International Conference on plastics in the marine environment

Introductory note prepared for the conference on plastics in the marine environment summarizing the magnitute of the problem, the impacts and projects aimed at minimizing the amounts of plastics in the ocean.

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1. Introduction

Marine litter is a global problem that originates from human activities on land and sea. It consists of items that have been made or used by people and deliberately discarded or unintentionally lost into the sea and on beaches. According to Greenpeace, it has been estimated that around 80% of all marine debris comes from land-based activities while the remaining 20% originate from ocean-based activities[1]. The land-based sources include poorly managed landfills, riverine transport, untreated sewage and storm water discharges, industrial and manufacturing facilities with inadequate controls, wind-blown debris, recreational use of coastal areas, and tourist activities[2]. Ocean-based sources include poor waste management in shipping and fishing vessel, waste from tourist ferries as well as poorly managed drilling platforms. Plastic debris comes in a wide variety of sizes and compositions and has been found throughout the world's oceans, carried by ocean currents and biological vectors, such as in the stomach contents of fish, mammals and birds. Plastics degrade extremely slowly in the open ocean, partly due to UV absorption by seawater and relatively low temperatures.

In the last century, plastics developed into a strong, long-lived, feasible material. This was followed by a sharp increase in the use of plastics for different purposes. To the food industry, plastic containers are very important to ensure food quality and safety, extend shelf life and reduce food waste. In many industries plastics substituted less perfect and in some cases more toxic materials. In the second half of the 20th century, plastics became one of the most universally-used and multi-purpose materials in the global economy. Today, plastics are utilised in more and more applications and they have become essential to our modern economy. The plastics industry has benefited from 50 years of growth with a year on year expansion of 8.7% from 1950 to 2012. Global production rose to 288 million tonnes in 2012[3]. Plastics now count for between 60-80% of all marine litter[2]. Of this around 10% originate from fishing activities[4]. Analysing marine litter, a strong trend from industrial plastics to consumer plastics has been identified. All types of plastics can be found in the marine environment, although depending on their characteristics they are found at different levels. As some types of plastics are denser (PS, PA, PET) they tend to sink to the seabed while other float on the surface (PE, PP)[5]. Consequently the breakdown of plastic litter differs between types of plastics.

Acronym	Full name	Example of use
PET (PETE)	Polyethylene terephthalate	soda bottles
PES	Polyester	polyester clothing
PE	Polyethylene	plastic bags
HDPE	High-density polyethylene	detergent bottles
PVC	Polyvinyl chloride	plumbing pipes
PP	Polypropylene	drinking straws
PA	Polyamide (aka nylon)	toothbrushes
PS	Polystyrene	take-out food containers

[1] Greenpeace. Plastic Debris in the World's Oceans.
[2] UNEP. 2011. Plastic Debris in the Ocean.
[3] PlasticsEurope. 2013. Plastics – the Facts 2013. An analysis of European latest plastic production, demand and waste data.
4 UBA. 2013. Factsheet 1: Impact of marine litter.
5 NOAA. What we know about: Plastic Marine Debris.

Problems in the marine environment caused by micro-plastics – tiny pieces of plastic or fibers which may act as a pathway for persistent, bio-accumulating and toxic substances entering the food chain – have been gaining increased attention lately. Micro-plastics are one of the degradation products of all plastics and may be small to very small, including just fibers or strands, with a range of compositions. They tend to fall into one of two categories: “primary” micro-plastic resin pellets used in the plastics industry, and in certain applications such as industrial abrasives and skin-care products; and “secondary” micro-plastics resulting from the degradation and breakdown of larger items, including so-called biodegradable plastics[6]. Primary micro-plastics include, for example, industrial spillage of pre-production pellets and powders, microscopic plastic particles that are used as abrasive scrubbers in domestic cleaning products and industrial cleaning applications such as shot blasting of ships and aircraft. Plastic items fragment in the environment because of exposure to UV light and abrasion, such that smaller and smaller particles form. Some plastics are even designed to fragment into small particles, but the resulting material does not necessarily biodegrade. Micro-plastics are known to have accumulated in the water column, on coastal and estuarine shorelines and in sub-tidal sediments worldwide[7].

