

Bibliographical study for the potential harm caused to the marine environment by items such as cigarette filters/butts, balloons, shotgun wads, cotton buds and bio-film support media. RAP Action 48

2021

Foreword

This work represents a contribution to the work of the Convention for the Protection of the Marine Environment of the North-East Atlantic (the « OSPAR Convention ») in relation to its marine litter objective “to substantially reduce marine litter in the OSPAR Maritime Area to levels where properties and quantities do not cause harm to the marine environment”.

OSPAR 2014 agreed a Regional Action Plan for Marine Litter (RAP ML) for 2014-2021 and is in the process of developing a new RAP that will align with the North East Atlantic Environment Strategy 2020-2030.

The RAP ML (2014-2021) defined the four key areas (themes) of actions to be implemented:

1. Actions to combat sea-based sources
2. Actions to combat land-based sources
3. Removal Actions
4. Education and outreach

The full Regional Action Plan and its outputs can be accessed via <https://www.ospar.org/work-areas/eiha/marine-litter/regional-action-plan>

This document is produced as a contribution to deliver against Action 48 of the RAP ML.

Acknowledgement

This report has been prepared by France as the task lead.

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1. Introduction

This document is produced within the scope of the OSPAR Regional Action Plan on Marine Litter in response to Action 48. The aim of Action 48 is *to evaluate the potential harm caused to the marine environment by items such as cigarette filters, butts, balloons, shotgun wads, cotton buds and bio-film support media.*

Once in the marine environment there are a range of impacts from macro and micro-litter including entanglement, injury and ingestion of litter by wildlife; the colonisation of floating debris by invasive species as well as toxicological effects of hazardous chemicals released by degrading plastics. There are also serious socio-economic implications from the loss of litter via waste management sources, including loss of tourism revenue, increased clean-up costs, particularly for municipalities along the coast and increased navigation hazards at sea. The work undertaken to date within OSPAR aims to collate knowledge from across the OSPAR Contracting Parties and, for two cases, characterise the potential harm.

Indeed, the CleanAtlantic project - and the three partners which are involved in the study: Cedre from France (action leader), Cefas from United Kingdom and Instituto Español de Oceanografía from Spain – developed two documents. These studies have provided a detailed evaluation of two of the items (cigarette butt filters and cotton buds) and resulted in two outputs:

- one on cigarette filters' behaviour, degradation, chemical contamination and toxicity in the marine environment for decision support;
- one on cotton buds' behaviour, degradation and impacts.

This current scoping study aims to gather supplementary information on all of the identified items in the action. The study is based on information submitted by Contracting Parties in response to an OSPAR questionnaire circulated during the summer 2020. The questionnaire aimed to gathering the studies that have been carried out to assess the potential harm caused to the marine environment by items such as cigarette filters/butts, balloons, shotgun wads, cotton buds and bio-film support media. It should be noted that these items are not the only ones to cause harm to the marine environment. In their questionnaire returns, some countries mentioned studies dealing with other items such as plastic bags (Action 44) or microbeads (Action 47). We propose to examine the impacts of these items in section 6 of this document.

Last but not least, this bibliographical study examines envisioned measures suggested by experts and scientists who were referenced to in the OSPAR questionnaire.

Responses to the questionnaire were provided by 11 Contracting Parties: Netherlands, the European Union, Sweden, Denmark, Belgium, the United Kingdom, France, Germany, Ireland, Portugal and Norway.

The highest number of responses was provided for balloons, as well as cigarette filters and butts, with fewer documents providing information on the impacts of cotton buds, shotgun wads and bio-film support media on the marine environment.

2. Balloons and sticks

The main concerns regarding the impacts of balloons and sticks on the marine environment (as well as ribbons and valves) lay within:

- their ingestion;
- the entanglement they can cause;
- their toxicity;
- the transport of persistent organic pollutants;
- the transport of invasive species;
- microbial and chemical contamination;
- chemicals release and microplastics;
- the alteration or modification of assemblages of species.

Six Contracting Parties (Netherlands, the European Union, the United Kingdom, France, Sweden, Germany) responded. In all, nineteen studies were mentioned.

Denmark indicated that, in Denmark, in 2018, approximatively 32.000 balloons filled with helium were released in mass releases where more than 50 balloons are released at one occasion (due to air traffic safety it is mandatory to get a permit if more than 50 balloons are released).

Besides from the impacts of balloons on the marine environment, these studies provide information on their impacts on human health and welfare, consider why balloons ended up in the marine environment, where responsibility lies and possible actions to reduce littering, and

discuss the relevance of biodegradable balloons as well as alternative materials for ribbons and valves.

1) Netherlands

The Netherlands provided information on two relevant studies relating to balloons and sticks.

Title: “Verdiepend onderzoek ballonnen in het mariene milieu” (In depth study on balloons in the marine environment) (2016) by the Netherlands Organisation for Applied Scientific Research (TNO).

Link: <https://www.noordzeeloket.nl/functies-gebruik/@168236/verdiepend-onderzoek/>

Summary: The study focuses on helium balloons made of latex, which are launched in the Netherlands. Sometimes they are equipped with valves, ribbons/ strings, cards and/or Hifloat (substances which makes helium filled latex balloons float longer). [...] The study answers the following questions:

- How many balloons are launched in the Netherlands each year?
- Where do these launched balloons end up?
- What is the biodegradability of latex and Hifloat in the environment?
- What is the environmental impact of balloons in the environment?

How the latex material of a balloon biodegrades depends on the environment in which a balloon ends up. Biodegradation of latex depends, among other things, on oxygen levels, sunlight, temperature, and the presence of microorganisms. [...] Under natural conditions with oxygen available, complete biodegradation in freshwater and sea water takes respectively approximately two, and two to five years. [...] Since it takes time to biodegrade latex balloons, they will be present in the environment for several years. In this study, the impact of the end of life of the balloons (assuming a complete cleanup of all balloons) has been compared to the impact of the rest of the life cycle of a balloon (raw material mining and production process of the balloons). [...]

Risks associated with latex balloons in the environment are accumulation of latex in organisms, and entanglement and suffocation of animals. Limited research has been conducted on entanglement and suffocation caused by balloons in the environment. Based on expert judgement, entanglement and suffocation are mentioned as a risk to environmental damage. The few existing studies into this effect show incidental entanglement and suffocation due to

plastics, but according to these studies the risks are relatively low. These studies have been conducted in relatively easily accessible environments. It is very difficult to conduct these studies in environments which are less accessible, for example the deep-sea. Additional research is necessary to better map the risk of entanglement and suffocation related to balloons. Accumulation of latex and PP in organisms is frequently found. Limited research has been done on how this relates to morbidity or mortality of these animals.

Therefore, no conclusion on the effect of accumulation of latex and PP in organisms can be drawn.

Based on toxicity research of latex condoms, it can be expected that latex balloons are not toxic. However, additives added to the balloons could be toxic. In this study, no information was found on additives in latex balloons (producers of latex balloons also did not provide this information). No specific studies on the toxicity of balloons were found.

Based on the toxicity of PP materials (e.g. plastic clips, baskets and toolboxes), it can be expected that valves and ribbons are not toxic. However, no specific studies on the toxicity of valves and ribbons were found.

Potentially persistent organic pollutants (Pops) could bind to latex balloons, PP valves, and PP ribbons. Too limited research has been done to draw conclusions upon. Future research should provide more insight on this topic.

For latex balloons at this moment, no alternative materials are available with comparable characteristics, lower environmental impacts and/or a higher biodegradability. For ribbons and valves, alternative materials with a higher biodegradability than PP are available. These could be either biobased or fossil based materials. Particularly suitable petroleum based polymers are: polycaprolactone, aliphatic polyesters (e.g. polybutylene succinate, polyfinyl alcohol and (partly hydrolyzed) polyvinyl acetate). The following biobased polymers are also particularly suitable to replace the PP in ribbons and valves: polyhydroxybutyrate, polylactide and starch based materials.”

Title: “Five Small facts about balloon litter” (2015) by J.A. Van Franeker

Link: https://www.wur.nl/upload_mm/5/f/d/b7e1f15e-7841-42bc-9382-01aacedc8d0d_Franeker2015_FiveFactsBalloons_EN-final.pdf

Summary: Animals may become entangled in ribbons preventing normal foraging activity. Animals also mistake balloon debris for food and ingest the material, which may block the stomach or intestines and lead to starvation. Latex rubber, in spite of its natural origin, does not

degrade quickly enough to avoid ingestion by marine wildlife. Balloon latex is described in about 2 percent of the stomachs that have been investigated.

2) European Union

European Union provided information on a Commission staff working document and on a relevant study relating to balloons and sticks.

Title: “Reducing Marine Litter: action on single use plastics and fishing gear” (2018), Commission staff working document - Impact Assessment.

Link: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52018SC0254>

Summary: At page 20, a table (see below) focuses on top 10 items (and among them cigarette butts, balloons, cotton buds sticks) and ranks the impact of each item, from « - » to « +++ », regarding entanglement, ingestion, transport of invasive species... Considering only cigarette butts, cotton buds sticks and balloons, balloons appear to be the item with the most impacts (five) on the marine environment (entanglement “+”, ingestion “+++”, pollution of marine waters “+”, transport of invasive species “+++”, microbial contamination “+++”). Depending on which criterion prevails (the number or the scale of the harmful effects), cigarette butts or balloons should be considered as the most problematic item.

