

Issue: ***The issue of pollution caused by maritime vehicle fuels and ballast water***

Forum: ***Environmental Commission***

Introduction:

The issue of pollution always has been a problem of mankind since the industrial revolution and the beginning of the use of fossil fuels. But only in the last decades countries became aware of this problem because the consequences of pollution became clear and the climate change progressed. Maritime vehicle fuels are supposed to be responsible for 3.3% of the human-made greenhouse gas emissions. The main reason why pollution caused by maritime vehicles is that heavy is that their engines burn the lowest grade of diesel fuel which is also considered as heavy fuel oil. It is estimated by the International Energy Agency (IEA) that the greenhouse gas emissions caused by marine transportation will increase by at least 50% by 2050. Furthermore pollution caused by ballast water is a big threat to not only various maritime ecosystems but also to human health and country`s economies that partial depend on their natural resources from their coast lines. Pollution caused by maritime vehicles and the use of ballast water is strongly stressing and destroying the marine environment and biodiversity and is furthermore contributing to the proceeding global warming.

What is pollution?

Pollution is the contamination of air, water or soil by substances that are harmful for the environment and its living organisms. Pollution can occur naturally for example trough volcanic eruptions or as a result of human activities such as the spilling of oil or the disposal of industrial waste. In regard to this issue pollution occurs through the use of maritime vehicle fuels that contain a huge amount of toxic substances that are discharged aerielly into the ecosystem through their burning in ship`s engines or directly as a result of oil spills. In case of pollution by ballast water the polluting “substances” are living organisms that are transferred into a foreign ecosystem, as a result of deficient ballast water management during its charging in the source post

and discharging in its destination port, that can cause damaging effects for example for domestic fish species.

Maritime vehicle fuels:

There are three major types of uses of marine vehicles that cause pollution. These are commercial, recreational and military. All these types contribute to emissions but commercial maritime vehicles contribute a large majority of marine emissions. Marine emissions by commercial maritime vehicles is rapidly growing since the last decade as a result of globalization and an increasing maritime transportation demand because of international trade and economic growth. The International Organization for Standardization has divided marine fuels up into six categories which are Marine Gas Oil (MGO), Marine Diesel Oil (MDO), Intermediate Fuel Oil (IFO), Marine Fuel Oil (MFO) and Heavy Fuel Oil (HFO). The most common marine fuels are IFO 180 and IFO 380. IMO 180 is a mixture of 98% residual oil and 2% distillate oil and IMO 380 consists of 88% residual oil and 12% distillate oil.

TABLE 12. Most Common Marine Fuels (Vis 2003, BP 2004, Exxon Mobil Marine 2006, CARB 2005)

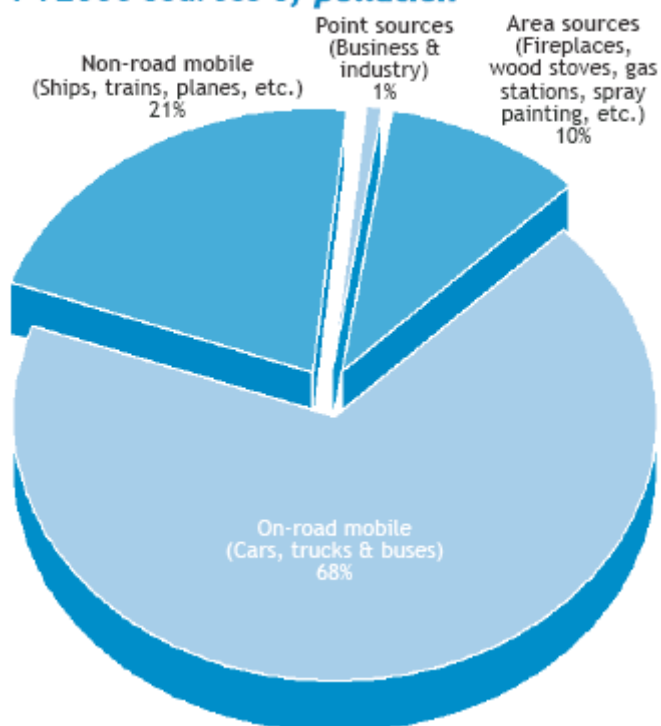
INDUSTRIAL NAME	ISO NAME	COMPOSITION	ISO SPECIFICATION SULFUR WEIGHT %	WORLD AVERAGE
Intermediate Fuel Oil 380 (IFO 380)	MRG35	98% residual oil 2% distillate oil	5%*	2.67%
Intermediate Fuel Oil 180 (IFO 180)	RME 25	88% residual oil 12% distillate oil	5%*	2.67%
Marine Diesel Oil	DMB	Distillate oil with trace of residual oil	2%	0.65%
Marine Gas Oil	DMA	100% distillate oil	1.5%	0.38 %

