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Executive Summary

The use of Single-Used Plastics (SUP) in Mallorca's hospitality sector is an enormous threat to the Balearic sea. To reduce SUPs, a large number of stakeholders need to be involved. This implies stimulating awareness and responsibility of SUPs by the hospitality sector and tourists, support for changing regulations at various levels in the EU, and overcoming the challenges presented by SUP reduction. For our commissioner, Oceana, the implementation of Plastic Free Zones (PFZs) to prevent plastic from entering the ocean have been explored. PFZs are defined here as areas where SUPs are highly restricted or completely eliminated. The zones serve to form a proof of concept whereby SUP is reduced with minimum drawbacks. The COVID-19 pandemic has stretched the tourism industry to its limits. Health and safety procedures have substantially increased the hospitality sectors' dependence on SUPs. The subsequent economic recession introduces novel challenges in the reduction of SUPs, whilst simultaneously offering a unique opportunity for a sustainable recovery.

1. Marine environment around Mallorca

Receiving almost 12 million visitors in 2018, the hospitality sector on Mallorca is of vital economic importance to the local population. The downside of this massive stream of tourists is the footprint they leave behind on the natural environment of Mallorca and its surrounding waters. Mallorca is highly dependent on resources provided by the sea. All six of Mallorcas coastal and marine ecosystems are impacted by plastic pollution. The most important ecosystem services for Mallorca are cultural services, which includes tourism. Revenue from tourism is affected the hardest by plastic pollution, mainly due to less visitors because of polluted beaches and increased clean-up costs. Entanglement and ingestion of plastics affect various animal species such as marine mammals, reptiles, fish, and seabirds. SUPs enter the marine environment in different ways. They can stem from Mallorca itself, through beach littering and heavy rains, or from other Mediterranean coastal locations, from surface currents and wind. As a result of oceanographic patterns, the highest amounts of plastics collected were on the North-West coasts of Mallorca and Ibiza. The majority of SUPs are composed of microplastics, and polyethylene is the most common plastic polymer found in the Balearic sea.

The success of Mallorca as a tourist destination has contributed to the environmental degradation of its coastal ecosystems caused by SUP, the very same ecosystems that support tourism on the island. As an international problem, the solution does not lie solely with Mallorca to reduce its SUP pollution. Nonetheless, Mallorca should empower itself as it attempts to become a global frontrunner in plastic reduction.

2. Awareness and responsibilities of stakeholders

A network of stakeholders is responsible for the contribution of marine plastic pollution on the Mallorcan coast and sea. The connection between actors such as the government, NGOs, tourism industry and tourists determine possible collaborations for Oceana. Various levels of government have already implemented SUP regulations, most notably Ley 8/2019 of the Balearic Islands. However, monitoring the application of these policy instruments is difficult. Hotel establishments in Mallorca have already begun implementing efficient practices in reducing SUP voluntarily. This behaviour should be encouraged and upscaled. Various measures for SUP reduction are important, such as directly banning, replacing or reducing SUPs, and measures such as

preparing a SUP-free environment by training staff and raising tourists' awareness. The disadvantages of these measures are mostly perceived by the hotel managers as expensive and bad for business. On the contrary, hotels which have already implemented these measures have reported cost savings and minimal effects on guest experience. Reports of successful measures can be useful for future guidelines and recommendations for hotels' implementation of PFZs.

Firstly, convincing the hotels in Mallorca to reduce their SUP use by highlighting the benefits and the wrongly perceived disadvantages is the biggest challenge. Secondly, tourists' awareness and responsibility remain the key factors that will motivate hotels to set the measures needed to act upon the plastic issue in Mallorca. Finally, providing hotels with the knowledge on how to reduce their SUP usage is a fundamental step towards encouraging effective SUP reduction.

3. Plastic-Free Zones

Implementing PFZs is expected to bring hurdles at both hotel and governmental levels. The implementation is considered costly and time-consuming. Plastic alternatives can be used in PFZs, which have different benefits and inadequacies. Furthermore, there is insufficient knowledge regarding alternatives and a lack of incentives for waste separation. There are various guidelines that can serve as inspiration for PFZs and are presented as a stepwise approach to reduce SUPs. They include eliminating unnecessary plastic, reuse models, using 100% recyclable or compostable plastics, sorting and recycling of all plastics, and the integration of staff and guests to spur collective action. A challenge that remains is the increased SUP use caused by the health and safety measures of the COVID-19 pandemic. Furthermore, hotels are currently more focused on financial recovery than on reducing SUP use.

Given the available alternatives for SUPs and the guidelines to reduce SUP in hotels, the concept of PFZs is feasible to implement in the hospitality sector in Mallorca. Thus, the industry's and government's will to implement these measures is what is required the most.

Based on the findings of this research, three key **recommendations** are put forward:

1. Create a tool kit for hotels to either start or further develop their SUP reduction efforts. This tool kit should focus on several aspects. First, the best practices necessary for the implementation of PFZs. Secondly, SUP reduction measures should be easily implementable. Thirdly, this tool kit should focus on the education and integration of staff. Finally, the benefits of SUP reduction should be emphasized in the light of the COVID-19 pandemic to dampen the dramatic increase of SUP as a direct consequence of the crisis.

2. Education & Public Campaigns are important to reduce SUPs. For a successful public campaign, it is important to focus on fostering responsibility by emphasizing the importance of the issue and tailoring the campaign towards specific nationalities. The campaigns should also attempt to balance empathy and facts to not overload individuals with information.

3. Improve stakeholder collaboration to increase bargaining power and integrate existing knowledge. It is possible to collaborate with policy makers, the hotel industry, local communities, other NGOs on the island, and scholars.

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Acronyms

CoM	Counsell of Mallorca (the island's council)
CPUE	Catch Per Unit Effort
CSR	Corporate Social Responsibility
DMO	Destination Management Organisation
EIA	Environmental Impact Assessment
EU	European Union
FMT	Fundació Mallorca Turisme
GDP	Gross Domestic Product
GTPI	Global Tourism Plastic Initiative
HDPE	High-Density Polyethylene
LDPE	Low-Density Polyethylene
MFA	Material Flow Analysis
NGO	Non-Governmental Organisation
NPAP	National Plastic Action Partnership
PCB	Polychlorobiphenyl
PET	Polyethylene Terephthalate
PFZ(s)	Plastic-Free Zone(s)
PP	Polypropylene
PS	Polystyrene
SARS	Severe Acute Respiratory Syndrome
SOCIB	Balearic Islands Coastal Observing and Forecasting System
SUP(s)	Single-Use Plastic(s)
UNWTO	United Nations World Tourism Organisation
WTP	Willingness To Pay
WWF	World Wide Fund for Nature

Interview Table

Code	Description	Date
BUS-1	Corporate Responsiblity Manager Large hotel chain	29-05-2020
BUS-2	Head of Policy and Sustainability Plastic Energy	02-06-2020
BUS-3	Project Manager MVO Nederland	04-06-2020
BUS-4	Sustainability and Circular Economy Department TIRME	05-06-2020
BUS-5	Founder/CEO & Sustainable Tourism Consultant Sea Going Green	09-06-2020
BUS-6	CEO Acqualife Dive Center Mallorca	via E-mail
BUS-7	CEO Travel without Plastic	18-06-2020
GOV-1	Waste Management Director Government of the Balearic Islands	03-06-2020
GOV-2	Waste Management Service Council of Mallorca (CoM)	19-06-2020
NGO-1	Director of Science La Asociación TURSIOPS (TURSIOPS)	03-06-2020
NGO-2	Founder Cleanwave	05-06-2020
NGO-3	Senior Marine Scientist Oceana	05-06-2020
NGO-4	Founder and CEO TODARUS	05-06-2020
NGO-5	Co-founder Save the Med Foundation	10-06-2020
UNI-1	Marine Scientist Universitat de les Illes Balears	29-05-2020
UNI-2	Senior lecturer University of South Australia	29-05-2020
UNI-3	Professor Wageningen University and Research	29-05-2020
UNI-4	Professor Wakayama University	03-06-2020
UNI-5	Professor The Hong Kong Polytechnic University	06-06-2020
UNI-6	Assistant Professor Universitat de les Illes Balears	08-06-2020
UNI-7	Post-doctoral Researcher Universitat de les Illes Balears	09-06-2020
UNI-8	Senior Lecturer Northumbria University- Newcastle	12-06-2020
RO-1	Policy specialist for Global Plastic Action Partnership World Resources Institute	05-06-2020
RO-2	Post-doctoral Researcher Balearic Islands Coastal Observing and Forecasting System (SOCIB)	11-06-2020

Introduction

As the largest of the Balearic Islands, located in the warm water of the Balearic Sea and with an average of 300 sunny days per year, Mallorca is a popular tourist destination (Lonely Planet, 2020). In 2018, the island received almost 12 million visitors (Balearic Tourist Agency, 2018), hence the hospitality sector is of vital economic importance to the local population. However, the downside of this massive stream of tourists is the environmental footprint, which negatively impacts the natural environment of Mallorca and the surrounding sea. The hospitality sector contributes heavily to the waste ending up in the ocean, of which a large part consists of plastics (Worm et al., 2017). Yet, this is only what is visible on land, as waste in deep waters is more difficult to determine (See Annex 1). Single-use plastic (SUP) is particularly problematic as it can cause damage to habitats and various species, while also leaking toxic substances into the water (See Annex 2). Tourists are a major factor contributing to plastic pollution. It is a problem that tourists generally have the intention to behave environmentally friendly on holidays, but do not always act accordingly (See Annex 3). Above all, the problem of plastics is exasperated by the current COVID-19 pandemic. However, this pandemic also creates a unique opportunity for further progress of SUP reduction on Mallorca (See Annex 5). This being said, the Balearic Islands already have a plastic reduction strategy in place set to commence in 2021 (See Annex 4).

Oceana Foundation has already been working to protect marine areas around Spain and is now working on decreasing the amount of SUP reaching the sea. This NGO aims to enhance the state of oceans and seas surrounding Europe, by introducing policy changes that target the most prominent problems impacting the marine environment. To achieve this, Oceana wishes to advance the idea of plastic-free zones (PFZs) as a way for the hospitality sector to reduce its SUP use. Therefore, the objective of this consultancy project is to better understand the impact and use of SUPs in the hospitality sector on Mallorca and the feasibility of PFZs, in consideration of the current COVID-19 situation. The overarching goal is to provide key recommendations on how to reduce the number of SUPs used in the hospitality sector on Mallorca. Specifically, recommendations will focus on improving networking, tips for future campaigns, and policy changes. To be able to formulate these recommendations, an analysis was done on five different subjects: Material flow, Environmental impact, Environmental consumer behaviour, Policy & best practice and Sustainable recovery post-COVID-19. Additional information and results of these expert reports can be found in the Annexes.

Based on the analysis of the five subjects, three major themes emerged as crucial aspects. The findings of the analysis of the themes are presented in this report and include:

Balearic Sea (Chapter 1)

Describes the various effects plastic has on the marine environment and on different other sectors, such as the fishing and tourism industries. The way plastics eventually end up in the sea is also mentioned

SUP Awareness (Chapter 2)

Gives the different possible actors involved in the reduction of SUPs and corresponding responsibilities. Describes the current situation in terms of SUP reducing measures that are already being undertaken.

Plastic-Free Zones (Chapter 3)

Gives the definition of PFZs, outlines possibilities for the implementation of PFZs and describes the possible challenges.

This consultancy project took place over a period of eight weeks. The COVID-19 pandemic has shaped the data collection as direct observations and onsite interviews were not possible. Thus, the emotion and attitude of the local residents towards plastic litter on their island is a topic that remains undescribed. Regardless, sufficient data has been gathered through a total of twenty-three online interviews, three online surveys, various content analyses, and literature reviews. A variety of people were interviewed, including scholars and scientists from different backgrounds, government employees, waste management employees, employees of NGOs, and employees of companies working to reduce plastic usage. A coding table of all conducted interviews can be found in the Interview Table Two of the three surveys targeted tourists: one questioned aspects of tourist behavioural intentions and the behaviour of tourists when being on holiday, while the other focused on the tourist's perception of stricter hygiene measures implemented in accommodations as the result of the corona crisis. The third survey targeted hotels and investigated current practices of hotels in regards to SUP reduction and what they are willing to do.

1

Impacts of single-use plastic on surrounding waters and local economy

Before SUPs reduction practices can be introduced, more knowledge about environmental and economic impacts and the material flow of plastic on Mallorca is needed. This chapter will first present the main marine and coastal ecosystems of Mallorca and characteristics of the local economy. As plastic pollution is one of the main threats to these ecosystems and their services, the routes of plastic entering the marine environment will be described hereafter. Subsequently, plastic debris and hotspots in the Balearic Islands are discussed, followed by the ecological and economic impacts of plastic pollution.

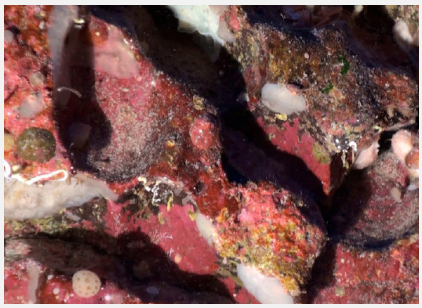
1.1 Mallorca's ecosystems & economy

In Mallorca, six of the nine marine and coastal ecosystems identified by the European habitat directive are present (Templado et al., 2012; Annex 2, section 2.1). These ecosystems are (Ayala Bonal et al., 2014): 1. Shallow sandbanks (Figure 1A), which mainly consist of fine sand sediments composed of remains of organisms; 2. Posidonia meadows (*Posidonia oceanica*) (Figure 1B), which represent 52% of these meadows in Spain, and constitute one of the main climax communities of the coasts; 3. Reefs (incl. seamounts) (Figure 1C), which can have both an organic and a geological origin; 4. Underwater structures caused by gas emissions, which are the result of carbonated precipitation from microbial oxidation; 5. Submerged or semi-submerged marine caves (Figure 1D), which are highly sensitive, fragile ecosystems, easily disturbed by external changes; and 6. Large coves and shallow bays, which contain a great diversity of sediments and a well-developed benthic community's zonation.

A
Sandbanks (Rondreis, n.d.)

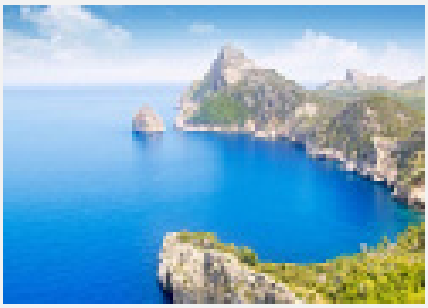
B
Posidonia Meadows (Kostas Papafitsoros)

C
Reefs (ZOEA, n.d.)



D
Underwater structures (OCEANA, n.d.)

E
Caves (Fornos et al., 2012)



F
Coves and bays (Hawkings, 2016)

Figure 1 Marine-coastal ecosystems of Mallorca.

For these six ecosystems, a list of target species, selected as an object of conservation for Mallorca, was constructed based on the findings of Ayala Bonal et al. (2014). These groups are marine reptiles (sea turtles), marine mammals, fish and seabirds (Annex 2, Appendix A). Globally, fish (21.94%) and seabirds (18.41%) are the most affected taxonomic groups by plastic pollution (LITTERBASE, n.d.), while sea turtles are used as a regional indicator of marine plastic litter in the Mediterranean Sea (INDICIT II, n.d.).

These six ecosystems provide essential services for human well-being and are often used as an indicator of the benefits that the environment provides to humans. These services are divided into four main categories (Annex 2, Table 1 & Appendix B), but the most important services for Mallorca are related to provisioning, regulating and cultural services (RO-2). Provisioning services include food and fishing, regulating services contribute to coastal protection and beach maintenance, and cultural services encompass tourism and leisure (Lattemann, 2010; Liquete et al., 2013; Ayala Bonal et al., 2014; Campagne et al., 2014).

The cultural services are extremely important for the Island's communities, as Mallorca's economy is highly dependent on tourism, as mentioned before in the introduction. From the total GDP of Mallorca in 2017, 73.76% was originating from the tourism sector (European Commission, 2020). The remainder of the GDP was earned in the industry sector (17.85%), the construction sector (5.65%) and agricultural sector (2.77%) (European Commission, 2020; UNI-1). Fisheries are also an important source of income for the inhabitants of the island. Fishermen have been around for many years, but since the tourism sector started to take off the fishing industry has decreased in size (Hatchery Culmarex, 2020).

The main threats to Mallorca's marine and coastal ecosystems are due to human activities, which include habitat destruction and fragmentation, climate change, overfishing, invasive species, and plastic pollution (Ayala Bonal et al., 2014). The threat of plastic pollution will be elaborated upon in section 1.4.