Table 4. Assessment of the impacts of top 10 items

	Entangle ment of marine wildlife	Ingestion by marine animal	Pollution of marine waters (chemicals release, microplastics)	Transport of invasive species (rafting)	Microbial contamina tion	Economic impacts on tourism	Economic impacts on fisheries	Potential human health impacts
Drinks bottles & caps	+	++	+	+++	+++	+++	+	+
Cigarette butts	-	+++	+++	+++	+++	++	++	+
Cotton buds sticks	-	+++	+	+++	+++	++	+	+
Crisp packets	+	+++	+	+++	+++	+++	++	+
Sanitary applications	+	++	++	+++	+++	+++	++	+
Plastic bags	+++	+++	+	+++	+++	+++	+++	+
Cutlery, straws & stirrers	+	+++	+	+++	+++	++	+	+
Drinks cups & lids	+	++	+	+++	+++	+++	+	+
Balloons & sticks	+	+++	+	+++	+++	+	+	+
Food containers	++	++	+	+++	+++	+++	++	+
Fishing gear	+++	++	++	+++	+++	+++	+++	+

Title: “Harm caused by marine litter” (2016), S. Werner *et al.*, Joint Research Centre (JRC).

Link: <https://publications.jrc.ec.europa.eu/repository/bitstream/JRC104308/lbna28317enn.pdf>

Summary: Marine litter can impact organisms at different levels of biological organization and habitats in a number of ways namely: through entanglement in, or ingestion of, litter items by individuals, resulting in death and/or severe suffering; through chemical and microbial transfer; as a vector for transport of biota and by altering or modifying assemblages of species.

3) Sweden

Sweden provided information on three relevant studies relating to balloons and sticks.

Title: “Using expert elicitation to estimate the impacts of plastic pollution on marine wildlife” (2016), by Wilcox *et. al.*

Link: <https://www.sciencedirect.com/science/article/pii/S0308597X15002985>

Summary: The text presents that quantitative predictions of plastic impacts were made for marine species. It stresses that ingestion and entanglement from litter poses bigger risk to marine fauna than chemical contamination. Fishing gear, balloons and plastic bags represent the greatest entanglement threats to marine fauna. The study rated plastic bags and utensils as the greatest ingestion threats for seabirds, turtles and marine mammals.

The text studies three different plastic litter impacts: entanglement, ingestion and contamination.

There were substantial differences among debris types in severity for entanglement. Fishing related items (buoys and rope, monofilament, nets) were the items that caused the most damage, given that an animal interacted with them. However, close behind these three items were balloons and plastic bags. In contrast, there was less difference among items in the expected effects of ingestion on animals. Balloons and plastic bags were expected to have the greatest ingestion impact, followed by monofilament line and plastic utensils. Contamination effects were relatively high for cigarette butts, hard plastic containers, and food utensils. Again, there were fewer differences across contamination in items in comparison with entanglement severity.

Title: “A quantitative analysis linking seabird mortality and marine debris Ingestion” (2019), by L. Roman, B. D. Hardesty¹, M. A. Hindell and C. Wilcox

Link: <https://www.nature.com/articles/s41598-018-36585-9>

Summary: Using cause of death data from 1733 seabirds of 51 species, the authors demonstrate a significant relationship between ingested debris and a debris-ingestion cause of death (dose-response). There is a 20.4% chance of lifetime mortality from ingesting a single debris item, rising to 100% after consuming 93 items. Obstruction of the gastro-intestinal tract is the leading cause of death. Overall, balloons are the highest-risk debris item; 32 times more likely to result in death than ingesting hard plastic. These findings have significant implications for quantifying seabird mortality due to debris ingestion and provide identifiable policy targets aimed to reduce mortality for threatened species worldwide.

Balloons were the marine debris most likely to cause mortality. Where ingestion of balloons or balloon fragments were found, these fragments were the known or probable cause of death in 18.5% of balloon ingesting sea-birds, with the ingestion of a balloon or balloon fragment 32 times more likely to result in death than ingestion of a hard plastic fragment (5 known/probable deaths from 32 balloons ingested). Other studies have highlighted balloons as a high-risk item for ingestion in other taxa. Of particular concern is that seabirds may select for balloons when foraging because of their resemblance to prey, especially squid. All balloons in this study were ingested by species that eat squid, suggesting these squid-feeding species are likely to have higher mortality rates. The authors suggest that reducing the presence of balloons and balloon fragments in the ocean would directly reduce seabird mortalities resulting from marine debris ingestion and would have eliminated the 23% of confirmed marine debris ingestion deaths in this study for which balloons were cause. They propose that the most immediate solution to reduce seabird mortality from anthropogenic marine debris ingestion would be to reduce the amount of marine debris, particularly the number of balloons, entering the ocean.

Title: “To turn off the tap of marine debris: a report on four objects” (2021), by S. Bautista Berrera, the Göteborgs University/ Väst kuststiftelsen.

Link: <https://vastkuststiftelsen.se/wp-content/uploads/2021/06/rapport-om-fyra-foremal-s-bautista.pdf>

Summary: This study focuses on four objects of relevance to the scoping study: balloons and sticks, cotton buds, shotgun wads and biofilm support media. The study considered why the objects ended up in the marine environment, where responsibility lies and possible actions to reduce littering. Balloons are objects so strongly associated with joy that it is almost impossible

to think of them as dangerous. However, balloons are one of the most harmful objects of the marine environment. Among birds studied, balloons were the main cause of death due to blockage of gastrointestinal tract. Balloons or balloon fragments were marine debris which killed almost one in five of the birds that mistaken them for food. Balloons are usually made of latex which is considered a degradable material. However, longevity depends and degradation on weather conditions and surroundings.

The report identifies responsibilities of the producers and authorities to make sure the requirements of the SUP are met and where necessary take further action. The report cites one company in Sweden that is aware of the changes in legislation and will be producing balloon sticks made of other materials such as paper.

4) United Kingdom

The United Kingdom provided information on three relevant studies relating to balloons and sticks, including one which was also mentioned by Sweden (“A quantitative analysis linking seabird mortality and marine debris Ingestion” (2019), by L. Roman, B. D. Hardesty¹, M. A. Hindell and C. Wilcox).

Title: “Defra and the Welsh Government report (2013) : Sky lanterns and helium balloons: an assessment of impacts on livestock and the environment” (2013), published by Moorhouse, Tompkins, Carter and Cao (ADAS Project Team).

Link:

<http://sciencesearch.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=Non e&Completed=0&ProjectID=18402>

Summary: The study found only a limited number of isolated incidents of balloons causing harm to wildlife, and to assess the extent of risk more details of incidents would be required. The main litter types recorded on UK beaches (2008-2015) are fragments of litter, mainly plastic and polystyrene, and food and drinks packaging. Latex balloons are not listed in the top ten litter items.

Title: “Choked, Strangled, Drowned: The Plastic Crisis Unfolding In Our Oceans” (2020), Oceana.

Link: <https://usa.oceana.org/publications/reports/choked-strangled-drowned-plastics-crisis-unfolding-our-oceans>

Summary: In this report, Oceana has compiled for the first time the available data on plastic ingestion and entanglements in marine mammals and sea turtles in U.S. waters, and found records of almost 1,800 animals from 40 different species swallowing plastic or becoming entangled in it (but the animals reflected in this report are far fewer than the true number of sea turtles and marine mammals that consume or become entangled in plastic in U.S. water). The biggest problem found was animals consuming plastic (90% of the cases examined). This happens because animals can mistake plastic for food or inadvertently swallow plastic while feeding or swimming. The result is that it can obstruct their digestion or lacerate their intestines, and all of this can interfere with their ability to feed and obtain the nourishment they need. These problems can lead to an animal's starvation and death. For instance, in 2019, news outlets across the world reported on a beaked whale that died after ingesting more than 88 pounds of plastic. The whale had starved, and its digestive acid, unable to break down the compacted mass filling its stomach, had begun eating away at the animal from the inside out. When animals become entangled in plastic, they can drown, choke to death or suffer physical trauma, such as amputation and infection. Entanglement can also lead to malnutrition when it prevents their ability to feed properly.

Some relevant key findings are :

- Eighty-eight percent of the nearly 1,800 animals were species listed as endangered or threatened with extinction under the Endangered Species Act (which means that plastic pollution can lead to certain species disappearing).
- Plastics affected animals at all life stages, from recently hatched sea turtles to seal mothers with actively nursing pups.
- In the cases where plastic ingestion was the likely cause of or contributor to death, seven involved just one piece of plastic. Plastics ranged in size and type, from microplastics that were perforating the gastrointestinal tract of a baby sea turtle to DVD cases and huge plastic sheets that had been swallowed by whales.
- Bags, balloons, recreational fishing line, sheeting and food wrappers were the most common types of identifiable plastics consumed by these animals.
- Plastic packing straps, bags and balloons with strings were the most common items entangling the animals.

5) France

France mentioned seven studies analyzing the harm caused by balloons, including sticks, to the marine environment.

