a verified weight or where a verified weight is found to be incorrect, such as repacking the container or driving it over a weighbridge, are a commercial matter for the parties. (Maritime New Zealand, 2015)

In addition, mis-declared weight helps evade customs charges, and may hinder security measures. A Ukrainian Customs survey in 2012 found 56% of inwards containers were overloaded. Overweight containers also increase costs, reduce ship efficiency (which adds to pollution), cause delays, and disrupt schedules. (King, 2014)

7. Problems of applying VGM

In the event a packed container is weighed at some point during its transport and found to differ from the declared VGM, national requirements may exist for how to deal with the situation, but there is no internationally defined requirement to notify any authority. Clearly, in order to minimize disruption to the supply chain, the stakeholders should communicate, plan in advance and agree what should be done in relation to any such container. If a container is found to be packed beyond the maximum mass permitted on its approval plate, it shall not be loaded on board a ship or transported by any other mode; the stakeholders will have to make arrangements to have the cargo repacked and for the apportionment of the costs involved. (TT Club, 2016)

8. Details of the SOLAS Amendments

In 2011 Australia, the Netherlands and Denmark proposed amendments to SOLAS to require that the shipper provide a verified weight when submitting cargo documentation.

The proposal followed the findings of the **MSC Napoli** and a number of other incidents worldwide, a formal study on the loss of containers, and a targeted inspection campaign. Initially the proposal sought to require all export containers to be weighed. Following negotiation, it was agreed to amend Chapter VI, Regulation 2 to require containers to have a verified weight, obtained by either:

Method One: weighing the packed container using calibrated and certified equipment; or

Method Two: weighing all packages and cargo items, including the mass of pallets, dunnage and other securing material to be packed in the container and adding the tare mass of the container to the sum of the single masses, using a certified method approved by the competent authority of the State in which packing of the container was completed.

The verified weight must be signed by a person authorized to do so by the shipper. It must also be submitted to the port or the master sufficiently in advance of loading to be used in the stowage plan. Where a verified weight is not provided, the master and the port representative will be obliged to refuse to load the container. (Maritime New Zealand, 2015)

The lack of a VGM signed by the shipper can be remedied by weighing the packed container at the port. If the marine terminal is not provided with equipment to weigh the container and provide a verified weight, alternative means must be found to obtain a verified container weight; otherwise, the packed container may not be loaded on to the ship. When a marine terminal receives a packed export container that does not have a VGM signed by the shipper, there should be processes in place at the terminal for obtaining the weight of such containers and using such weights in the vessel stow plan.

Terminals and carriers will need to agree on how these situations will be handled. If a packed container is weighed at the load port, that weight is to be used for vessel stow planning. Vessel stow plans should use verified weights for all packed containers loaded on board. (WSC, 2015)

9. Possible Problem Solving Solutions

There is no mandatory requirement for containers to be weighed prior to shipment, in many ports in the world. Possible amendments to SOLAS Convention, which has competence and jurisdiction over the ship-port interface, to ensure verification of container weight prior loading on board vessel could be a start. In this context, it can be required to marine terminal operators to weigh a stuffed cargo container upon receipt and to have a verified container weight before loading a stuffed container on board the ship for export. This requirement is to be applied to all loaded containers, whether received through the port facility gate or transshipped at the port facility via another vessel, barge or rail wagon. In this way, the verified container weight should be provided to the vessel operator for use in confirming and finalizing the vessel stowage plan.

All weighing equipment used to provide a verified weight must be calibrated and certified. Weighing equipment means a scale, weighbridge, lifting equipment or any other device which is capable of determining the actual gross mass of a packed container or of packages and cargo items, pallets, dunnage and other packing and securing materials. (ICHCA)

Weighing containers before loading commences is one of these measures and is endorsed and recommended by almost all container shipping lines. Delaying containers from being shipped due to overloading will be a powerful incentive to shippers to correctly declare the weight and there were moves to

educate those who stuff the containers. A possible solution can be that all lifting equipment/machinery in the marine chain to be fitted with devices that permit to determine the weight being lifted. In this way, the power is passed in the marine terminal operator's hands to verify the accuracy of declared weight and take the correct loading decisions accordingly.

Whenever a container is lifted, it is possible to accurately determine the weight by fitting with equipment like:

- **Quay crane** – so the weight is known before the crane driver attempts to move the container;
- **Truck gates:** are to capture the weight prior to reaching the quay area. Weight scales are commonly added on existing gate lanes to enable this function for entering traffic;
- **Train/Rail Interchange** – weighing systems installed on spreaders of the container handling equipment that service the train.

10. Conclusion

The problem with falsely declaring weight is serious. It has led to total losses of ships. Given that container ships sometime fail to comply with industry safety protocols, in the absence of significant regulatory changes, container losses seem likely to continue. Mandating the verification of container weights offers the best hope of abating the frequency of loss incidents, as overloading and improper stacking of containers on ships is often identified as a root cause of loss. International efforts to prevent these accidents from occurring should, therefore, be supported. A streamlined mandatory container loss reporting system implemented by the IMO would also provide resource managers with a

powerful tool. Resource managers could better understand and respond to the phenomenon of container loss if they were informed of all accidents that occur. Consistent enforcement through repeated assessment of fines and damage settlements might urge greater shipping industry attention to this problem.

The IMO's new rules on weight will tighten the control on overloading, but they are not an absolute bar and are unlikely to solve the problem by themselves. Presently more and more information is being released by national authorities on how they plan to implement SOLAS. Carriers and other parties are beginning to align their activities. It will require a lot of cooperation to support the transition from a legal framework to an operational one which will also have a commercial impact. Currently there is no uniform worldwide procedure agreed, for this reason implementation will be done country by country and as per country regulations. As expected, national variations are emerging, especially related to tolerances and penalties for non-compliance. Carriers have also started to release how and when they want to receive Verified Gross Mass (VGM). It is clear that while many parties are addressing the subject, many decisions still need to be made in order to meet the July 1, 2016 deadline. (ECU Line, 2016)

11. Recommendation

The Egyptian government should assign vessel operators and marine terminal operators to be dedicated to monitoring the whole process of weighing the containers before being loaded onboard vessels. This should be done hand in hand with providing the Egyptian ports with the efficient devices and equipment used to weigh the containers prior to loading.

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Piracy in Gulf of Guinea causes, efforts and solutions

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Abstract

Piracy is a global phenomenon negatively affecting the security of the entire maritime traffic in the world. There are three geographical areas which have become zones of concern. Piracy in South East Asia, specially the Strait of Malacca and the South China Sea has been seen as problematic from the 1990s onwards. The coast of Somalia and the Horn of Africa achieves increasing attention since 2007 on the other side Piracy in West Africa, notably the Gulf of Guinea, has become the third major recognized area under threat since 2011. In all cases major international shipping routes are concerned and fairly extensive regional and international actions have addressed piracy.

This paper use qualitative research technique by demonstrating the current maritime security situation in west of Africa especially Gulf of Guinea supported by statistical analysis of piracy incidents through (2010-2016) , discusses the causes and the regional efforts dealing with this dilemma, then presents a number of recommendation aiming to eradicate the threat of piracy and enhance maritime security in that region. As a result of this paper None of recommendations will gain enough progress to be self-sustaining, however, until the considerations of maritime security in the Gulf of Guinea is raised from the operational to the governmental level and there is political willingness in West African countries to defend the region's waters, the Gulf of Guinea will remain a challenged security area.

Keywords: Maritime Security, Piracy, Gulf of Guinea.

1. Introduction

Translated into its original Latin form, “pirates” literally mean “enemies of mankind”. so, by definition, pirates are “not enemies of one state but of all states” and therefore appear as an unparalleled, participate security risk at the global level (Tepp, 2012). Pauper governance, high depravity, and the lack of significant economic chances in the region obstruct the effectiveness of global anti-piracy practices and allow piracy to thrive, resulting in increased maritime insurance costs, higher global oil prices, and the growth of regional black markets.

Maritime crime off the coast of West Africa is a rising security threat, making the region Africa's current piracy hotspot. In most incidents, Nigerian criminals steal oil-related cargo from vessels in Nigerian national waters. During the decade, the Gulf of Guinea has become one of the most critical maritime areas in the world. Maritime insecurity is a main regional trouble that is obstructs the development of this strategic economic area and threatening maritime trade in the short term and the constancy of coastal states in the long term (Richardson, 2015).

This paper demonstrates the current maritime security situation in west of Africa especially Gulf of Guinea supported by statistical analysis of piracy incidents through (2010-2016) , discusses the causes and the regional efforts dealing with this dilemma, then presents a number of recommendation aiming to eradicate piracy threat and enhance maritime security in that region.

2. Definition of Piracy

The definition of maritime piracy has varied over time and modified depending on context. The development of the notion reflects the politics of the day, Evidenced by the segregation of pirates from buccaneers and privateers in the past (Konstam, 2007). The Greeks and Roman separated between robber pirates and pirate societies. Pirate societies were ones which indiscriminately confiscated persons or goods without a official declaration of war (Goodwin, 2006). By the seventeenth century, the idea of labeling a society as piratical was no longer acceptable. Instead pirates were seen as individuals who formed groups and were united in wrongdoing, these groups were not delegate of a state (Rubin, 2006).

The first international notation of piracy occurred in the 1958 Geneva Convention on the High Seas (Article 15) and the later in the 1982 United Nations Convention on the Law of the Sea (UNCLOS) (Article 101). According to these piracy consists of:

a) Any illegal acts of violence, detention, or any act of depredation committed for private ends by the crew or the passengers of a private ship or a private aircraft, and directed:

I. On the high seas, against another ship or aircraft, or against persons or property on board such ship or aircraft;

Ii. Against a ship, aircraft, persons or property in a place outside the jurisdiction of any State;

b) Any act of voluntary participation in the operation of a ship or of an aircraft with knowledge of facts making it a pirate ship or aircraft;

c) Any act of inciting or of intentionally facilitating an act described in subparagraph (a) or (b) of this article.

The International Maritime Bureau (IMB) in its annual reports, defined piracy as an act of boarding or attempting to board any ship with the apparent intent to commit theft or any other crime and with the apparent intent or capability to use force in the furtherance of that act. Issues arising from the definition of IMB above, is that, intent, specification, extent and the use of force are principal elements to be considered in what constitute piracy and not necessarily where or location of occurrence. This definition is adopted in this study for the sake of analytical convenience, and due to the fact that it encapsulates both the features of sea piracy, armed robbery, and sea theft. Hence, this study sees sea piracy simply as sea theft or robbery.