* IMO regulation capping sulfur at 4.5% supercedes ISO specification

Residual oil is the heaviest fraction of the distillation of crude oil which causes a high viscosity and makes pre-heating and a specific temperature for the storage and pumping necessary why it is only used in large ships. MFO is defiled with metallic remains such as Nickel, Vanadium, Sodium and Calcium and furthermore contains various toxic chemicals which is the reason why maritime vehicles are responsible for 18-30% of all the world's nitrogen oxide (NO₂) pollution and 9% of the global Sulfur oxide (SO₂) pollution. These chemicals are supposed to be cancer and asthma causing. It is estimated that because of this toxic composite a large cruise liner produces as much pollutant as 5 million passenger cars would produce if they would

travel the same distance. Due to its high concentration of Sulfur which is very harmful for the environment the switch from the commonly used marine fuel oils to diesel oil especially close to coastlines and ports can result large emission reductions and would lower the medical risk for humans which arises through the output of toxic CO_2 , SO_x and SO_2 emissions. Because of its drawbacks and the impurity trough water and other substances that are normally not contained in liquid fuels IFO is one of the cheapest liquid fuels on the market which is a reason why it is still used by maritime vehicles since the consume a huge amount of fuel.

FY2006 sources of pollution



Impact of maritime vehicle fuels on the ecosystem and the human health:

Maritime vehicle engines produce toxic gases such as sulfur dioxide SO_2 , nitrogen oxide NO , carbon monoxide CO and carbon dioxide CO_2 . The Environmental Protection Agency (EPA) announces these components of exhaust from maritime vehicle engines as to be likely human carcinogens. Furthermore CO_2 and NO_2 contribute to the appearance of ozone (O_3) which considerably lowers air quality and contributes to the appearance of haze and poses a health risk not only for animals but also for humans, especially in cities near coast lines and with economically

important ports. Due to the high sulfur concentration in maritime vehicle fuels its exhaust triggers acid depositions which lead to acid rain, eutrophication of aquatic systems and the nitrification of water. Experts estimated that in 2008 the daily worldwide emission of NO averaged 97,9 tons and SO₂ emissions 58,1 tons, which is an extensive increase since in 2002 the daily NO and SO₂ emissions only averaged 38,4 and 22,8 tons. They further estimate that the land based emissions will decline in many parts of the world due to emission regulations but in 2020 maritime vehicles will be the main source of air pollution. As already mentioned the by maritime vehicles produced toxic emissions have expansive consequences for the environment and the human health some of the consequences will now be further explained.

NO₂ strongly irritates the lungs and even may cause lasting respiratory illnesses. It further causes acid rain, which is not only harmful for maritime and terrestrial ecosystems but also damages agriculture and thereby causes financial losses, and eutrophication that leads to a dieback of fishes and other species in the concerned regions and effects a further loss of biodiversity. NO₂ is furthermore jointly responsible for the appearance of ozone (O₃) that is responsible for reduced lung functions and is accompanied with symptoms such as coughing, nausea, pulmonary congestion and causes permanent damages in the lungs. SO₂ as well causes respiratory illnesses and furthermore the aggravation of existing cardiovascular diseases. SO₂ is not only harmful for the human body but also for many plants since it damages their foliage and causes the corrosion of buildings and monuments. Also mentioned before was CO, it enters the bloodstream and thereby reduces the oxygen delivery within the body which leads to several physical drawbacks. CO is most serious for people who already suffer from cardiovascular diseases.