Titles and links:

- F. Claro & P. Hubert, « Impacts des macro-déchets marins sur les tortues marines en France métropolitaine et d’Outre-mer », (2011) Rapport GTMF-SPN 1. MNHN-SPN, Paris, page 52 : http://www.cestmed.org/wp-content/uploads/2015/01/ClaroHubert_2011.pdf
- F. Dell’Amico & D. Gambaiani, « Bases scientifiques et techniques en vue de l’élaboration d’un objectif de qualité environnementale pour l’impact des déchets sur les tortues marines en Europe » (2013), page 53 and annexes : http://www.cestmed.org/wp-content/uploads/2015/01/DellAmicoGambaiani_20131.pdf
- G. Darmon, C. Miaud, F. Claro, D. Gambaiani, F. Dell’Amico, F. Galgani, « Pertinence des tortues caouannes comme indicateur de densité de déchets en Méditerranée, dans le cadre de la Directive Cadre Stratégie pour le Milieu Marin » (2014), page 32 and annexes : http://www.cestmed.org/wp-content/uploads/2015/01/Darmon_etal_20141.pdf
- G. Darmon, C. Miaud, F. Claro, G. Doremus, F. Galgani, Risk assessment reveals high exposure of sea turtles to marine debris in French Mediterranean and Metropolitan Atlantic waters” (2017), *Deep Sea Research Part II: Tropical Studies in Oceanography* 141: 319-328: <https://archimer.ifremer.fr/doc/00346/45697/45317.pdf>
- G. Darmon, INDICIT consortium, C. Miaud, “Implementation of the indicator of marine litter impacts on sea turtles and biota in RSC and MSFD areas” (2019), page 68, Annexes and Summary: <https://indicit-europa.eu/cms/wp-content/uploads/2020/10/Final-presentation-Final-meeting-2019.pdf>

Summary: These studies conclude that sea turtles (especially *Caretta caretta* and *Dermochelys coriacea*) are considered as bio-indicator of litter ingestion for the OSPAR Convention. The literature reviews indeed report that turtles tend to ingest plastics, one hypothesis being that they confound litter items with their natural preys. Balloons would be confused with jellyfish, one of sea turtle’s preferred prey.

The occurrence of litter ingestion is one of the highest in France at a global scale. Most ingested items are single-use plastics, which are generally difficult to identify. Balloons have already been found from the digestive tracts and the faeces of loggerhead and leatherback turtles collected in the French Atlantic and Mediterranean facades. The impacts of plastics, balloons in particular, on sea turtle's health, are difficult to quantify. If the cases of mortality are few (difficulties to assess the causes of death), the indirect impacts on body condition and satiety are recognized.

Title : G. Darmon, J. Mansui, D. Fromont, J.P. Arnaud, « Etude de faisabilité pour la mise en œuvre d'une surveillance nationale de la distribution et des impacts des macro-déchets sauvages sur le continuum fleuve-mer » Projet RiverSe, page 100 and Annexes

Link : https://hisaproject.org/wp-content/uploads/2021/01/RiverSe-_-Surveillance-Macro-D%C3%A9chets-_-HISA-project-_-2020.pdf

Summary : Balloons are ingested by species, which can also get entangled in balloons ribbons. Ingestion and entanglement are frequently the cause of sub-lethal effects. They can impact growth, the ability to feed, move or protect from predators (lacerations, amputation of a limb, infectious complications...), and therefore in the long term, could affect fertility and the ability to survive. Ingestion of plastic bags and other anthropogenic material can also cause gas and air pockets in the digestive tract, which can lead to problems with flotation and diving ability in sea turtles. This can stimulate a feeling of satiety, but the individual still lacks the energy resources provided by natural food, necessary to ensure its vital needs or its growth. Finally, plastic additives or the pollutants that plastics absorb into the environment interfere with endocrine functions, affect the development of the individual by modifying thyroid and growth hormones, and lead to malformations of the reproductive organs. When plastic becomes microplastics, it can potentially cause damage to the brain and changes in behavior.

Title : INDICIT II consortium, 2021. Implementation of indicators of marine litter impacts on sea turtles and biota in Regional Sea Conventions and Marine Strategy Framework Directive areas. Final report – 1st February 2019 – 31st July 2021.

Link : unpublished

Summary: Evaluating health status and litter impact on health is a challenge which depends on the objective. The parameters to be collected for defining when to release an animal after a stay in rescue centre (eg, feeding behaviour, buoyancy, blood biochemistry, fat reserves, etc.) will not be the same as those used to assess the populations and species' status (survival,

fertility, population structure, etc.). In loggerhead turtles *Caretta caretta*, a common litter impact indicator for the OSPAR area, mortality or sub-lethal impacts are not attributed to a particular type of debris. The ingestion of several or even a single item can lead to death, either due to obstruction (e.g. plastic bag, biomedical filter) or perforation (ex: cotton bud/lollipop stick, fragment of hard plastic) of the digestive tract. However, while over 97% of the mortality is likely to have an anthropogenic origin (e.g., bycatch, propeller), less than 2% of the 1,100 turtles autopsied under the INDICIT project were killed by litter. Rather, litter debris can cause sub-lethal effects, a decrease in body condition that reduces the ability to move and eat, the reproductive capacity and the long-term survival. In living turtles, litter ingestion can cause buoyancy problems due to air pockets in the digestive tract (e.g. bag, balloon). The health status can be assessed by blood tests, which is no longer possible with dead individuals. Among the 1,100 necropsied turtles collected in the framework of the INDICIT project (1988-2009, OSPAR and Barcelona Regional Sea Conventions areas), nearly 70% ingested litter, mainly plastic, on average 1.94 ± 1.26 g or 6.67 ± 0.55 pieces per individual (relative to individual size: 0.1 ± 0.033 g / kg or 0.16 ± 0.013 pieces / cm). No relationship between visual or biometric body condition indices (fat reserve, plastron concavity, body mass or carapace length) and litter ingestion could not be demonstrated. However, all plastics represent more than 38% of the material ingested by the turtles on average. The long-term consequences are difficult to measure. According to simulations from mechanistic models published in the literature (which make the link between energy reserves and expenditures for maintenance, growth, reproduction and survival), this high rate could have very serious consequences on the long term, on growth and reproductive capacities, and could therefore have repercussions on population dynamics. Moreover, the fact of not finding any link between individuals' characteristics and litter ingestion suggests that ingestion is unavoidable due to the omnipresence of litter in the marine environment.

6) Germany

Germany mentioned three studies regarding the harm caused by balloons to the marine environment.

Title: “A quantitative analysis linking seabird mortality and marine debris ingestion” (2019)
by L. Roman, B.D. Hardesty, M.A. Hindell, C. Wilcox

Link: <https://www.nature.com/articles/s41598-018-36585-9>

Summary: Marine debris ingestion is a globally recognized threat to marine biodiversity, yet the relationship between how much debris a bird ingests and mortality remains poorly understood. Hence, the study aims at linking seabird mortality and marine debris ingestion, and ranks balloons as the number one top item posing risk for ingestion in wildlife. There is a 20.4% chance of lifetime mortality from ingesting a single debris item, rising to 100% after consuming 93 items. Obstruction of the gastro-intestinal tract is the leading cause of death. Overall, balloons are the highest-risk debris item; 32 times more likely to result in death than ingesting hard plastic.

Title: “Harm caused by Marine Litter” (2016), by Werner *et al.*

Link: <https://mcc.jrc.ec.europa.eu/documents/201709180716.pdf>

Summary: Fishing related gear, balloons and plastic bags were estimated to pose the greatest entanglement risk to marine fauna. The results of a study commissioned by the United States National Marine Debris Monitoring Program indicated that 32.3 % of beach litter obtained from dedicated cleanups across the United States had the potential to entangle animals. From the nine items which contributed to this total, the five most numerous were plastics bags of less than one meter length, balloons, rope longer than one meter, fishing line and nets.

Title: “Five Small facts about balloon litter” (2015), by J.A. Van Franeker

Link: https://www.wur.nl/upload_mm/8/7/8/008bad55-b0a4-4b85-b770-1aaccfa3626e_5_Fakten_luftballons.pdf

Summary: Debris from balloons represents a danger, because animals may become entangled in ribbons preventing normal foraging activity. Animals also mistake balloon debris for food and ingest the material, which may block the stomach or intestines and lead to starvation. Latex rubber, in spite of its natural origin, does not degrade quickly enough to avoid ingestion by marine wildlife and potential damage to their digestive system. It is impossible to give figures for the number of animals dying from entanglement or ingestion of latex balloon remains. Occasionally, wildlife that died from entanglement or a blocked digestive system is found. At least 2% of fulmar stomachs investigated has remains of balloons.

3. Cigarette filters and butts

The main concerns regarding the impacts of cigarette filters and butts on the marine environment lay within:

- Their toxicity;
- Their degradation into microplastics.

Five Contracting Parties (France, the European Union, Ireland, Belgium, Germany), responded with studies. In all, fourteen studies were mentioned.

Besides from the impacts of cigarette filters and butts on the marine environment, these studies evaluate the current treatment channels and the appropriate conditions of treatment, discuss the biodegradability of cigarette filters made of cellulose and one of them focuses on the situation in Australia (clean-up costs, regulatory response, key policy actors, potential remedies at both the domestic and international levels).

1) France

France provided information on four relevant studies relating to cigarette filters and butts.

Title: “Study of collection and treatment channels for cigarette butts” (2017),
by the National Institute of Industrial Environment and Risks (INERIS).

Link: <https://www.ineris.fr/fr/etude-filieres-collecte-traitement-megots-cigarettes>

Summary: The study classifies butts as hazardous waste. Indeed, the nicotine content leads to the classification of butts under the hazard property 6 (HP 6) which corresponds to an « acute toxicity », while ecotoxicological tests carried out (and which take prevalence) led to the classification of butts under the HP 14 “Ecotoxic”.