1.1. Magnitude of the problem

It is close to impossible to estimate how much plastics remain in the marine environment as the redistribution and accumulation differs widely between areas and depth. In 1997, Greenpeace estimated that about 6.4 million tons of waste reached the marine environment on a yearly basis. This number has most likely increased but given that around 70% is plastics, that would leave the total annual amount of plastics being introduced to the ocean at around 4.5 million tons. Numerous estimations exist with numbers as high as 10 million tons[8]. UNEP has suggested that the average of between 13.000 – 18.000 pieces of plastics can be found in each square kilometre (km^2) of sea. The distribution of plastics is however very uneven as it is highly dependent on ocean circulation. Plastics are being carried by ocean currents to a limited number of sub-tropical convergence zones where the plastics accumulate. These high-density zones, also called gyres, have proven to have a concentration of up to 200.000 plastic pieces per square kilometre (km^2). Five areas with very high concentration of plastics have been identified, in the N-Pacific, S-Pacific, N-Atlantic, S-Atlantic as well as in the Indian Ocean (see figure).

[6] IMO. 2013. Experts forge ahead in the global assessment of micro-plastics in the marine environment.
[7] UK Parliament. 2012. Written evidence submitted by Professor Prof. Richard C. Thomson (WQ17).
[8] Plastic change. 2014. Plastic Change.

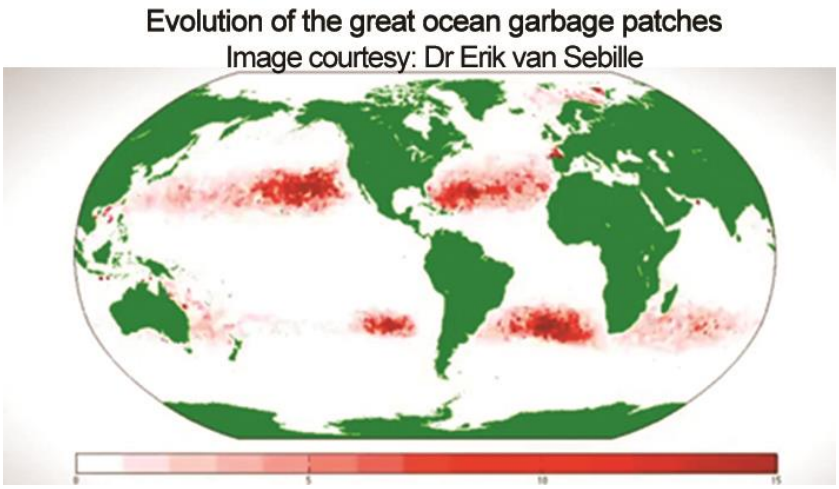

Figure 1: The five plastic gyres. Picture from the Australian Research Council.[9]

1.2. Impacts on environment and society

Ocean plastic debris can have various negative impacts on nature and society. Environmental impacts include mortality or sub-lethal effects on plants and animals through entanglements, captures and entanglement from ghost nets, physical damage and ingestion including uptake of micro-particles (mainly micro-plastics) and the release of associated hazardous chemicals, facilitating the invasion of non-indigenous species, altering benthic community structure. Social impacts include a.o. reduction in aesthetic value and public safety, economic impacts take form e.g. in cost to tourism, damage to vessels, fishing gear and facilities, losses to fishery operations and cleaning costs.[10]

Analysis shows that 663 different species have encountered marine litter. Of these encounters, around 57% are encounters with rope and netting, 11% fragments, 10% packaging, 8% other fishing related litter and 6% micro-plastics. Plastic litter impacts marine ecosystems through ingestion and uptake of plastics by organisms or through entanglement and strangulation. The ingestion of plastics by organisms is of high concern as it provides a channel for hazardous chemicals into the food chain. At the same time plastics break down slowly and thus remains in the food chain. Furthermore, even when plastic material brakes down it still does not disappear. Numerous studies have shown plastics in stomachs of a numerous different species. For example, plastics was found in around 95% of

[9] Australian Research Council. 2013. Tracking the garbage deserts of the ocean.
[10] European Commission. 2011. Commission staff working paper: Relationship between the initial assessment of marine waters and the criteria for good environmental status.