3. The Nature of the Gulf of Guinea's Maritime Insecurity and Statistical review

Pirate activity in the Gulf of Guinea varies to that in the Indian Ocean. Somali pirates concentrate on kidnap for ransom; captivate vessels and controlling their cargo and crew in order to extortion money from a ship-owner. In the Gulf of Guinea pirates launch attacks primarily from Nigeria, with the aim of stealing cargo, equipment or valuables from a vessel and its crew. Kidnapping of crew-members happens, but is rarer than in the Indian Ocean, and hence levels of violence are high as Gulf of Guinea pirates are less concerned with maintaining the wellbeing of hostages. Piracy attacks and armed robbery at sea in the Gulf of Guinea comprised average fifth of all recorded maritime incidents globally from 2010-2016(IMB, 2016).

These figures represent only a fraction of the actual attacks in the region as ship owners and governments downplay incidents to avoid increased shipping costs or a reputation for insecurity (Osinowo, 2015). (fig.1) shows Actual and Attempted of World pirate attacks (2010 - Jun2016)

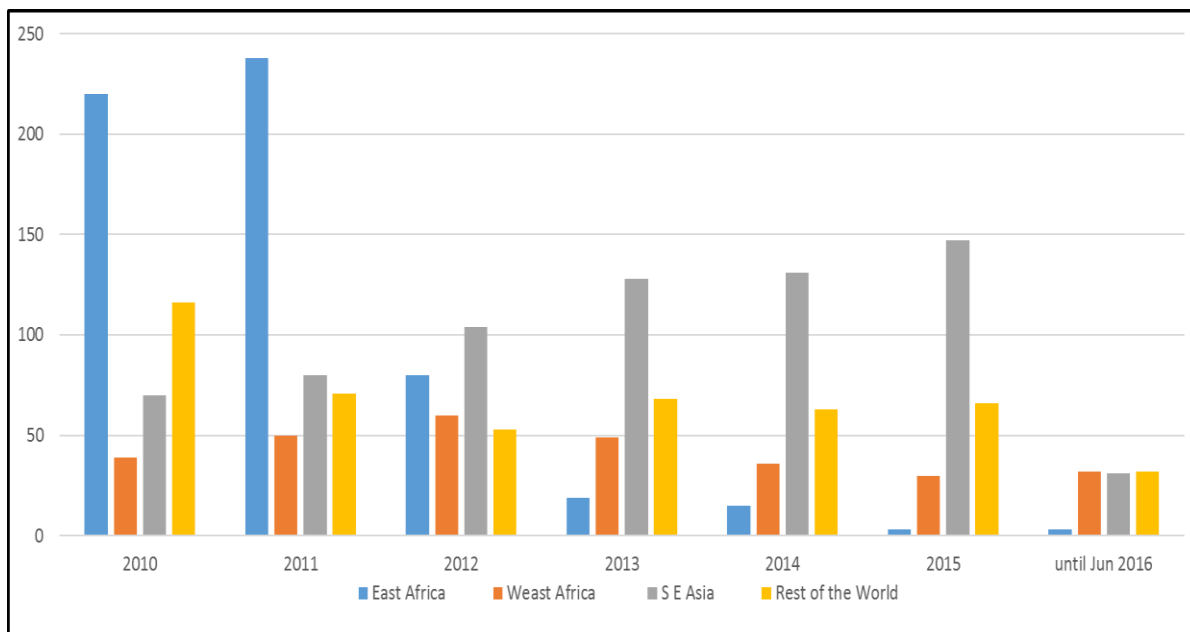


Figure. 1: Actual and Attempted of World pirate attacks (2010 - Jun2016)

Source: By author adopted from IMB, 2016

Anchorage and approaches to the ports of Bonny and Lagos (Nigeria), Cotonou (Benin), Lomé (Togo), Tema (Ghana), and Abidjan (Côte d'Ivoire) are especially vulnerable with large numbers of merchant ships often hang around in these areas. In the busy port of Lagos, hundreds of vessels loiter for days along the roadsteads (calm areas of water near harbors where ships can anchor) in view of limited capacity of West and Central African ports for offloading. Dominate measures in the approaches to these ports still weakened (Osinowo, 2015). Piracy is under-reported by as much as 50 percent in West Africa, either due to victims' desire for discretion or the lack of survivors (Richardson, 2015). Despite these analytical challenges, a trend can be discerned from data collected by the International Maritime Bureau (IMB), a subsection within a specialized criminal division of the International Chamber of Commerce (ICC).

Maritime crime off the coast of West Africa increased from 8.8 % of the global total in 2010

to 11.6 % in 2011, surged to 20.2 % in 2012, and has declined slightly to 19.7 % in 2013, and 15.5 % in 2014. unexpectedly in the first half of 2016 has reached to the peak of 32.7 % of attacks globally, from this percentage piracy cases were recorded on Nigeria's territorial waters represent the majority by 75% of total attack in that region. (Table.1) shows Actual and Attempted attacks in West Africa (2010-Jun2016).

The apparent growing importance of West African piracy is distorted by an overall decrease in universal piracy. On the other side Piracy in the Gulf of Aden has break down since a peak of 237 incidents in 2011, to just 15 attacks in 2014 and only 3 attacks in 2015 also 3 attacks in the first half of 2016, that represent the lowest percent of attacks globally which ensured that the piracy moved actually from east to west of Africa (IMB, 2016). (Fig. 2) An overview map of pirate attacks in East and West Africa (2010-2014).

Table.1: Actual and Attempted attacks in West Africa (2010-Jun2016).

	2010	2011	2012	2013	2014	2015	Jun-2016
Angola	-	1	-	-	1	-	1
Benin	-	20	2	-	-	-	-
Cameroon	5	-	1	-	1	1	2
Dem.Rep.Congo	3	4	2	-	1	3	2
Tome&Principe	-	-	-	-	1	-	-
Gabon	-	-	-	2	1	-	-
Guinea	6	5	3	1	-	3	-
New Guinea	-	-	-	-	-	1	-
Ivory Coast	4	1	5	4	3	1	1
Nigeria	19	10	27	31	18	14	24
Liberia	1	-	-	-	1	2	-
The Congo	1	3	4	3	7	5	1
Mauritania	-	-	-	1	-	-	-
Morocco	-	-	-	1	1	-	-
Togo	-	6	15	7	2	-	1
Sierra Leone	-	1	1	2	1	-	-
Region sub- Total	39	51	60	52	38	30	32
World Total	445	439	297	264	245	246	98
Percentage of Region to world	8.8%	11.6%	20.2%	19.7%	15.5%	12.2%	32.7%

Source: By author adopted from IMB, 2016



Figure 2. An overview map of pirate attacks in East and West Africa (2010-2014)

Source: IMB, 2015

4. Causes of Piracy in the Gulf of Guinea

There are many factors contributing to piracy in the Gulf of Guinea. These factors include “legal and jurisdictional weakness, favorable geography, conflict and disorder, underfunded law enforcement, inadequate security, permissive political environments, cultural acceptability, and promise of reward”. More specifically, “maritime piracy in Nigeria is directly linked to oil development and the resulting economic, social, and environmental conditions in the Niger Delta” (Tepp, 2012). The citizens of this region depend mainly on oil income, yet – due to government perversion and profiteering – only a small percentage of the revenue reaches the local residents. Unemployment and the lack of economic opportunities encourage many to turn to piracy as a means of livelihood. Although terrorist organizations benefit from cooperating with pirates, attacks are largely motivated by financial and not political gain, and thus do not stem from terrorist organizations (Tepp, 2012).

In spite of the increasing tide of piracy in the Gulf of Guinea, many countries in the region, especially Angola, Equatorial Guinea, and the Democratic Republic of Congo have largely disregard the issue. These nations have instead focused on inter-state issues on land, paying little attention to serious maritime security issues. Combined with the poor socioeconomic conditions of these countries, this lack of foresight concerning piracy encourages individuals with limited economic opportunities to turn toward maritime crime, feeding in to the reproduce relationship between maritime piracy and regional rockiness (Vrey, 2009).

In a strict context, this regional instability is not simply a security issue at sea, but is a secondary production of state failure and bad governance. State failure quickly leads to insecurity and insecurity on land can easily extend to maritime security. Nigeria specifically has increasing incidences of piracy based on

“the culmination of years of inattention, desperation and lawlessness in the area bordering the globally vital shipping route” (Neethling, 2010). Thus, the prevalence of piracy off the coast of Nigeria can be attributed both to the country’s dependence on oil production and the politicians’ mismanagement of natural resources.

Heighten the problem; most local ship owners are not ready to fairly outfit their ships to defend them from piracy because such costs would significantly cut into their earning. Moreover, West Africans see piracy as a threat to be addressed by government forces rather than by private effort. However, local navies are not equipped to patrol the vast Gulf territory, and because insurance companies cover the cost of stolen goods, there is little incentive for the maritime industry to combat piracy. in addition, rampant depravity often makes local patrols effectively worthless as Nigerian naval forces may be easily kickback (Boot, 2009). Although the apparent need for international support in uprooting piracy, there exists both a lack of legal authority and a lack of international will to prosecute pirates, two major obstacles to international anti-piracy procedure. Actually, Western nations prefer not to try pirates themselves because they often lack the legal jurisdiction to punish those found guilty. Instead, they prefer that pirates be tried locally, requiring pirates to be transferred to local governments capable of prosecution. Instead of Western nations following through with this difficult and unpromising process, pirates are often simply freed. Without international efforts to end maritime piracy, however, unstable governments may not be capable of reaching a state of steadiness. More importantly, the lack of coordination nature of different initiatives aimed to treat security problems in the Gulf of Guinea presently block international efforts from being active (Shafa, 2011).

5. Efforts to Counter-Piracy in the Gulf of Guinea

Attacks on shipping in the Gulf of Guinea have exposed the vulnerability of the region's maritime space. This has precipitated various countermeasures. A number of regional associations have been effectively involved in countering piracy in the region; these are (Kuppen, 2016):

- The Gulf of Guinea Commission (GCC) created in 2001 but only operational in March 2007, when its Executive Secretariat was set up in Luanda.
- The Economic Community of West African States (ECOWAS).
- The Economic Community of Central African States (ECCAS).
- The Maritime Organization of West and Central Africa (MOWCA) established to ensure a cost-effective shipping service for sub-regional countries focusing on safety and combating pollution.