1.2 Routes of plastic entering the marine environment

During this study, four possible leakages of SUPs from Mallorca into the marine environment have been identified. Firstly, beach littering has been found as a major problem of plastic pollution in Mallorca. As indicated in Annex 1, Fig. 1, possible leakages of SUPs may occur through the waste collection system via the wind. Leakages from garbage trucks are not possible since these are closed (BUS-4). Moreover, many negative reviews of tourists on TripAdvisor highlighted the plastic accumulation in the beaches on Mallorca (TripAdvisor, 2019). Therefore, it may be stated that a significant amount of plastic pollution comes from littering by tourists and/or local citizens.

Secondly, heavy rain negatively affects current wastewater pipe systems in Mallorca (BUS-4, GOV-1). Rainwater is not collected separately from wastewater by the drainage system in Mallorca (BUS-4). During heavy rains, valves are open to prevent the formation of torrents, and excessive water is also directly discharged into the sea. Consequently, rainwater and wastewater include many different types of plastics, especially sanitary products that may be released into the sea without treatment (GOV-1).

Thirdly, as shown in Annex 1, Figure 3, the North Current which reaches out along the coasts of southern Europe affects the surface currents in the Balearic area. Likewise, the mesoscale circulations arising from the Algerian sub-basin, which contribute to the creation of the Balearic current, also influence the surface currents in this area (Ruiz-Orejón et al., 2018). Those currents facilitate the dispersion of marine plastics and allow them to reach distant coasts or sink at the bottom of the ocean. It is not unusual to encounter plastics originating from North-Africa or mainland Spain on Mallorca's beaches (BUS-6).

Finally, it is seen that sea-surface wind has an effect on the distribution depth of plastics near the sea surface. High wind conditions cause wind-induced mixing in the water, which results in capturing fewer plastic pieces. Therefore, the sea-surface wind speed is an important factor regarding the distribution of macroplastics in the waters (Compa et al., 2020).

1.3 Plastic debris and hotspots in the Balearic Islands

According to Worm et al. (2017), macroplastics comprise any plastic debris larger than 2cm and therefore encompass most of the SUPs. These plastics are the most identifiable items in the marine environment and can easily be retrieved from the sea due to their size and their tendency to float (Bauske et al., 2019). Macroplastic fragments in the water can break down into smaller pieces by chemical or physical processes such as photo-oxidation (Ruiz-Orejón et al., 2018) and become microplastics (1µm-5mm) or nano plastics (<1µm) (Worm et al., 2017). The microparticles are therefore easily transported by surface currents in the water. Measurements done in the summer of 2014 showed that concentrations of microplastics in the waters of the Balearic Islands were higher (875,446 items/km^2), compared to the number of macroplastics (2,897 items/km^2) (Ruiz-Orejón et al., 2018).

Ruiz-Orejón et al. (2018) reported that rigid plastics fragments (plastics that retain hard structure) make up nearly 90.67% of the total floating plastic composition around Mallorca. Other plastic compositions such as film fragments accounted for 6.97%, fishing lines for 1.51%, foams for 0.72%, industrial pellets for 0.11% and plastic ropes for 0.11% (Figure 2).

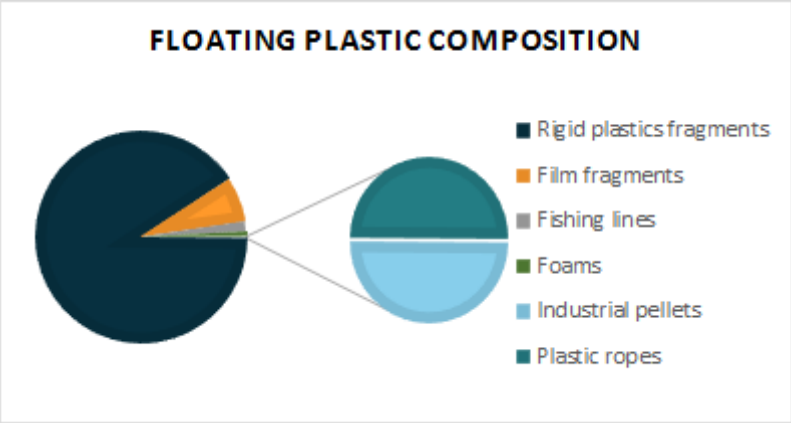


Figure 2 The composition of floating plastics around Mallorca

Considering the polymeric characteristics of plastic particles larger than 700 µm, Suaria et al. (2016) and Compa et al. (2019) identified polyethylene (HDPE and LDPE) (for instance plastic bottles, bags and shampoo containers) as the most common found polymeric type. Polyethylene (52%), polypropylene (PP) (16%) and synthetic paints (7.7%) (Suaria et al., 2016). These findings can be explained by the large use of disposable packages and the fact that these particles have a lower density than seawater and therefore float (Compa et al., 2019).

It appears difficult to determine exact locations with the largest amounts of floating plastic debris in the Balearic Islands due to the different oceanographic conditions throughout the year (UNI-2). It has been reported that large amounts of plastic debris are found on the Mediterranean seafloor, floating on the surface, as well as on beaches and in coastal environments (Suaria et al., 2016). Ruiz-Orejón et al. (2018) found that the highest amounts of plastics were found on the North-West coasts of the islands of Mallorca and Ibiza (see Annex 1, Figure 4 for the locations). On the North-Western coasts, the islands are geomorphologically abrupt and present pocket beaches, preventing tourists from visiting the area. Due to this characteristic, the oceanographic conditions in this area can influence the floating plastic concentration around these islands. The surface currents around the islands are formed in spring and summer when the northern conditions weaken and the surface waters from the Algerian sub-basin cross the channels of Ibiza and Mallorca, influencing the plastic flow.

1.4 Ecological and economic impacts of plastic

Plastic debris is a serious threat to biodiversity. As described in Annex 2, section 3, the accumulation of plastic debris in all our oceans, as a result of increased plastic production, concentrates in the open ocean and around shorelines (Gall & Thompson, 2015). This is also the case for Mallorca. All marine and coastal ecosystems and the majority of the related species of the Balearic islands are negatively affected by nano-, micro-, meso- and macro-plastics (NGO-1; NGO-5). The most important impact of plastic debris on these marine species in Mallorcan environments is entanglement and ingestion (NGO-1; RO-2). An overview of a wide range of consequences can be found in Annex 2, Appendix C.

In general, entanglement is causing more deaths than ingestion. Entanglement is mostly caused by illegal or discarded fishing gear ("ghost gear"), which often consists of plastic ropes and nets (NGO-1; Worm, 2017). In Mallorcan waters, marine mammals, turtles and seabirds are often subject to entanglement (NGO-1). Ingestion is in the majority of the cases due to animals mistaking plastic for food. This is either caused by the tactile or visual misidentification of the plastic product, or by the flavouring compounds on the surface of the plastic debris which animals are attracted to (Saliu, Montano, Leoni, Lasagni & Galli, 2019; Worm et al., 2017). Sea turtles often confuse floating plastic bags for jellyfish, as both jellyfish and plastic bags have visual similarities and share the same structure (Schuyler et al., 2012). Once the plastic is ingested, it blocks the gastrointestinal of the turtle and causes impediments and injuries, especially in green turtles (*C. mydas)* (De Carvalho et al., 2015).

The ingestion of plastic by seabirds is related to the sense of smell. These species have a highly evolved olfactory organ. Their planktonic prey is frequently absorbed by plastics that float at the sea surface and release chemicals that are attractive to seabirds. This causes both entanglement and ingestion, which often results in lethal and sublethal effects (Worm et al., 2017). Laboratory experiments have found evidence that the Mediterranean mussel (*M. galloprovincialis*) and the stony sea urchin (*P. lividus)* ingest microplastics in Mallorcan marine environments (Plastic Busters MPAs, 2020a; Plastic Busters MPAs, 2020b).

Besides harming species, plastic pollution is negatively impacting Mallorca's marine and coastal habitats. Microplastics absorb contaminants such as pesticides, heavy metals and PCBs from the environment. It subsequently releases these contaminants and plastic additives in the environments and the food web (Saliu et al., 2019). Since microplastic is very persistent, it furthermore restricts gas exchanges between pore water and the overlying water. This can result in anoxia or hypoxia, which in turn alters the structure of the macrobenthic community and interferes with the natural functioning of marine ecosystems (Balestri, et al., 2017).

Evidence exists of Posidonia meadows incorporating plastic particles during their formation. This can have ecological implications for the diffusion of this seagrass species into other environments and the plastics are likely to enter the food web (Pietrelli et al., 2017). Moreover, a study by Balestri et al. (2017) showed that shallow sandbanks can act as bioplastic sinks. Plastics can easily accumulate in the soft seabed floor, as sediment conditions hamper plastic degradation. Lastly, coral reefs are also known to incorporate microplastics. However, corals can reduce their autotrophic activities to become more reliant on heterotrophic feeding activities. By doing this, they can maintain the same metabolism rates during stressful periods such as bleaching events (Saliu et al., 2019), which are likely to increase in the future. As of now, no studies have analysed the uptake of (micro)plastics by coral reefs on Mallorca, yet it can be assumed that the effects discovered by Balestri et al. (2017) will be similar for Mallorcan reefs.

Table 1 Plastic pollution costs for the Mediterranean (Dalberg advisors, 2019)

Sector	**Costs/year**
Hospitality sector	€ 268 million
Fishing sector	€ 138 million
Maritime industry sector	€ 235 million
Total	€ 641 million

Besides threatening biodiversity, plastic pollution has an impact on the local economy. Table 1 provides an overview of the plastic pollution costs per year for the Mediterranean. Tourism counts for the majority of Mallorca's GDP. This sector is affected the hardest by plastic pollution in terms of economic losses (Dalberg Advisors, 2019), mainly due to the loss of aesthetic environmental value, which is a cultural ecosystem service (RO-2). An extensive reduction in marine litter on beaches can generate large economic benefits to residents

and increases the sector's reputation, as they will be seen as more sustainable (Newman et al., 2015; BUS-1). Furthermore, plastic pollution can be detrimental to human health and safety. Floating or stranded debris can cause long-term health concerns and direct injuries. Lastly, labour costs of clean-up efforts, often paid for by municipalities, have to be taken into consideration. Clean-up projects can cost up to millions of euros. For example, the latest beach and shore clean-up project of the Balearic Islands cost approximately €3.3 million, with maintenance costs and new clean-up vessels included (UN Noticias Local, 2017).

Another important sector for Mallorca that is negatively affected by plastic pollution is the fishing sector. Marine plastic waste is clogging the engines of fishermen's vessels and their fishing nets, thereby damaging the equipment. This leads to a disturbance in fishing activities, as plastic is being caught instead of fish. Plastic pollution is decreasing the Catch Per Unit Effort (CPUE), as fishermen spend more time cleaning out plastic from their nets than before. Some fishermen even claim that they are catching more plastic than fish. However, the total fishing yield remains the same (NGO-1). The maritime industry sector is also negatively affected by plastic pollution. This sector consists of transport in the form of shipping and yachting. Floating plastic debris can get entangled in the propeller blades of ships or pile up within engines. Costs related to this are delays, including downtime of vessels and the inability to perform, and additional maintenance costs as divers are needed to remove plastics. Moreover, port facilities and waterways have to be cleaned in order to prevent clogging, adding to the delay and clean-up costs (Deloitte, 2019).

2

Insights and challenges for stakeholders to reduce SUP

In order to reduce SUPs, stakeholders need to be aware of the consequences of their current practices. In Mallorca, these stakeholders cover a wide range from the hotel industry, to tourists, local municipalities, as well as different levels of government and scholars. However, depending on the different roles of these players within the stakeholder landscape, raising awareness and changing behaviour does not come without challenges. Hence, the positives and negatives of adopting sustainable measures need to be addressed and the different roles of stakeholders. Major themes include awareness, education, persuasion as well as combining economic and environmental concerns. This chapter presents an overview of the stakeholders involved in the context of Mallorca, the role they play, and the potential barriers they face on the road to SUP reduction.

2.1 Perceived Stakeholder Awareness & Responsibilities

The Balearic government, the hospitality sector and the tourists themselves are amongst the key stakeholders on Mallorca that are involved in the battle for SUP reduction. The major stakeholders and their relationships are depicted in Figure 3. This stakeholder map highlights potential collaborations. These collaborations would allow knowledge exchange, and the formulation and persuasion of a common goal, For example, it could lead to increased lobbying power towards policymakers. Efforts to reduce SUP on Mallorca are already in place (BUS-4). Therefore, Oceana can benefit from the expertise of the active members of the network.

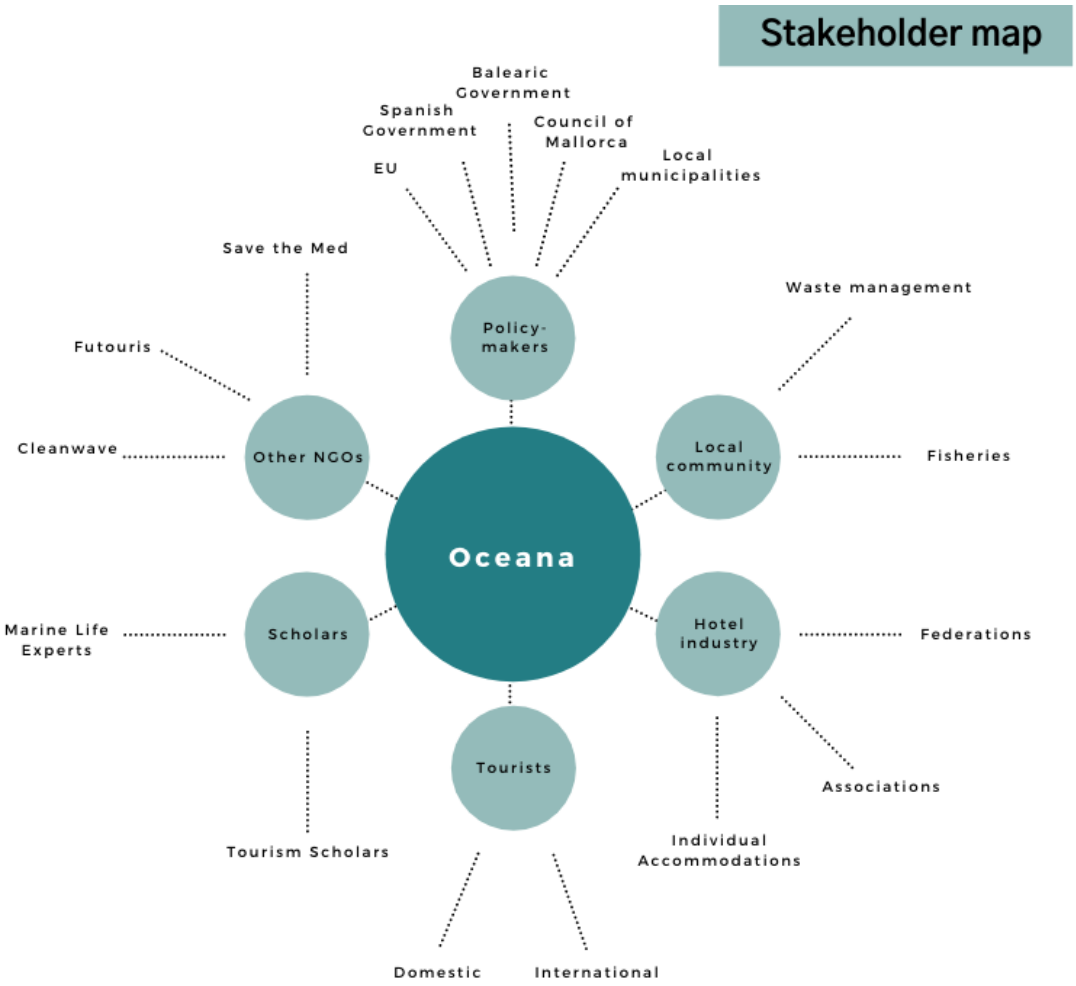
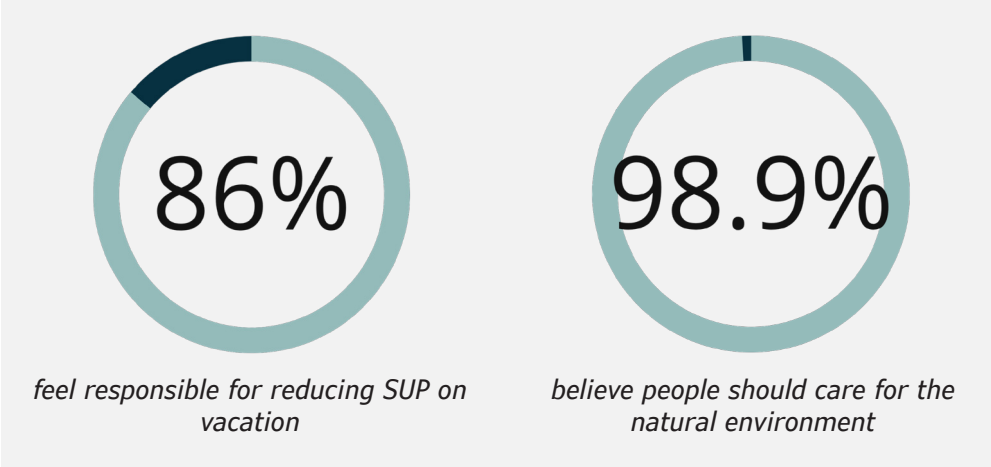


Figure 3 Key stakeholder groups deemed important in the road to SUP reduction (Mallorca)

2.1.1 Tourist Awareness & Responsibility

Research on tourist behaviour showed that awareness regarding marine pollution, willingness to change, and perceived individual responsibility are among the main factors that influence environmental behaviour (Barr, 2007). Tourists who are aware of the consequences of their practices and the importance of SUP reduction are more likely to adopt environmentally friendly behaviour (NGO-2). Therefore, it is of great importance that tourists are made aware of the consequences of SUPs.