Northern Fulmars sampled in the North Sea and around 56% of planktonic samples from the Mediterranean.[11]

Entanglement and strangulation mostly impacts larger species such as marine mammals, birds and fish. Entanglement and strangulation is to a large extend related to derelict fishing gear and is usually the result of ghost fishing, that is fishing gear that keeps fishing after it is lost. It has been estimated that around 1,254 km of fishing lines is lost at sea on an annual basis. This has been reported to impact shark populations, seals, etc. Additionally, species have been found to confuse plastics with something else, thus the material has been found to be used in bird nests and as substitute for shells.[12]

The impacts on society can include the ingestion of plastics through the food chain. Additionally, nations spend large amounts of time and money on coastal clean-up while at the same time coastal and marine pollution can impact the revenue from tourism. In some cases, plastics in the sea have been reported to cause damage to fishing gear causing increased reparation cost for the industry.[13]

[11] UBA. 2013. Factsheet 1: Impact of marine litter.
[12] UBA. 2013. Factsheet 1: Impact of marine litter.
[13] UBA. 2013. Factsheet 1: Impact of marine litter.

2. Projects and initiatives

Several actors have actively participated in a number of local, national, regional and global initiatives to address the problem of plastic marine debris and to seek realistic solutions. However, in spite of all these initiatives and a number of international conventions, the problem persists and grows even bigger every year. Public awareness seems to be increasing though, and a lot of measures have been developed that definitely may contribute to an improved situation in the coming years. This chapter lists a few promising initiatives of this kind.

2.1. International conference on Prevention and Management of Marine Litter in European Seas

The International conference on prevention and management of marine litter in European seas[14] was held in Berlin, Germany on 10-12th of April 2013. The German Federal Environment Agency (UBA) on behalf of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) and the European Commission DG Environment were co-organizers of the conference. The conference had four aims:

1. To facilitate cooperation between stakeholders in order to stimulate the development of regional action plans.
2. Be the European contribution to the Honolulu strategy
3. Bring existing and planned marine litter initiatives to the attention of a wider audience.
4. Support information exchange between EU member states to ensure a coherent implementation of the Marine Strategy Framework Directive.

The conference was a very valuable initiative not only as a key to the development of strategies to tackle marine litter, but also to provide a summary of material and research available on the problem in Europe. The most important documents in regards to this were the Issue Paper[15] as well as the three factsheets dealing with the impacts[16], the sources[17] and the preventive measures[18]. These documents provide an excellent overview of the situation in European seas along with a comprehensive overview of available literature and research.

2.2. IMO

IMO – the International Maritime Organization – is the United Nations specialized agency with responsibility for the safety and security of shipping and the prevention of marine pollution by ships. IMO is the Administrative Secretariat of the Joint Group of Experts on the Scientific Aspects of

14 UBA. 2013. The International Conference on Prevention and Management of Marine Litter in European Seas.
15 UBA. 2013. Issue Paper to the "International Conference on Prevention and Management of Marine Litter in European Seas".
16 UBA. 2013. Factsheet 1: Impact of marine litter.
17 UBA. 2013. Factsheet 2: Source of marine litter.
18 UBA. 2013. Factsheet 3: Measures for the prevention of marine litter.

Marine Environmental Protection (GESAMP)[19], an advisory body that advises the United Nations (UN) system on the scientific aspects of marine environmental protection. The potential problems of micro-plastics n the marine environment were brought to the attention of GESAMP in 2010.