In response to the rising maritime threat, the Economic Community of Central African States (ECCAS) developed an incorporated Strategy for Maritime Security (ISMS) in 2008, which called for a common regional framework for regulating maritime activities off Central Africa. In 2009, it stimulated the Regional Coordination Center for Maritime Security in Central Africa (CRESMAC) in Pointe-Noire, Republic of Congo. Under the ISMS, CRESMAC is responsible for commanding three centers for multinational coordination (CMCs), the primary value of this initiative is to embankment information sharing and authorization protocols required in the tracking of suspicious vessels across maritime border.

The Nigerian Maritime Administration and Safety Agency (NIMASA) and the Nigerian Navy (NN) have established the Maritime Guard Command for regular patrol of Lagos waters, while the Nigerian Marine Police patrol inland waterways.

In addition, NIMASA is partnering with the Nigerian Air Force to establish a maritime air unit at Benin to carry out surveillance. With a view to withstand the rising piracy trouble along its coast, Ghana is setting up an electronic vessel traffic management and information system (VTMIS) to sequel its sea and air patrols (Bateman, 2012).

The International Maritime Organization (IMO), side by side with MOWCA, is improving the Integrated Coast Guard. Function Network. This will supply regional mechanism for combating piracy and armed robbery against ships, and for enhancing maritime security in general for the area expansion from Mauritania to Angola (Bateman, 2012).

In 2010, amelioration in operational cooperation between the NN and NIMASA resulted in essential lowering in attacks around Lagos Harbor. Under the cooperation, jointly manned vessels leading law enforcement and antipiracy patrols backed with electronic surveillance assets, especially within the territorial seas and harbor approaches. In May 2013, two special maritime security companies cooperated with the NN to launch the Secure Anchorage Area (SAA), which extend security to vessels in a specified area off Lagos Port. The SAA presents armed preservation for vessels wishing to either anchor or carry out ship-to-ship transmit operations offshore. In 2014, NIMASA, in collaboration with the NN and the Nigerian Air Force, unveiled a Satellite Surveillance Centre (SSC). The SSC tracks all vessels in Nigerian waters and can identify each vessel's IMO number. This initiative sequel the existing array of sensors installed along Nigeria's coastline under the Regional Maritime Awareness Capability (RMAC) program confirmed by the United States and the United Kingdom. different other regional and international partners also adopted supportive resolutions and programs, including the African Union, United Nations, European Union, IMO, and G8(Osinowo,2015).

In the meanwhile, depending on lessons learned from the Gulf of Aden, the shipping industry formed the Maritime Trade Information Sharing Centre for the Gulf of Guinea (MTISC-GOG). With the aim of becoming an allocated focal point for incident reporting, information sharing, and the recent maritime security guidance, the MTISC-GOG is headquartered at the Regional Maritime University in Accra, Ghana and offers participating ships with 24-hour-per-day security reportage. It can also provide information to national maritime operational centers in the region and Interpol (Osinowo, 2015). The fact of a permanently shifting threat informed the Yaoundé Declaration of June 2013 in which the

heads of government from ECOWAS and ECCAS agreed to establish a Maritime Inter-Regional Coordination Center (MICC) in Yaoundé, Cameroon. A “Code of Conduct Concerning the Repression of Piracy, Armed Robbery against Ships, and Illicit Maritime Activity in West and Central Africa” was adopted to further promote collective efforts on information sharing, interdiction, prosecution, and support to victims. Enforcement of the noncommittal Code of Conduct has been slow going, however. In particular, the delayed operationalization of the MICC highlights the need for greater political will (Osinowo, 2015). The Maritime Regional Architecture zones in the Gulf of Guinea (fig. 3).

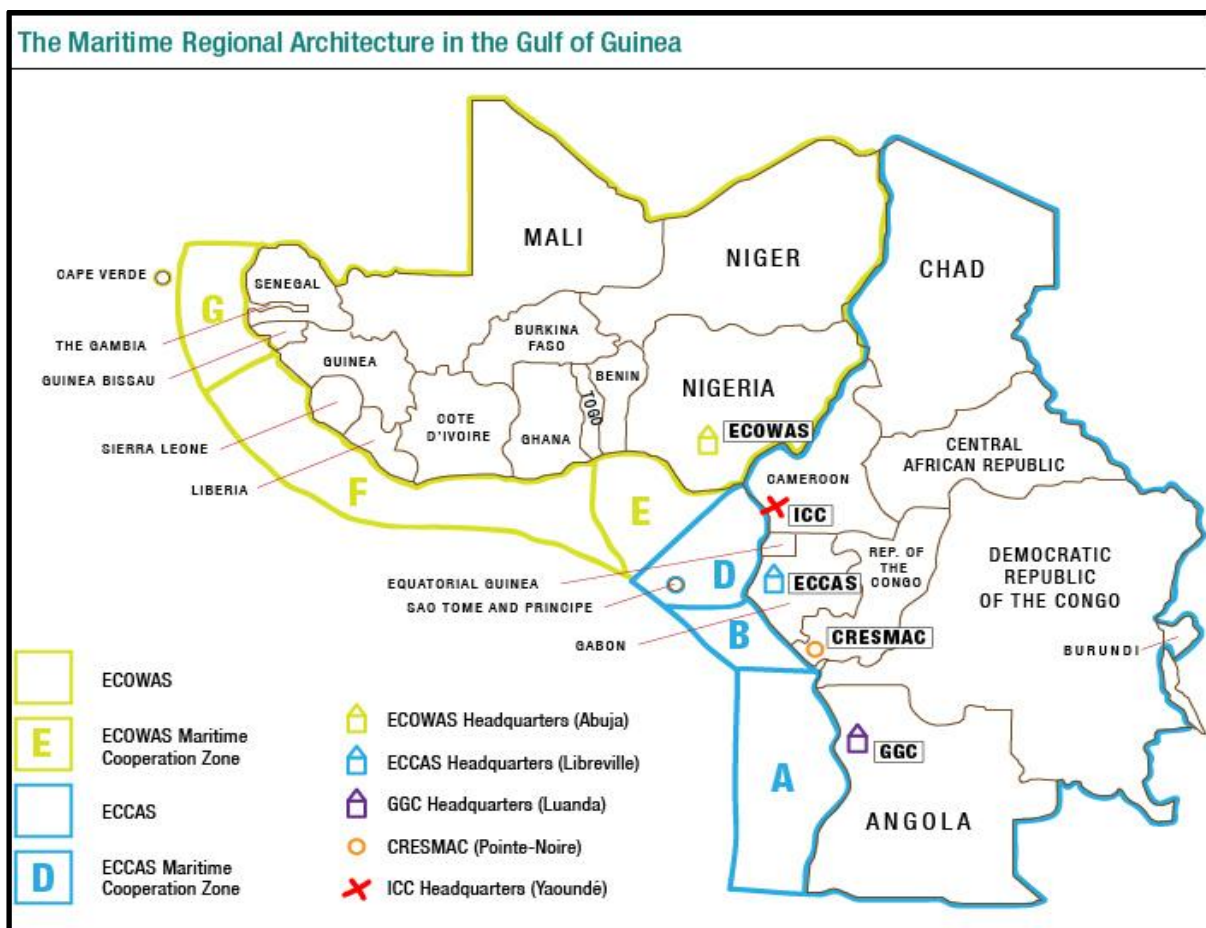


Figure 3. The Maritime Regional Architecture zones in the Gulf of Guinea.
Source: Kuppen, 2016

6. Improvement and solutions

The following are the suggested solutions to improve maritime security in the region of Gulf of Guinea.

6.1. Enforcement coordination. The restricted number of piracy-related trials emphasizes the necessity for greater coordination of legal efforts in the region as stated in the Memorandum of Understanding between ECCAS, ECOWAS, and the Gulf of Guinea Commission. To do that, a comprehensive review of every country's legal framework should be conducted to enable each to effectively trial piracy offenders. Members of the judicial system should be trained in coordination with maritime enforcement agencies in order to speed up and standardize the process of evidence collection and preservation to facilitate efficient and fair trials. The establishment of courts allocated to dealing with piracy and sea robbery trials may help minimize this lateness.

6.2. Region's navies' collaboration. Permitting of a standing forum for Zone E heads of navies by the ECOWAS Committee of Chiefs of Defense Staff (CCDS) could submit much-needed collaboration for assortment efforts of the region's navies. This protocol needs to be recurring among other zones under ECOWAS. The Political Affairs, Peace and Security Department of ECOWAS has the responsibility in this context to support the energizing of the zonal coordination mechanisms for all member states, including common understandings and prosecutions of cross-border and extraterritorial crimes. Accomplishment and enforcement of the ECOWAS Integrated Maritime Strategy, therefore, be worth the imperative attention and adherence of all stakeholders, including the influenced coastal communities.

6.3. Asset Necessity. A classes preventive mechanism characterized by maritime air patrols, ship-borne patrols, ground and satellite based surveillance assets will be needed to observe and secure the Gulf of Guinea. Countries with long shorelines or piracy hotspots should think about possession of fixed and rotary wing maritime patrol aircraft. These expectation, though aspirant, give a planning guide for governments, navies, foreign companies, and shareholders.

6.4. Profiling piracy networks. Smashing the cyclical chain of attacks on shipping in a cost-effective manner requires a strong power for profiling maritime crime and sharing information among stakeholders in the region. this capability would involve observing transiting ships, their crews, and their ownership with a view to profiling suspected ships and persons, comprising activities in coastal communities. A watch list for suspect vessels as well as human accomplices should be developed, modernizes, and participate.

6.5. Partnership correlation. More cooperation is necessary through international partners and African governments in the international waters around the Gulf of Guinea. Operations Atlanta, Ocean Shield and Combined Task Force 150/151 in the Gulf of Aden and Indian Ocean give a flexible pattern. Improving security is more about the strategic management of maritime space than it is about naval fleets and patrol craft. Central and West African states must define clearer transit corridors and anchorage sites for protection of merchant vessels in their territorial waters and Exclusive Economic Zones. This would be similar to the Internationally Recommended Transit Corridor that has functioned well in the Gulf of Aden and has been replicated as a Voluntary Reporting Area in the Gulf of Guinea by the MTISC-GOG.

6.6 focused on ashore economic growth.