Regarding responsibility, the survey that was spread among tourists showed that 86% of the people agree or strongly agree with the statement 'I feel responsible for reducing the use of SUP when I am on holiday'. However, tourists are strongly inclined to see the government as the leader of change, as they can create binding policies to enforce a general shift to more sustainable behaviour of consumers (see Annex 3). 96.5% of the respondents of the survey feel that the government has an important role in minimizing the use of SUP. It is hard for individuals to perceive their own impact as significant if their values and actions are not supported by a higher level of governance in law.



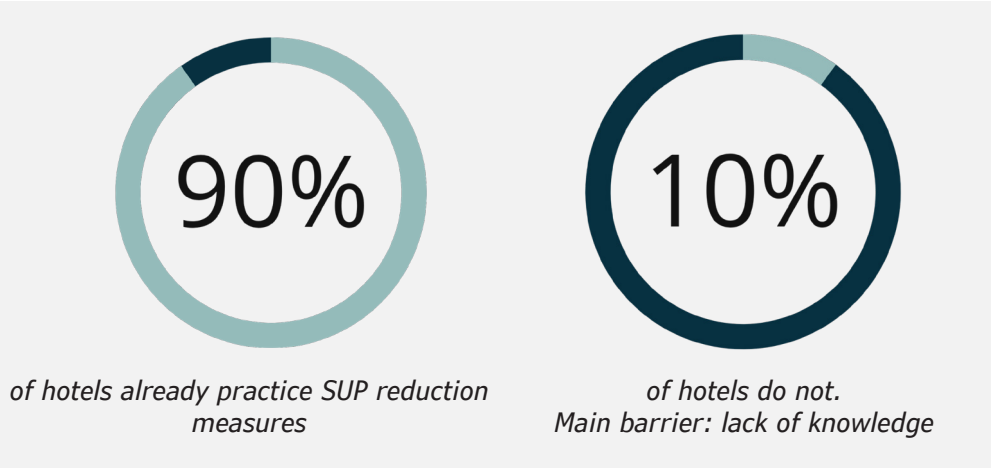
To make tourists aware of the consequences of SUP and their responsibility on the matter, people must be open to change their behaviour. The openness to change varies among different demographic groups. To give an example, the survey that was spread among tourists showed that people in the age of 18-35 and 56-65 are more willing to take action. Furthermore, Dutch, Italian, Spanish, British and German respondents are more willing to undertake action to change their behaviour in comparison to, for example, French respondents (see Annex 3). This is interesting information for future campaign strategies that will be devoted to reaching tourists on the matter. Therefore, awareness campaigns together with strong environmental policies are necessary to regulate environmentally friendly behaviour amongst the diverse population of tourists (see Annex 3 & Annex 4).

2.1.2 Government Awareness & Responsibility

The government of the Balearic Islands is aware of the SUP issue. This manifested itself in the implementation of the new legislation *ley 8/2019* that bans certain SUPs, which exceed the guidelines for the SUP EU-directive (Annex 4). Policies are an important tool to restrict or reward certain behaviour (Thøgersen, 2002). However, it is not easy to control its implementation. Therefore, voluntary commitment and transparent monitoring efforts from the local hospitality industry are crucial to tackle the SUP reduction (NGO-2).

2.1.3 Hospitality Awareness & Responsibility

The hospitality sector is another relevant stakeholder that possesses the ability to influence environmental behaviour. This is in line with the results of the survey that was distributed among tourists, which showed that 88.6% of the people believe that the hospitality sector plays an important role in minimizing the use of SUP. The sector can adopt different measures for SUP reduction, thereby offering tourists access to sustainable options. This is relevant to decrease SUP-use, as consumers are more likely to adopt sustainable practices if these practices are easy to use and cheap to implement. Moreover, businesses can stimulate environmentally friendly behaviour by rewarding tourists with, for example, discounts for using a reusable coffee mug or water bottle (Jacobs, 2019).



2.2 Practices, Benefits & Challenges in reducing SUPs

The Balearic government supports efforts for SUP reduction. However, a possible limitation stems from low-qualified government officials who sometimes lack adequate knowledge about the issue and thus cannot formulate the most suitable solutions (NGO-2). Due to the shortcomings at the higher levels of governance, it is necessary to highlight and encourage the good practices executed by the hotels. As it turned out, SUP reduction comes with financial savings and increased competitiveness for hotels (BUS-7), but also tourists and locals co-benefit from cleaner environments (Newman et al., 2015) . Consequently, many hotels are already engaged in the process of plastic reduction (BUS-4, Annex 4). In the following section, the current best practices of SUP reduction in Mallorca are highlighted, after which their related benefits and implementation challenges are laid out.

2.2.1 Best practices

The most effective measure to reduce SUPs is a complete ban. Below the state-level, some hotel chains in Mallorca decided to ban or heavily restrict SUP-use. An example of this is Melia Hotels International who, as a hotel chain, removed single-use containers from bathrooms to use 75% less plastic, decreasing plastic waste by 45,000 kilos per year (Hospitality Net, 2019). These actions would be in line with the EU directive on SUPs (see Annex 4). However, not all SUPs will be taken into consideration in this new regulation (as listed in Annex 1, table 2). Therefore, these gaps still need to be filled in voluntarily by the hospitality industry. Recommendations by the WWF, the Global Tourism Plastics Initiative guidelines and the Travel Without Plastic toolkit can serve as orientation (BUS-7; WWF, 2019; UNWTO, 2020).

Another SUP reduction measure performed by hotels is the '*available upon request*' strategy whereby commodities such as bathroom amenities and shower caps are only available upon request. The benefit of this is that SUPs are reduced without affecting the quality of the guest's experience. It is worth mentioning that besides environmental concerns, SUP reduction can lead to financial savings for hotels (BUS-7; see Annex 4).

Alternatives to SUPs are materials such as glass, bamboo, paper or stainless steel. They have the benefit of giving the hotel an environmentally friendly image, which is preferred by many guests and can moreover lead to attracting additional customers (BUS-7; WWF, 2019; Futouris, 2019). To reduce the use of single-use water bottles, reverse osmosis water fountains were installed in hotels and public places in Mallorca (NGO-2). Each hotel guest consumes on average 4-5 bottles of water per day, therefore, refillable bottles can prevent the production of a large amount of plastic (NGO-2). The provision of refillable bottles requires less storage space than the provision of SUP bottles, thus making storage space available for other uses (NGO-2). Therefore, in the long run, shifting to alternative reusable materials can benefit the environment while simultaneously reducing costs for businesses.

Furthermore, SUP reduction efforts can open the doors to alternative forms of tourism such as eco-tourism. The results from a survey sent to tourists suggest that consumers are attracted to hotels adopting eco-friendly measures to reduce plastic (see Annex 3). Moreover, these same tourists are willing to pay more for their 'green' accommodation. Hotels that adopt measures to reduce plastic waste attract a growing audience of environmentally conscious tourists.

The advantages of a clean and plastic-free coast go well beyond the preservation of a healthy pristine ecosystem and its services. A clean beach also makes the destination more attractive. For Mallorca, natural heritage, and in particular the marine environment, is the biggest asset to attract tourists. Therefore, it is important to continue with the SUP reduction practices already in place. However, there is little unity in the approach of hotels to reduce SUP in Mallorca. Accordingly, Oceana can attempt to collaborate with the local Hotel Federation. This collaboration would aim at creating a more united, inclusive approach, supported by frameworks and guidelines tailored to the specifics of Mallorca.

2.2.2 Challenges of Single-Use Plastic reduction

Several challenges exist in the reduction of SUP in the hospitality sector. Moreover, the COVID-19 pandemic puts more stress on the hospitality sector and causes several barriers for the reduction of SUP.

Hotels have highlighted higher costs of SUP alternatives (BUS-7; Travel Without Plastic, 2017). If managed correctly, these costs can be accounted for by increasing the re-use of reusable items. However, some reusable alternatives to SUPs are not received well by the customers. For example, consumers state that paper straws affect the taste of beverages in a negative way (BUS-3; Futouris, 2019). Furthermore, tourists may prefer the original and trusted products as they are perceived to be more hygienic or handy.

The water refill stations placed on the island also have a downside. Reverse osmosis water fountains are an expensive technology which leads to some hotels having to charge for their water. The usage of water dispensers also requires the adoption of reusable cups which has other drawbacks. One important issue concerning reusable cups is that some guests do not seem to perceive the difference between reusable and single-use cups, which can result in unnecessary wastage with high financial costs (Futouris, 2019; WWF, 2019).

Another challenge is the attitude-behaviour gap, which is one of the biggest barriers to SUP reduction. The attitude-behaviour gap explains the phenomenon where tourists behave in a way that is not in line with their intrinsic values concerning the environment. SUPs are still frequently used and left behind on beaches worldwide. This indicates that people must be made more aware of their responsibilities and of the consequences of their current behaviour. This is further elaborated on in Annex 3.

Although, in times of crisis,such as COVID-19, client satisfaction is more important than ever to keep the tourism industry going, particularly for smaller businesses with little savings that need to recover quickly from the crisis to survive (see Annex 5). Consequently, it is advisable to promote SUP reduction measures that do not harm guests' experience during their stay.

2.3 Stakeholder Collaboration

Further practices are relevant for plastic reduction, such as collaboration of local recycling plants and hotels to optimise the recycling process (Gent, Malcolm Richard, et al, 2009). As of now, there is no recycling plant on the island of Mallorca. The plastics are shipped to the mainland which makes recycling more expensive for the local communities (NGO-2, GOV-2). In addition, producing new plastic is cheaper than recycling SUP, further disacentivising recycling. In that regard, the Spanish government is already working on a regulation that aims at increasing taxes on plastic waste that will impact the production, the import and the acquisition of single use plastic packaging (Olive Press, 2020). The goal is to reduce the cost of recycling so that recycled materials may compete with SUPs. Stakeholders should collaborate to make recycling a more financially feasible and thus enhance the circular economy (NGO-2; RO-1).

Staff training in the hospitality sector is one important strategy for raising guests' awareness. Although, some companies find it time-consuming and difficult to educate their staff considering the strong turnover in the hospitality industry (WWF, 2019).

The hospitality sector is essential in supporting guests' SUP reduction activities. Organising a beach clean-up, jointly conducted by staff and guests are a great way to raise awareness and demonstrate the negative consequences of SUP use. Demonstrating that sustainable behaviour does not negatively affect the quality of the vacation is another way. The guests' awareness of the problem is crucial for the involvement of tourists' contributions in reducing SUP. Beach cleaning programmes are often deemed not helpful, as wind patterns and marine currents on Mallorca quickly undo the efforts by washing up new trash on the shore. However, beach clean-ups have a strong long-lasting impact on the guests' awareness of plastic pollution, who then understand the problem and feel part of something bigger (NGO-2).

3

Plastic Free Zones

3.1 Definition of Plastic-Free Zones

A solution to combat plastic pollution is the introduction of PFZs in the hospitality sector. The idea arose after tourists indicated a willingness to pay more for plastic-free accommodation (See Annex 2). The concept is relatively new and is not yet defined in literature and policy documentation. Within this report, PFZs are defined as a 'zone where there is a significant amount of (single use) plastic reduction through elimination or substitution with other materials, thereby decreasing the impact on the environment.' An exact figure for the significant amount of plastic reduction is still to be determined. However, this should be at least a reduction of a high percentage (>80%), defined by further research, to make an impact and go beyond the SUP items banned by the EU law. Rather than a bordered area, the zones refer to specific places where a plastic reduction is achieved. For example, various rooms in a hotel, an area at the beach or restaurants can be designated as PFZs. In these areas SUPs or unnecessary plastics are eliminated and if necessary other materials may be used to replace the plastics.

3.2 Examples of Plastic-Free Zones

There are already a few countries including Belize, Chile and Greece who have either banned SUP items such as plastic bags and plastic food utensils or imposed levies on plastic bags (Gray, 2018). On a smaller scale, a few hotel groups and tour operators started reducing SUPs. As mentioned in the previous chapter, Melia hotels have made efforts to reduce SUPs. Another example is Iberostar, a global hotel chain (with locations in Mallorca) which implemented a Wave of Change. Wave of Change is a program that made them the first SUP free hotel chain globally (NGO-2). TUI has also initiated the Blue Rocador, which eliminates 60 million disposable plastic parts in the day-to-day operations of the hotel. They are trying to achieve this by using refillable drinking bottles, soap dispensers, corn starch straws and involving guests in clean-up activities (TUI Group, 2020).

3.3 Hurdles to implementing Plastic-Free Zones

Barriers that hamper the implementation of SUP reduction practices were identified. Issues are high costs, inadequate products and services, lack of suppliers, rigid guest expectations, insufficient knowledge about environmentally friendly alternatives and their impact on ecosystems. Hotels usually only think about how to replace plastic packaging, but not about how to consistently avoid waste (WWF, 2019 & NGO-2). There is a risk with high initial investments, due the uncertainty about financial returns and the limited interest, which hampers hotels to reduce their environmental impact (Ramirez & George, 2019). Besides the high initial investment there are also hotel chain branding standards that require certain SUP items to be in hotel rooms, inhibiting local hotels to reduce SUP and therefore discourage hotels to be progressive (BUS-7).

Besides the problems at the hotel level, there are also problems at the governmental level with scarce human and economic resources hindering the law implementation process (GOV-1). The transposition of European directives into national law at a local level takes a lot of time and it is really hard to enforce legislation at the local level due to bureaucratic procedures. While at times there are no incentives from the government to improve the waste separation, in some municipalities there are fines if the waste is not sorted right (Futouris, 2019).

The progress of SUP reduction is hampered by the COVID-19 pandemic. Due to the subsequent financial crisis, the tourism sector focuses on the immediate recovery of tourism and reinstate of livelihoods (UNWTO, 2020; Crossley, 2020; BUS-5). With concerns over the pandemic, both hotels and tourists prioritize hygiene measures over environmental concerns, which comes with an increase in SUP use (UNI-5; BUS-5). Consequently, any progress already made towards SUP reduction will either halt or even be undone (BUS-3). Besides, the unpredictability of COVID-19 makes creating effective precautionary plans difficult (UNI-4).

3.4 Alternatives to consider in Plastic-Free Zones

With the reduction of SUPs, the tendency is to replace products instead of eliminating them, even though elimination is usually more effective. When SUPs cannot be eliminated, alternatives can be used. The following section will discuss various alternatives (mentioned in the previous chapter) including glass, stainless steel, bamboo, and cardboard. Table 2 presents an overview of costs, environmental impact and usage lifespan of SUP alternatives compared to SUP. The table is based on the text below, which can be referred to as a further explanation.

Table 2 Costs, environmental impact and usage lifespan of SUP alternatives

Alternatives	Cost	Environmental Impact	Usage lifespan
Glass	++	++	+
Stainless steel	++	++	++
Bamboo	+	-	+
Cardboard	-/0	-	0

Compared with SUP

++	: much higher
+	: higher
0	: same
-	: lower

3.4.1 Glass

Glass bottles, as an alternative to plastic PET bottles, are both more expensive and have a higher environmental impact. Studies found that whereas PET bottles would cost € 0.16 to manufacture and transport, glass bottles would cost € 0.19. Glass bottles are more expensive to transport since they are much heavier which contributes to more carbon dioxide pollution (Gray, 2018). Additionally, mineral water in glass bottles is also more expensive for the consumer. Not to mention, that glass is also a form of marine litter. A study conducted in the Balearic Islands found that when sorting marine litter samples by type and weight, glass was the most abundant (Alomar, Compa, Deudero, & Guijarro, 2020).

3.4.2 Stainless Steel

Stainless steel bottles, as an alternative to plastic bottles, are more expensive to produce. Stainless steel is more energy intensive but has a much longer lifespan (Northrop, 2015) and is therefore more appropriate for re-use. In comparison to glass, stainless steel is more practical to travel with. However, in restaurants consumers prefer glass bottles over stainless steel since appearance is also important (NGO-2).