A working group (WG-40) was formed under the GESAMP to work on the issue of micro-plastics. The working group has completed a draft assessment report, covering the inputs of plastics and micro-plastics into the ocean, from land- and sea-based human activities; the mechanisms and rates of particle degradation and fragmentation; the processes controlling particle transport and accumulation; the interaction of micro-plastics with organisms, and potential physical and chemical impacts; and public perceptions about marine litter in general and micro-plastics in particular. A final global assessment report on micro-plastics in the ocean will be presented at the 2nd International Ocean Research Conference[20] in Barcelona, Spain, in November 2014.[21]

2.3. UNEP's Honolulu strategy

The Honolulu strategy[22] is a framework developed by the United Nation Environmental Programme (UNEP) and the U.S. National Oceanic and Atmospheric Administration (NOAA). It provides nations with tools to work actively with reducing marine litter and its impact on ecology, human health and economy.

The Honolulu strategy is intended for use as a:

- Planning tool for developing or refining spatially or sector-specific marine debris programs and projects
- Common frame of reference for collaboration and sharing of best practices and lessons learned
- Monitoring tool to measure progress across multiple programs and projects.

The framework is not focused on one level of governance in particular but rather works as a provider of common language and focal points that stakeholders within municipalities, nations, regions can work with to establish an action plan.

The Honolulu framework identifies nineteen strategies under the umbrella of the three main goals:

1. reduced amount and impact of **land-based sources of marine debris** introduced into the sea,
2. reduced amount and impact of **sea-based sources of marine debris**, including solid waste; lost cargo; abandoned, lost, or otherwise discarded fishing gear (ALDFG); and abandoned vessels, introduced into the sea,
3. reduced amount and impact of **accumulated marine debris** on shorelines, in benthic habitats, and in pelagic waters.

[19] GESAMP. 2014. Joint group of experts on the scientific aspects of marine environmental protection.
[20] UNESCO. 2005. 2nd International ocean research conference.
[21] IMO. 2013. Experts forge ahead in the global assessment of micro-plastics in the marine environment.
[22] NOAA and UNEP. The Honolulu strategy: A global framework for prevention and management of marine litter.

The strategies themselves are designed to be applicable all over the world regardless of specific conditions or challenges. Along with describing the purpose of the individual strategies, the Honolulu framework offers a set of indicators that can be used to monitor performance. By offering a set of measuring indicators, the framework provides a globally applicable measurement tools which allows for an easier comparison between regions and countries which in its turn enhances and simplifies the global discussion.

2.4. EUs Marine Strategy Framework Directive

European Union's Marine Strategy Framework Directive was adopted on 17 June 2008, came into force on 15 June 2008 and was due to be transposed into national legislation by 15 July 2010. The aim of the directive is to protect more effectively the marine environment across Europe.[23]

According to Article 5 of the directive each member state shall develop a marine strategy for its marine waters.[24] Member states sharing a marine region or subregion shall cooperate to ensure that, within each marine region or subregion, the measures required to achieve the objectives of the directive are coherent and coordinated across the marine region or subregion concerned. Before 15 July 2012 the states were supposed to do an initial assessment of the current environmental status of the waters concerned and the environmental impact of human activities thereon. Simultaneously, good environmental status (GES) for the waters concerned should be determined and a series of environmental targets and associated indicators established with the aim to achieve GES by 2020. By 15 July 2014 the member states should have established and implemented a monitoring programme for ongoing assessment and regular updating of targets, except where otherwise specified in the relevant Community legislation. And by 2015 at the latest, the states should develop a programme of measures designed to achieve or maintain good environmental status.

The Marine Strategy Framework Directive lists four European marine regions – the Baltic Sea, the North-east Atlantic Ocean, the Mediterranean Sea and the Black Sea – located within the geographical boundaries of the existing Regional Sea Conventions. Cooperation between the member states of one marine region and with neighbouring countries which share the same marine waters, is already taking place through these Regional Sea Conventions.