Oil pollution:

Yet another aspect of pollution caused by maritime vehicle fuels is the direct oil pollution by oil spills. Even though oil spills occur less frequently than pollution by the daily use of maritime vehicle fuels they have devastating effects. Oil spills may occur due to the onshore or offshore release of crude oil from tankers, offshore platforms, drilling rigs and wells. Oil spills have extensive consequences for the maritime environment and also for the human health. The released oil that causes

the oil spill is very harmful for many sea birds, mammals with heavy fur and species that rely on scent to find their babies or mothers. Because of the heavy scent of oil the mothers cannot find their offspring which means that the offspring dies without the care of the dam. This can cause long lasting damages in populations of endangered



species. When oil accumulates in bird's feathers it damages their ability to fly and to escape from predators and as birds clean their plumage they may partake of the oil which causes fatal damage to their gastrointestinal tract and liver. These birds die an agonizing death even if they are cleaned. Studies have shown that often less than one percent of contaminated birds survive an oil spill. As well as for birds oil has hazardous impacts on mammals. When their fur is clotted with oil it influences its insulating effect and leads to complications with their body temperature. Furthermore oil can blind animals and causes dehydration. Another important aspect is that if microorganisms are contaminated with the damaging substances the released oil contains, these substances enter the food chain and thereby may also be a danger for humans when they consume creatures from the sea that contain these substances.

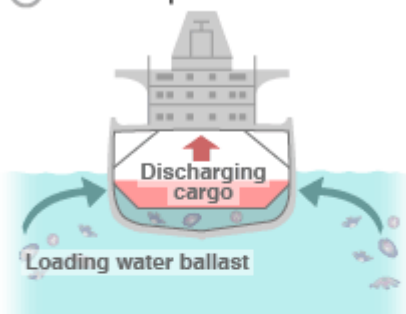
An alarming example for such an oil spill was the Exxon Valdez incident in Alaska in March 1989. An oil tanker ran aground on the Alaskan coast and dumped a massive amount of oil into the ocean. The consequences were immense. Despite efforts of scientists and many volunteer workers over 400,000 seabirds, 1,000 sea otters and a boundless number of fish were killed. This incident shows the immense impact of oil to the marine environment.

What is ballast water?

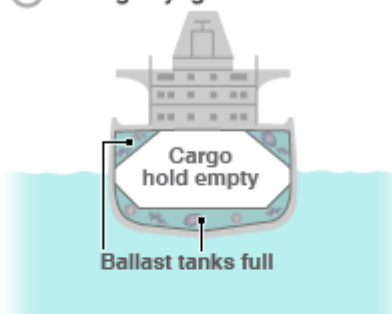
Ballast water is used to compensate a maritime vehicle's change in cargo load, shallow draft conditions or bad weather conditions. It is necessary to maintain ideal buoyancy and handling conditions. When a maritime vehicle has no or just very little cargo but has to travel from one port to another, ballast water is needed to stock up the ballast tanks to ensure the vehicles' balance and stability. While a vehicles' cargo is discharged in its source port the ballast tanks are filled with water from the basin. Now the vehicle's cargo is empty during the voyage and the ballast tanks are filled with water. When the vehicle gets to his destination port the ballast water is discharged while the cargo is loaded. When the cargo is hold full there is no ballast water needed to keep the vehicles' balance. The charged ballast water typically contains a variety of biological materials such as plants, animals, viruses and bacteria. When the ballast water that was charged in the sources port is discharged in the destination port this biological material attains to a foreign biotope. This can cause considerable environmental and economic damages to the marine ecosystem because the alien and often invasive species may have no natural enemies or concurrent species and therefore can spawn uncontrolled and eliminate domestic species.

BALLAST WATER CYCLE

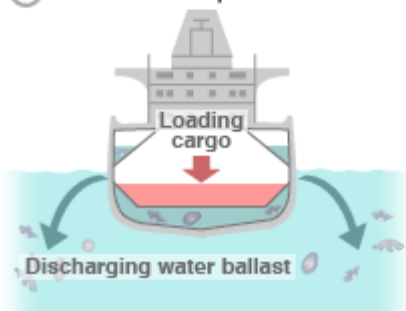
① At source port



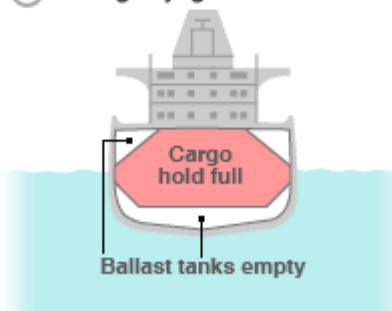
② During voyage



③ At destination port



④ During voyage



SOURCE: GloBallast

Ballast water treatment:

Ballast water treatment systems are inspired by other industrial applications such as waste water treatment systems. There are three basic technologies possible which are often combined within one system. Those technologies are mechanical, physical and chemical. As already mentioned most systems combine these technologies as “Two Phase Treatment Systems” in the first step they use the mechanical technology and in the second step either physical or chemical treatment. Before ballast water treatment systems can enter the market they need to be approved by the IMO and by now there are 29 different approved systems. However, constraints such as availability of space, costs of implementation and the level of environmental friendliness play an important role in the decision of whether implementing or not implementing a ballast water treatment system in one`s maritime vehicle. Another problem is that efficient ballast water treatment systems today do not work as quickly as they should since the charging or discharging of ballast water has to be done during the ship`s cargo is charged or discharged, which happens within only a few hours. Guidelines and rules for the treatment of ballast water are implemented in the IMO`s International Convention for the Control and Management of Ship`s Ballast Water and Sediments and their ballast water treatment plan. But the problem is that this convention hasn`t been ratified and entered into force yet because at least thirty nations that have a combined merchant gross tonnage of 35% of the global tonnage are necessary to ratify the convention. This means that by now ballast water treatment systems are not obligatory for every maritime vehicle and ballast water can be discharged nearly uncontrolled.

Consequences of invasive species from ballast water:

The often in ballast water contained alien species are a threat to the concerned



ecosystem and the local economy. In this case alien species include bacteria, microbes, small invertebrates, eggs, cysts and larvae of various species. If they survive the voyage and do not die due to a lack of oxygen they may establish reproductive populations, become invasive and replace domestic species which means a huge damage to biodiversity and valuable natural riches. An example for such an invasive species is the Zebra Mussel which originally came from the Black Sea in East Europe and was introduced to western and northern Europe, including Ireland, the Baltic Sea and the eastern half of North America. The Zebra Mussel settles all available hard surfaces and displaces domestic aquatic life by manipulating the habitat, ecosystem and food web. It furthermore causes fouling problems on infrastructure such as bridges and maritime vehicles and blocks water intake pipes, sluices and irrigation ditches.

United States Environmental Protection Agency (EPA):

The EPA is an independent agency of the US government to monitor and secure the environment and human health. They were founded by President Nixon on November 2nd 1970 and today employ 17.000 employees. Besides other important issues the EPA has dealt with topics such as pollution in general, marine protection and has introduced various regulations and acts concerning these topics which were besides the comprehensive research they are doing the basis for international policies concerning ballast water and pollution caused by maritime vehicle fuels. Their work covers the education of people concerning environmental issues, publishing information, doing research on environmental issues and furthermore working together with the US government by setting standards for laws that are written by the congress and NGOs to strengthen their work and make the process of improving environmental impacts by maritime vehicle fuels and ballast water more effective.

United Nations International Maritime Organization (IMO):

The IMO is a specialized agency of the United Nations and was established in 1948 and entered into force in 1958 but at that time was named Inter-Governmental

Maritime Consultative Organization. The name was then changed in 1982 in IMO. It has the task to ensure the safety and security of international shipping and the prevention of pollution caused by maritime transportation. The IMO is actively involved in the UNs decision making when it comes to questions concerning the marine environment and international legislations that concern amongst others pollution caused by maritime vehicles and the damages caused by the frivolous use of ballast water. The IMO was responsible for the introduction of the International Convention for the Control and Management of Ship`s Ballast Water and Sediments and will be responsible for the abidance of the set standards and regulations when the convention will enter into force.

Global Investigation of Pollution in the Marine Environment (GIPME):

GIPME was founded in 1974 after the United Nations Conference on the Human Environment held on Stockholm in 1972. It is an international program of scientific investigations concerning marine contamination and pollution. This international cooperative program is mainly co-sponsored by the United Nations Environment Program (UNEP) and works closely together with regional sea programs on monitoring and research on marine pollution.

Joint Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP):

GESAMP is an advisory body of the UN and was established in 1969 and consists of 16 experts. Its task is to advise the UN on the scientific aspects of marine environmental protection trough conducting and supporting marine environmental assessments, undertaking studies and analysis of specific topics. GESAMP is sponsored by nine different UN bodies such as the International Maritime Organization (IMO), United Nations Development Program (UNDP) and World Meteorological Organization (WMO). GESAMP is publishing several reports and documents annually to fulfill their mission which is "To provide authoritative,

independent, interdisciplinary scientific advice to organizations and governments to support the protection and sustainable use of the marine environment”.