3.4.3 Bamboo

As an alternative to plastic, bamboo has already been used in the hospitality industry for toothbrushes and straws (Van Der Lugt & King, 2019). According to a study by the United Nations Environment program (2017), the start-up cost for producing personal care products such as bamboo brushes, and bamboo straws is high. However, there is also scope to scale up these initiatives and make them more cost effective. Nonetheless, some products created using bamboo fibres are semi-synthetic products and therefore still composed of elements that are not fully biodegradable (Van Der Lugt & King, 2019). Unfortunately, some products such as bamboo coffee cups are still marketed as a green alternative and fully compostable (NGO-2), whereas they will only biodegrade via industrial composting and are not recyclable.

3.4.4 Cardboard

Cardboard in combination with cellophane and paper can be used as a plastic alternative for food packaging (United Nations Environment program, 2017). According to a recent study regarding COVID-19, cardboard may be more hygienic than plastic. It was found that the virus can last up to 24 hours on cardboard whereas it can last up to 72 hours on plastic (Van Doremalen et al., 2020). Additionally, cardboard can also be used for packaging of soap bars as an alternative to SUP bottles in the hospitality sector (United Nations Environment program, 2017). This would be an effective change since the vast majority of hotel chains use SUPs in bathroom amenities (BUS-7). Additionally, the cost of cardboard in 2019 declined by 80.3% (Highlander International Recycling, 2020).

3.5 Guidelines for Plastic-Free Zones

Next a summarized version of the guidelines for the implementation of PFZs is presented. The full version and the number of hotels which already implemented certain practices can be found in Annex 4, Appendix D. WWF (2019) and the Global Tourism Plastic Initiative (GTPI) (UNWTO, 2020) have provided guidelines from which lessons could be learned on how to shape and implement a PFZ in practice.

3.5.1 Elimination of unnecessary plastic

In many instances, plastic packaging can be removed from products while maintaining its utility (Futouris, 2019). For example, the plastic wrapped flip flops. This is without counting the amenity kits which most hotels provide to receive their 4-star recognition (Futouris, 2019). As each autonomous region sets its own requirements for hotel ratings, a dialogue is needed with the Balearic Islands government to implement amendments to these standards.

3.5.2 Reuse models

Plastic water and shampoo bottles collectively account for a huge amount of plastic waste which can easily be solved by using reuse models. Initiatives for installing refill stations and providing reusable cups or refillable bottles have appeared across the island. A study by Futouris (2019) in the Balearic Islands, found that many of the hotels provided reusable glasses or hard plastic cups which guests could freely refill. Tourists were very open to using their own water bottles and water dispensers, as long as the water is of similar quality (Futouris, 2019). To replace soap, shampoo and shower gel bottles in hotel bathrooms, some hotels have installed dispensers.

3.5.3 Requesting 100% recycled plastic from suppliers

For the plastics that cannot be eliminated or avoided, they should be 100% recycled as to not use virgin materials and stay within the cycle of the circular economy. For hotels, their role for using only 100% recycled plastic primarily revolves around the plastics that they request from suppliers. It is important to address this issue with the suppliers and demand a reduction of these methods from them or adopt alternative ways of delivery (Futouris, 2019, TUI Group, 2020).

3.5.4 All plastic is sorted and recycled

Any plastic that can be recycled needs to be correctly separated and disposed of (use of closed bins). This prevents plastic from leaking into the environment. Hence, providing separate waste bins per waste stream is a priority. Unfortunately, this is not the case in many hotels in Mallorca, especially for guests' waste bins. In most hotels surveyed by Futouris (2019), there were few if not no possibilities for the guests to separate their waste in their rooms or food in the breakfast areas. It seems that waste separation largely depends on the hotel staff and such a responsibility needs to be transferred to the guests themselves.

3.5.5 Communication and integration of staff and guests

Raising awareness and implementing educational campaigns are said to be essential to get hotels and companies to introduce more environmentally friendly measures (NGO-4). The overall pressure to reduce plastic pollution on Mallorca has increased the last three years. Movements to reduce plastic have become bigger and plastic pollution received more attention, which has in turn been taken up by the government, companies and hotels (NGO-2). Without strong public awareness and pressure, companies and hotels would not have made such SUP reductions (BUS-2).

By directly interacting with the guests, staff can easily explain the reasons for the environmentally friendly measures taken by the hotels and help the guests understand how they can be part of their reduction initiatives (NGO-2; TUI guideline). The WWF (2019) saw that more communication led to greater support from guests and thus increasing how environmentally aware the guests were. This made it easier for hotels to switch to dispensers and eliminate single-use packaging (Futouris, 2019). However, as indicated in Annex 3, a balance needs to be found between an overwhelming amount of information and a lack of information to reduce consumer scepticism.

3.5.6 Collective collaboration

A successful sustainability strategy cannot be implemented without the support of the most important stakeholders. This includes hotel staff, hotel guests, suppliers, local government, waste collectors and other NGOs (see Figure 3, section 3.1). It is important for hotel staff to know why and how they can implement plastic reduction initiatives. It has been stated that many hotels, although willing to reduce their plastic usage, do not know how and what alternatives are available (NGO-2, NGO-4, BUS-7). Therefore, it is extremely important to provide the framework and instruction manual of what to do for hotels. For example, the NGO Travel Without Plastic has developed a toolkit which hotels can use as a guide (BUS-7). The methods and in what ways this should be done is further elaborated on in Annex 4.

The general conclusion from both frameworks was that elimination of unnecessary plastic had the greatest impact, which could be partly accomplished by implementing reuse models. Furthermore, if any plastic is purchased and used, it should be 100% recyclable or reusable plastic. When it can no longer be used, it should be properly sorted and recycled. Finally, increasing the awareness of staff and guests to create the right habits is important.

4 Conclusion

The objective of this consultancy project was to increase understanding of the impact and use of SUPs in the hospitality sector on Mallorca and investigate the feasibility of PFZs. The following chapter elaborates on the main findings concerning this objective.

First of all, the Balaeric sea is essential for Mallorca's hospitality industry. It provides provisioning, regulating, supporting and, most importantly for tourists, cultural ecosystem services. Large streams of tourists heavily contribute to plastic pollution which end up in the environment, damaging the ecosystems of Mallorca. Although the hospitality sector is a main contributor to the plastic pollution problem, it also suffers from the negative impacts. Plastic pollution namely affects aesthetic value and increases the need for clean-up activities, which is expensive. **This shows that both the solutions and challenges lie in reducing or substituting the amount of SUP used in the hospitality sector on Mallorca.**

However, high implementation costs, inadequate products and services, and a lack of knowledge of -, or bad experience with -, suitable alternatives hinder the implementation of plastic reduction practices. The COVID-19 crisis has delayed plastic reduction efforts as hotels, for example, are currently prioritising financial recovery and personal hygiene over sustainability. This results in an increase in SUPs such as masks and gloves. Nevertheless, in the long run it is worth investing in reducing SUPs, as it can facilitate a new wave of ecotourism and increase competitiveness between hotels. Above all, cleaner beaches and waters lead to a more attractive image of Mallorca.

Literature and survey results show a willingness of tourists to reduce SUPs, but they feel the government should take the necessary first steps. The hospitality sector and the government are already working towards reducing SUPs in the Balearic Islands. The new legislation, Ley 8/2019 (Article 23), of the Balearic Islands describes a great variety of different plastics that should be banned by the year 2021. However, bottles larger than 200ml, products offered by the minibar service in the hotel rooms as well as amenities, are examples of SUPs that have been left out of the legislation. Moreover, re-use models are not being widely implemented in hotels yet, and different options of plastic alternatives are not always well accepted. **In consequence, more effort from both the government and the hospitality sector should be invested to overcome the disadvantages and challenges of SUP reducing measures.**

A method to boost the reduction or substitution of SUPs is via the implementation of PFZs on Mallorca. For a significant reduction of SUPs in PFZs the following aspects should be considered: eliminating all abundant plastics, using reusable alternatives, requesting 100% recycled/compostable plastics from the suppliers, facilitating sorting and recycling stations, and communicating about the measures with the staff and visitors. To create recycling stations, collaboration between waste management and the hospitality sector is of key importance as there is no recycling installation on Mallorca yet. **Certain hotels have already implemented successful plastic reduction practices, a proof of concept of the feasibility of PFZs in reducing SUPs.**

5 Recommendations

Several opportunities for Oceana to contribute to a decrease in SUPs are described in the conclusion. Accordingly, the recommendations elaborate on different opportunities for collaboration, give guidance to possible campaigns and specify implementable strategies to reduce SUPs. The recommendations can be classified into three main categories: create a Tool Kit, Education & Public Campaigns and Stakeholder Collaboration.

5.1 Create a Tool Kit

As tourists view the hospitality sector as being partly responsible for SUP reduction, it is important to work closely with hotels to implement policy changes and improvements. Therefore, the first recommendation is to create a Tool Kit for hotels aimed at making adjustments to reduce SUPs which go beyond government legislation. Going beyond the government legislation means targeting plastics not included in the EU plastic ban of 2021 (Annex 1, Table 2). The Tool Kit should contain guidelines and measures on how to reduce SUPs and how to inform and encourage tourists to act accordingly. Several factors are important to focus on in this Tool Kit:

- Implementation of PFZs should be advised as a possible way to reduce SUPs. Different ways of introducing these can be proposed such as: eliminating unnecessary plastic (e.g. removing the single-dose containers in bathrooms), transferring to certain re-use models, or using alternatives for plastic (e.g. glass, stainless steel, or bamboo).
- There is willingness among hotel staff to reduce SUP but there is a lack of knowledge which prevents staff from acting. Therefore, it is important to bridge this gap by focusing on educating staff.
- In light of the current COVID-19 pandemic, the benefits that SUP reduction can bring to hotels have to be highlighted. This refers to both finances as well as improved destination image. The economic benefits can help hotels which are struggling financially, whereas a boosted destination image can attract more tourists in the long run. Possible financial incentives, made available to adapt to sustainable practices, are beneficial to persuade hotels into collaboration.
- Plastic reduction measures should be easy to implement for the tourists, as accessibility makes tourists more prone to cooperate.

5.2 Education and Public Campaigns

Part of the solution to reduce SUPs is awareness. To ensure the sustainable implementation of SUP reduction strategies, individuals should be made aware of and be educated about the consequences of plastic use. Oceana can provide education by setting up awareness campaigns in public spaces which attract a lot of tourists and local residents at places such as airports, tourist offices, schools or supermarkets. In order to create a successful campaign, there are several elements that can be taken into consideration:

- The necessity of the problem should be stressed by emphasizing the negative consequences of SUP pollution on human life. To foster more responsibility, it should be made clear that individual behaviour can actually make a difference.
- Create campaigns tailored to the kind of information different nationalities wish to receive, as it is easier to change behaviour of people who are genuinely open to it. Therefore, it would be most useful to tailor campaigns to tourists visiting Mallorca from the Netherlands, Spain, Italy, France, Germany and the United Kingdom. It would be required to collect additional information for these nationalities.
- Provide the right amount of information to tourists with a balance between empathy and facts. A way would be to trigger tourists' emotions, for example by showing an image of the impact of plastic on a marine animal. Additionally, the survey showed that tourists are not all aware of the facts surrounding plastic pollution. For example, only 41.01% of the respondents are aware that most plastic in the ocean has not directly been dumped into the water (see Annex 3, section 4).

In light of the current COVID-19 crisis, tourists are extra careful when it comes to their safety. Consequently, there is an increase in plastic use as a result of the COVID-19 pandemic (Bengali, 2020). There is indication that the survival rate of the virus is shorter on materials other than plastic, for example cardboard (Van Doremalen et al., 2020). This can work in Oceana's favour in campaigns by emphasizing the benefits of alternatives for protective wearables. To stress this even further, it appeared from one of the surveys that a major part of the respondents are open to other disinfectants than ones which include plastic packaging (See Annex 5, section 5.2).

5.3 Collaboration

There are two main reasons for Oceana to start collaborating with other parties: to join forces in order to have more persuasion power and to take advantage of pre-existing knowledge. Specific information regarding Mallorca can be obtained when a local network is created. Several opportunities for collaboration with different stakeholders are:

Policy makers

The Government of the Balearic Islands and the Council of Mallorca are very committed to reducing SUPs. Both institutions are willing to collaborate with Oceana in the reduction of SUP in the hospitality sector. These collaborations could enhance the voluntary agreements in hotels to reduce SUPs left out of the new legislation. In addition, Oceana can provide scientific research to the government for future policy implementation.

Hotel industry

Oceana may collaborate with the hotel industry as they are interested in the same goal. Using a policy Tool Kit, Oceana can help advise hotel owners how to reduce SUPs by, for example, presenting alternatives for plastics. Additionally, when organizing activities (e.g. beach clean-ups), hotels and their guests can be involved in order to raise awareness regarding SUP reduction.

Local community

Similar to the hotel guests, the local community can be involved in educational campaigns to raise awareness. Also, the community could provide more specific knowledge on local circumstances on Mallorca. This includes identifying plastic hotspots, economic effects of plastic pollution on livelihoods (fishers, dive schools) and perception and difficulties when implementing PFZs. Moreover, waste management companies on Mallorca have expressed interest in collaboration with Oceana. Additionally, collaboration could come in the form of sharing data, or Oceana helping to bridge the gap between hotels and waste management companies. Through collaboration a more efficient recycling system can be created.

Other NGOs

It is recommended to collaborate with local NGOs that have in-house and Mallorca specific knowledge to share research. A wide range of NGOs is already present, which can help identify more specific flows and amounts of plastic on Mallorca. Possible ways of collaboration with other NGOs may include: creating a communication platform between NGOs to discuss local actions taken, launching joint projects in case of overlapping aims, or funding of undertaken sustainable practices which match their goals. Examples of NGOs include Cleanwave and Save the Med.

Scholars

Various experts have been gathering specific data on plastic pollution on Mallorca. Examples of institutions that might be suitable for collaboration are the Balearic Island Coastal Observing and Forecasting System (SOCIB), the Autonomous University of Barcelona and the University of the Balearic Islands. SOCIB wants to develop systematic and persistent monitoring systems to research accumulation and distribution of plastic around the Balearic Islands. The Autonomous University of Barcelona and the University of the Balearic Islands have already been collaborating on research on the plastic issue on the Balearic Islands. It is possible that they may be able to provide different experts with knowledge on different fields, concerning the subject.

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Annexes

Expert Reports

1. Material Flow Analysis

2. Environmental Impact Analysis

3. Environmental Consumer Behaviour Analysis

4. Policy and Practice Analysis

5. Sustainable Recovery Analysis

Expert Report 1

Material Flow Analysis

Written by

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List of Abbreviations

CoM	The Consell de Mallorca (The island's Council)
HDPE	High-Density Polyethylene
LDPE	Low-Density Polyethylene
MFA	Material Flow Analysis
PET	Polyethylene Terephthalate
PP	Polypropylene
PS	Polystyrene
SUP	Single-Use Plastic

List of Interviews

BUS-1	Large hotel chain employee
BUS-4	Aina Canaleta Safont - Tirme Parc de Tecnologies Ambientals de Mallorca
BUS-6	Servane Daniel - Aqualife Dive Centre Cala d'Or
UNI-2	Ángel Miguel Amores Maimó - Universitat de les Illes Balears
GOV-1	Sebastià Sansó i Jaume - Government of the Balearic Islands

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Main Findings

1. A large amount of plastic waste is generated by the 3-4 star hotels in Mallorca, the amount is estimated to total 7,720 tons annually. Five main plastic types generated from the hotels are identified, which include PET, HDPE, LDPE, PP and PS. Most of these plastics were generated in guest rooms and restaurants.

2. A significant amount of the SUP items used in hotwels will be banned after the implementation of the Balearic Islands' single-use plastic ban law and the EU legislation. Various large hotel chains have already implemented strategies for the elimination of single-use plastics.

3. Generated waste is collected, transferred and treated. Incineration is primarily preferred as a treatment method on the island. Though, not all of the generated plastic waste is being treated. SUP waste could leak into the terrestrial environment and can eventually end up in the sea. Different ways of leakages are identified: leakage by beach littering (tourists and the waste collection system), heavy rains, the surface currents and the wind.

4. The highest concentrations of plastic found in the waters are microplastics, of which rigid plastic fragments make up for ±90.67% and polyethylene is the most common type found. The highest amounts of plastics were found on the North-West coasts of Mallorca and Ibiza. Here, the oceanographic conditions play an important role in the transportation of plastics in the waters.

1. Introduction

The two-way relationship between waste generation and tourism has started to receive a lot of attention. On the one hand, the tourism industry contributes significantly to the production of waste, whereas on the other hand, a "five-star holiday means a waste-free landscape, clean beaches and healthy oceans" (Bauske, von Münchhausen, Plitharas, & Tsoukalas, 2019, p. 7). Within the tourism industry, hotels are often seen as big generators of waste. To combat marine pollution, the hotel industry has been urged to take drastic matters to reduce their waste volumes (Bauske et al., 2019). One way to reduce these waste volumes is to assess the single-use plastic (SUP) items used in hotels.