Titles and links:

- F. Dell’Amico, D. Gambaiani, « Bases scientifiques et techniques en vue de l’élaboration d’un objectif de qualité environnementale pour l’impact des déchets sur les tortues marines en Europe », page 53 and annexes : http://www.cestmed.org/wp-content/uploads/2015/01/DellAmicoGambaiani_20131.pdf
- G. Darmon, C. Miaud, F. Claro, D. Gambaiana, F. Dell’Amico, F. Galgani , « Pertinence des tortues couannes comme indicateur de densité de déchets en Méditerranée, dans le

cadre de la Directive Cadre Stratégie pour le Milieu Marin », page 32 and annexes : http://www.cestmed.org/wp-content/uploads/2015/01/Darmon_et al_20141.pdf

- G. Darmon, J. Mansui, D. Fromont, J.P. Arnaud, « Etude de faisabilité pour la mise en œuvre d’une surveillance nationale de la distribution et des impacts des macro-déchets sauvages sur le continuum fleuve-mer » Projet RiverSe, page 100 and Annexes : https://hisaproject.org/wp-content/uploads/2021/01/RiverSe_-_Surveillance-Macro-D%C3%A9chets-_HISA-project-_2020.pdf

Summary: These studies conclude that cigarette butts could be ingested by sea turtles, but they are probably disintegrated very quickly in the digestive tract making the chances of identifying such items minimal.

Cigarette butts are also used in nest construction by birds with consequences on individual’s health and even on the environment when butts are still hot. For a species of land bird, cigarette butts in nests promoted immunity and mass growth of chicks, but they also induced genotoxic erythrocyte disorders (decreased genome integrity) in chicks and adults. Furthermore, an experience carried out on an urban population of house sparrows and finches has shown that nests with smoked cigarette filters have less parasites than those with non-smoked cigarette filters. Hence, nicotine could repel parasites. In any case, effects of the contaminants retained in the butts are clearly possible.

The authors propose to authorize only degradable cigarette buds, to distribute pocket ash trays, impose ash trays on bar terraces and to forbid smoking on beaches.

2) Ireland

Ireland provided information on two relevant studies relating to cigarette filters and butts.

Title: “Toxicity of cigarette butts, and their chemical components, to marine and freshwater fish” (2011) by E.Slaughter, R. M. Gersberg, K. Watanabe, J. Rudolph, C. Stransky and T. E. Novotny

Link :

https://www.researchgate.net/publication/51062567_Toxicity_of_cigarette_butts_and_their_chemical_components_to_marine_and_freshwater_fish

Summary: Cigarette butts are the most common form of litter in the world. Thousands of chemicals are present in a cigarette, the residues of which may be found in littered cigarette butts.

Leachate from cigarette butts is acutely toxic to representative marine and freshwater fish species. Leachates from smoked cigarette butts with remnant tobacco were significantly more toxic to fish than the smoked filters alone, but even unsmoked filters exhibited a small level of toxicity.

Title: “A critical review of the issue of cigarette butt pollution in coastal environments” (2019) by M.C. Barbosa de Araujo and M. F. Costa

Link: <https://bit.ly/33d1kq4>

Summary: The longer cigarette butts stay in the environment, the greater the pollution caused. One single cigarette butts can contaminate 1000L of water. Two processes are mainly responsible for cigarette butts impacts in natural environments: the leaching of cigarette butts compounds by rainwater and its transference to water bodies through urban runoff. The main compounds include nicotine, aromatic polycyclic hydrocarbons and metals.

Cigarette butts have been found in the stomach contents of marine fauna (fish, birds, whales) that accidentally ingested them during feeding. Chemicals present in cigarettes can also be harmful to aquatic organisms. Nicotine provokes acute poisoning, palsy of gills, convulsion and death.

Cigarette butts are a pervasive, toxic and recalcitrant type of marine litter that requires urgent attention from manufacturers, users, authorities and the public to prevent the ingestion of cigarette butts by biota and water pollution from its leachate.

3) Belgium

Belgium provided information on four relevant studies relating to cigarette filters and butts.

Title: “Environmental impacts of tobacco product waste: International and Australian policy responses” (2017) by L. A. Wallbank, R. MacKenzie, P.J. Beggs.

Link: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5347528/>

Summary: Discarded cigarette filters contain residue from chemicals used in tobacco cultivation and cigarette production, including pesticides, herbicides, insecticides, fungicides, rodenticides, arsenic, nicotine, polycyclic aromatic hydrocarbons (PAHs), and heavy metals. Cellulose acetate filters are photodegradable but not biodegradable, meaning the source material eventually becomes diluted in water and soil. Arsenic, cadmium, and lead are included on the WHO’s list of 10 chemicals of major public health concern, while PAHs are carcinogenic, mutagenic, and teratogenic and the The US Environmental Protection Agency (EPA) has designated 16 PAHs as priority pollutants.

Unsmoked cigarette filters containing no tobacco, smoked cigarette filters containing no tobacco, and smoked cigarette butts consisting of smoked filters and tobacco, are acutely toxic to marine and freshwater fish. In 2015, researchers in Taiwan reported that embryos of medaka (also known as the Japanese rice fish, *Oryzias latipes*) exposed to low concentrations of leachates from unignited tobacco and filters showed elevated heart rates and accelerated development, while high concentrations resulted in lowered heart rate, suppressed development, and increased mortality. Research conducted into the impact of filter leachates on tide pool snails in Australia found a 100% mortality rate among all species subjected to leachate concentration from five cigarette butts per litre soaked for 2 h, after eight days. Lower concentrations led to species-specific differences in mortality.

Title: “Toxicity of cigarette butts, and their chemical components, to marine and freshwater fish” (2011) by E. Slaughter, R.M. Gersberg, K. Watanabe, J. Rudolph, C. Stransky, T.E. Novotny

Link: <https://pubmed.ncbi.nlm.nih.gov/21504921/>

Summary: The LC50 (Lethal Concentration) for leachate from smoked cigarette butts (smoked filter + tobacco) was approximately one cigarette butt/l for both the marine topsmelt (*Atherinops affinis*) and the freshwater fathead minnow (*Pimephales promelas*). Leachate from smoked cigarette filters (no tobacco), was less toxic, with LC50 values of 1.8 and 4.3 cigarette butts/l, respectively for both fish species. Unsmoked cigarette filters (no tobacco) were also found to be toxic, with LC50 values of 5.1 and 13.5 cigarette butts/l, respectively, for both fish species.

Toxicity of cigarette butt leachate was found to increase from unsmoked cigarette filters (no tobacco) to smoked cigarette filters (no tobacco) to smoked cigarette butts (smoked filter + tobacco).

Title: “Analysis of metals leached from smoked cigarette litter” (2011) by J. W. Moerman and G. E. Potts.

Link: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3088461/>

Summary: All metals (Al, Ba, Cr, Cu, Fe, Pb, Mn, Ni, Sr, Ti and Zn) were detected in leachates 1 day after sample addition and were released at varying rates. No clear relationship between pH within the range typical of precipitation and metal concentration leached was observed.

Based on the gradual release of multiple metals over the full 34-day study period, cigarette litter was found to be a point source for metal contamination. The apparent rapid leaching of other metals may increase the risk of acute harm to local organisms.

Title: “Variation in, and causes of, toxicity of cigarette butts to a cladoceran and microtox” (2006) by T. Micevska, M.S. Warne, F. Pablo, R. Patra.

Link: <https://pubmed.ncbi.nlm.nih.gov/16328625/>

Summary: Cigarette butts are the most numerically frequent form of litter in the world. In Australia alone, 24-32 billion cigarette butts are littered annually. Despite this littering, few studies have been undertaken to explore the toxicity of cigarette butts in aquatic ecosystems. The acute toxicity of 19 filtered cigarette types to *Ceriodaphnia cf. dubia* (48-hr EC50 (immobilization)) and *Vibrio fischeri* (30-min EC50 (bioluminescence)) was determined using leachates from artificially smoked cigarette butts. There was a 2.9- and 8-fold difference in toxicity between the least and most toxic cigarette butts to *C. cf. dubia* and *V. fischeri*, respectively. Overall, *C. cf. dubia* was more inherently sensitive than *V. fischeri* by a factor of approximately 15.4, and the interspecies relationship between *C. cf. dubia* and *V. fischeri* was poor ($R(2) = 0.07$). This poor relationship indicates that toxicity data for cigarette butts for one species could not predict or model the toxicity of cigarette butts to the other species. However, the order of the toxicity of leachates can be predicted. It was determined that organic compounds caused the majority of toxicity in the cigarette butt leachates. Of the 14 organic compounds identified, nicotine and ethylphenol were suspected to be the main causative toxicants. There was a strong relationship between toxicity and tar content and between toxicity and nicotine content for two of the three brands of cigarettes ($R(2) > 0.70$) for *C. cf. dubia* and one brand for *V. fischeri*. However, when the cigarettes were pooled, the relationship was weak ($R(2) < 0.40$) for both test species. Brand affected the toxicity to both species but more so for *V. fischeri*.

4) Germany

Germany provided information on three relevant studies relating to cigarette filters and butts.

Title: “Leverage Points for Reducing Single-Use Plastics” (2017) by C. Sherrington, C. Darrah, S. Watson, J. Winter

Link: <https://www.eunomia.co.uk/reports-tools/leverage-points-for-reducing-single-use-plastics-background-research/>

Summary: Single-use plastics make up on average 49% of beach litter, with cigarette butts being the most littered item in all four European Regional Seas Areas. In the European Union, 580 billion cigarettes are smoked annually. In Germany alone, 106 billion cigarettes are smoked annually. . Slovenia, Belgium, Luxembourg, Czech Republic, Greece, Austria, Estonia, Hungary, Croatia and Cyprus are the 10 countries with the highest annual consumption of cigarettes. 24% of the pollution of the Mediterranean sea, 53% of the pollution of the Baltic sea is due, 14% of the pollution of the North Atlantic and 43% of the pollution of the Black Sea, is due to cigarettes.