Timeline of events

19th century: Introduction of steel hulled vessels that needed the use of ballast water

Steamships gradually replaced sailing ships for commercial shipping

1903: First signs of alien species introduced through the use of ballast water in the North Sea after a mass occurrence of the Asian phytoplankton Algae *Odontella*

1948: The United Nations International Maritime Organization is established

1970s: Scientific community becomes aware of the problem of invasive species introduced through ballast water

1969: GESAMP is established

1970: United States Environmental Protection Agency is established

1973: MARPOL `73 (didn't enter into force due to a lack of signatures)

1978: MARPOL `78 → additional protocol to MARPOL `73

1980s: The United States and Canada have big problems with invasive species in their waters and bring their concern to the attention of IMO's Marine Environment Protection Committee (MEPC).

1982: UN Convention on the Law of the Sea is signed by 117 parties

1983: The combination of MARPOL `73 and `78 entered into force

2004: International Convention for the Control and Management of Ship's Ballast Water and Sediments is introduced (not yet ratified)

List of relevant resolutions and other documents:

- *International Convention for the Prevention of Pollution From Ships "MARPOL"*
(short form for marine pollution)
- *UN Convention on the Law of the Sea*
- MEPC resolution 50(31)
- Resolution A.868(20)
- *International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention)*
- Resolution MEPC.173(58) in October 2008

Helpful links & "how to prepare as a delegate"

<http://www.imo.org/OurWork/Environment/BallastWaterManagement/Documents/Compilation%20of%20relevant%20Guidelines%20and%20guidance%20documents%20-%20June%202014.pdf>

<http://www.c2es.org/docUploads/aviation-and-marine-report-2009.pdf>

<http://www.imo.org/OurWork/Environment/Pages/Default.aspx>

<http://people.hofstra.edu/geotrans/eng/ch8en/conc8en/ch8c1en.html>

<http://maritime.about.com/od/Ports/a/Imo-Ballast-Water-Standards.htm>

<http://maritime.about.com/od/Pollution/tp/Imo-Ballast-Water-Convention-Participating-Nations.htm>

<http://www.rwo.de/rwo/ressources/documents/1/25412,Ballast-Water-Guide-2013.pdf>

Sources

<http://www.brighthubengineering.com/marine-engines-machinery/24522-how-emissions-from-marine-engines-increase-air-pollution/>

<https://people.hofstra.edu/geotrans/eng/ch8en/conc8en/ch8c1en.html>

http://en.wikipedia.org/wiki/Environmental_issues_with_shipping

http://en.wikipedia.org/wiki/Fuel_oil#Maritime

<http://www.c2es.org/docUploads/aviation-and-marine-report-2009.pdf>

<http://www.unep.ch/regionalseas/main/partners/gipme.html>

<http://www.imo.org/OurWork/Environment/BallastWaterManagement/Pages/Default.aspx>

http://dev.ulb.ac.be/ceese/ABC_Impacts/glossary/marinefuels.php

<http://www.marineinsight.com/marine/marine-news/headline/how-ballast-water-treatment-system-works/>

<http://www.google.de/imgres?imgurl=http%3A%2F%2Fseapics.com%2Fassets%2Fpictures%2F099981-450-zebra-mussel.>

http://albeniz.eng.uci.edu/dabdub/My_Reports/R007_ARB_04-752.pdf

Questions the delegate should consider while doing research

Is my country located at a sea/ ocean?

Does my country have economically important harbors?

Is my country`s coastline already suffering from the consequences of ballast water?

Did my country sign the documents that are listed above?

Is my country actively involved in the shipping industry?

What are the local laws concerning this issue of my country?

How does my counties environmental policy look like?

Is the decrease of pollution of importance for my country or does it have other priorities?

I hope that my research report helped you to get an overview about the topic so that you can now start further research and write your position paper and resolution. If you have any questions concerning the issues on the agenda for the Environmental Commission or anything else concerning MUNOH 2014 please feel free to contact me or Frederik!

Please send your position papers/ policy statements as soon as possible to ec@munoh.de because Frederik and I have to review and if needed to correct them before the conference starts.

With best regard Josefine Lambrecht