Case in the Niger Delta and common poorness in the region emphasize the necessity for more combined infrastructural development, Providing job opportunities for young people, and coastal environmental preservation. Furthermore, given the socioeconomic effects of illegal fishing, pollution, and environmental degradation, state and local governments across the region must concentrate on maritime-related policy issues that immediately effect coastal citizens. This encompass enforcing laws governing foreign companies' intrastate shipping, appropriate implementation of environmental laws, and developing shipbuilding, fishing, and other industries where considerable production shortcomings still found. Nigeria's Petroleum Industry, which integrates measures aimed at deepening responsible exploitation, improving local community participation, and benefitting host communities with economic, social, and infrastructural development could also assure enhanced economic chances in coastal zones. At least, multinational oil companies should reconsider their existing community evolution strategies.

7. Conclusion

Piracy in the Gulf of Guinea raises a unique, shared energy threat and funds terrorist groups along West Africa. However, contrary to what happened in the Gulf of Aden, success cannot build on international warships, but will depend on the strength of national and other international forces to enable an integrated, regional maritime security force. Promote expansion of good governance and well-established institutions in the region will help target the root causes of these cases and guarantee long-term steadiness. Until there is political volition in each Central and West African country to protect the region's waters,

the Gulf of Guinea will remain defies security gap. Ship owners, governments, and regional bodies against the over-commercialization of maritime security. The international community also participate a concern in fighting piracy due to economic as well as security concerns. however, until the considerations of maritime security in the Gulf of Guinea is raised from the operational to the governmental level and there is political willingness in West African countries to defend the region's waters, the Gulf of Guinea will remain a challenged security area.

Recommendation

- Activating political, interagency and interstate obligations to counter piracy and related crimes in waters of the Gulf of Guinea will build on creating powerful capacity for surveillance, reaction, and fulfillment.
- Territorial combined effort dealing with threats to good order at sea should be enhanced, and improved moreover, cooperation between agencies at a local level, including obviously fixed responsibilities for agencies and the specification of risk assessments related to piracy.
- Multilateral or dual legal dispositions should be considered to expedite capture, investigation, hot pursuit, prosecution and extradition, exchange of witnesses, sharing of clues, inquest, seizure and confiscation of the piracy proceeds.
- It is essential to establish mutual trust and respect between national organizations involved in counter-piracy activities. This is best built through regular information sharing, to develop effective counter-piracy strategies.
- The role of regional information-sharing center like MTISC-GOG should be enhancement as a supportive measure to improve information sharing.

- Availability of capacity required including patrol ships, aircraft, surveillance systems, judicial systems and facilities, and personnel with the essential skills and training.
- Countries of Gulf of Guinea should be parties to all relevant international conventions dealing with illegal activities at sea and the national legislation should be integrated with it.
- The requirements of the International Ship and Port Facility Security (ISPS) Code must be strictly followed and the Company Security Officers should monitor vessels for compliance with BMP guidelines.

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Contributions of Egyptian women to sustainable Development in the maritime industry

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ABSTRACT

This paper aims to study the commencement of women's work in the field of maritime transport in Middle East to prepare a strategic plan that supports the visions and trends affecting the decision-making that serves the interests of women, as an active partner in the development.

Moreover, it highlights what Arab women gained and achieved at various levels for sustainable development, as they became a truly active partner in development in the Middle East not as a previous traditional culture in the region, but as they represent half of the society, refusing to remain on the sidelines of events. In addition, they want to be in the storming work in difficult areas and difficult physically and neurologically aspects, and the difficulties and challenges they face and what should be presented to fulfill the rights of women working in the maritime field and strengthen their role in the maritime proving field equality between women and men.

Confirming that Arab women are no longer a spectator of what is happening around the Arab world, regionally and globally, but interacting and contributing with the movement of the world around them in all fields and levels.

Keywords: Egyptian women, sustainable development, women rights

1- Introduction

Although women since the early 1900s have been hired in the field of maritime industry, their employment has been rare and largely limited to stereotypical female roles on passenger ships such as; children's nurses, stewardesses for women passengers and laundresses. Moreover, on a global scale women's employment in the field is still extremely limited, estimated at about 1.2 percent of the total seafaring population of 1.2 million. Most female seafarers are from developed countries and mostly employed in the passenger shipping sector. The gender difference is also apparent at the higher officer

level with 42 percent of men and 7 percent of women in these positions. Women continue to be employed in hotel and service positions rather than men whom are always employed in the marine and galley positions. Women seafarers have an average age of 31 years compared to 35 years for men; this age difference is stronger in the hotel sector.(.)

2- The challenges facing Arab women in the maritime industry.

The most important challenge facing Middle Eastern women is the lack of adequate vocational education due to lack of training programs and specialized rehabilitation for women, especially in the use of modern

Technologies. In addition, the level of community's awareness of women's importance in development is due to the presence of social and cultural barriers impede and limit women's contribution to the development of society, which resulted in putting off women's role. (Supreme Council for Women of Bahrain -2008)

Secondly, communities do not accept the idea of women working in certain professions especially if these working opportunities are outside her country, in particular, under the pretext of travelling and transportation continuously and these constraints are present in all areas in general, but exist in particular in the field of marine shipboard. These restraints exist only in the Arab community, while is exactly the opposite in the Western society, whilst Arab women have managed to prove their efficiency and strength and durability compared with those around the world. (Third Conference of the Arab Women's Organization in Tunisia, 2010)

The suffering of Arab women is due to accumulation of traditions and habits, and from this standpoint, this perspective should be corrected. It is an urgent priority that requires standards of social and cultural upbringing of generations on the right vision of women and their role and value in Arab society.

Also, one of the barriers facing Arab women is that husbands believe that the increa Women Seafarers receive lower wages even though what they do is exactly similar to that of their male colleagues. (Third Conference of the Arab Women's Organization in Tunisia, 2010)

Se in a wife's working hours reflects negatively on her household work. As well as the objection of some families to employ their daughters in some areas fearing that they break traditions and values of the community,

Finally, there is still discrimination in promotion between men and women, where a man can get promotions naturally hindering Although they are mostly wrong beliefs.

the arrival of working women for leadership positions because of the lack of conviction of officials. Although with increased knowledge and aspirations of social, economic and cultural progress, the increase of women's employment didn't increase in Arab societies, and it raises questions why women's employment in the maritime field is still frowned upon despite the fact that working women became a reality in all fields and specialties. (Mahfouz 2008)

Thus, developing programs, educational and cultural seminars should exist to raise awareness of the professional and political importance of working women and raise knowledge of what is new in the community and how to take advantage of it.

3- The difficulties women faced while working onboard

There's an obvious preference for employing men than women in many professions, hence women face discrimination when they enter the maritime field. In some countries they are not allowed the privilege of maritime education, they are even prevented from taking courses that qualify them for working in the Maritime Field.

The intolerance of ship owners to employ women is due to their belief that women won't be able to work as good as men since she is subject to frequent interruptions such as marriage or motherhood. This could lead to her inability to follow-up training and qualifying courses, which reduces the efficiency of her work.

Women Seafarers receive lower wages even though what they do is exactly similar to that of their male colleagues. (Third Conference of the Arab Women's Organization in Tunisia, 2010)

3-1 The rights of women Seafarers in the maritime field:

Correcting this erroneous idea of women not being able to work as good as men is a top priority, it requires community's efforts in the first place to make the young generations realize the importance of women. Arab societies are fully responsible of protecting women's rights and their employment status. Moreover all Arab countries should sign a treaty to end discrimination against women. (Third Summit of the Organization of Arab women Tunisia in October, 2010)

And, it must also provide social protection and legal safeguards that must be met for women working in maritime field like women who are employed in any other work field and the most important of these rights included in the treaty are:

- The right to work and equality with men.
- The right to enjoy the same employment opportunities and apply for the same criteria in the selection.
- The freedom to engage in employment or occupation, and the right to get a promotion and Career Level and vocational training.
- The right to social security in the case of retirement, unemployment, sickness and disability.
- The right of dismissal from work because of pregnancy or maternity leave or child care.
- The right to paid holidays.

- Work to eliminate discrimination between men and women and find parity in enrollment between public service and rights in career advancement and opportunities for rehabilitation and training.

- The right to health care, occupational safety and protection of the right to maternity and child-bearing.

- International Maritime Organization that provides for Member States to allow and not to prevent women from working aboard of ships regardless of her sex.

- To ensure the right of women against any form of discrimination between men and women in any maritime labor, in terms of equipment, and working conditions or facilities

- Women sailors right to form or join any union to represent themselves

- Better representation of women through labor unions

4- The benefits of women's service in the maritime field

There is a big advantage in the employment of women on board ships as they create a more social environment, seeing that the nature of the marine life has changed in the recent years, since the nature of maritime labor differed from what went on in terms of acceleration loading and unloading operations in ports and also the development of the shipbuilding industry, which led to the increase in the speed of ships and reducing the number of crew members. With the presence of women as part of the ship's crew, the sense of isolation felt by many of the sailors can be reduced and help integrate a natural social life. Moreover, according to the statistics of the International Labor a shortage of certain categories of

Sailors are apparent; particularly class (A) maritime officers. Women are regarded as the source of untapped talent that we need to rely on to make up for this shortfall, for this reason the Secretary-General of the International Maritime Organization has called for maritime companies in the world to pay more attention to the recruitment of female sailors as part of a widespread campaign to solve the problem of labor shortages on board ships.

The International Maritime Organization stated that there is no fundamental reason for the lack of participation of women and to take advantage of employment opportunities in the maritime industry, but it is believed that a mere 1% to 2% of its global workforce of seafarers estimated total population of about 1.2 million are women (ILO). The previous Secretary General of the (IMO) Aftimos Mitropoulos states that women are untapped resources that can provide part of the solution to the problem of labor shortage on board the ships world's merchant fleet (and this is reflected thus on the Arab fleet).

5- The view of the international organizations of women involvement in the maritime field

5-1 International Maritime Organization (IMO) and Women Seafarers

IMO established a program called the Integration of Women in the Maritime Sector (IWMS), aiming to make a concerted effort to help the industry move on from that tradition and to help women achieve a good representation within the maritime sector that is more in keeping with twenty-first century expectations. The primary objective of this program is to encourage IMO Member States to open the doors of their maritime institutes to enable women to train alongside men and so acquire the high level of competence that the

Maritime industry demands.

