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MARINE POLLUTION FROM SHIPS' BALLAST WATER

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ABSTRACT

Today, ballast water is the most common method used in vessels to regulate stability, to increase draught, to improve trim, and hence, to ensure a safe voyage.

These waters, which are carried by ships in variable quantities, are loaded at the source port and are discharged sometimes thousands of miles away at the destination port. This entails the introduction of organisms, at different stages of their life cycles, that may cause a zoological pollution which could threaten the survival of the vegetation and animal species of the area where the ballast water is discharged.

There is increasing concern about this problem which is severely affecting the marine environment. The International Maritime Organisation is being urged to update and complete its present regulations on this issue.

Key words: Pollution, Ballast, Waters.

1. INTRODUCTION

Shipping transports over 90% of the merchandise and basic products around the world and is, thus, an essential element of international trade.

Ballast can be defined as any solid or liquid material that is carried by ships to increase the draught, to modify the trim, to regulate the stability or to maintain the tension loads within acceptable and safe limits.

Therefore, ballast is an essential element in safe navigation both for moving in ballast to the loading port and for completing the displacement of a ship that is only partially loaded. It has been acknowledged that, at present, the only efficient method of impeding the propagation of unwanted organisms is to prevent the discharge of ballast tanks in ports where the waters have a different zoological composition to that of the source port.

Water has been used as ballast since 1880, substituting solid materials, such as sand, stones, bricks and iron pieces, that were commonly used in those days. In general, these solid ballast materials did not pose a zoological threat. (Clarkson, 1999), (Plaza, Perera and Melón, 2003).

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2. ZOOLOGICAL IMPACTS

When ships began loading thousands of tonnes of seawater as ballast from remote ports, many local life forms were collected inadvertently and transported to new regions across the oceans. Increasing ship speeds also contributed to the survival of these species during the voyage, helping them to thrive in new seas with no natural predators.

Alien organisms that travel across the oceans in ballast water are having severe effects on the marine environment, maritime facilities and human health.

In comparison to fuel spills and other types of marine pollution caused by shipping, organisms and exotic sea species cannot be purified or absorbed by the oceans. Once they have been introduced, it is almost impossible to eliminate them, whilst they may cause severe damage.

3. INVASIVE SPECIES

Specific examples include: the introduction of the European zebra mussel (*Dreissena polymorpha*) in the Great Lakes of North America, resulting in expenses of billions of dollars for pollution control and cleaning underwater structures and water pipes. See figure 1. (http://www.great-lakes.net/envt/flora-fauna/invasive/zebra.html, 1992).

Figure 1: St. Lawrence Seaway and Great Lakes

The American comb jellyfish (*Mnemiopsis leiyi*) was introduced in the Black Sea and the Azov Sea (to the north of the former), causing the near extinction of anchovy and sprat fisheries.

The bacillus *Vibrio cholerae* (the causative agent of cholera) was probably transported from Asia to the coastal waters of Latin America via ballast water discharges . The dinoflagellate genera *Gymnodinium* and *Alexandrium*, which poison shellfish, were discharged into Australian waters, causing impacts on the shellfish industry. (Plaza, Perera and Melón, 2003).

The following table shows alien species in Australian waters.

Table 1: Origin of alien species in Australian waters

ALIEN SPECIES IN AUSTRALIAN WATERS	POSSIBLE ORIGINS
Yellow fin goby fish	Japan, NE Asia
Striped goby fish	Japan, NE Asia
Japanese sea bass	Japan, Korea, China, Hong Kong
Sobaity seabream	Arab Sea
Slater (invertebrate)	New Zealand, Chile
Mysid shrimp species	Japan
Polychaete worm species	Japan, New Zealand, Pacific Ocean, India
Molluscan species	Asian Pacific Coast
Sea slug	Japan, New Zealand, South Africa, Mediterranean Sea

4. BALLAST SAFETY

Ships are designed and built to cruise through water carrying a full load of cargo and/or of passengers. Hence, in order to navigate safely, a ship moving in ballast or partially in ballast, must fully load its tanks. This means that the ship will be sufficiently submerged so as to have the propeller and rudder operating efficiently, which will prevent heeling, particularly in bad sea conditions.

Some types of vessels, such as tankers and carriers of dry cargo, mineral and liquid gas, require large volumes of ballast water, especially for long voyages in ballast. Other types need smaller quantities of ballast at almost all times, independently of the load, to control the stability, the trim and the load line. Examples include container ships, ferries, freight vessels, passenger ships, roll-on-roll-off, fishing boats, factory and military ships, etc. (Plaza, Perera and Melón, 2003).