To gain better insights into the flows and stocks of the single-use plastics generated in the hospitality sector, a material flow analysis (MFA) has been conducted. The MFA also determines which SUP ends up in the waters, and eventually, the oceans. An MFA is a systematic way to clearly show flows and stocks of material which provides a better understanding of the general system (Bogucka, Kosinska, & Brunner, 2008). By conducting an MFA, systems can be well defined and shortcomings in the system can be observed easily.

The main aim of this report is to determine: *How do single used plastics generated in Mallorca's hotels flow and stock in the waste system and into the ocean?*

To do so, the following research questions have been answered:

- *What types of SUP do hotels in Mallorca use?*
- *What is the operation of SUP's lifecycle processes in Mallorca's hotel industry?*
- *What are the potential marine plastic hotspots around Mallorca?*

The research was conducted online by doing a desktop study and by interviewing/communicating with potential stakeholders through online platforms, such as Zoom, Skype and via emails. The scope of the hospitality sector in Mallorca was narrowed down to targets at large (>300 rooms) and 3-4 star hotels (see Appendix A) as they produce more waste than hotels in lower star categories (Camilleri-Fenech, Sola, Farreny, & Durany, 2020). From the available literature, calculations and estimations were made since precise data was often lacking. Furthermore, a material flow map was designed and the existing hotels in Mallorca were mapped out. Reviews of tourists from TripAdvisor were also taken into account. Throughout this report, personal communications with stakeholders are cited with specific codes (see list of codes).

This expert report will mainly focus on the types and use of single-use plastics in the hospitality sector of Mallorca, followed by the waste management system in Mallorca and the possible occurring leakages of plastics into the marine environment as well as characteristics and amounts of plastics in the waters. The report will be completed with a conclusion, some limitations and possible recommendations.

2. Analysis

2.1 Single-use plastic in Mallorca: the role of hotels

In general, generated plastic waste is widely distributed throughout hotels in departments such as guest rooms, the reception, kitchen and restaurant. Five main categories of plastics used in hotels were identified by Vermöhlen & Mikenzo (2019) and can be found in Table 1. Among these, PET, HDPE and LDPE are recyclable whereas many single-use items produced by PP and PS are difficult to recycle. Therefore, finding plastic alternatives and putting them into practice is crucial.

Table 1 Main categories of plastics hotels make use of

Type of polymer	Examples of use
Polyethylene Terephthalate (PET)	PET bottles (plastic bottles)
High-Density Polyethylene (HDPE)	Shampoo bottles
Low-Density Polyethylene (LDPE)	Frozen food bags
Polypropylene (PP)	Disposable cups, plates, plastic straws
Polystyrene (PS)	Disposable coffee cups, plastic cutlery

Information derived from (Vermöhlen & Mikenzo, 2019)

Table 2 provides a more detailed overview of the SUP items that are commonly found in hotels. The table also indicates alternatives for these SUPs and which will be banned after the implementation of the Balearic Islands' single-use plastic ban law (ley 8/19) and the EU legislation.

Table 2 Detailed overview of the SUP items commonly found in hotels

Type of SUP	Alternatives	Banned after law/legislation implementations
Wristbands (all-inclusive hotels)	Woven wristbands	
Plastic key cards	- (Sustainable) wooden keycards - Mobile-phone app	
Amenities/toiletries	Dispensers with soap, shampoo and shower gel (refillable containers)	
Cotton swabs	Biodegradable cotton swabs	X
Toothbrush	- Toothbrush on demand - Wooden/bamboo toothbrush	
Cleaning materials (bottles)	Refillable flasks	
Plastic bin bags	Biodegradable alternatives	
Plastic laundry bags	- Reusable laundry bags (linen, cotton) - Laundry on demand only	
Plastic water bottles	- Glass bottles - Water dispenser close to the rooms/ refill stations - Water fountains	
Plastic straws and stirrers	Biodegradable straws and wooden stirrers	X
Single-use coffee capsules	Reusable coffee press/cafetiere Reusable coffee capsules Biodegradable coffee capsules	X
Plastic sachets & packets (Mayonnaise, ketchup, jam, butter etc)	Dispensers	
Single-use plastic food wrapping	Placing the food in boxes and/or trays	
Plastic dishes (e.g.disposable trays, plates, cutlery, drinking cups)	- Reusable cutlery/washable plates - Porcelain/ china crockery - Biodegradable plates and cutlery	X
Plastic lined tea & coffee bags	Loose tea bags	
Gloves	-	
Plastic bags	- Reusable bags (e.g. linen bags) - Not providing a bag or on request only	X

Information retrieved from (Bauske et al., 2019; Travel without Plastic, 2018; Vermöhlen & Mizenko, 2019)

In general, all unnecessary SUP items such as plastic straws have been eliminated by hotels in Mallorca (BUS-4). Three large Spanish hotel chains, namely Iberostar, Melía, and RIU (all found in Mallorca) have been implementing strategies to reduce SUPs since 2017. Due to their size, these large hotels are expected to generate the most single-use plastic waste (BUS-4; GOV-2). Yet due to their efforts to improve their image and reduce SUPs, they might proportionately generate less plastic per customer than smaller hotels with lesser financial opportunities. At the time of the writing and taking the collected data into account (June 2020), no correlation has been found between the presence of large hotels and plastic waste accumulation on the beach of Mallorca. *(see Appendix A & C2)*

Iberostar was a pioneer in SUP reduction campaigns in the hospitality sector and has eliminated plastic from its hotels (BUS-4). Iberostar was also the first hotel chain to achieve its goal of plastic-free hotel rooms throughout Spain. By replacing plastic water bottles with reusable bottles, Iberostar eliminates over 45,000 bottles annually which prevent the annual generation of 1,350 kg of plastic waste (One Planet Network, 2020). Furthermore, through plastic reduction measures, Melia eliminated 894,000 plastic bottles; over 185,000 reduction in cans, and over 100,000 bottles of water, which they replaced with purified water sources. This also prevented the use of more than 33,600kg of plastic in bathroom amenities, equivalent to a reduction of 42% in plastic waste (Melia Hotels International, 2020). Finally, the RIU hotel chain successfully eliminated 690 tons of single-use plastics in their Spanish hotels (BUS-1).

However, the COVID-19 crisis has significantly impacted these SUP reduction initiatives. To a large extent, the highly contagious nature of COVID-19 has led to an increase in SUP usage. For example, numerous items of single-use plastics, such as individual gloves, masks and food wrapping, have been reintroduced by hotels in order to ensure the safety of their guests (BUS-1).

> “Something that really impacts me is that we normally buy in bulk. For example, bread. They were, you know, in a big tray, but now and because of safety they all have to be individually packed. So that obviously is a lot of plastic. (...) We have gone backwards a lot, and we weren’t able to do anything about it.”
>
> *(BUS-1)*

This could mean that in near future, more single-use plastics are generated in the hospitality industry. More information about the influence of COVID-19 on SUP reduction in the hospitality industry can be found in *Annex 5*.

2.2 The waste system management in Mallorca

The island’s Council, also called The Consell de Mallorca (CoM), has been responsible for the preparation, procession and approvals of the sectoral plan and management for non-hazardous waste in Mallorca since 2000 (Arbulú, Lozano, & Rey-Maquieira, 2016; Weber, Calaf-Forn, Puig-Ventosa, Cabras, & D’Alisa, 2018). It has commissioned two private companies to treat distinct types of waste on the island: TIRME SA for the urban waste, and Mac Insular for the construction and demolition waste, bulky waste and tires (Consell de Mallorca, 2020). Further, municipalities are responsible for waste collection and transportation, but their costs are covered by EcoEmbes. Nowadays, TIRME operates most of the waste plants and facilities in Mallorca on behalf of the CoM (Weber et al., 2018).

Regarding waste collection, municipal solid waste is separated under five different categories: glass, paper and cardboard, light packaging, residual waste and bio-waste (European Commission, 2016). The fraction of light packaging includes the most recycled SUPs and is made up of different sorts of polymers such as PET, HDPE and LDPE. In order to separate waste, waste collection needs to collaborate with citizens and companies

for a good/better procedure (Arbulú et al., 2016). Moreover, some municipalities, such as Esporles and Sant Llorenç, also adopted a door-to-door collection method to improve the recycling rate. With this method, the average recycling rate in 2013 increased by approximately 35% (Weber et al., 2018). Furthermore, five transfer stations were built in Alcúdia, Binissalem, Campos, Manacor and Calvià. These transfer stations serve as intermediaries to improve the efficiency of the waste transport and minimize the costs of transferring the daily waste from the containers to the treatment facilities (Arbulú et al., 2016; Bauske et al. 2019;).

The waste is selected, processed, disposed and incinerated after being transported to TIRME. Incineration facilities, operated by TIRME, play a key role in the waste management system in Mallorca as the capacity of the incineration plants is 732,000 tons per year, making it the largest in Spain (Weber et al., 2018). In 2012, the capacity of the incineration plants was increased and the landfills were all shut down. All urban waste in Mallorca would now be either incinerated or sent to mainland Spain for recycling (BUS-4; Weber et al., 2018). Additionally, in 2012, the Balearic Parliament also approved the import of waste from other EU countries to balance the cost of operating daily the incineration system (Efe, 2012). There has been continuous public opposition to the incineration system as incineration and waste import conflicts with the principles of the waste hierarchy (Weber et al., 2018). Indeed, according to the general waste hierarchy, waste minimization should be preferred to waste recovery. Yet Mallorca's waste management system recovers energy by incinerating municipal solid waste instead of reducing its generation, and, in doing so, generates greenhouse gases (Arbulú et al., 2016; Papargyropoulou et al., 2014). The operative costs of the Son Reu incineration plant are covered by the municipalities and depend on the amount of waste they send to incineration. Since the amount of waste sent to incineration has decreased, the costs for operating the incinerator daily and thus, the waste management fee, have increased (Weber, et al., 2018).

In 2008, only 2,008 tons (2.5%) of all the material entering the plants of the Balearic Islands' waste management ended up recycled or re-used. Of those 2,008 tons, 1,400 tons (70%) was textile (Rezero, 2019). Despite the selection process, some recyclable plastics can end up incinerated due to their small size or to incorrect selection from citizens who might mistake the types of material they are throwing away (BUS-4; GOV-1). More recently, Ecoembes reported a recycling rate of 78% for light packaging, while another official source which will remain anonymous stated the actual rate lied between 25% and 33%.

2.3 Flows & stocks of single-use plastic

As indicated earlier, many hotels in Mallorca have started to reduce their usage of SUPs drastically (BUS-1; BUS-4). This is, of course, great news overall. For the material flow analysis (MFA) however, these reduction strategies have made it difficult to precisely indicate the amount of single-use plastic waste generated by hotels. This MFA therefore solely focuses on assumptions regarding the plastic generated in 3-4 star hotels in Mallorca in 2018.

As expressed in Figure 1, hotels receive SUP products (such as toiletries and kitchenware) from their suppliers. SUPs are then used in different departments of the hotels (e.g. in guest rooms, bars and restaurants) (Vermöhlen & Mizenko, 2019). Likewise, other types of SUP products are sold to tourists in local shops. Moreover, tourists might bring SUP in and out of Mallorca (for instance PET water bottles, toiletries and plastic bags).

The generated plastic waste is then transported to waste selective collection plants in Mallorca. Here, recyclable plastics are exported to mainland Spain (Cleanwave, 2020) for further processing and production of new products, while other plastics are transferred to the incineration plant for energy recovery (Simon, 2012).

Furthermore, leakage of SUPs into the terrestrial environment can take place via the waste management system. Indeed, waste that is blown away from overfilled public trash cans enters the natural environment. However, this does not concern the yellow selection containers which are supposedly closed. In turn, there shouldn't be any leakage from garbage trucks as those are supposedly closed as well (BUS-4). Finally, SUP on the beaches can end up in the sea (*see also section 3.2.4*). The data collection, sources and explanations of the assumptions of Figure 1 are summarized in Table 3.

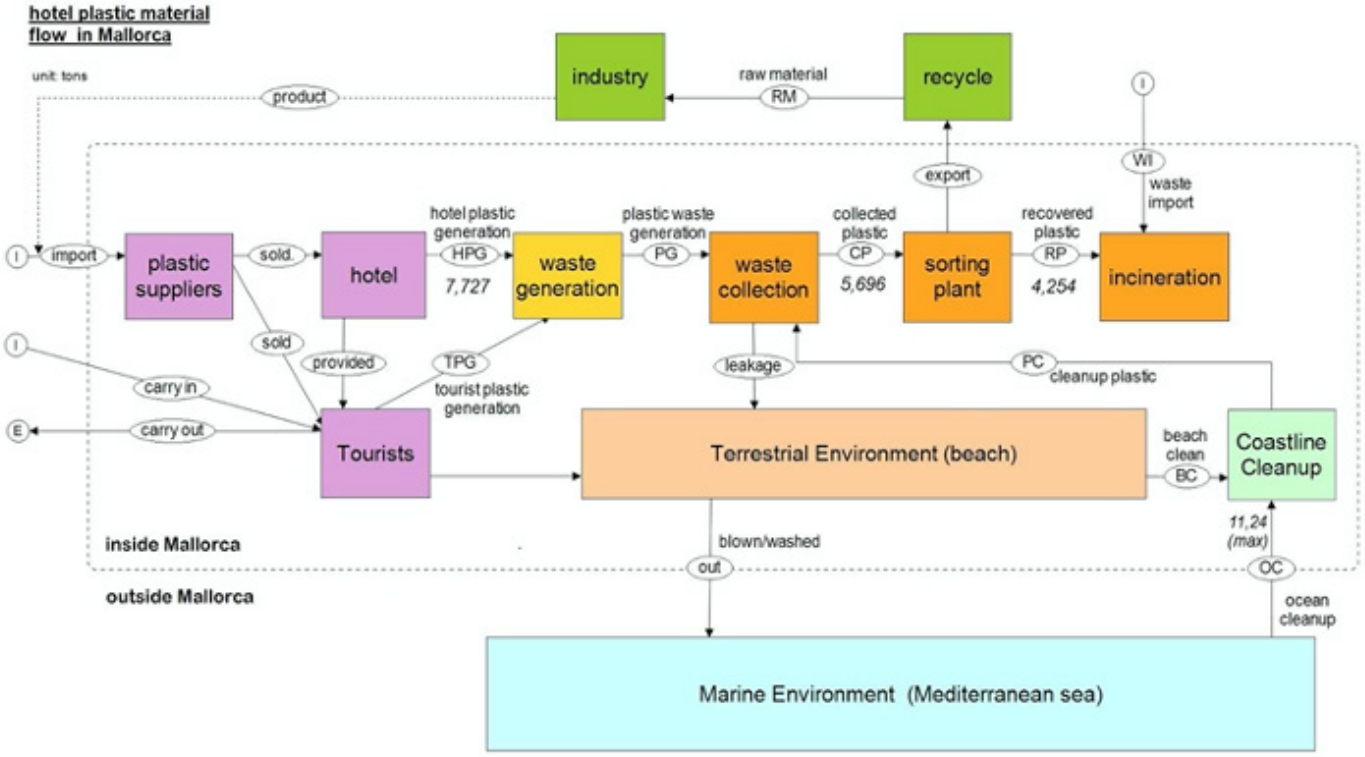

Figure 1 Representation of the plastic flows and stocks in and around Mallorca (Own design, 2020)

Table 3 Sources of data and assumptions

Data	Number	Source	Main assumption
Plastic generated in 3-4 star hotels	7,727 tons	Melia Hotels International (2020) Govern Illes Balears (2020a)	Plastic generation of Melia can represent the average amount of plastic generated from 3-4* hotels; 5200kg/hotel* 1486 hotels
Percentage of plastic generated from 3-4 star hotels among the whole island	33.08%	Govern Illes Balears (2020b)	7,727tons from 3-4* hotels/23,360 tons from the whole island
Selective plastic collection (3-4 star hotels)	5,696 tons	Bauske et al. (2019)	The calculated percentage of plastic generated from 3-4* hotels is reliable 17,271 tons * 33.08%
Recovered plastic	4,254 tons	TIRME (2018) TIRME (2020)	The calculated percentage of plastic generated from 3-4* hotels is reliable 21,670 recovered light packaging * 60% of plastic * 33.08% from 3-4* hotels
Collected plastic from the waters by "trash boats"	11,24 tons	Bauske et al. (2019)	The calculated percentage of plastic generated from 3-4* hotels is reliable 34 tons of coast clean up * 33.08%

Adapted from Sevigné-Itoiz, Gasol, Rieradevall, & Gabarrell (2015)

2.4 Marine pollution

2.4.1 Origins of marine plastic pollution

Plastic debris in the coastal areas of the Balearic Islands consists mostly of new items coming from the highly populated coastal areas as well as from other regions of the western Mediterranean Sea (BUS-6; Compa, Marsh & Deudero, 2019). Due to the presence of organic material, seagrass and algae on plastics in the waters, the study of Compa et al. (2019) suggests that these types of plastics in coastal areas come from nearby sources. Weathering characteristics (for instance micro-cracks and biofouling) of other plastic items indicate the amount of time of these plastics in the waters. Four ways through which large quantities of plastic waste might end up in the sea around Mallorca are identified: beach littering, strong rains and torrents, surface currents, and superficial winds.