Title: “Littered cigarette butts as a source of nicotine in urban waters” (2014) by A.L. Roder Green, A. Putschew & T. Nehls

Link: <https://www.sciencedirect.com/science/article/pii/S0022169414004107>

Summary: This study demonstrates that (i) cigarette butts accumulate in high numbers in urban areas and (ii) the nicotine which is released from such litter poses a significant threat to urban water resources. Cigarette butts are continuously littered into the urban environment, and accumulate in areas where they are not regularly removed by private or municipal actors (e.g. tree pits). Each littered cigarette butt can potentially release nicotine in concentrations higher than the threshold value of hazardous and toxic waste defined by the European Union. Having its nicotine fully released to standing water, only one cigarette butt can contaminate an amount of 1000 L water to concentrations above the predicted no effect concentration (PNEC) of only $2.4 \times 10^{-3} \text{ mg L}^{-1}$.

Title: “Arctic sea ice is an important temporal sink and means of transport for microplastic” (2018) by I. Peeken, S. Primpke, B. Beyer, J. Gütermann, C. Katlein, T. Krumpfen, M. Bergmann, L. Hehemann, G. Gerdt.

Link: <https://www.nature.com/articles/s41467-018-03825-5>

Summary: Conventional cigarette cellulose filters are not made of paper, but cellulose acetate degrading to microplastics, which was detected in Arctic sea ice in 2018.

5) European Union

The European Union provided information on a Commission staff working document relating to cigarette filters and butts.

Title: “Reducing Marine Litter: action on single use plastics and fishing gear” (2018), Commission staff working document - Impact Assessment.

Link : <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52018SC0254>

Summary : At page 20, a table (see below) focuses on top 10 items (and among them cigarette butts, balloons, cotton buds sticks) and ranks the impact of each item, from « - » to « +++ », regarding entanglement, ingestion, transport of invasive species... Even if cigarette butts do not represent a risk of entanglement (contrary to balloons), they are very likely (+++) to being ingested, polluting and contaminating marine waters, as well as to transporting invasive species. Depending on which criterion prevails (the number or the scale of the harmful effects), cigarette butts or balloons should be considered as the most problematic item.

Table 4. Assessment of the impacts of top 10 items

	Entangle ment of marine wildlife	Ingestion by marine animal	Pollution of marine waters (chemicals release, microplastics)	Transport of invasive species (rafting)	Microbial contamina tion	Economic impacts on tourism	Economic impacts on fisheries	Potential human health impacts
Drinks bottles & caps	+	++	+	+++	+++	+++	+	+
Cigarette butts	-	+++	+++	+++	+++	++	++	+
Cotton buds sticks	-	+++	+	+++	+++	++	+	+
Crisp packets	+	+++	+	+++	+++	+++	++	+
Sanitary applications	+	++	++	+++	+++	+++	++	+
Plastic bags	+++	+++	+	+++	+++	+++	+++	+
Cutlery, straws & stirrers	+	+++	+	+++	+++	++	+	+
Drinks cups & lids	+	++	+	+++	+++	+++	+	+
Balloons & sticks	+	+++	+	+++	+++	+	+	+
Food containers	++	++	+	+++	+++	+++	++	+
Fishing gear	+++	++	++	+++	+++	+++	+++	+

4. Cotton buds

The main concerns regarding the impacts of cotton buds on the marine environment lay within:

- Their ingestion;
- Chemicals release and microplastics;
- The transport of invasive species;
- Microbial contamination.

Two Contracting Parties (European Union and France) responded with studies. In all, seven studies were mentioned.

Besides from discussion the impacts of cotton buds on the marine environment, these studies relate more generally to the issue of single-use plastic, and consider the role that the European Union must play in reducing marine litter.

1) France

France provided information on six relevant studies relating to cotton buds.

Titles and links:

- F. Claro and P. Hubert, « Impacts de macro-déchets marins sur les tortues marines en France métropolitaine et d’Outre-mer » in Rapport GTMF-SPN 1. MNHN-SPN, Paris, page 52 : http://www.cestmed.org/wp-content/uploads/2015/01/ClaroHubert_2011.pdf
- Dell’Amico F., Gambaiani D., « Bases scientifiques et techniques en vue de l’élaboration d’un objectif de qualité environnementale pour l’impact des déchets sur les tortues marines en Europe » (2013), page 53 and annexes : http://www.cestmed.org/wp-content/uploads/2015/01/DellAmicoGambaiani_20131.pdf
- Darmon G., Miaud C., Claro F., Gambaiana D., Dell’Amico F., Galgani F., « Pertinence des tortues couannes comme indicateur de densité de déchets en Méditerranée, dans le cadre de la Directive Cadre Stratégie pour le Milieu Marin » (2014), page 32 and annexes : http://www.cestmed.org/wp-content/uploads/2015/01/Darmon_etal_20141.pdf

- Darmon G., Miaud C., Claro F., Doremus G., Galgani F., “Risk assessment reveals high exposure of sea turtles to marine debris in French Mediterranean and Metropolitan Atlantic waters” (2017) *Deep Sea Research Part II: Tropical Studies in Oceanography* 141: 319-328: <https://archimer.ifremer.fr/doc/00346/45697/45317.pdf>
- Darmon G., Miaud C., “Implementation of the indicator of marine litter impacts on sea turtles and biota in RSC and MSFD areas” (2019), page 68, annexes and Summary: <https://op.europa.eu/en/publication-detail/-/publication/4cc3465b-7554-11ea-a07e-01aa75ed71a1/language-en/format-PDF/source-127481647>

Summary: These studies conclude that cotton buds have regularly been found ingested by sea turtles. Cotton buds can be mistaken for lollipop sticks, both items have been found ingested by turtles. If such items have been found both in the digestive tract of necropsied individuals and excreted by living individuals, they could perforate the digestive tract.

Cardboard or biodegradable plastic cotton swabs do not degrade quickly enough to not cause an impact.

Title : INDICIT II consortium, 2021. Implementation of indicators of marine litter impacts on sea turtles and biota in Regional Sea Conventions and Marine Strategy Framework Directive areas. Final report – 1st February 2019 – 31st July 2021.

Link : unpublished

Summary: see above (pages 15-16).

2) European Union

The European Union provided information on a Commission staff working document relevant relating to cotton buds.

Title: “Reducing Marine Litter: action on single use plastics and fishing gear” (2018), Commission staff working document - Impact Assessment.

Link : <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52018SC0254>

Summary : At page 20, a table (see below) focuses on top 10 items (and among them cigarette butts, balloons, cotton buds sticks) and ranks the impact of each item, from « - » to « +++ », regarding entanglement, ingestion, transport of invasive species... Even if cotton buds do not represent a risk of entanglement, they are very likely (+++) to being ingested, to transporting

invasive species and to contaminating marine waters. Moreover, they are likely (+) to polluting marine waters with chemicals and microplastics.

Table 4. Assessment of the impacts of top 10 items

	Entangle ment of marine wildlife	Ingestion by marine animal	Pollution of marine waters (chemicals release, microplastics)	Transport of invasive species (rafting)	Microbial contamina tion	Economic impacts on tourism	Economic impacts on fisheries	Potential human health impacts
Drinks bottles & caps	+	++	+	+++	+++	+++	+	+
Cigarette butts	-	+++	+++	+++	+++	++	++	+
Cotton buds sticks	-	+++	+	+++	+++	++	+	+
Crisp packets	+	+++	+	+++	+++	+++	++	+
Sanitary applications	+	++	++	+++	+++	+++	++	+
Plastic bags	+++	+++	+	+++	+++	+++	+++	+
Cutlery, straws & stirrers	+	+++	+	+++	+++	++	+	+
Drinks cups & lids	+	++	+	+++	+++	+++	+	+
Balloons & sticks	+	+++	+	+++	+++	+	+	+
Food containers	++	++	+	+++	+++	+++	++	+
Fishing gear	+++	++	++	+++	+++	+++	+++	+

5. Shotgun wads

During hunting, shotgun cartridges are used, consisting of two pieces of plastics: a shot shell and a shot wad. The shot wad is needed due to safety, since steel shots cause harm to the gun barrel. The wads that are ejected together with the shots are rarely collected during hunting, as they end up 2040 meters from the shooter. Therefore, the shot wad is left in nature, while it might be ingested by marine species and be a source of microplastic particles and beads. It is for example estimated that shotgun wads accumulate to some 2030 tons of plastics in nature a year in Denmark. In some additional monitoring Jakob Strand did at the Danish beaches during 2019 and 2020, 191 shotgun cartridges were observed, out of these 29% were Shells and 71% were Wads (unpublished data). However, a recent government investigation in Sweden about tax on single use plastic items¹, looked into the issue of littering from shot wads. The investigators concluded that there is too little information available to suggest any measures for

¹ <https://www.regeringen.se/4a2d2b/contentassets/31501c9d8a6343f1a3ff8345a3515dc4/skatt-pa-engangsartiklar-sou-202048.pdf>

shot wads. More information is needed regarding the magnitude of the problem and available alternatives.