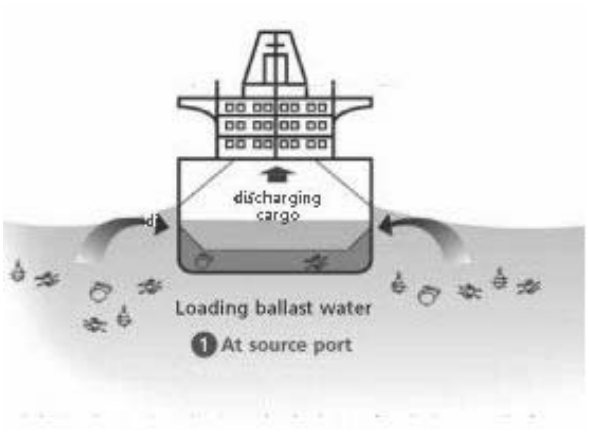
5. POLLUTION

It is estimated that each year approximately 12,000 millions of tonnes of ballast water are transferred all around the world. Depending on the size and the purpose, ships may carry volumes ranging from hundreds of litres up to 100,000 tonnes of ballast water. This water, which is probably collected and pumped into the ballast tanks from the port to which the cargo is delivered, or from its surroundings, may contain aquatic organisms in all their life cycle stages.

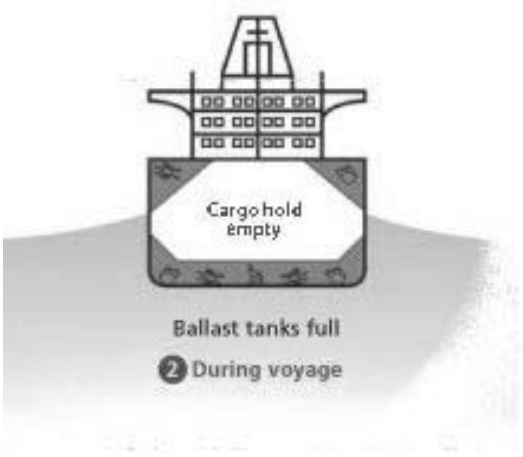
It is believed that, at present, ballast water may be carrying over 5,000 animal and plant species per day all around world. (Zhou, 2002).

The survival rate after discharge depends on the conditions of the receptor area: species coming from zones with similar conditions - particularly as regards salinity and temperature - have a higher probability of survival. Research studies indicate that, generally, less than 3% of the transported species establish themselves in the new regions but provided that one predator fish species is successful, the damage to the local ecosystem could be very severe. (imo.org).

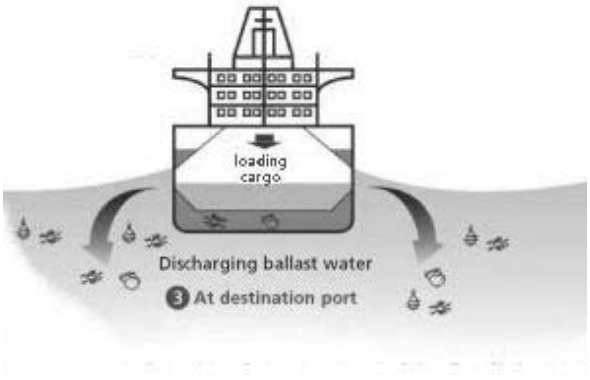
Figure 2. Transfer of micro-organisms in ballast water



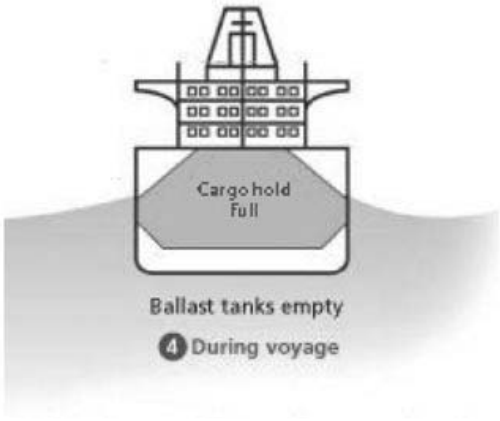
Loading ballast water with micro-organisms



Ballast tanks full during voyage



Discharging ballast water



Ballast tanks empty

6. IMO RECOMMENDATIONS

Over the last decade the International Maritime Organization (IMO) has worked in conjunction with its Member States to confront the problem. The *Guidelines for preventing the introduction of unwanted organisms and pathogens from ships' ballast water and sediment discharges* were first adopted in 1991.