Beach littering

A significant amount of plastic pollution comes from littering. Eighteen reviews of tourists retrieved from TripAdvisor pointed out the "gross" state of many beaches around the island and their discontent at the quantity of plastic floating in the sea (*Appendix B*). Some also pointed out the pollution in areas surrounding the beaches, such as parking lots (Cala Torta in 2014) (TripAdvisor, 2020b). Another tourist expressed their discontent at the state of cycling trails, being *"littered with single-use water bottles, sports drinks, and wrappers for energy bars"* (TripAdvisor, 2019). While most reviews pointed towards tourists to explain the state of the beach, one expressed disappointment at coming across so much waste during low season (TripAdvisor, 2020d). Whether this waste was left there by citizens or tourists several months before this observation, is unclear. Furthermore, the lack of public bins on the beach was also pointed out.

On the other hand, not all beaches seem polluted, such as Cala Ratjada, Cala Mesquida, Son Serra/Son Real (TripAdvisor, 2020a). But there seems to be a lack of monitoring and maintenance for many others. In an answer to a negative review complaining about the pollution and the passiveness of the lifeguard, the hotel Alua Soul Mallorca Resort stated that they "do not take care of the beach" and that "although they try to keep the beach clean, they cannot do more than complaining" (TripAdvisor, 2020c). The Alua Hotel and Resort chain has shown willingness to commit to the environment. For instance, through organising beach clean-ups and training staff (Bauske et al., 2019). Yet, it seems that even hotels engaged in eco-friendly practices reach their limits when trying to reduce direct beach littering.

Although no direct observation was possible, a stakeholder (BUS-6) provided pictures of intense littering found in the water and near hotels in Cala d'Or, probably generated through touristic activities (Figure 2). Plastics also seem to accumulate in the streets from which it slowly moves to the sea (RO-2).

Figure 2 Waste found by contacted divers in the vicinity of hotels in Cala d'Or (BUS-6)

Formation of torrents

Wastewaters in Mallorca are collected and treated before being discharged into the sea or re-used for human consumption. Moreover, the island periodically goes through episodes of strong rains (BUS-4; GOV-1). The sudden flow of extreme water results in the formation of torrents that play a role in washing waste into the sea.

First, due to gravity, litter is likely to accumulate in lower areas where torrents are likely to form and will be carried to the sea during episodes of heavy rain. Secondly, this sudden inflow of water will put pressure on the drainage system of the island. To take some pressure off the pipes and avoid any accident, valves are open, and water is also let out. At this moment, both wastewaters deriving from human activities and rainwater are released and find their way to the sea. They can carry all sorts of waste with them. It could be an escape route for sanitary products such as tampons, pads or other medical or hygienic items which have been known to be carelessly flushed away. The Baleares are building "stormwater tanks", such as in Palma, to filter the rainwater out of the drainage system and alleviate it (GOV-1). However, this measure is costly and time-consuming as the whole pipe system of Mallorca needs to be adjusted to prevent such incidents. We have not been able to quantify the contribution of those leakages to the total plastic pollution in the coastal waters.

Surface currents

All marine litter is a mixture of both debris from the islands and transported from other regions of the Mediterranean Sea. In the Balearic area, the surface currents are modified by the North Current (NC) that goes along the coasts of southern Europe and by the mesoscale circulations coming from the Algerian sub-basin, which benefit the formation of the Balearic current (BC) Figure 3. The surface water from the Algerian sub-basin crosses the channels of Ibiza and Mallorca in spring and summer. Fronts and eddies (vortices) can cause plastics to be distributed lower in surface waters. Therefore, together with the coastal morphology, they can also act as a barrier to land-coastal debris (Ruiz-Orejón, Sardá, & Ramis-Pujol, 2018).

Although most of the plastic pollution around Mallorca comes from the island itself, plastic waste generated in other parts of the Mediterranean can be brought to Mallorca by those currents. Waste from mainland Spain or France, or coming from the North African coast judging by the Arabic letters on them, can also be encountered in the Balearic sea (BUS-6; UNI-2; RO-2)

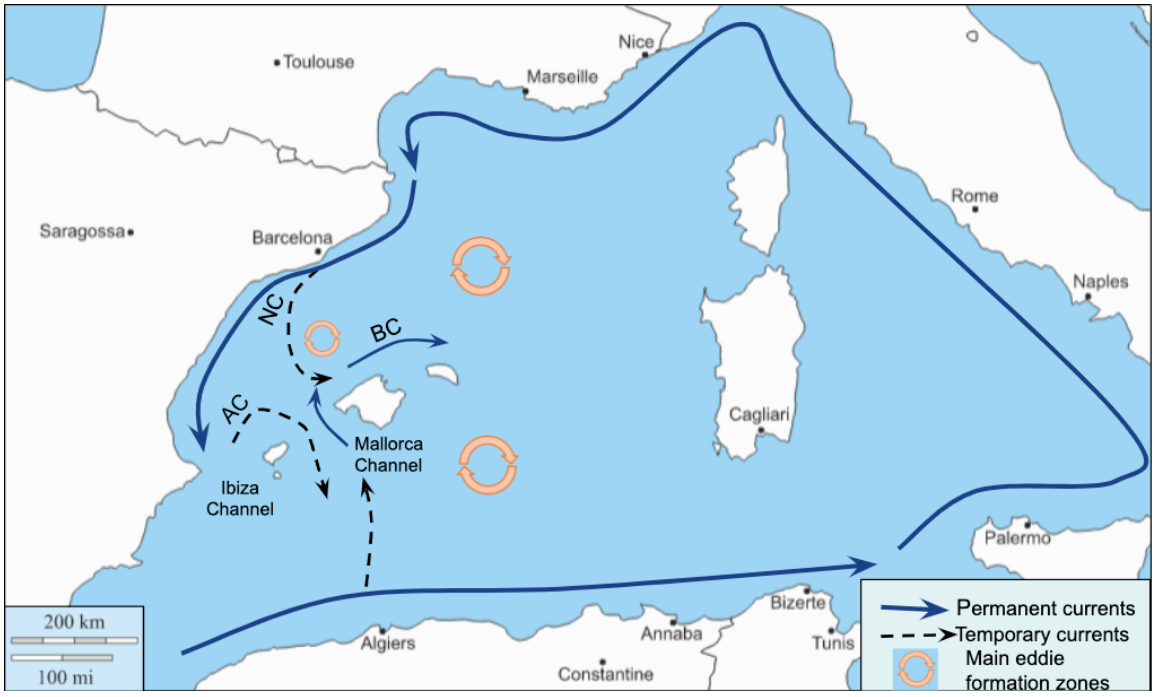

Figure 3 Surface currents in the Balearic area
Adapted from *d-maps.com (2020)*

Superficial wind

Compa et al. (2020) measured plastic concentrations in the Mediterranean Sea using surface trawl approaches and concluded that wind forcing has shown an effect on the vertical distribution of plastic items on the sea surface. Tows in high wind conditions capture fewer plastic pieces due to the vertical distribution in the mixed layer because of wind-induced mixing. The superficial wind speed is, therefore, an important factor regarding the distribution of macroplastics in the waters. Not only currents play a role in the distribution of floating macroplastics in the waters, but the wind as well (UNI-2).

2.4.2 Tourism & coast clean-ups

The appearance of coastal marine debris on beaches is very common, especially in the summer where the amount is twice as normal due to an increased number of tourists visiting the beaches (Compa et al., 2019). Looking specifically at July (when tourism activities are at the highest), trash boats collected almost 15 tonnes of waste out of the water off the coasts of the Balearic Islands and about half of the waste consisted of plastic (Bauske et al., 2019). Therefore, according to Compa et al. (2019), the tourism sector can be a potential source of floating marine debris from land as well as maritime activities in the Balearic Islands and throughout the west Medditeranean.

The Balearic government conducts yearly coastal cleanups from May to September through the Centro de Coordinación de Limpieza del Litoral de las Illes Balears ("Ley 8/2019, de 19 de febrero, de residuos y suelos contaminados de las Illes Balears," 2019). Between 2004 and 2018, more than 2,000 tons of waste were retrieved from the coastal environment of the Balears. In 2017, a total of 44,263kg of waste was retrieved around the four islands, of which 42.77% was plastics. Of this total, 23,713kg (54%) was retrieved in Mallorca, which is not surprising given the size of Mallorca compared to the three other islands (Govern Illes Balears, 2018).

In comparison, in 2018, a total of 58,089.57kg of waste was retrieved around the four islands, 34,113kg of which (58,73%) were retrieved from the beaches and coastal waters of 24 municipalities in Mallorca. Of that 34,113kg, 45,81% were plastics (15,546kg), which represented an increase of 2-3% compared with the previous year. The proportion of plastic retrieved differed greatly across municipalities. For instance, plastics amounted for 99% of the total waste retrieved in Muro, while it made up only 13% of the total amount in Pollença and Deià (Govern Illes Balears, 2018). Detailed data per municipality and month can be found in *Appendix C.*

2.4.3 Categorisation of marine plastic waste

Plastic debris categorisation

Plastic debris is commonly categorised by size. According to Worm et al. (2017), macroplastics comprise any plastic debris bigger than 2cm and thus, encompass most SUP. Mesoplastics range from 2cm to 5mm. Really small plastic debris, usually fragments of an initial plastic product, is called microplastics (1µm-5mm) or nano plastics (<1µm). In this report, the term macroplastics is used to refer to both macro- and mesoplastics. As nano plastic is harder to detect and little research has been done to quantify it around Mallorca, it is not included in the following section on marine plastic concentration.

Macroplastics are the most easily identifiable items and can be more easily retrieved from the sea, due to their size and floatability. According to Bauske et al. (2019), the vast majority of plastic waste found on the beach and in the sea surrounding Mallorca comes from food-related items. This includes mainly food and beverage packaging (such as snacks, sweets, soda cans, bottles and tetra paks) followed by lids and caps, plastic cutlery, plates and straws, light plastic bags, plastic cups and paper cups with plastic lining. Hygienic products such as cotton swabs are also a common occurrence. Many of the aforementioned plastic items were reported on the beaches and coastal waters of Mallorca by other visitors (BUS-6; TripAdvisor, 2019/2020).

After a while, macroplastic fragments can break down into smaller pieces due to photo-oxidation and other chemical or physical processes. The presence of these microparticles suggests fragmentation processes that indicate their persistence in the environment and can therefore easily be transported by surface currents and reach distant locations (Ruiz-Orejón et al., 2018). Microplastics are nevertheless less sensitive to superficial winds than macroplastics (UNI-2)

Plastic concentration

Table 4 shows that concentrations of microplastics measured in the waters of the Balearic Islands are the highest, while macroplastics are the lowest.

Table 4 Results of floating plastic concentrations in the Balearic Islands

Floating plastics concentrations		
Average	**Particle concentration (items/km2)**	**Weight concentration (g(DW)/km2)**
Microplastic	875,446	298.13
Mesoplastic	23,299	161.49
Macroplastic	2,897	706.1

Adapted from Ruiz-Orejón et al. (2018)

About 91.41% of all floating plastics in the Balearic Island consists of rigid fragments (plastics that retain hard structure). Looking specifically at the floating plastic composition of Mallorca, the vast majority of the total floating plastics particles is made up from rigid fragments (Compa et al., 2020; Ruiz-Orejón et al., 2018) and accounts for nearly 90.67%, while 6.97% consists of film fragments, 1.51% fishing lines, 0.72% foams, 0.11% industrial pellets and 0.02% of plastic ropes (Ruiz-Orejón et al., 2018).

Furthermore, Suaria et al. (2016) identified the polymeric characteristics of plastic particles >700 µm and defined 16 different polymer typologies. The largest identified polymeric type was polyethylene (HDPE and LDPE) (52%) such as plastic bottles, bags, containers and sanitary products. A study by Compa et al. (2019) confirmed this as well. Polyethylene was followed up by polypropylene (PP) (16%) such as food wrappers, straws, bottles, face masks, sanitary products; and synthetic paints (7.7%). These results can be explained by the large use of disposable packages and the fact that these particles have a lower density than seawater and therefore float (Compa et al., 2019).

2.4.4 Plastic hotspots in the sea

Studies about the abundance of floating micro-sized particles mostly focus on the North-western part of the basin (RO-2). It has been reported that large amounts of plastic debris are found on the Mediterranean seafloor and are floating on its surface (Table 5), as well as on beaches and coastal environments (Suaria et al., 2016).

Table 5 Floating microplastic concentrations in the Mediterranean Sea

Floating microplastic concentrations		
Area	**Sampling period**	**Mean abundance± SD (Max) (g/km2)**
North Western Mediterranean	July–Aug 2010	2020 (2280)
Western Mediterranean	Sept 2011–Aug 2012	187 (216)
Mediterranean	May 2013	423 (1934)
Central West Mediterranean	May 2011–June 2013	579.3 (9298)

Adapted from Suaria et al. (2016)

Even in the study of Ruiz-Orejón et al. (2018), the highest density points of plastics were found on the North-West coasts of the islands of Mallorca and Ibiza (Figure 4). On the North-Western coasts, the islands are geomorphologically more abrupt and pocket beaches are present, which makes it less visited by tourists (RO-2). Therefore, the oceanographic conditions can actively modify the floating plastic concentration around these islands. However, it appears difficult to point out exact locations with the largest amounts of plastic debris due to the different oceanographic conditions throughout the year (UNI-2).

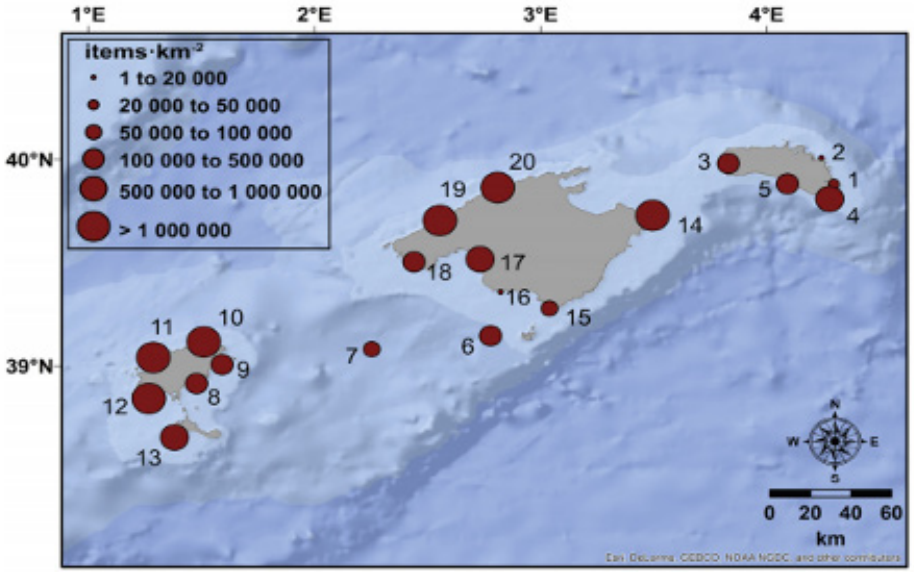

Figure 4 Distribution of plastic particle concentrations in the coastal waters of the Balearic Islands Reprinted from Ruiz-Orejón et al. (2018)

3. Conclusion

This report aimed to identify the main question: *How do single used plastics generated in Mallorca's hotels flow and stock in the waste system and into the ocean?* by answering the following research questions:

- *What types of SUP do hotels in Mallorca use?*
- *What is the operation of SUP's lifecycle processes in Mallorca's hotel industry?*
- *What are the potential marine plastic hotspots around Mallorca?*

Types of SUP used in Mallorca's hotels

Overall, the single-used plastics that are used by hotels include PET, HDPE, LDPE, PP and PS plastic types. The usage of these types of plastics is widely spread throughout hotels, but most single-use plastic waste is generated in the guest rooms and the restaurant. Examples include plastic bin bags, plastic straws and stirrers, cotton swabs and PET water bottles. A significant amount of the SUP items used in hotels will be banned after the implementation of the Balearic Islands' single-use plastic ban law (ley 8/2019) and the EU legislation. Also, various large hotel chains have implemented strategies for the elimination of single-use

plastics. However, the current COVID-19 crisis has been affecting these reduction strategies profoundly as numerous previously eliminated SUP items are being reintroduced to the hotels to ensure the health and safety of staff and guests. It is therefore unavoidable that more SUP will be generated in the hospitality sector in the future as long as there is no vaccine for COVID-19.