Three Contracting Parties (Ireland, the United Kingdom and France) responded. This represents, in all, five studies.

Besides the impacts of shotgun wads on the marine environment, these studies consider why they end up in the marine environment, possible actions to reduce littering, and discuss the use of biodegradable wads.

1) Ireland

Ireland provided information on a relevant study relating to shotgun wads.

Title: “Plastic litter from shotgun ammunition on Danish coastlines - Amounts and provenance” (2018) by N. Kanstrup and T. J.S. Balsby

Link: <https://strandoghavjagt.dk/forum/attachment/1385>

Summary: Shot shells and shot wads can be covered by sediments either at the sea bottom or along the shoreline. They can stay unexposed and unchanged for years. Some items may remain floating for many years and be subject to erosion and become microplastic particles and beads. Any microplastic residues may be ingested by invertebrate life and accumulated in higher trophic level.

Cartridge shells and wads are made from LDPE, though wads, for some types of non-toxic shot, may be produced from high density polyethylene (HDPE). These plastics are not biodegradable under normal environmental conditions. Ultra violet light and other physical impacts stimulate degradation, but even with such exposure breakdown can take hundreds of years. With no exposure such plastic items may persist indefinitely. Collected litter seem to be old and this shows the decomposition rates of this type of litter. A substantial quantity of plastic ammunition litter will expose coastal habitats to a harmful source of pollution for many years to come. The authors recommend that responsible managers, hunters and ammunition manufacturers will take action now to reduce the problem and, thereby, protect ecosystems, wildlife and the sustainability of hunting.

2) United Kingdom

The United Kingdom provided information on a relevant study relating to shotgun wads.

Title: “Plastic Litter from Shotgun Ammunition in Marine Ecosystems – Problems and Solutions” (2021) by N. Kanstrup; N.M. Hansen; B.E. Pallesen; N. Ma; M. Andersen; A.P. Vestbø; L.T. Andersen; P. Sommer-Larsen.

Link: <https://www.preprints.org/manuscript/202105.0218/v1#>

Summary: Parts of shotgun cartridges are a significant source of plastic litter in the marine environment. Empty cartridge shells may not be picked up by the hunter who fired them, and plastic wads that serve to separate the propellant from the shot load, are lost down-range when a shot is fired. Such litter items constitute a cosmetic and aesthetic problem on coastlines and may cause harm to marine animals and in the later stages of decomposition break down into harmful micro plastic particles. There exists no reliable estimate of the global exposure of marine ecosystems to this plastic source. However, in some countries it has been subject to closer examination, including for example Denmark, where the annual contribution of plastic wads into marine systems was estimated to 600,000 pieces (c2 tonnes), and the accumulated density of washed-up items (both wads and shells) was 3.7 items per 100 m coastline.

3) France

France provided information on three relevant studies relating to shotgun wads.

Titles and links:

- F. Dell’Amico, D. Gambaiani, « Bases scientifiques et techniques en vue de l’élaboration d’un objectif de qualité environnementale pour l’impact des déchets sur les tortues marines en Europe », page 53 and annexes : http://www.cestmed.org/wp-content/uploads/2015/01/DellAmicoGambaiani_20131.pdf
- G. Darmon, C. Miaud, F. Claro, D. Gambaiana, F. Dell’Amico, F. Galgani, « Pertinence des tortues couannes comme indicateur de densité de déchets en Méditerranée, dans le cadre de la Directive Cadre Stratégie pour le Milieu Marin », page 32 and annexes : http://www.cestmed.org/wp-content/uploads/2015/01/Darmon_etal_20141.pdf
- G. Darmon, J. Mansui, C. Fromont, J.P. Arnaud, « Etude de faisabilité pour la mise en œuvre d’une surveillance nationale de la distribution et des impacts des macro-déchets

sauvages sur le continuum fleuve-mer » (2019) Projet RiverSe, page 100 and Annexes : https://hisaproject.org/wp-content/uploads/2021/01/RiverSe_-_Surveillance-Macro-D%C3%A9chets_-_HISA-project_-_2020.pdf

Summary: These studies conclude that no shotgun wad, cartridges or related item was found in the faeces of loggerhead turtles managed by French care centres in the Atlantic and Mediterranean facades, nor in the digestive tract of autopsied loggerhead and leatherback turtles. However, shot pellets can be found ingested by animals, as in freshwater birds, possibly confusing them with gravel (literature review 3), p.71).

6. Bio-film support media

Bio-film support media are small plastic washers from 1 to 5 centimeters in diameter. They are used in wastewater treatment plants by multiple industries such as fish farms, food or papermaking industries. Bacteria are to fix on these plastic elements and to be degraded more efficiently. Bio-film media enables to clean the water faster in smaller basins, leading to a less expensive wastewater treatment process. Unfortunately, due to some malfunctioning or unfortunate circumstances, treatments basins may overflow and biomedial flow in the rivers.

Four Contracting Parties (Denmark, Sweden, the United Kingdom, and France) responded with studies. In all, seven studies were mentioned.

According to a Danish project mentioned by Denmark (“Plastic Free Sea/Plastic Free Roskilde Fjord” by Plastic Change, Roskilde University and Aarhus University), biomedial were found on the monitored beaches around Roskilde Fjord in significant amounts. The specific type of biomedial found by the fjord did not seem to stem from WWTPs, but was sold for use in private garden ponds, and there is therefore an imminent probability that the escaped biomedial in the fjord at least partly originated from garden ponds, perhaps both at the dealers themselves and in the private gardens around the fjord. This specific source can be tackled by awareness raising and to mount a fine mesh net on the outlet.

Besides from studying the harmful effects of bio-film support media on the marine environment, the studies provide information on their use and function, consider how it ends up in the marine environment, where responsibility lies and possible actions to reduce littering.

1) Denmark

Denmark provided information on a relevant study relating to bio-film support media.

Title: “Sewage filter media and pollution of the aquatic environment” (2018) by Surfrider Foundation Europe.

Link: <https://surfrider.eu/en/our-missions/scientific-legal-expertise/biomedica-70164.html>

Summary: Large numbers of small plastic cylinders have been found washed up along French coasts since 2008, particularly on beaches in the Bay of Biscay. These objects have been identified as the media used as bacterial biofilm carriers in the wastewater treatment process. Pollution in the form of these plastic cylinders now seems to affect every coastline in the world. Biomedica spread through the environment if they escape from wastewater treatment plants, firstly through freshwater systems and then in the sea. Some of them will end up being washed up on the coast, some- times thousands of kilometers from their source.

Understanding the environmental, weather and water-related factors allow to understand how biomedica spread: they are land-based source transported in waterways and in the marine environment.

Aside from the harm that plastic can potentially cause to marine species (strangulation, entanglement, ingestion, transportation of invasive species) as well as on the sea bed (smothering) and to humans (socioeconomic and physical impacts), plastics also break up into small pieces through exposure to UV light (photodegradation) and mechanical abrasion. Plastics degrade very slowly in the natural environment, and as they do so they also release toxic substances (chemical additives, flame retardants, etc.), which can act as endocrine disruptors, for example. Microplastics can adsorb high concentrations of persistent organic pollutants (POP) such as polychlorobiphenyls (PCBs) and DDT.

2) Sweden

Sweden provided information on a relevant study relating to bio-film support media.

Title: “To turn off the tap for marine debris: a report on four objects” (2021) from Santiago Bautista Berrera, Göteborgs University/ Väst kuststiftelsen.

Link: <https://vastkuststiftelsen.se/wp-content/uploads/2021/06/rapport-om-fyra-foremal-s-bautista.pdf>

Summary: The study provides an introduction to MBBRs (Moving bed biofilm reactors), their use and their function. It goes on to explain reasons for the leakage or release of biofilm support media into the marine environment. The technology is currently used in 55 of the 1700 wastewater treatment plants in Sweden. The study mentions that bio-film support media contaminate the marine environment.

Responsibility for pollution from this media is identified in the report as shared and whilst there are some relevant legislation, enforcement is challenging. The report advises increased emphasis on implementing good practice in facility operation.

In terms of addressing the issue, the report notes low public awareness of this littering problem and a need to increase regulation to hold polluters accountable. Another suggestion made is to mark the support media with codes to enable tracking.

3) United Kingdom

The UK provided information on a relevant study relating to bio-film support media.

Title: “Bio-Bead pollution on our beaches” (2018) by the Cornish Plastic Pollution Coalition.

Link:

http://www.ramepbc.org/CPPC_Biobead_Pollution_on_our_Beaches_2nd_Edition_July_2018.pdf

Summary: This report provides an analysis of sources of bio-bead loss and recommendations for water companies. The toxic additives within the pellets are noted as being harmful to any wildlife consuming them. Research has shown that pellets such as Bio-Beads are frequently consumed by marine wildlife that mistake them for food. Independent tests to analyse adsorbed persistent organic pollutants as well as chemical additives within the plastic structure of the Bio-Beads have both revealed very high levels of hazardous compounds such as polycyclic aromatic hydrocarbons, lead, antimony, bismuth and bromines, which would impact on the health and/ or reproductive capacity of animals eating them

4) France

France provided information on four relevant studies relating to bio-film support media.