Later, in 1997, the IMO proposed resolution A.868 *Guidelines for the control and management of ships' ballast water to minimize the transfer of harmful aquatic organisms and pathogens*, which was definitively adopted in January 2001. (A.868, 1995).

In the meantime, the United Nations Organization, during the Conference on Environment and Development (UNCED) held in 1992, had asked the IMO to adopt adequate regulations on ballast water discharges to prevent the propagation of non-indigenous species. Furthermore, in its Declaration on Environment and Development,

it proclaimed that the precautionary approach should be widely applied by States according to their capabilities. (IMO/FAO/UNESCO, 1992).

Most recently, the IMO convened an International Conference to be held in February 2004, aiming to adopt a new "International Convention for the control and management of ballast water and discharge sediments".

However, many IMO delegates consider that it is too early to hold this Conference as there are important aspects of the draft that have not been agreed upon by the majority of the delegations. Another reason is that, with the present technology, it is not possible to apply the techniques to eliminate the invasive species in ballast water specified in the draft. In addition, many of the State representatives are people who do not belong to the maritime sector.

Finally, it should be mentioned here that the most important issues on the draft are, first, that the ballast water exchange must be at least 200 nautical miles from the nearest land and in water at least 200m in depth and, secondly, that all ships under the Convention are required to have on board and implement a Ballast Water Management Plan, specific to each ship and approved by the Administration. (OMI, 2004), (Anave, 2003).

Fortunately, it seems that concern over this issue is increasing and there is a growing recognition that we must find solutions to this present-day problem which is already having severe economic and environmental impacts.

7. CONCLUSIONS

1. - There is no current method or technology that can completely prevent the introduction of alien species into port and river waters.
2. - The majority of the existent technologies of ballast water treatment cannot be installed on board without modifying the ship's structural design.
3. - The IMO developed and sent a series of Codes of practice guides and recommendations for minimising the introduction of unwanted aquatic organisms by shipping, that are being used at present. At the moment, the best available option to prevent this is by returning and diluting the ballast water.
4. - A plan of ballast operations, together with the ship load plan, could provide more flexibility when managing ballast water. This would result in an increased control of the situation and the weather as a means to reduce the transfer of unwanted species in ballast water.
5. - The IMO Member States are continuously considering the possibility of an amendment to MARPOL 73/78 by including a new annex. In essence, this annex would make the use of the existent Codes and guides compulsory.
6. - The problem of non-indigenous species' transfer does not only affect the maritime industry but also has implications for society in general.

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APENDICE: CONTAMINACIÓN MARINA POR AGUAS DE LASTRE DE LOS BUQUES

INTRODUCCIÓN

En la actualidad, el transporte marítimo transporta más del 90% de las mercancías y productos a través de las aguas de todo el mundo, lo que le convierte es un elemento indispensable en el comercio internacional.

El lastre se puede definir como todo sólido o líquido colocado en un buque para aumentar su calado, modificar el asiento, regular la estabilidad o mantener las cargas de tensión dentro de unos límites aceptables y de seguridad.

El agua se empezó a utilizar como lastre a partir de 1880, sustituyendo a los materiales sólidos como arena, piedras, ladrillos y piezas de hierro, que era lo que habitualmente se utilizaba hasta entonces. Dicho lastre sólido, en general, no ofrecía peligros zoológicos. Actualmente, el agua, es el elemento más comúnmente utilizado como lastre.

Estas aguas, que los buques transportan en cantidades variables, se cargan en el puerto de partida para ser descargados en el de llegada, a veces a miles de millas de distancia,

provocando con ello la introducción de formas de vida, en diferentes fases, que pueden ocasionar una contaminación zoológica, y que supone un grave riesgo para la subsistencia de las especies vegetales y animales de la zona donde se descargue el agua de lastre.

Cuando los buques empezaron a cargar como lastre miles de toneladas de agua del mar en puertos distanes, empezaron a recogerse inadvertidamente formas de vida locales que luego serían transportadas a nuevas regiones a través de los océanos.

La mayor velocidad y autonomía de los buques contribuyó a que las especies invasoras sobrevivieran más fácilmente a las travesías y llegaran a lugares más remotos, para instalarse en mares que carecen de depredadores naturales.