One of the findings of a report from the Commission on the first phase of implementation of the Marine Strategy Framework Directive, published in February 2014, was that marine litter, mostly plastic, is a growing issue in the EU. In the North Sea, over 90% of Fulmar sea birds have plastic in their stomach and on average 712 items of litter are found on 100 m stretch of beach on the Atlantic Coast. The impacts of this increasing problem are manifold, according to the report, and their magnitude not yet fully known.[25]

The EU has initiated a number of activities related to the widespread problem of plastic debris in the ocean, in addition to the development of regional marine strategies.[26] The Commission is e.g. exploring options to set an EU-wide quantitative reduction headline target for marine litter, as called for in the recently-agreed 7th Environment Action Programme. As a first step of this the Commission opened up a public consultation process in October 2013 to collect opinions from citizens and stakeholders on how this problem can best be addressed. The consultation was open until 18 December 2013. Based on the outcome and in conjunction with a review of the targets of the Waste

[23] European Commission Environment. Legislation: The Marine Directive.
[24] European Commission. 2008. DIRECTIVE 2008/56/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive).
[25] European Commission Environment. 2008. Legislation: The Marine Directive. REPORT FROM THE COMMISSION TO THE COUNCIL AND THE EUROPEAN PARLIAMENT. The first phase of implementation of the Marine Strategy Framework Directive (2008/56/EC).
[26] European Commission Environment. Marine and Coast. Descriptor 10: Marine Litter.

Framework Directive, Packaging Directive and Landfill Directive, the Commission aims to develop an initial headline reduction target for marine litter. Such a target could be included in a wider Communication on waste, to be adopted in 2014.[27]

2.5. OSPAR

The Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) noted in the Bergen statement[28] of 2010 that "*…quantities of litter in many areas of the North-East Atlantic are unacceptable, and therefore we will continue to develop reduction measures and targets, taking into consideration an ambitious target resulting in a reduction in 2020*". The commission has therefore been working on a Regional Action Plan for Prevention and Management of Marine Litter in the North-East Atlantic[29]. The Regional Action Plan (RAP) includes the objectives, actions, measuring and monitoring methods and the implementation strategy that the commission will work with to minimize marine litter. As a regional, trans-boundary organisation, the OSPAR provides a good platform for countries in the North-East Atlantic to work with common solutions as marine litter is a global problem. Like the Honolulu framework, the RAP is a way to enhance cooperation throughout the region while providing a common language for further discussion.

After a list of actions were agreed upon in June 2014 OSPAR has been collecting information from contracting parties on persons that should act as task managers and contributors to these actions. It is foreseen that task managers will take initiatives to start work on developing these actions further, so as to make them more concrete and more operational.

2.6. NOAA

The National Oceanic and Atmospheric Administration (NOAA) in USA works actively with the topic of marine litter through its Marine Debris Program[30]. The organisation has been in the forefront of multiple international and national efforts to reduce marine litter as well as supporting and leading research in the field. As already mentioned, NOAA cooperated with UNEP to develop the Honolulu strategy. They've additionally hosted two international research workshops on micro-plastics[31], the last one in 2011. The organisation has an active program on fishing gear with the aim of innovative development of gear that could minimize the loss of gear at sea and the impacts of derelict gear. In addition to their individual projects, the organisation also provides very good basic information about marine litter through the program's homepage.

[27] European Commission Environment. How can we reduce marine litter? Press release 18 October 2013.
[28] OSPAR Commission. 2010. Bergen statement.
[29] OSPAR Commission. 2014. Regional Action Plan for Prevention and Management of Marine Litter in the North-East Atlantic: OSPAR Agreement 2014-1.
[30] NOAA. 2014. Marine debris.
[31] NOAA. 2011. Proceedings of the second research workshop on microplastic marine debris.