The second key priority under IMO's program is the regional harmonization, which is resulting in the establishment, through IMO support, of 6 regional associations for women in the maritime sector covering the following regions: Africa, Asia, Latin America, and the Pacific Islands. IMO continues to support the participation of women in both shore based and sea going posts, in line with the goals outlined under the United Nations Millennium Development Goal (MDG) 3 "Promote gender equality and empower women", under the slogan: Training- Visibility – Recognition. (Women in the maritime industry –IMO, 2013)

5-2 International Transport Federation (ITF) and Women Seafarers

There are millions of women are employed in the transport industry worldwide, as bus drivers, rail drivers and workers, port workers, and in airlines. Although a lot of progress occurred in recent times regarding women employment in many areas, the fact remains confirmed that the majority of workers in the maritime industry are men.

The International Transport Federation (ITF) had risen in its conference for women working in the Sea held in Brazil - Rio de Janeiro, 10 April 2005; many important issues have been stated as follows:

- Issues concerning the representation of women by trade unions.
- Relevant issues to achieve the best representation of the working women on board cruise ships specifically.
- Issues related to globalization and its impact on women working at sea.
- issues of union representation , where the issue was raised of workers in the maritime

domain to its importance in the presence of a union representative is working to solve their issues and find solutions for the problems related to them.

- Unions should promote equal opportunities for men and women in the maritime industry, with the recognition that employers are responsible for the recruitment process on board their ships.
- Maritime unions should address the issue of retaining women in the sea, and the development of policies to reduce the obstacles placed in the way of women sailors and work to continue in their jobs at sea.
- The Union calls on the International Transport Workers (ITF) employers and unions ILO to prioritize the following issues that have been identified as being of vital importance to women seafarers.
- Reduction of gender stereotypes within the industry.
- Access to confidential medical advice and the provision of sanitary materials of contraception on board the ships.
- Develop an approach to maternity benefits.
- Develop policies appropriate training on board ships, including training and education for new women sailors. (ITF, 2005)

5-3 ILO and Women Seafarers

"Our organization is very serious about gender issues and takes them into account in all areas of our work", says Brandt Wagner, a Maritime Specialist at the ILO. "Thus, a study had been made by ILO regarding the women's seafarers, and it shows that the bulk of women seafarers are concentrated in the hotel personnel of cruise ships, and these are mostly in rating grades. Only 7 per cent of women seafarers are officers and the rest (93 per cent) are ratings. By comparison, 42 per cent of male seafarers

are officers and 58 per cent are ratings. In addition, the study clarify that while some ship owners and ship managers with experience of employing women are very positive about women's performance, when they are employed as instructors at Maritime Training Institutes, all too frequently what women face is sexism, intolerance and harassment. (ILO, 2003)

Furthermore, the ILO statistics shows there are further anomalies in seafarers' employment. Currently, OECD countries recruit the largest proportion of women employed on cruise ships (51.2 per cent), followed by Eastern Europe (23.6 per cent), the Far East (13.7 per cent), Latin America and Africa (9.8 per cent) and South Asia and the Middle East (1.7 per cent). On the other hand, most male seafarers are recruited from the Far East (29.1 per cent), followed by 23.3 per cent from OECD countries, 17.8 per cent from Latin America and Africa, 12.3 per cent from Eastern Europe, 7.5 per cent from South Asia and the Middle East.

Despite, the ILO issued the Maritime Labor Convention (MLC) 2006, which entered into force at 20th of August 2013, and it says in Article III; "Each Member shall satisfy itself that the provisions of its law and regulations respect, in the context of this Convention, the fundamental rights to: (d) the elimination of discrimination in respect of employment and occupation" many employers still appear not to have made specific provision relating to the employment and conditions of work for women.

5-4 EU and Women Seafarers

According to study of EU Seafarers Employment in the final report by European Commission in May 2011, Only 6 countries (Bulgaria, Germany, Lithuania, Norway, Sweden, UK,) provide detailed information in national statistics on women employment, from which the two below tables were drawn up:

The first one shows the percentage of women employment on the total of seafarers, by department:

Table 1

	TOTAL WOMEN EMPLOYMENT		
%	DECK	ENGINE	CATERING
OFFICERS	26,85	7,47	65,68
RATINGS	5,98	0,65	93,17

(European Commission,2011)

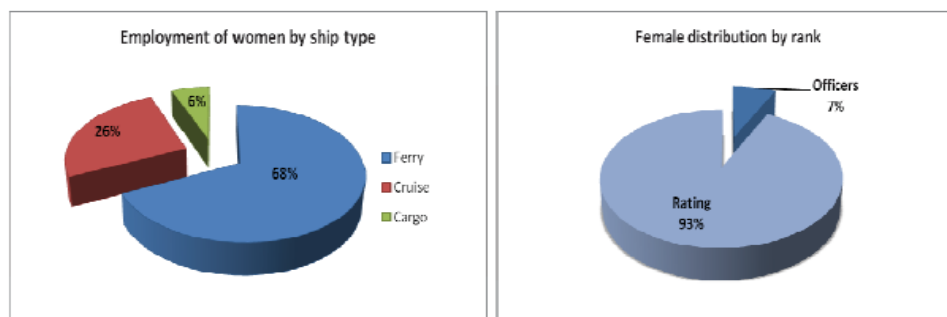
The second shows the repartition **by department** of the **total of women seafarers**:

Table 2

	% OF TOTAL SEAFARERS			TOTAL
%	DECK	ENGINE	CATERING	
OFFICERS	1,07	0,28	33,26	1,75
RATINGS	1,85	0,32	35,28	14,91

(European Commission,2011)

The only comprehensive study on Women employment in the maritime industry seems to be an **ILO** survey carried on by the **Seafarers International Researcher Centre** (Cardiff, UK) in 2003 (Women seafarers, Global employment policies and practices). From this study, women in Scandinavian countries make up more than 10% of the seafaring workforce, 8, 3% in the UK, 4, 2% in Germany, when figures for other European countries are negligible. Individual results for the four above countries are broadly in line with these figures 8 years after - The **ILO** survey highlighted that women seafarers were concentrated in **hotel personnel on passenger ships**



(Figure no.1)

Source: Belcher, Samson ,Thomas , Veiga and Zhao Women Seafarers: global employment policies and practices. ILO,2003

Above figures certainly reflect employment in EU and Norway on passenger vessels, mostly ferries. Numbers of women officers or ratings **in other departments remains negligible**, although the number of women in the maritime schools has increased over these past years. Compared with figures of 2003, the 2010 results remain disappointing although efforts have been made during these past years by both ship owners and unions to attract young women towards sea careers.

(European Commission, 2011)

5-5 Globalisation of World Cruise Shipping and Women seafare

Modern cruise shipping is one of the youngest sectors in the maritime industry. It took off in the 1960s when jet airlines were introduced to commercial service and destroyed the liner trade (Cartwright & Baird, 1999:23-28). The nature of cruising has changed fundamentally from a

mode of transport to entertainment, and to its current status of maritime tourism. The industry has been globalised in the past 20 years and the globalisation process was particularly intense through the 1990s, as indicated in terms of capital, labour and market composition (passengers and geographic coverage).

Women were certainly found sailing on the ships estimated at 5% in the 1980s. Since the 1990s, women have begun to be used as another ‘new source of labour supply’. The development of the market forces, in particular the change in the composition of the passengers and the industry’s difficulty in recruiting qualified male seafarers, led to a steady increase in female employment on cruise ships. Today, women make up 18-20 per cent of the total labour force on cruise ships – around 20,000-23,000 in number. Although the number of women on individual ships varies greatly, the average level of female composition of the workforce on cruise ships is significant.

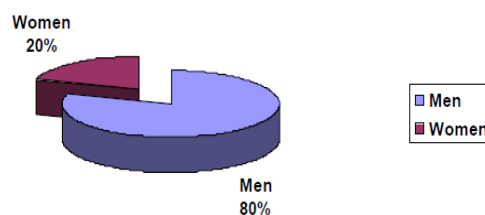


Figure no.2: female employment on cruise ships
(Zhao,2003)

A little over 50% of the women are employed from developed countries, with the other half recruited from Eastern Europe, Asia, Latin America and other developing countries as illustrated in the following pie chart

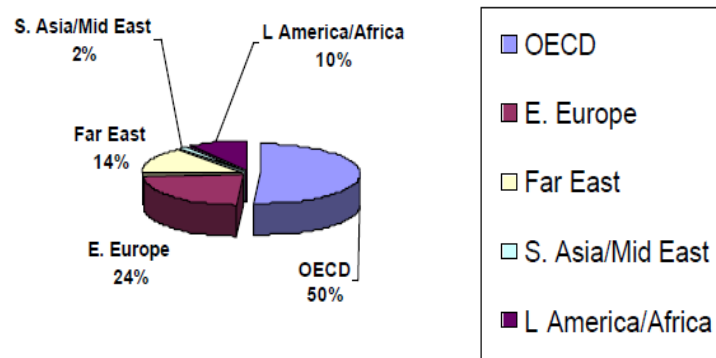


Figure no.3 (Zhao,2003)

It is worthwhile noting that the regional composition of the female workforce deviates from that of the male workforce. In contrast, as shown in Figure below, significantly more male seafarers are from Asian countries (41%). This may indicate that women are still not encouraged to take employment away from home and it is still a taboo for women in some countries in Asia to work on ships.

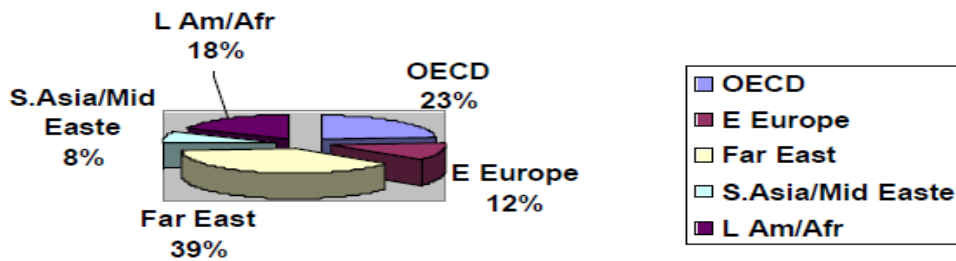


Figure no.4 (Zhao,2003)

Seafarers on cruise ships are located in different departments. As shown in the following graph, marine seafarers only consist of a little over 18% of the total workforce onboard. Most seafarers (82%) are located in hotel, catering and other none marine departments.