Titles and links:

- F. Dell'Amico, D. Gambaiani, « Bases scientifiques et techniques en vue de l'élaboration d'un objectif de qualité environnementale pour l'impact des déchets sur les tortues marines en Europe », page 53 and annexes : http://www.cestmed.org/wp-content/uploads/2015/01/DellAmicoGambaiani_20131.pdf
- G. Darmon, C. Miaud, F. Claro, D. Gambaiana, F. Dell'Amico, F. Galgani F., « Pertinence des tortues couannes comme indicateur de densité de déchets en Méditerranée, dans le cadre de la Directive Cadre Stratégie pour le Milieu Marin », page 32 and annexes : http://www.cestmed.org/wp-content/uploads/2015/01/Darmon_etal_20141.pdf
- G. Darmon, J. Mansui, C. Fromont, J.P. Arnaud, « Etude de faisabilité pour la mise en œuvre d'une surveillance nationale de la distribution et des impacts des macro-déchets sauvages sur le continuum fleuve-mer » (2019) Projet RiverSe, page 100 and Annexes : https://hisaproject.org/wp-content/uploads/2021/01/RiverSe_-_Surveillance-Macro-D%C3%A9chets-_HISA-project_-_2020.pdf

Summary: These studies conclude that bio-film support medias have regularly been found ingested by sea turtles in France. Although the turtle specimens were collected in the French Mediterranean facade, such ingestions would be possible in the Atlantic. For example, the ingestion of a biofilm support media by a loggerhead turtle was noted by a French Mediterranean rescue centre (CestMed) some days after the dysfunction of a wastewater treatment plant on the Tuscan coast. Another biomedias ingested by a turtle in Corsica probably caused the death by suffocation or digestive blockage (media found in the mouth, without food content in the intestines).

Title : INDICIT II consortium, 2021. Implementation of indicators of marine litter impacts on sea turtles and biota in Regional Sea Conventions and Marine Strategy Framework Directive areas. Final report – 1st February 2019 – 31st July 2021.

Link : unpublished

Summary: see above (pages 15-16).

7. Other Items

Other items mentioned by the Contracting Parties are:

- food containers and packaging for sweets, cakes, ice cream and snacks;
- plastic bags, garbage bag handles, plastic strips of decomposed bags;
- bottle caps;
- plastic cups;
- lids for coffee cups;
- stirrers;
- sanitary napkins and finger rinses;
- yogurt pots;
- children's gourds to take away (fruit juice or compote);
- craft-tape from cardboard packaging;
- nylon threads, fragments of nets, lost nets, fishing lines or other fishing litter such as buoys and ropes;
- fireworks;
- dog poo bags.

1) Sweden

Sweden mentioned a government investigation relating to several types of litter due to the food industry.

Title: “Government investigation – Tax on single use items” (2019).

Link:

<https://www.regeringen.se/4a2d2b/contentassets/31501c9d8a6343f1a3ff8345a3515dc4/skatt-pa-engangsartiklar-sou-202048.pdf>

Summary: The text studies the impact of cups for beverage and food containers and packaging for sweets, ice cream and snacks. The investigators make a taxation proposal to reduce single-use plastic items to multiple-use and single-use items in materials other than plastic.

2) Portugal

Portugal mentioned a study relating to plastic bags.

Title:

“Plastic ingestion in oceanic-stage loggerhead sea turtles (*Caretta caretta*) off the North Atlantic subtropical gyre” (2017) by C. Pham, Y. Rodríguez, A. Dauphin, R. Carriço João P.G.L. Frias, F. Vandeperre, V. Otero, M. Santos, H. Martins, A. Bolten and K. Bjørndal, *Marine Pollution Bulletin*.

Link: <https://www.sciencedirect.com/science/article/pii/S0025326X17304885>

Summary: This study reports the ingestion of marine debris by loggerhead turtles in the North Atlantic subtropical gyre where 83% of the animals had ingested plastic fragments such as plastic bags. Large microplastics (1–5 mm) accounts for 25% of the total number.

3) France

France mentioned five studies relating to several types of litter.

Titles and links:

- Dell’Amico F. & Gambaiani D., “Bases scientifiques et techniques en vue de l’élaboration d’un objectif de qualité environnementale pour l’impact des déchets sur les tortues marines en Europe” (2013), page 53 and annexes
- Gambaiani D., Senegas J.B., Claro F., Darmon G., Marobin-Louche D., Poisson F., Four A. (2018). Implication des pêcheurs dans la conservation : Le cas des petits métiers de la zone Nature 2000 Camargue, Poster Fish Forum – Forum on the Fish science in the Mediterranean and Black Sea, Rome, Italy.
- Darmon G., INDICIT consortium, Miaud C., “Implementation of the indicator of marine litter impacts on sea turtles and biota in RSC and MSFD areas” (2019), page 68, Annexes and Summary.
- Darmon G., Mansui J., Fromont C., Arnaud J.P., “Etude de faisabilité pour la mise en œuvre d’une surveillance nationale de la distribution et des impacts des macro-déchets sauvages sur le continuum fleuve-mer” (2019) Projet RiverSe, page 100 and Annexes.

Summary: These studies highlight that various other types of litter are found ingested by loggerhead and leatherback turtles, both indicator species in the OSPAR area (OSPAR Agreement 2020-03). These are mostly plastics, most of which being single-use plastics from

take-out restaurants and picnics. This same litter is collected by fishing nets in the Mediterranean but are probably the same in the Atlantic façade, given the litter found in the digestive system of necropsied turtles.

These items are mainly plastic bags, packaging for cakes or candies, bottle caps, plastic cups, lids for coffee cups, stirrers, flasks like salad dressing to take away. The CESTM also report other litter such as sanitary napkins or finger rinses ingested by leatherback turtles. In their nets, fishermen also very regularly find cups, yogurt pots, children's gourds to take away (fruit juice or compote), craft-tape from cardboard packaging. These items are composed by multi-layer components, such as aluminum and plastic, or braided polymers which decompose into threads. Litter from fishing activities, such as nylon threads and fragments of nets, are also very regularly found ingested, and by compressing the digestive system, they can cause quite serious impacts on the health of individuals. Lost nets, fishing lines, or other fishing litter such as buoys and ropes, also regularly cause entanglements. Filiform litter, such as the garbage bag handles or plastic strips of decomposed bags, are also very regularly been found ingested. They also cause impacts on other taxa, such as birds, who regularly use them in making nests.

Among the measures to be taken, the authors mention to:

- encourage the reusable items (water bottles, bottles for fruit juice or compote), reusable coffee cup (detected by coffee machines),
- work specifically with the catering sector, use table bins,
- encourage drinking tap water,
- use reusable water bottles, provision with bulk water in cisterns with taps,
- set up returnable glass bottles,
- post signs so as not to add waste in the event of overflowing bins, encourage people to always bring their own bin to take away.
- display panels so as to not add waste when bins are overflowing, encourage the use of own bins,
- in parallel with punitive measures, work on awareness,
- include in the programs of clean beaches, and extend to rivers and lands.

Title : INDICIT II consortium, 2021. Implementation of indicators of marine litter impacts on sea turtles and biota in Regional Sea Conventions and Marine Strategy Framework Directive areas. Final report – 1st February 2019 – 31st July 2021.

Link : unpublished

Summary: see above (pages 15-16).

4) Germany

Germany mentioned fireworks and dog poo bags.

4.1 Fireworks

According to the Umweltbundesamt in Germany 30.000-40.000 tons of litter each year is stemming from fireworks, which after firing in many cases end up in the environment uncontrolled and widespread due to the explosive nature of the events.

4.2 Dog poo bags

In Germany, almost 8 million dogs are registered producing around 16 million dog poos daily. It is estimated that more than 500 million single use plastic bags are used to collect the dog poos. The public cleansing service Wilhelmshaven acts on the assumption, that 20 percent of the total bags used are discarded in the environment.

8. Conclusions and envisioned measures

Some conclusions and envisioned measures can already be proposed from the studies mentioned by the OSPAR Contracting Parties:

- **When it comes to pollution due to balloons**, the possibility to ban (especially concerning wish balloons, where a fine can be issued in case of infringements) or regulate (e.g. requirement of an approval at least beforehand) the use or release of these items during social events. Indeed, Denmark has submitted a proposal in HELCOM to ban the mass release of balloons². It has to be noted that taxation is not a suitable measure to decrease balloon litter; information activities or a ban is a better way forward. Besides, balloon sticks could be made of other materials such

2 https://bcc-production-attachments-us-west-1.s3-us-west-1.amazonaws.com/1f816c70-f366-11ea-bc4e-0242ac110002?X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-Credential=AKIAS5PME4CTVEEQXIYT%2F20200915%2Fus-west-1%2Fs3%2Faws4_request&X-Amz-Date=20200915T073932Z&X-Amz-Expires=3600&X-Amz-Signature=317949a0cc24927e1481f5044b7132fcff216262469d525c5293cc8d169a52b1&X-Amz-SignedHeaders=Host&response-content-disposition=inline%3B%20filename%3D%22Ban%20on%20mass%20balloon%20%252850%20ballons%2529%20releases.pdf%22&response-content-type=application%2Fpdf

as paper. It could also be considered to raise awareness (e.g. by registry offices, through citizen initiatives such as ‘Ban a Ballon’ in Netherlands-Belgium) about the environmental impact of the launching of balloons, and the usage of alternatives such as soap bubbles, helium filled foam clouds or seed bombs (AG Landbasierte Einträge des Runden Tisches Meeresmüll 2019).³

- **To address the marine pollution linked to cigarettes filters and butts**, the opportunity to support smoking cessation projects, authorize only degradable cigarette buds (however, the shift to cellulose filters should not exempt users from disposing their waste in appropriate collection systems), distribute pocket ashtrays, impose ash trays on café and restaurant terraces, create more visible ashtrays that would be better placed and empty them more often, forbid smoking on beaches, increase the density of waste bins and decrease the distance between waste bins on beaches. Awareness about the consequences of these items on marine biodiversity (such as carried out by Zakhyntos NP) could also be raised (e.g. through large double-ashtrays asking funny questions⁴) as well as incentives to create behavioral change. More restrictive laws, environmental campaigns and extended producer responsibility schemes could also be applied to tobacco products. For instance, in the UK, at the September roundtable on Smoking Related Litter, Minister Pow asked parties to consider whether a non-regulatory producer responsibility scheme could be developed for tobacco waste products (<https://www.gov.uk/government/publications/defra-engagement-with-the-tobacco-industry-on-litter/smoking-related-litter-roundtable-meeting-2-sep-2020>). UK Government has decided that a regulatory approach may be required to ensure that the industry takes sufficient financial responsibility for the litter created by its products and to prevent them from undermining public health policy. The Environment Bill will allow UK to legislate for extended producer responsibility schemes, which could be applied to tobacco products. Cigarette and tobacco product packaging is already covered by the proposed packaging producer responsibility scheme, which is currently undergoing a second phase of consultation.