2.7. Nordic Projects

The Nordic Council of Ministers (NCM) is the official inter-governmental body for co-operation in the Nordic Region. Nine working groups are operated under the NC of environmental ministers, one of them being the marine group. The group[32] supports the Nordic countries with activities and seeks to fund projects that contribute to build up a scientific basis and create foundation for joints efforts against pollution in the Nordic marine and coastal environments. This also in principle creates a basis for common Nordic initiatives within international work on marine and coastal areas; generates a common knowledge about the state and development of marine pollution in the Nordic countries and their neighbouring areas; and promotes Nordic cooperation within the marine environment.

Examples of ongoing projects funded by the marine group:

- Plastics in fulmars. Research on plastics in the stomach and inner organs of dead fulmars from Shetland, Iceland and Svalbard.
- Marine waste in Nordic waters. Compilation of knowledge on marine litter for further discussions on how the problem can be dealt with within the administration.
- Sewage treatment plants as source for micro-plastics. Research on sewage treatment plants in Finland, Sweden and Iceland.
- Marine littering and its sources in Nordic waters. Project on litter at the beach.
- Conference on plastics in the marine environment. Held in Reykjavík, Iceland on the 24th September 2014.

2.8. Helsinki Commission

HELCOM (Baltic Marine Environment Protection Commission - Helsinki Commission) is the governing body of the Convention on the Protection of the Marine Environment of the Baltic Sea Area,[33] with Denmark, Estonia, the European Union, Finland, Germany, Latvia, Lithuania, Poland, Russia and Sweden as contracting parties. The commission has numerous projects that directly or indirectly deal with measuring and mitigating plastic litter in the Baltic Sea. The work of HELCOM includes a study of Synthetic microfibers and particles at a municipal waste water treatment plant[34] as well as the development of appropriate indicators[35] to monitor marine litter. Furthermore the commission works on the development and implementation of policy measures in the contracting countries in order to ensure the environmental quality of the Baltic Sea.

2.9. Projects in Iceland

Iceland is involved in a number of the projects and cooperation mentioned above. However, only a small part of available research focus on Iceland (or Icelandic waters) in particular. Some individual

[32] NMR. 2014. Havgruppen (HAV).
[33] HELCOM. 2014. Baltic Marine Environment Protection Commission.
[34] HELCOM Base-project. 2014. Synthetic microfibers and particles at a municipal waste water treatment plant.
[35] HELCOM Monas-group 2014. Marine Litter in the Baltic Sea: sources, monitoring approaches, possible common indicators and first lines of thinking on measures: MONAS 20-2014, 5-4.

projects have been carried out, either as parts of bigger regional and international projects or as individual research papers. As a part of an OSPAR strategy, the plastic ingestion by Northern Fulmars in the North-East-Atlantic has been measured. The results for Iceland can be found in a research by Susanne Kühn and Jan A. van Franeker[36] published in the Marine Pollution Bulletin. Anna-Theresa Kienitz did her MSc thesis on the marine debris in the coastal environment at Hornstrandir nature reserve[37]. There she mapped out the marine debris washed up to shore in this area of North-West Iceland.

2.10. NGO‘s and individual initiatives

The magnitude of marine litter and its devastating impact on marine ecosystem have inspired NGO’s and organisations to lobby against increasing plastics in the marine environment. This has mostly been done through education and awareness raising activities, providing research and campaigning for improvements on policy levels. The 5 Gyres organisation[38] actively works with informing and educating people on the magnitude of the five plastic patches in the world oceans. Their work contains research projects that aim at mapping and understanding the problem of plastic marine debris, including expedition where plastic is fished out of the ocean, measured and in some cases the source is identified. The organisation has done research expedition of all the gyres, the latest one being the 2014 North Atlantic Viking Expedition[39] where the amount of plastics between Bermuda and Iceland was measured. Recently the organisation has been working on passing a bill through Californian legislation[40] focused on banning micro-beads from cosmetics and other consumer products.

Further examples include the UK based charity Plastic Oceans[41] which has created one of the many available videos on plastics in the marine environment[42]. The Story-of-stuff project[43] has also addressed the problem through blogs[44], podcasts[45] and videos as a part of their awakening campaign on modern consumption patterns. Other initiative include the Danish NGO Plastic Change[46], the Netherland-based Plastic Soup Foundation[47] and Plastic Pollution Coalition[48]. These are only examples of numerous initiatives concerning plastics in the ocean.