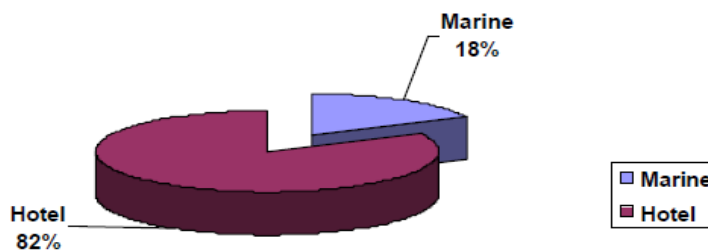


Figure no.5 (Zhao,2003)

The workforce is segregated by gender. For example: there is only one woman amongst all the captains in the SIRC Seafarers Database (which contains crew lists collected from 100 ships). Over 20% of the total male work force is located in the Marine sector, women's representation in the workforce of this sector is less than 0.5%. All the ship doctors are men; all the ship nurses are women. As shown in Figure 6, women are concentrated in hotel and other 'non-technical' sectors of the ship as cabin stewardesses, waitresses, cleaners or utility workers and their representation in the marine and the galley departments is extremely low.

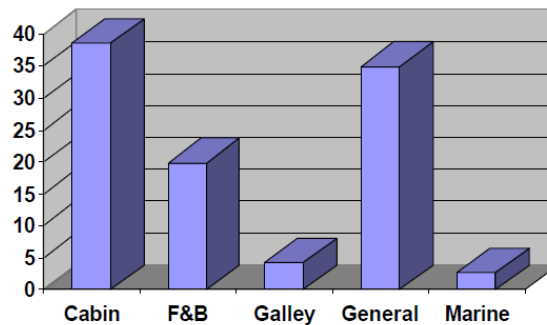


Figure no.6 (Zhao,2003)

Finally it was found that more women have begun to take important positions on today's cruise ships. Some of them have advanced to key positions as pursers, cruise directors, financial controllers, housekeepers, food and beverage managers, chefs or even executive chefs. Women are found employed in middle, or even senior positions with supervisory or managerial responsibilities. A closer look shows however, that most of these women managers or supervisors are from developed countries. Women from developing countries have much less opportunities for promotion.(Zhao,2003)

6- The role of the Arab Academy for Science, Technology and Maritime Transport (AASTMT) in support of the role of Arab women in the maritime transport sector:

In addition to the fact that the AASTMT is initiating the introduction of women's maritime domain academically by allowing them to study in the College of Maritime Transport and Technology, they have also an academic branch of Arab Women's International League for women working in the maritime transport sector and trade (Women in Shipping & Trading Association "WISTA"), which is a

Non-governmental and non-profit organization. Also, one of the AASTMT objectives is to increase the percentage of representation of women leaders in the management of maritime transport and improve the performance of women working in the maritime field, in order to achieve high quality in performance and a change in the society enriched by the transfer of the experiences of women leaders. As well as contact similar institutions to increase women's empowerment and activation of its leadership role. The AASTMT is also in this context established "the Arab Forum" for Women working in the field of maritime transport

Zones. The Middle Eastern and African countries in collaboration with the International Maritime Organization, has provided a memorandum of understanding signed in 2007 between the AASTMT and the International Maritime Organization and the maritime transport sector in the Arab Republic of Egypt to the establishment of this forum , which aims to win the support of the community, and advocate for the interest of women at the regional and international levels and to achieve effective participation in leadership and decision-making in the field of maritime transport industry. The Forum held the first training course in June 2008 under the title of "leadership skills for women working in the maritime field" and was attended by 21 representatives from 9 Arab countries, women leaders working in the ports and shipping companies, and other activities related to the Shipping field. The second training was held in Durra of KSA at July 2009 under the title "A study in the marine environment" and was addressed by 19 women leaders from seven Arab countries, while the third training session; was in April 2010 under the title of "climatic factors and their impact on water resources" and was addressed by 21 speakers of the women leaders in seven Arab countries, and are holding these sessions at the headquarters of the AASTMT in Alexandria, in full coordination with the International Maritime Organization, which provides academic potential of all to succeed it. (Academic achievement of the Arab Academy for Science, Technology and Maritime Transport 2007-2010)

7- Conclusion

In conclusion, although the number of women seafarers in the Middle East has increased, they are still a small number compared to men. Whether the cause of this is communities

Traditions and habits or the prejudice and discrimination of ship owners, societies should start being aware of the role of women. Instead of marginalizing women and confining their jobs onboard to stereotypical female service positions, maritime companies should certainly start employing women in order to compensate their labor shortage. Moreover lack of sufficient training courses and equal opportunities are all from the many challenges facing Arab women in the maritime field. Accordingly, Arab countries must work harder on eliminating those barriers standing against women and provide them with more opportunities instead, it must also provide women seafarers their equal and complete rights. Meanwhile international organizations such as the IMO and ITF became conscious of women's significance in the maritime field; as a result they launched programs and campaigns to enable women to participate in both shore based and sea going posts. Besides international organizations, the AASTMT has played an important role in reinforcing the representation of women in the maritime industry by establishing the Arab Forum and permitting women to enroll in the college of maritime transport and technology. After all the efforts done by organizations and forums, changing of societies views on women seafarers and the acceptance of maritime companies is still extremely needed.

8- Recommendations:

- Allow Arab women to train and work on board ships, and give the opportunity to them to prove themselves in this area similar to those in other countries of the world.
- Change policies and attitudes that support the division of labor based on gender and institutional support for women.

- Work on the open areas of work for women in the maritime sector in all specialties and not confined to work on board vessels such as shipping companies, Agencies and Brokers chartering of vessels at the port and work in all shore fields.

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Environmental Detection of Heavy Metals Concentration in Mangroves at Safaga Shore-line.

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Abstract

The purpose of this study was to investigate the concentration levels of heavy metals in different species of the main three marine algal divisions from the Mangrove area coastal waters, Egypt. The divisions included Chlorophyta—green seaweeds (*Caulerpa sertularoides*, *Halimeda opuntia* and *Halimeda macrolob*), Phaeophyta—brown seaweeds (*Cystoseira indica*, *Hormophysa cuneiformis*, *Sargassum cinereum*, *Padina boergesenii*, *Dictyopteris acrostichoides*, *Turbinaria ornate* and *Cystoseira nodicaulis*), and Rhodophyta—red seaweeds (*Jania rubens*, *Laurencia obtuse* and *Sarconema scinaoides*). The heavy metals, which included cadmium (Cd), lead (Pb), copper (Cu), manganese (Mn) and zinc (Zn) were measured by Atomic Absorption Spectrophotometer (AAs). The concentrations of heavy metals in all algal species are in the order of $Cu > Mn > Zn > Pb > Cd$. The results also showed that the uptake of heavy metals by different marine algal divisions was in the order of Chlorophyta > Phaeophyta > Rhodophyta. These heavy metals were several order of magnitude higher than the concentrations of the same metals in seawater. This indicates that marine alga progressively uptake heavy metals from seawater.

Keywords Heavy metals. Chlorophyta. Phaeophyta. Rhodophyta. Mangrove area. Egypt.

Introduction

Determinations of heavy metal concentrations in aquatic organisms are usually preferred than their measurements in seawater and sediment. The concentration of metals in water is very low and shows wide fluctuations. Metal concentrations in the sediment can be changed by the oxidation–reduction potential, organic content, pH, and the grain size composition (Topcuoglu *et al.*, 2003). On the other hand, macro algae can be used as bio-monitors to give information on concentrations of heavy metal or changes in metal availabilities in the

the surrounding environment, besides their abundance in various environmental systems (Capiomont *et al.*, 2000; Campanella *et al.*, 2001; Ferrat *et al.*, 2003a,b; Topcuoglu *et al.*, 2003). In general, algae are widely distributed in the aquatic environment and are sedentary, easy to collect, identify, and the bioaccumulation of heavy metals occur in high degrees; satisfying all the fundamental requirements for bioindicators (Campanella *et al.*, 2001; Conti, 2002). In particular, macro algae are recognized to concentrate metals up

to levels many times larger than those found in the surrounding waters (Farias et al., 2002; Jones, 1922; Black and Mitchell, 1952). The cell wall of algae consists of a variety of polysaccharides and proteins, some of them containing anionic carboxyl, sulfate, or phosphate groups that are excellent binding sites for metal retention. The binding of metals by macro algae was shown by Bryan, (1969) to be strong, with only a minimal exchange between bound metals and ambient water. Macro algae are able to accumulate heavy metals, reaching concentration values that are thousands of times higher than their corresponding concentrations in sea water (Conti and Cecchetti, 2003). Algae bind only free metal ions, the concentrations of which depend on the nature of suspended particulate matter (Seeliger and Edwards, 1977; Luoma, 1983; Volterra and Conti, 2000), which, in turn, are formed by both organic and inorganic complexes.

Mangrove area (k 17), is located at the end of Safaga bay, about 77 km to the south of Hurgada City, ($26^{\circ} 36' 59''$ N and $34^{\circ} 00' 41''$ E). It is distinguished by mangrove trees (*Avicennia marina*) and tidal zone reach to about 100 m occupied by sand mud and small rocks, the tidal zone followed by deep water which begins with 5 m. There is successful transplantation operation carried out in this area by Egyptian Environmental Affairs Agency (EEAA). Little quantitative data are available on the concentration of metals in seaweeds for this area. Little quantitative data are available on the concentration of metals in seaweeds general pollution of this area. In an effort to gain some insight into the level of metal contamination which might exist in the coastal marine environment in this area.

Algae samples were collected from Mangrove area during the spring of 2014 at depths ranging from half to 1 m. The algal groups

included Chlorophyta—green seaweeds (*Caulerpa sertularoides*, *Halimeda opuntia* and *Halimeda macrolob*), Phaeophyta—brown seaweeds (*Cystoseira indica*, *Hormophysa cuneiformis*, *Sargassum cinereum*, *Padina boergesenii*, *Dictyopteris acrostichoides*, *Turbinaria ornate* and *Cystoseira nodicaulis*), and Rhodophyta—red seaweeds (*Jania rubens*, *Laurencia obtuse* and *Sarconema scinaoides*).