Los organismos foráneos que se desplazan a través de los océanos aprovechando el agua de lastre de los buques han venido creando importantes problemas para el medio ambiente marino, las instalaciones marítimas y la salud humana.

Entre varios ejemplos cabe citar los siguientes: la introducción del mejillón cebra europeo (*Dreissena polymorpha)* en los Grandes Lagos de Norteamérica, la medusa americana (*Mnemiopsis leidyi*) introducida en el Mar Negro y en el Mar de Azov, o el bacilo *Vibrio cholerae* (agente causal del cólera), que fue transportado desde Asia a las aguas costeras de América Latina.

Expresando el problema en cifras, se calcula que en todo el mundo se transfieren unos 12.000 millones de toneladas de agua de lastre cada año. Cada buque puede transportar desde varios centenares de litros hasta 100.000 toneladas de agua de lastre, según las dimensiones y finalidades del buque. Se estima que, actualmente, el agua de lastre puede transportar más de 5.000 especies de animales y plantas al día, en todo el mundo.

Una de las grandes problemáticas que presenta este tipo de contaminación es que, a diferencia de contaminaciones marinas causadas por el tráfico marítimo, los organismos y las especies marinas exóticas no pueden ser depuradas ni absorbidas por los océanos. Una vez introducidas son casi imposibles de eliminar.

La mejor forma de impedir la propagación de organismos no deseados, es prevenir que se descarguen los tanques de lastre en puertos con aguas zoológicamente diferentes a las del puerto de salida.

La preocupación por este problema es creciente y se insta a la Organización Marítima Internacional (O.M.I.) a que consiga consensuar con las delegaciones una actualización de la normativa existente y completar los vacíos existentes sobre este problema, que afecta gravemente al medio ambiente marino.

METODOLOGÍA

La metodología utilizada en el presenta artículo ha consistido en la consulta de diversa bibliografía, para poder entender correctamente la evolución y estado actual del tema tratado.

Se ha utilizado, además de la bibliografía ordinaria la información disponible en la red, en portales de organismos internacionales solventes. La bibliografía ha sido tanto nacional como internacional.

Finalmente complementamos el artículo con la información más reciente en cuanto a la legislación correspondiente a dicho tema por parte del organismo correspondiente, la OMI.

Después de esta elección metodológica, se efectuó la revisión de los textos, figuras y tabla. Para esta tarea, utilizamos como herramienta fundamental los textos ya seleccionados y a nuestra disposición. Estos nos servirán para dar el alcance verdadero en ambas vertientes, una en aclarar el problema y otra en constatar nuestros puntos de vista y conclusiones. Estas serían, en suma, las características esenciales de esta investigación para que el panorama quede todo lo definido que es posible y dotado de medios técnicos e informativos como instrumentos de primer orden para la creación del presente artículo.

Posteriormente, el análisis del material recopilado, el examen y compresión de los contenidos tanto en el tiempo como en el espacio, configurarían el estudio del contexto. Como en toda revisión, la documentación consultada es el sostén de nuestras opiniones sobre el tema propuesto, llegando finalmente a las conclusiones que culminan este trabajo.

CONCLUSIONES

1. Ningún sistema o práctica utilizada en la actualidad puede evitar totalmente la introducción de especies foráneas en las aguas de puertos y ríos.
2. La mayor parte de las técnicas diseñadas específicamente para el tratado del agua de lastre existentes en la actualidad, requieren una modificación del diseño estructural del buque para poder ser instaladas a bordo.
3. La OMI ha desarrollado y enviado una serie de guías voluntarias que se utilizan en la actualidad. Estas guías nos animan a minimizar la introducción de organismos acuáticos indeseados a través del transporte marítimo. Actualmente, la mejor opción para minimizar esta introducción es el método de relastrado y dilución.
4. El plan de operaciones de lastre de un buque, realizado conjuntamente con el plan de carga del viaje, podría dar mayor flexibilidad a la hora del manejo del agua de lastre. De esta forma, se podría controlar la situación y la hora para minimizar el transporte de especies no deseadas en el agua de lastre.
5. Los estados miembros de la OMI están continuamente sondeando la posibilidad de añadir un anexo al MARPOL 73/78. Esencialmente, este anexo implicaría la obligación de uso de las guías voluntarias existentes.
6. El problema de la transferencia de especies no indígenas tiene implicaciones para toda la sociedad y no afecta solamente a la industria marítima.