Operation of SUP's lifecycle in Mallorca's hotel industry

Assumingly, plastic waste generated by the 3-4 star hotels in Mallorca totals 7,720 tons annually. This plastic waste is collected, transferred and treated. In contrast to the general waste hierarchy, incineration is primarily preferred as a treatment method in the waste management system of Mallorca. The single-use plastic waste could leak into the terrestrial environment via the hotel and/or via the waste management system (e.g. through the wind or rain). As the garbage trucks are closed, no leakage is supposed to occur here. Single-use plastic waste on the beaches can end up in the sea.

Potential marine plastic hotspots around Mallorca

Concerning the plastic hotspots, the highest amounts of plastic debris can be found on the North-West coasts of the islands of Mallorca and Ibiza. The oceanographic conditions can actively modify the floating plastic concentration around this area, as tourists cannot visit these North-West coast areas. However, pinpointing exact plastic hotspot locations is difficult, due to the variability of oceanographic conditions throughout the year.

Overall, it can be concluded that large hotels in Mallorca generate a huge amount of SUP, but are working on minimizing this. Yet, not all of the generated plastic is being treated. SUP leakages occurring from the waste management, littering by tourists and the formation of torrents are the main identified causes of SUP ending up in the surrounding waters.

4. Limitations

Whilst conducting this research, various limitations occurred. First of all, the lack of direct observations made it difficult to precisely assess the types and quantities of plastic waste found in Mallorca. The report, therefore, entirely relies on interviewees' own experience and documents analysis. Assumptions and calculations were thus made by using documents written by many different stakeholders (such as government, scientists, waste management authorities and NGOs) and were issued in different years. Concerning the document analysis, collecting data specific to Mallorca required using local resources, usually in Castilian or in Catalan. Due to the language barrier, official sources were not browsed extensively, and it is expected that much can still be learnt from these documents. The fragmented data overall made it difficult to quantify the entire material flow chart.

Moreover, difficulties in contacting hotels were encountered. Understandably, hotel managers have different priorities at the moment due to the current COVID-19 crisis. However, this has resulted in a lack of data concerning plastic generation in hotels. Researchers confirmed that plastics entering hotels come from many different sources, but this research could not identify those entry points and their quantities.

In addition to data specific to hotels, data specific to tourists was not available. It was therefore not possible to identify tourists' use of SUP in and out of hotels and to observe differences or patterns across hotels or areas. Because of this, it was difficult to assess the fraction of SUP generated by tourists and not by Mallorcan citizens, and how much of this fraction ended up in the waste management system or how much leaked into the natural environment.

Nevertheless, despite those challenges and the gaps concerning quantities, it was still possible to paint the big picture of plastic flows in Mallorca.

5. Recommendations

To find more specific data concerning the SUP waste generated in hotels, the following recommendations are proposed:

1. Conduct annual surveys

In general, data for a Material Flow Analysis is often collected through a survey. In this case, the data was mainly collected through qualitative methods, which provided interesting insights, but was not conclusive enough. Therefore, conducting an annual survey with hotel managers/owners to bridge this data gap is recommended. Especially as such a survey could identify:

- Possible entry points of plastics in hotels and their quantities;
- The total amount of SUP used per hotel and per department;
- The progress of the hotels concerning their reduced SUP (i.e. total amount of SUP reduced annually);
- A potential link between SUPs consumption and age, nationality, or type of holiday-goers.

Hotel owners/managers should be attracted to participating in this annual survey by providing them with rewards before or after completion of the survey. These do not necessarily have to be financial incentives but could for example include the provision of knowledge. The enforcement of the ley 8/2019, could lead to hotels owners feeling pressured to reduce their SUP usage, but they may not see, or know about, the benefits. Use this to your advantage by clearly communicating the advantages of SUP reduction (e.g. combating marine pollution, cost-cutting benefits, etc.) to hotel owners.

2. Collaborate with TIRME SA

TIRME SA is a large private company responsible for waste management on the island. During this research, TIRME has shown interest in the evolution of this project and mentioned the possibility of working together with Oceana. This collaboration could aid in bridging the gap concerning reliable data regarding the SUP waste generated in hotels. Especially as TIRME works together with large hotel chains in Mallorca (such as IberoStar, RIU and Melia) to assist in the adoption of SUP-reduction practices, their input is of high value. Additionally, TIRME has already reduced considerable amounts of SUPs within its own premises.

3. Waste generation database Iles de Balears

Moreover, the government of the Balears is also working on building an exhaustive database of waste generation and management per municipality. Transparency being a fundamental value for the government, they will provide online resources for citizens who want to consult and keep track of waste generation and management online. As for now, the platform is not complete but documents and official reports are already available. It is recommended to conult the platform of Mallorca's government (www.caib.es) for information regarding waste generation and management in Mallorca, more specifically, this page where the government publish their reports: http://www.caib.es/govern/sac/fitxa.do?codi=3609542&coduo=919&lang=es

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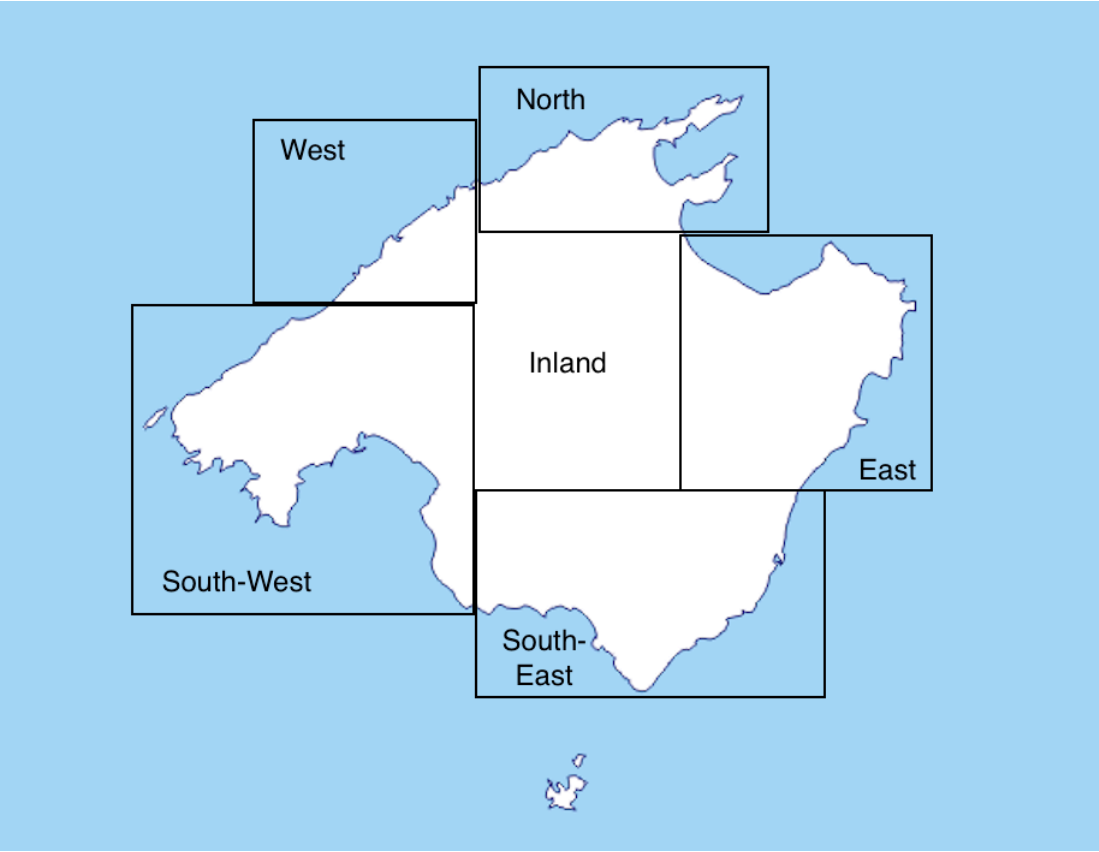
Appendices

Appendix A
Overview of large 3 to 4* hotels in Mallorca per area



Map retrieved from d-maps.com (2020)

NORTH				
Name	**Municipality**	**City**	**Num-ber of Rooms**	*****
Portblue Club Pol-lentia Resort & Spa	Alcúdia	Alcúdia	532	4*
Condesa	Alcúdia	Port d'Alcúdia	475	4*
Jupiter	Alcúdia	Port d'Alcúdia	463	3*
Saturno	Alcúdia	Port d'Alcúdia	326	4*
Iberostar Alcudia Park	Muro	Platja de Muro	366	4*
Iberostar Playa de Muro	Muro	Platja de Muro	396	4*
Iberostar Albufera Playa	Muro	Muro	348	4*
Fergus Pollensa Park & Spa	Port de Pollença	Pollença	316	3*

SOUTH-WEST				
Name	**Municipality**	**City**	**Number of Rooms**	*****
RIU Playa Park	Palma	Platja de Palma	475	4*
RIU Bravo	Palma	Platja de Palma	437	4*
Globales Palma Beach	Palma	Platja de Palma	318	3*
Pabisa Sofia	Palma	Platja de Palma	328	3*
Taurus Park	Palma	Platja de Palma	341	4*
Hipotels Gran Playa de Palma	Palma	Platja de Palma	368	4*
Caballero	Palma	Platja de Palma	372	4*
Iberostar Cristina	Palma	Platja de Palma	405	4*
Palma Bay Club	Palma	Platja de Palma	442	3*
Helios	Palma	Can Pastilla	315	3*
Meliá Palma Marina	Palma	Palma	345	4*
Belvedere Park	Palma	Cala Major	414	3*
Sol Guadalupe	Calvià	Magaluf	493	4*
Samos	Calvià	Magaluf	444	4*
BH Mallorca II	Calvià	Magaluf	328	4*
BH Mallorca I	Calvià	Magaluf	328	4*
Sol House the Studio	Calvià	Magaluf	373	3*
Sol Katmandu Park & Resort	Calvià	Magaluf	404	4*
Sol Barbados	Calvià	Magaluf	428	4*
Sol Palmanova	Calvià	Palmanova	326	4*
Ibersol Son Caliu Mar & Beach	Calvià	Palmanova	315	4*
Son Antillas	Calvià	Palmanova	316	4*
Sol Palmanova I	Calvià	Palmanova	327	4*
Santa Lucia	Calvià	Palmanova	332	4*
Pionero	Calvià	Santa Ponça	319	4*
Zafiro Rey Don Jaime	Calvià	Santa Ponça	416	4*
Beverly Playa	Calvià	Peguera	443	3*
Hotel Roc Gran Camp de Mar	Andratx	Camp de Mar	416	4*

EAST				
Name	**Municipality**	**City**	**Number of Rooms**	*****
Club Hotel Tropicana Mallorca	Manacor	Cala Murada	371	3*
Canario Park	Manacor	Cales de Mallorca	323	3*
America	Manacor	Cales de Mallorca	372	4*
Samoa	Manacor	Cales de Mallorca	331	3*
Sol Casa Antena	Manacor	Cales de Mallorca	334	3*
Sa Coma Playa	Sant Llorenç des Cardassar	Coma (La)	326	4*
Hotel Mediterraneo	Sant Llorenç des Cardassar	Coma (La)	399	4*

SOUTH-EAST				
Name	**Municipality**	**City**	**Number of Rooms**	*****
Club Colonia De Sant Jordi	Ses Salines	Colònia De Sant Jordi	395	4*
Club Cala Marsal	Felantix	Portocolom	347	4*
Barcelo Ponent Playa	Felantix	Cala Ferrera	432	3*
Palia Hotel Dolce Farniente	Santanyí	Cala D'Or	302	3*
Iberostar Club Cala Barca	Santanyí	Porto Petro	734	4*
Luna Park	Llucmajor	Arenal (L')	318	3*
Bahia de Palma	Llucmajor	Arenal (L')	423	3*

Appendix B
TripAdvisor Reviews

Type	Colour
Beach	
Other	

Date	Quote
Cala Millor	
August 2015	When we got there in August 2015, there was lots of plastic waste in the water that touched you every few seconds when swimming. Some of our group found it disgusting. The beaches further to the north (Cala Ratjada, Cala Mesquida, Son Serra/Son Real) were completely clean, but this one was not, not at all.
August 2015	Lovely long sandy beach ,but spoilt by litter in the sea and on the beach.Not kept very clean was horrified to discover so many plastic bags in the sea whilst swimming.
Cala d' Or	
August 2018 Alua Soul Mallorca Resort	Nice hotel, nice location, great evening shows, very good fresh and varied food, eaten very well, unfortunately beach and water full of plastic and cigarettes, the lifeguard did not clean anything and he did not say anything to people about the behaviour. It could be a great holiday unfortunately these things were too negative, swimming in the sea and finding all these little bits of plastic, bottles, bags IS NOT VERY NICE. Response hotel: Hi Michele, First we'd like to thank for giving us your thoughts. However, we do not take care of the beach. We regret you had an uncomfortable time at the beach, but we only provide the services inside the hotel. Of course we try to keep the beach clean but we cannot do more than complaining. Still, thank you for trusting us and we hope you you could enjoy all the others points.

Date	Quote
Cala Sa Nau	
July 2015	Gorgeous from a Distance -- Plastic Nightmare Cala Sa Nau is totally gorgeous from a boat or when walking the nearby bluffs. Yet, when we got to the beach we were shocked by floating plastic bags, one after another. I spent my time at the beach pulling plastic bags and other junk out of the water. Little fragments of plastic stuck to my legs; I can't imagine how unhealthy this is for the fish. How can they survive. We left feeling totally sad for the way this beautiful beach is treated.
July 2015	The cove is very small and quite dirty with litter. The sea, being a cove was strewn with litter, empty plastic cups and lots of seaweed.
Cala Pi beach	
August 2016	Well I can honestly say how disappointed we were in this beach. The beach was disgusting, the stench of sewage everywhere, water was littered with plastics, etc, don't think we will ever go back there again.
Cala d'Es Pou	
August 2019	Beach was acceptably clean (yes a few bits of litter if you looked hard enough).
June 2019	I really enjoyed our time on this beach. Yes it's a bit grim with the plastic in the sea. But if you see it PICK it up. I spent hours collecting what I could and people looked at me like I was some kind of loon. If you are there put your rubbish in the bin, pick up what you see in the water dont just think someone else will do it. We go to these places to enjoy it , treat it with some respect.
Cala Agulla	
September 2019	The place is looking really nice from the nature perspective.Still unfortunately this attracts a lot of tourists and not all of them are leaving with their trash, most of them are leaving it behind.
July 2019	Beautiful clean beach with amazingly clear blue water!
June 2015	This beach could be one of the best in Europe, easily. The sea is amazing, so blue and clean. But its ruined by the tourists. Its ruined by the groups of young people you go there and drink and put loud music and fill the sand with cigarettes and dirt.
July 2016	Very crowded and masses of plastic floating around in the surf.
Playa de Magaluf	
September 2018	Nice beach, they try to clean it, but there's still garbage tourists don't bother to put in the trash bins.

Date	Quote
Playa de Magaluf (cont.)	
July 2019	A bit dirty and very full of people. I the afternoon the water was not that clear anymore :-/
December 2017	Me and my husband went out on a Pedalo Boat on Magaluf Beach and whilst the beach seemed very clean, whilst we were out in the sea there was lots of wrappers and bits of rubbish
Platja d'es Trenc	
November 2018	Sooooo disappointing!! Can't believe we paid 7Euros to see a beach laced with trash. I know we're off season and the water is choppy but we thought for sure it would live up to even half the hype. So many more beautiful places on the island. Gross (not sure if they were dead or not) jellyfish things washed up all over the shore. Seriously there was trash evwrywhere. I remember reading one review about how are there no trash bins on the beach and I totally agree. Sooooooooooooo disappointing and such a waste of money.
Cala Torta	
April 2014	When you arrive at the beach your are met with piles of trash, plastic and rubbish flying all over the parking area, the beach it self is not so bad. Too bad, it's a nice little beach with out too many people, because t's away from the hotels...which is probably why it is not cleaned up. Bit disappointing to see a lovely place soiled like this.
Cycle routes around Puerto Pollensa	
2019	There is a very easy way to find the popular cycle routes around Puerto Pollensa and that is to follow the trail of litter left by your fellow cyclists. Verges of country lanes will be littered with empty single use water bottles; sports drink containers and wrappers for energy bars. Avoid any container that still appears to contain liquid – sometimes single use bottles are recycled for a different purpose!