Material and Methods

The collected samples were initially washed under a flow tap water and washed again three times with double distilled deionized water to remove mineral particles, organisms and other external adherent. Samples were weighed into a pre weighed petri dish, and then dried at 80°C until constant weight. The dried samples were weighed and placed in a cleaned dried mortar separately and grounded to fine particles and then sieved using a sieve of particle size 0.02 mm. Each sample of 0.5 g were transferred into clean dried beaker (100 mL), 5 mL of aqua regia HCl and HNO_3 (3:1) was then added to the sample for digestion. The samples were allowed to be evenly distributed in the acid by stirring with a glass rod and then the beaker was placed on the heater. The digested sample was filtered into a graduating cylinder and the filtrate was made up to 25 mL using distilled water. Concentrations of heavy metals were measured using a flame atomic absorption spectrophotometer and expressed as $\mu\text{g g}^{-1}$ (P. Karthick et al., 2012). The analysis of cadmium (Cd), copper (Cu), manganese (Mn), lead (Pb) and zinc (Zn), were performed with SHIMADZU atomic absorption spectrophotometer AAS – 6800.

Results

The analysis results of the three algal groups are summarized in Table 1 and are illustrated in Fig. 1. The results showed that Chlorophyta division have the highest concentrations of heavy metals followed by Phaeophyta division and then by Rhodophyta division.

	Cd	Pb	Cu	Mn	Zn
Chlorophyta					
<i>Halimeda opuntia</i>	0.43	3.37	8.41	5.02	3.86
<i>Caulerpa sertularioides</i>	0.98	2.74	13.11	13.97	9.25
<i>Halimeda macroloba</i>	0.46	3.42	8.47	4.98	3.95
Range	0.43 – 0.98	2.74 – 3.42	8.41 – 13.11	4.98 – 13.97	3.86 – 9.25
Phaeophyta					
<i>Cystoseira indica</i>	0.58	2.84	8.54	6.88	5.96
<i>Hormophysa cuneiformis</i>	0.48	2.43	8.69	6.45	4.38
<i>Sargassum cinereum</i>	0.49	2.57	8.26	5.42	5.22
<i>Padina boergesenii</i>	0.60	1.14	5.28	3.54	3.14
<i>Dictyopteris acrostichooides</i>	0.59	3.05	5.32	5.18	5.12
<i>Turbinaria ornate</i>	0.41	1.15	9.28	7.12	1.28
<i>Cystoseira nodicaulis</i>	0.49	2.91	9.84	6.12	5.27
Range	0.41 – 0.60	1.14 – 3.05	5.28 – 9.84	3.54 – 7.12	1.28 – 5.96
Rhodophyta					
<i>Jania rubens</i>	0.58	2.37	6.21	5.01	4.76
<i>Laurencia obtuse</i>	0.28	1.24	6.61	5.45	3.49
<i>Sarconema scinaoides</i>	0.52	2.67	7.26	5.31	4.86
Range	0.28 – 0.58	1.24 – 2.67	6.21 – 7.26	5.01 – 5.45	3.49 – 4.86
sediment	1.85	42.39	11.99	30.24	236.2
Seawater	0.25	1.6	1.21	1.74	0.19

Table 1 Concentrations ($\mu\text{g g}^{-1}$) of heavy metals in marine green seaweed (Chlorophyta), brown seaweed (Phaeophyta), and red seaweed (Rhodophyta) algal species.

Chlorophyta

The concentrations of various heavy metals in different Chlorophyta species vary (Table 1, Fig. 1a). The concentration of Cd ranged from 0.43 to 0.98 $\mu\text{g g}^{-1}$ with minimum and maximum concentrations in the *Halimeda opuntia* and *Caulerpa sertularoides* species, respectively. The concentration of Pb ranged from 2.74 to 3.42 $\mu\text{g g}^{-1}$ and the minimum concentrations were in the *Caulerpa sertularoides* species whereas the maximum concentration was found in the *Halimeda opuntia* species. For Cu, the concentration ranged from 8.11 to 13.11 $\mu\text{g g}^{-1}$ and the minimum concentration was found in the *Halimeda opuntia* species and the maximum concentrations were determined in the *Caulerpa sertularoides* species. The maximum concentrations of Mn, which ranged from 4.98 to 13.97 $\mu\text{g g}^{-1}$, were found in the *Caulerpa sertularoides* species, whereas the minimum concentration was observed in the *Halimeda opuntia* species. The Zn concentrations ranged from 3.86 to 9.20 $\mu\text{g g}^{-1}$ and the minimum concentrations were found in the *Halimeda opuntia* species and the maximum concentrations were observed in the *Caulerpa sertularoides* species.

Phaeophyta

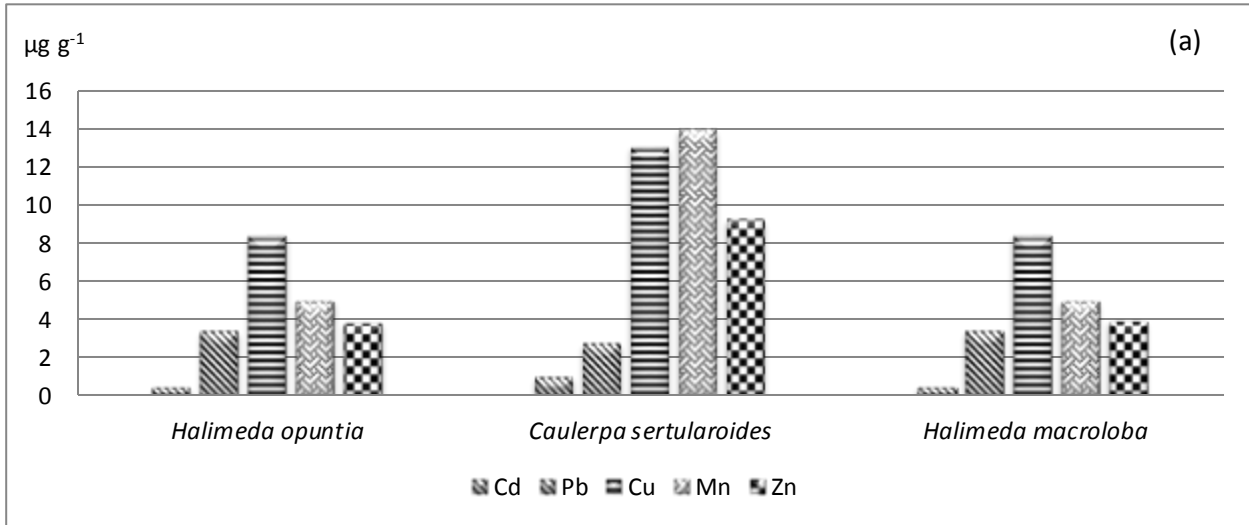
The concentrations of various heavy metals in the samples of different Phaeophyta species are shown in Table 1 and Fig. 1b. The concentration of Cd was found to range from 0.41 to 0.60 $\mu\text{g g}^{-1}$ and its minimum concentration was determined in the *Turbinaria ornate* species and the maximum concentration in the *Padina boergesenii* species. The Pb concentration ranged from 1.14 to 3.05 $\mu\text{g g}^{-1}$. The minimum concentrations of Pb were determined in *T Padina boergesenii* species and the maximum concentration was found in the sample of the *Dictyopteris acrostichoides*

Species. For Cu, the concentration ranged from 5.28 to 9.84 $\mu\text{g g}^{-1}$. The minimum concentration of Cu was observed in the *Padina boergesenii* species and the maximum concentration was in the *Cystoseira nodicaulis* species. The Mn concentration ranged from 3.54 to 7.12 $\mu\text{g g}^{-1}$ and its minimum concentration was determined in the *Hormophysa cuneiformis* species whereas the maximum concentrations were measured in the *Turbinaria ornate* species. The minimum concentration of Zn, which ranged from 1.28 to 5.96 $\mu\text{g g}^{-1}$, was found in the *Turbinaria ornate* species and the maximum concentration was in the *Cystoseira indica* species.

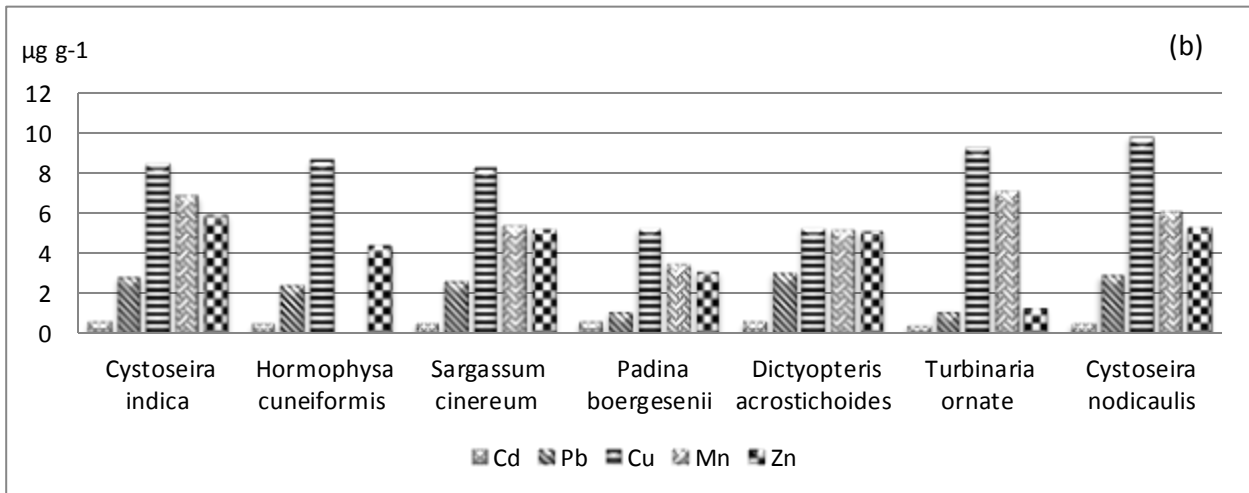
Rhodophyta

The concentrations of various heavy metals in different species of Rhodophyta vary as shown in Table 1 and Fig. 1c. The Cd concentration, which ranged from 0.28 to 0.58 $\mu\text{g g}^{-1}$, with a minimum in the *Laurencia obtuse* species and maximum in the *Jania rubens* species. For Pb, the concentration ranged from 1.24 to 2.67 $\mu\text{g g}^{-1}$ with a minimum concentration in the *Laurencia obtuse* species and a maximum in the *Sarconema scinaoides* species. For Cu, the concentration ranged from 6.21 to 7.26 $\mu\text{g g}^{-1}$ and its minimum concentration was determined in the *Jania rubens* species and the maximum concentration was measured in the *Sarconema scinaoides* species. The concentration of Mn, which ranged from 5.01 to 5.45 $\mu\text{g g}^{-1}$, showed a minimum concentration in the *Jania rubens* species and a maximum concentration in the *Laurencia obtuse* species. In the case of Zn, the concentration ranged from 3.49 to 4.86 $\mu\text{g g}^{-1}$. The maximum concentration of Zn was found in the *Laurencia obtuse* species and the maximum concentration was in the *Sarconema scinaoides* species.