When it comes to addressing cigarettes filters and butts pollution, the UK explained that local councils in the UK are responsible for taking enforcement action against littering, including littering of smoking products. At the September roundtable on Smoking Related Litter, Minister Pow asked parties to consider whether a non-regulatory producer responsibility scheme could

3 AG Landbasierte Einträge des Runden Tisches Meeresmüll, UAG „Kommunale Vorgaben und Kontaktstelle „Knotenpunkt plastikfreie Küste“ (September 2019). Handlungsoptionen für Kommunen zur Reduktion des Plastikmüllaufkommens: Sammlung von Best-Practice-Beispielen (https://www.muell-im-meer.de/sites/default/files/2019-10/UAG-KV_Leitfaden-Best-Practice-090919.pdf).

4 *Ibidem*

be developed for tobacco waste products. Notes from this meeting are available at:<https://www.gov.uk/government/publications/defra-engagement-with-the-tobacco-industry-on-litter/smoking-related-litter-roundtable-meeting-2-sep-2020>

UK Government has decided that a regulatory approach may be required to ensure that the industry takes sufficient financial responsibility for the litter created by its products and to prevent them from undermining public health policy. The Environment Bill will allow to legislate for extended producer responsibility schemes, which could be applied to tobacco products. Cigarette and tobacco product packaging is already covered by the proposed packaging producer responsibility scheme, which is currently undergoing a second phase of consultation.

-To tackle pollution from cotton buds, the possibility to encourage the use of alternatives, both reusable and non-single-use, that do not use plastic. They include: U-tips, a cotton bud-like tool made of plastic that can be washed under the tap, other types of make-up tools such as spongetipped applicators and synthetic bristle brushes and craft and cleaning tools (e.g. technical cleaning swabs made of plastic and foam) all of which can be cleaned and washed time and time again. These alternatives could be made more available to the public. In the study mentioned by Sweden “Mapping Plastic Flows in Sweden”, the authors propose several measures to prevent littering from cotton swabs:

- Legislate against plastic cotton swabs so that they disappear from the market. Only allow cotton swabs with a stick of degradable material, such as paper.
- The problem should be tackled upstream, at the source. The amount of cotton swabs thrown in the toilet needs to be minimized. Households need clear information that cotton swabs must not be thrown down the drain. Senders of this information may be, for example, sellers of cotton swabs and water and waste companies. Vendors of cotton swabs should take more responsibility and, for example, more clearly label the packaging with information on where the cotton swab should be thrown.
- Continued conversion of combined pipes to separate pipes for stormwater and wastewater. In the past, it was more common to have common pipes for waste and storm water, and flooding can be a problem there. Nowadays, separate pipes for waste and stormwater are normally built so that only stormwater (which normally does not contain any cotton swabs at all) can be filled.

Water and sewage companies can review how and where to purify overflowed wastewater and how overflows can be reduced.

Regarding the prevention of marine pollution caused by cotton buds, the UK has established the ban on supplying plastic straws and stirrers and plastic-stemmed cotton buds. This ban came into force on Thursday 1 October 2020.

-When it comes to pollution from shotgun wads, hunters could be entitled to retain/retrieve empty shotgun shells during hunting so as to discard them later with their household waste. Regulatory and civil society actions could support such a campaign, for example through implementation of a deposit system for used empty cartridges, as known for other potential waste items e.g. plastic or glass bottles. Hunters and their clubs could also initiate or get actively involved in existing beach clean-up programmes. Wads require a different approach as hunters cannot retrieve wads when hunting. The only way to prevent dispersal of wadplastic is to switch away from plastic to wads made from marine biodegradable or soluble materials that are not harmful in the marine environment. Technology for this is already in place and several products are available on the market and used in a variety of cartridges. Biodegradable alternatives made for example of compressed cardboard already exist, but the degradation still has to be examined. Furthermore, such a ban on nondegradable shot wads should be accompanied by information campaigns on the need for picking up the shotgun ammunition shells. The ammunition shells are easier to collect as they land close to the shooter. Awareness should be risen on the impact of shotgun wads on the marine environment amongst hunters and civil society, in part to increase pressure for voluntary behavior change. Denmark has submitted a proposal in HELCOM to include an action for a ban or phasing-out on non-degradable shot wads and information campaigns targeted hunters.⁵

-Regarding pollution from bio-film support media and microbeads, wastewater treatment plants could have systems in place to collect microbeads and prevent the loss of biofilm support medias. More emphasis could be placed on the implementation of good practices in facility

⁵ https://bcc-production-attachments-us-west-1.s3-us-west-1.amazonaws.com/1ecc1596-f366-11ea-bc4e-0242ac110002?X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-Credential=AKIAS5PME4CTVEEQXIYT%2F20200917%2Fus-west-1%2Fs3%2Faws4_request&X-Amz-Date=20200917T124955Z&X-Amz-Expires=3600&X-Amz-Signature=cbf2d50c9aba1a59b374973af456d753f2c36072fd1233da304125cf72fdcf7a&X-Amz-SignedHeaders=Host&response-content-disposition=inline%3B%20filename%3D%22Ban%20%2528phasing-out%2529%20on%20non-degradable%20shot%20wads%20and%20info%20campaigns%20targeted%20at%20hunters_updated.pdf%22&response-content-type=application%2Fpdf

operation, and regulation increased to hold polluters accountable. Awareness could be risen about this littering problem. Another suggestion that can be made is to mark the support media with codes to enable tracking.

-Last but not least, some Contracting Parties mentioned other items causing harms to the marine environment and proposed several measures to address pollution from plastic items :

- to encourage the use of reusable items (e.g. water bottles or coffee cups);
- to ban single use plastic products such as plastic cutlery and plates; beverage stirrers; straws; food containers and cups made of expanded polystyrene; oxo-degradable products such as carrier bags that fragment to micro fragments; wet wipes and cleaning products;
- to tax single-use items, adopt punitive measures, and that more people raise fines;
- to improve public access to tap water and encourage drinking tap water;
- to develop returnable products, especially on beach areas and event catering;
- to develop and assist beach cleaning events, as well as raising awareness on plastic pollution;
- to improve the organization of waste selection on beaches, and to adopt labels and certificates;
- to extend to rivers and lands the programs of clean beaches;
- to implement systems to collect microbeads in wastewater treatment plants;
- to work specifically with the catering sector, use table bins;
- to post signs so as not to add waste in the event of overflowing bins, encourage people to always bring their own bin to take away;
- to create more visible rubbish bins that would be better placed, and to empty them more often;
- to strengthen social standards, clarify the possibility of getting rid of litter and emphasize personal responsibility, for example by informing and advertising with messages that strengthen social norms (e.g. sense of participation, ownership and commitment), engage voices and channels that are specifically aimed at young people (e.g. Youtubers and influencers).

-Concerning pollution from fireworks, measures taken and envisaged could include bans especially close to protected areas, central fireworks in distance to aquatic systems, laser and light shows as alternatives and timely clean-ups after events.⁶

-As for pollution from dog poo bags, measures could include the provision of colourful bags to prevent littering, higher density of waste bins, fines and cautions (e.g. by public waste watchers) and awareness raising in dog owners.⁷

Additional issues considered by the German Round Table on Marine Litter in a published best-practice-guide for municipalities to reduce the emergence of plastic waste are:

- Returnable systems in beach and event catering;
- Unpacked solutions;
- Improved organisation of waste selection on beaches;
- Yellow bins instead of yellow bags;
- Certificates and labels;
- Improvements in public provisioning;
- Assistance in clean-ups;
- Cooperations.

The guide is currently being translated to English and will be available in autumn 2021.

See: AG Landbasierte Einträge des Runden Tisches Meeresmüll, UAG „Kommunale Vorgaben und Kontaktstelle „Knotenpunkt plastikfreie Küste“ (September 2019). Handlungsoptionen für Kommunen zur Reduktion des Plastikmüllaufkommens: Sammlung von Best-Practice-Beispielen (https://www.muell-im-meer.de/sites/default/files/2019-10/UAG-KV_Leitfaden-Best-Practice-090919.pdf).

⁶ https://www.muell-im-meer.de/sites/default/files/2019-10/UAG-KV_Leitfaden-Best-Practice-090919.pdf

⁷ *Ibid.*