[36] Marine pollution bulletin. 2012. Plastic ingestion by the northen fulmar (Fulmarus glacialis) in Iceland.
[37] University of Akureyri. 2013. Marine debris in the coastal environment of Iceland‘s nature reserve, Horndstrandir – Sources, consequences and prevention measures.
[38] 5 Gyres. 2014. 5 Gyres: For a planet free of plastic pollution.
[39] 5 Gyres. 2014. The 5 Gyres North Atlantic viking gyre expedition.
[40] Ecowatch. 2014. Industry lobby tries to block bill that would protect U.S. waters from plastic microbeads.
[41] Plastic Oceans. 2014. Plastic Oceans.
[42] Youtube: PlasticOcean‘s Channel. 2010. Plastic in our Oceans.
[43] The story off stuff project. 2014. From a movie to a movement.
[44] The story off stuff project. 2014. Choking the oceans with plastic.
[45] The story off stuff project. 2014. Sailing past plastic: Episode 18.
[46] Plastic change. 2014. Plastic change ™.
[47] Plastic soup foundation. 2014. Plastic soup foundation.
[48] Plastic pollution coalition. 2014. Plastic pollution coalition.

2.11. Documentaries

The five plastic gyres or patches, in particular the Great Pacific Garbage Patch (GPGP), have become the focal point of many documentaries and short-films covering plastic pollution. This perhaps as the patches are a great visualisation of human impact on nature. The documentaries, as the NGO's, aim at educating and raising awareness about the severity of the issue. One of the most influential documentary is *Midway* by Chris Jordan[49], but even before the movie was premiered, the trailer had created a strong response due to its very visual presentation of the impacts plastics in the marine environment have on species. Another documentary packed with information is *Garbage Island: An ocean full of plastic*[50] which can be watched in full length on Youtube. Plastic pollution in the marine environment is also addressed in the movie *Message in the waves*[51] where BBC looks at the environmental challenges that Hawaii faces. The short-doc *Plastic Seas*[52] furthermore describes the problem as a catastrophic threat to the future.

Not all documentaries cover the plastic gyres directly. In the movie *Ghosts in the Baltic Sea*[53], Joakim Odelberg explores the ghost nets left by the fishing industry off the coast of Sweden. The movie is funded by the organisation Baltic Sea 2020.

[49] Midway Film. 2012. Midway: Message from the gyre.
[50] Youtube: VICE. 2012. Garbage Island: an ocean full of plastic (part 1/3).
[51] Youtube: abeslogic. 2012. Message in the waves – Plastics in the ocean: FULL VIDEO.
[52] Youtube: Jeneene Chatowsky. 2013. Plastic SEAS.
[53] Youtube: KvarnvikenFilm. 2012. Ghosts in the Baltic Sea.

3. Discussion

Introduction of discussion points to be further introduced at the conference.

- What is the main cause of the problem?
- Where are the biggest problems/loopholes in the current system?
- How does the problem affect the branding of Iceland and the branding of the Nordic countries in general – tourism, fish export, etc.
- What can be done to minimize the amount of plastics in the marine environment
    - What can the industry do?
      (Plastic producers, the fisheries sector, waste management companies, etc.).
    - What can users do? (Professional users and private citizens).
    - What can authorities do?
    - What role can NGO's play?
- Is the problem being dealt with properly at regional/international level?
- How can the problem be dealt with on a regional/international level?
- Are there lessons to be learned from actions taken on other environmental problems?
- Is there further research needed? In that case, in what field?
- Solutions do exist – why are we not applying those? Examples might include:
    - Enhancing development in fishing gear?
    - Limiting or forbidding micro-plastics as ingredients in consumer goods?
    - Improving sewage plants ability to catch micro-plastics?
    - Incinerating sludge from such plants to keep micro-plastics out of the soil?

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