Chlorophyta



Phaeophyta



Rhodophyta

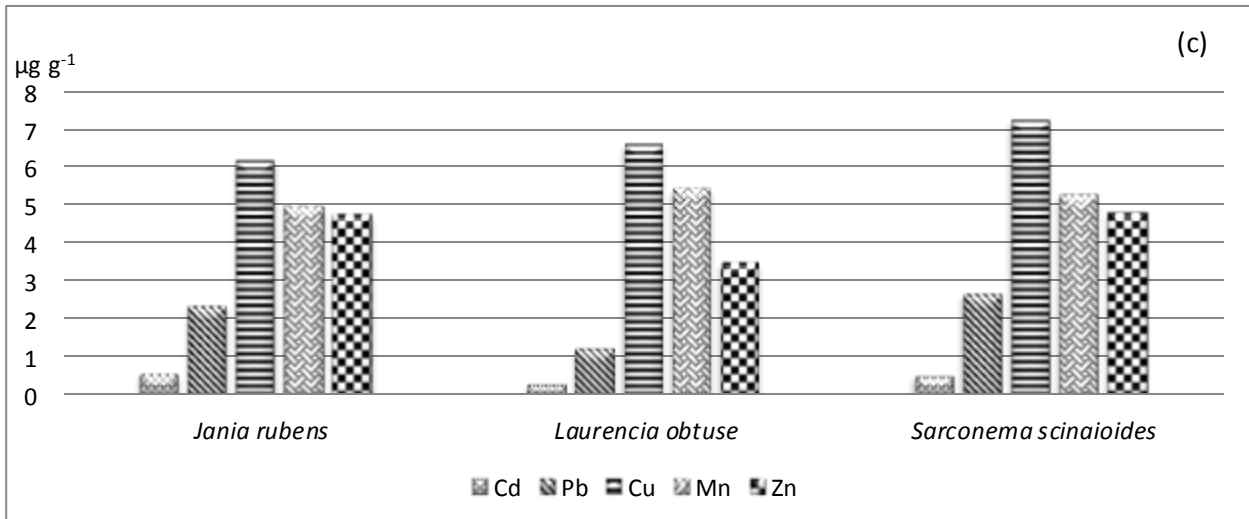


Fig. 1: The concentrations of different heavy metals measured in tissues of (a) Chlorophyta, (b) Phaeophyta and (c) Rhodophyta.

Discussion

The concentrations of heavy metals in different algal plants vary between different species. Chlorophyta species were found to contain more heavy metals than Phaeophyta and Rhodophyta species (Table 1, Figs. 1, 2). The uptake of heavy metals by different marine algal divisions is in the order of Chlorophyta > Phaeophyta > Rhodophyta (Fig. 2). The content of heavy metals in various algal species is in the order of Cu > Mn > Zn > Pb > Cd as shown in Fig. 2.

It is obvious that the concentrations of heavy metals in marine algal species are several orders of magnitude higher than the concentrations of the same metals in seawater (Table 1; Donat and Dryden 2001; Gerlach 1976; Pytkowicz 1983; Turner et al. 1980; Whitfield 1979). They are lower in concentrations levels relative to their levels in sediments (Szefer et al. 1999), with the exception for Cu, which are higher in algal species. This indicates that these algal species are not contaminated and the sources of metals are natural. The presence of high concentrations of Cu in marine plants can be attributed to the fact that they are important micronutrients for various metabolic functions of the plants (Donat and Dryden 2001). The fact that metal concentration in these aquatic plants are typically several orders of magnitude higher than concentrations of the same metals in the water has led to support some speculation that metal may become progressively concentrated at higher trophic levels in aquatic food chains due to food chain magnification (Clark 1998; Laws 2000). The wide range of metal concentrations in different algal species reflects the importance of biochemical factors in affecting the relative tendency of different tissues to concentrate pollutants. Such biochemical or physiological differences may also play a major role in

causing certain species to concentrate pollutants to a much higher levels than other organisms, regardless of the relative position of the species in the aquatic food chain (Millward and Turner 2001).

Additionally, the marine plants including algal plants are important in marine biogeochemical cycles not only because they are able to concentrate large quantities of elements (relative to seawater), but also because they can transport them in a variety of ways. These include: detritus sink and decomposition of organic matter in the sediments; direct release through plant tissue-water exchange, and part of aquatic food chain (Millward and Turner 2001).

The concentrations of heavy metals in various Chlorophyta species were found to be relatively high compared those in other two algal plants (i.e., Phaeophyta and Rhodophyta; Fig. 2). This indicates that Chlorophyta group has the tendency to uptake more metals than the other two groups. The concentrations are in the order Cu > Mn > Zn > Pb > Cd

In marine brown seaweeds (Phaeophyta), the concentration levels of heavy metals are less than in green seaweeds (Chlorophyta). The concentrations are in the order of Cu > Mn > Zn > Pb > Cd. different species of Phaeophyta division are selectively accumulate heavy metals (Table 1).

The concentration levels of heavy metals in marine red seaweeds (Rhodophyta) are less than the concentrations in green seaweeds (Chlorophyta), and brown seaweeds (Phaeophyta). The heavy metal concentrations are in the order of Cu > Mn > Zn > Pb > Cd. Also, different species of Rhodophyta division show selectivity toward the accumulation of heavy metals, (Table 1).

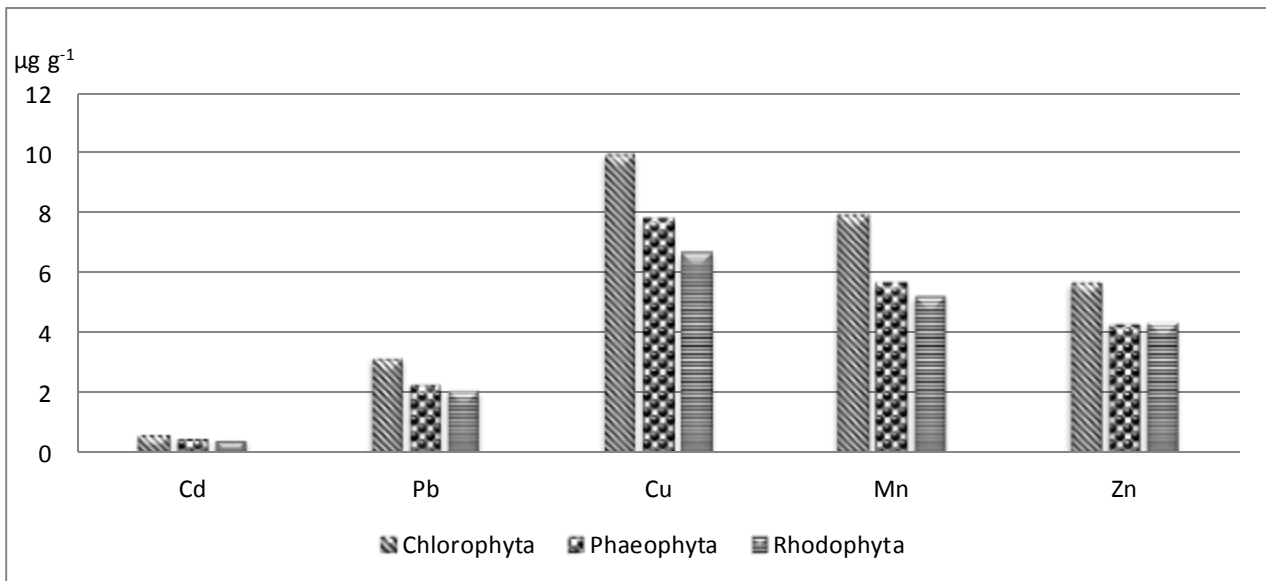


Fig. 2 The concentration of heavy metals in the three divisions of macroalgae.

Conclusion

It should be apparent that the concentration of metals associated with particulate materials including living species, is at least order of magnitude higher than the concentrations of metals dissolved in the water. It is also true in general that the concentrations of metals may differ greatly between one species to another and between different species in the same group.

In general, one ascribes these concentrations differences in the tendency of metals to bind to the various molecular groups found within the cells of each organism, as well as to the degree of the organisms exposure to the metal as influenced by its metabolic characteristics and its position in the food chain.

Apparently, marine algae may play a significant role in biogeochemical cycles of heavy metals in the coastal zones of Egypt.

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The History of GPS

GPS, originally designed for military and intelligence applications at the height of the Cold War in the 1960s, with inspiration coming from the launch of the Soviet spacecraft Sputnik in 1957, the Global Positioning System (GPS) - is a network of satellites that orbit the earth at fixed points above the planet and beam down signals to anyone on the earth with a GPS receiver. These signals carry a time code and geographical data point that allows the users to pinpoint their exact position, speed and time anywhere on the planet.



Transit was the first satellite system launched by the USA and tested by the US Navy in 1960. Just five satellites orbiting the earth allowed ships to fix their position on the seas once every hour. In 1967 Transit was succeeded by the Timation satellite, which demonstrated that highly accurate atomic clocks could be operated in space. GPS developed quickly for military purposes thereafter with a total of 11 "Block" satellites being launched between 1978 and 1985.

However, it wasn't until the USSR shot down a Korean passenger jet - flight 007 - in 1983 that the Reagan Administration in the US had the incentive to open up GPS for civilian applications so that aircraft, shipping, and transport the world over could fix their positions and avoid straying into restricted foreign territory.



Upgrading the GPS was delayed by NASA space shuttle SS Challenger disaster in 1986 and it was not until 1989 that the first Block II satellites were launched. By the summer of 1993, the US launched their 24th Navistar satellite into orbit, which completed the modern GPS constellation of satellites - a network of 24 - familiar now as the Global Positioning System, or GPS. 21 of the constellation of satellites were active at any one time; the other 3 satellites were spares; in 1995 it was declared fully operational.

The current GPS network has around 30 active satellites in the GPS constellation, Today GPS is used for many of navigation applications, route finding for drivers, map-making, earthquake research, climate studies, and an outdoor treasure-hunting game and many other social application known as geocaching.