Information derived from TripAdvisor (forum & reviews)

Appendix C
Waste retrieved details

C1 Details of waste retrieved during governmental coastal clean-ups per municipality and per month, in 2018 (in kg)

Municipality	May	June	July	August	September	Total
Estellencs	0.00	92.68	63.24	19.30	19.81	195.02
Fornalutx	0.00	66.30	65.79	159.04	251.69	542.81
Sant Llorenç	82.45	89.25	66.30	420.75	451.35	1,110.10
Escorca	0.00	282.63	341.62	201.03	601.80	1,427.07
Banyalbufar	0.00	96.90	132.60	260.10	114.75	604.35
Deià	0.00	663.00	471.75	224.40	374.00	1,733.15
Valldemossa	0.00	104.55	97.75	219.30	85.00	506.60
Son Servera	53.55	96.05	77.35	136.00	140.25	503.20
Capdepera	0.00	226.95	348.50	316.20	311.95	1,203.60
Campos	0.00	272.00	272.00	289.00	276.25	1,109.25
Ses Salines	0.00	389.30	357.00	450.50	484.50	1,681.30
Sóller	0.00	717.40	598.57	795.18	896.75	3,007.90
Sta Margalida	67.58	151.73	210.80	60.78	185.73	676.60
Muro	25.50	93.50	96.05	8.50	8.50	232.05
Artà	58.23	208.25	116.88	116.88	155.55	655.78
Manacor	455.60	653.65	1,005.55	781.15	990.25	3,886.20
Santanyí	47.18	521.90	851.70	1,122.00	874.65	3,417.43
Alcúdia	148.75	521.90	481.95	310.25	348.50	1,811.35
Felanitx	141.53	136.85	536.35	355.30	438.60	1,608.63
Llucmajor	46.75	361.25	457.30	308.55	226.10	1,399.95
Andratx	0.00	164.21	168.29	110.80	66.22	509.52
Pollença	0.00	1,095.65	318.75	271.15	463.25	2,148.80
Palma	418.20	553.95	749.28	854.25	354.45	2,930.12
Calvià	147.90	243.91	296.65	237.53	286.88	1,212.87

Adapted from Govern Illes Balears (2018)

C2 Details of plastic waste retrieved during governmental coastal clean-ups per municipality, in 2018

Municipality	Total amount waste retrieved in 2018 (kg)	Amount of plastic waste retrieved in 2018 (kg)	Proportion of plastic waste retrieved in 2018
Alcúdia	1,811.35	1,539.65	85%
Andratx	509.62	300.62	59%
Artà	655.78	236.08	36%
Banyalbufar	604.35	157.13	26%
Calvià	1,212.80	230.43	19%
Campos	1,109.25	488.07	44%
Capdepera	1,203.60	613.84	51%
Deià	1,733.15	225.31	13%
Escorca	1,427.07	713.54	50%
Estellencs	195.02	76.06	39%
Felanitx	1,608.63	1,126.04	70%
Fornalutx	524.81	298.55	55%
Llucmajor	1,399.95	629.98	45%
Manacor	3,886.20	1,865.38	48%
Muro	232.05	229.73	99%
Palma	2,930.12	1,084.14	37%
Pollença	2,148.80	279.34	13%
Santanyí	3,417.43	1,435.32	42%
Santa Margalida	676.6	257.11	38%
Sant Llorenç	1,110.10	932.48	84%
Ses Salines	1,681.30	672.52	40%
Son Servera	503.20	261.66	52%
Sóller	3,007.90	751.98	22%
Valldemossa	506.60	111.45	22%
TOTAL	34,113.58	15,546.81	45,81%

Adapted from Govern Illes Balears (2018)

Expert Report 2

Environmental Impact Analysis

Written by

Merijn Bouman | Ella Busuttil | Carmen Noriega Hoyos | Matthijs Slegt | Steffan Thomas | Margriet Zwart

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Main Findings

1. The main marine ecosystems of Mallorca identified were shallow sand banks, Posidonia meadows, reefs, underwater structures caused by gas emissions, submerged or semi-submerged marine caves, and large coves and shallow bays. All these ecosystems are affected by plastic pollution.

2. The largest impact of plastic on marine organisms are entanglement and ingestion, which affected four major taxonomic groups (reptiles, marine mammals, seabirds and fish)

3. Cultural services are the ecosystem service most negatively affected by plastic pollution, especially aesthetic services.

4. Economic damages caused by plastic pollution are hardest felt in the hospitality sector, which includes tourism. The main losses stem from less attendance from tourists due to the loss of aesthetic value, clean-up costs and waste management costs.

5. Although Plastic Free Zones in the hospitality sector may have high initial costs, this is compensated by long-term savings, an increased reputation of the sector and positive effects on the ecosystem services the sector is reliant upon.

1. Introduction

"There is wide recognition that marine debris does not belong, nor does it need to be in the marine environment" (Gall and Thompson 2015; p178). Despite all recognition, man-made debris can be found in all marine habitats around the world and is one of the major threats to biodiversity. Of this encounter between individuals and debris, plastic items are among the most abundant types of marine debris, accounting for at least 92% of the total amount (Gall & Thompson, 2015). Plastic pollution is of great concern because of its abundance and persistence in the environment (NGO-1). It may take up to several hundreds of years before the resistant, recalcitrant plastic items are decomposed completely. Ultimately, plastic items do degrade just as organic materials do, however the rate at which this environmental degradation takes places is extremely slow.

A plethora of studies show the detrimental impacts of plastic on the environment, and how those effectively end up having an effect on the humans of tomorrow (Gall & Thompson, 2015; Worm, Lotze, Jubinville, Wilcox & Jambeck, 2017). However, not much research has been performed yet about those impacts on Mallorca. Mallorca is a member of Spain's Balearic Islands, situated in the western Mediterranean. Encompassing the island, there are rich ecosystems that make the area a biodiversity hotspot, even by the Mediterranean's standards (Ayala Bonal et al., 2014). To target effective policy to reduce the amount of single-use plastic that enters the ocean from Mallorca's hospitality sector, it is important to discover how exactly plastic debris affects the inhabitants of the island, and their livelihood.

Therefore, the main research question this report tried to answer, is:

'How will the implementation of Plastic Free Zones as a strategy for reduction of Single Use Plastics (SUP) impact the coastal and marine ecosystems, their services, and local economy of Mallorca?'

In order to answer this question, several sub-questions had to be answered first:

1. *What are the main marine and coastal ecosystems in Mallorca and their ecosystem services?*
2. *What impacts do plastics have on the coastal and marine ecosystems, their species and their services, and the use of natural resources?*
3. *What impacts do plastics have on the local economy of Mallorca?*
4. *What are the costs and benefits of Plastic Free Zones for Mallorca?*

These questions have been answered by literature research, document analysis and confirmation from interviewees. First, in this report the marine and coastal ecosystems, their target species and ecosystem services have been identified. These services are important, as all ecosystems provide unique and vital services to humans. Secondly, the effects of plastic on those ecosystems and species were assessed through an Environmental Impact Assessment (EIA). Following the EIA, the possible impacts of the implementation of Plastic Free Zones (PFZs) on Mallorca's ecosystems and economy was estimated using a few select examples.

2. Marine and coastal ecosystems of Mallorca and their ecosystem services

This chapter will provide an overview of the **main marine and coastal ecosystems on Mallorca,** including their target species for conservation and ecosystem services. First of all, it is important to make a clear **distinction** between **habitats** and **ecosystems**, as the **terms** were sometimes used **interchangeably** by **stakeholders** in the interviews (NGO-1; NGO-5; RO-2). The reason for this could be that in Spain, and Europe in general, the classification of marine-coastal environments is through habitats, however their definitions differ. For Spain (Resolution of March 22, 2013), the *"Fichas del Inventario Español de Hábitats Marinos"* (Sheets of the Spanish Inventory of Marine Habitats) group hundreds of them (Templado et al., 2012), while the Europe habitats directive (D. 92/43/EEC) only identifies nine types of habitats (Ayala Bonal et al., 2014). The definition of **habitat** is stated as *a terrestrial or aquatic area differentiated by its geographic, abiotic, and biotic characteristics, either entirely natural or semi-natural, in which the species live in any stage of their life cycle.* Meanwhile, an **ecosystem** comprises *a set of interconnected habitats that constitute a functional unit* (Templado, et al., 2012). Considering the definitions of habitats and ecosystems, the Europe habitats directive is describing ecosystems rather than habitats.

2.1 Description of the main marine and coastal ecosystems

For Mallorca, six of the nine marine-coastal ecosystems of the European habitat directive were identified, and those ecosystems were previously described in Spain by Red Natura 2000 (Ayala Bonal, et al., 2014). A brief description of the six ecosystems and ecological importance is given below:

Shallow sandbanks

Permanently submerged sublittoral sandbanks, with a water depth of <20m. The banks are mainly made up of fine sand sediments. In the Balearic Islands, sediments are mainly composed of remains of organisms (shells and calcareous skeletons). The sandbanks could be colonized with vegetation belonging to the *Zosteretum marinae, Cymodocea nodosa* and seagrass species, or without any vegetation at all. Sporadic patches of *Posidonia oceanica* are also associated with this ecosystem. It plays a **key role in coastal sedimentary processes**, mainly in the dynamic of the beaches, acting as a **sediment sink to areas** of the coast.

Posidonia meadows

Characteristics of the Mediterranean infralittoral zone. *P. oceanica* grows on a hard or soft substrate and constitutes one of the main climax communities of the coasts. These meadows are essential for the functioning of coastal marine ecosystems since they have high ecological value and their spatial structure allows the coexistence of a great diversity of species. Besides, it helps in the **protection of the coastal zones**; its rhizomes fix the sediment and form a structure that cushions the action of currents, waves, and storms. Also, they function as sediment traps that allow the **generation of high-quality biogenic sands.**

Reefs

Can have both an organic and a geological origin, with a depth range from infralittoral to bathyal zones. In Mallorca, they mainly consist of hard and compact substrates on hard or soft bottoms. Reefs can harbour a zonation of benthic communities of algae and animal species, as well as coralline concretions (inlays, and bivalve shell beds). This **"meta-habitat"** provides **support, shelter, and food** for more than 1,000 plant species and more than 7,000 animals. Furthermore, are important for maintaining the life cycle of multiple species, as reefs act as **reproduction zones**, and are essential **nurseries** for juvenile species.

Underwater structures caused by gas emissions

Complex structures consisting of rocks with heights of <4m, located on depths between 350 and 2,000m. These structures are the resulting carbonated precipitation from microbial oxidation. The formations are intersected by fracture planes that intermittently release gas. The unique and exceptional ecological value of these **highly diversified ecosystems** resides in the association of chemosynthetic communities with sediments and methane leaks, that give rise to a habitat where primary production does not depend on solar energy.

Submerged or semi-submerged marine caves

Caves located below the sea level or exposed to it in high tide. The lateral and lower communities are composed of marine invertebrates and algae. These caves are fragile ecosystems since the communities that form them develop complex and delicate balances that are highly sensitive and easily disturbed by external changes. For this reason, certain organisms have been **very good indicators of the health of the waters**, the climate, and changes in the sea level throughout geological history.

Large coves and shallow bays

Large coastal depressions with limited influence of freshwater. They are protected from the action of waves and contain a great diversity of sediments and substrates. This ecosystem is ecologically important as it **protects from disturbances caused by global changes.** Furthermore, this ecosystem provides suitable areas for fish aggregation.

The **main threats** to the **marine-coastal ecosystems** and their services are due to human activities. For Mallorca, these threats include **habitat destruction and fragmentation** (habitat loss, raw material extraction, infrastructures, illegal funding), **climate change**, overfishing, infiltration by invasive species and **pollution** (aquaculture, tourism, plastic pollution) (Ayala Bonal, et al., 2014). This study focuses on the plastic footprint of anthropogenic activities.

2.2 Target species

Target species, selected as an **object of conservation**, are chosen for their **stand-out characteristics** such as being umbrella species (migratory habits through different ecosystems), their conservation status or fishing importance. For Spain, Ayala Bonal *et al.* (2014) identified a list of target species within **four major taxonomic groups.** These groups are reptiles (**sea turtles** (Figure 1A)), **marine mammals** (Figure 1B), **fish**

and **seabirds**. Globally **fish** (21.94%) and **seabirds** (18.41%) are the **most affected** taxonomic groups **by plastic pollution** (LITTLERBASE, n.d.). While, **sea turtles** are used as a **regional indicator** of **marine plastic litter** in the **Mediterranean Sea** (INDICIT II, n.d.). The **target species** within these groups are **listed in Appendix A**, including only the species that are present in **Mallorca** and play a role for Mallorca's communities.

Figure 1 Target species for conservation in Mallorca. A. Loggerhead turtles (C. caretta). Save the Med (https://www.savethemed.org/es/our-projects/research-projects/). B. Bottlenose dolphin (T. truncatus). Tursiops Marine Research (https://www.asociaciontursiops.org/copia-de-colabora).

2.3 Ecosystem services

Marine ecosystem services are **essential for human well-being** and are often **used as an indicator of the benefits** that the environment provides to humans. These services are divided into four main categories: supporting, provisioning (supplies), regulating and cultural services. The definition of these marine services is summarised in Appendix B (Liquete et al., 2013; Campagne et al., 2015; Lattemann, 2010), and the relation between the six marine ecosystems in Mallorca and their services (Ayala Bonal et al., 2014) are listed in Table 1. For Mallorca in general, the **most important services** are related to **provisioning** services (raw materials and/or food), which are mainly derived from fishing. In terms of **regulating** services, ecosystems have a protection service against extreme weather events. The Posidonia meadows provide a nursery service (supporting) and protect against beach erosion (regulating). Probably the most important service for the social system is the **cultural ecosystem service**, consisting of aesthetic, physical, spiritual, and mental services. And for the economic system, the most important service is recreation and tourism services (cultural), which is the main economic sector in Mallorca (RO-2).

Ecosystem Services		Marine-coastal Ecosystems of Mallorca					
		Sandbanks	Posidonia	Reefs	Underwater structures	Caves	Coves and Bays
Supporting	Biodiversity maintenance	X	X	X	X	X	X
	Life cycle maintenance	X	X	X	X	X	X
	Biomass generation	X	X	X	X	X	X
	Carbon sequestration	X	X	X	X	X	
Regulating	Water quality	X	X	X	X	X	X
	Climate regulation	X	X	X	X	X	X
	Oxygen release	X	X	X	X	X	X
	Beach maintenance	X	X	X	X	X	X
	regulation	X	X	X	X	X	X
Provisioning (supply)	Food and fishing	X	X	X	X	X	X
	Temperature and salinity regulation	X	X	X	X		
	Raw materials	X	X	X	X		X
	Scientific and medical resources	X	X	X	X	X	X
	Ornamental resources	X	X	X		X	
	Transport and communications						X
Cultural	inspiration	X	X	X		X	X
	Tourism and leisure	X	X	X		X	X
	Generation of knowledge	X	X	X	X	X	X
	Traditional activities	X	X	X	X	X	X

Table 1 Marine ecosystem services of the identified marine- coastal ecosystem in Mallorca.

3. Environmental Impact Assessment

As mentioned in the introduction, man-made debris, especially plastic debris, is a **major threat to biodiversity.** The increased global production and usage of plastics has led to an **accumulation of an excessive volume of plastic debris in all of our oceans** (Gall & Thompson, 2015; Worm et al., 2017). It has been estimated that between 15 and 51 trillion plastic particles are freely floating in marine environments globally. This plastic debris **concentrates around shorelines and in open ocean gyres.** Plastic debris that is not floating at the surface potentially ends up in marine sediments and the deep sea, which may have evolved into microplastic sinks. Microplastic concentrations in the sediment (by volume) are estimated to be four to five orders of magnitude higher than microplastic concentrations in the water column (Worm et al., 2017). Evidence suggests that **quantities of plastic are increasing** in a lot of locations around the world, despite clean-up efforts from the coastal and marine environment (Gall & Thompson, 2015). This is also the case in Mallorca, where it became evident from interviews that **all marine habitats are negatively affected** by plastic pollution (NGO-1; NGO-5), and this is clearly a human made problem (NGO-5).

This chapter will provide the Environmental Impact Assessment, consisting of the impact of plastic on marine and coastal ecosystems and their species. The impact of plastic on the related marine and coastal ecosystem services will be elaborated upon in section 5.2.

3.1 Entanglement and ingestion

Nano-, micro-, meso- and macro plastics **affect almost all marine species** in the marine environment of the Balearic islands (Plastic Busters MPAs, 2020a). One of the **most important** and most documented **negative impacts of plastic debris** on marine organisms is **ingestion and entanglement** (Worm et al., 2017; Gall & Thompson, 2015). This is also true for Mallorca, as was confirmed by several interviewees (NGO-1; RO-2). The type of plastic ingested by marine trophic level is depicted in Fig. 3 and the impact of plastic pollution per specific marine species category relevant for Mallorca is further elaborated upon in Appendix C. **Entanglement** affects at least 243 species globally, mostly caused by **illegal or discarded fishing gear** ("ghost gear") (Worm et al., 2017; NGO-1). The majority of entanglement incidents include encounters between plastic rope and netting and the individual, whereas the majority of ingestion is caused by plastic fragments (37%). A research of Gall & Thompson (2015) reported that entanglement is most common for species like **marine mammals, sea turtles and seabirds**, which are all highly represented in Mallorcan marine environments. Furthermore, entanglement is a more common cause of direct death or harm than ingestion.

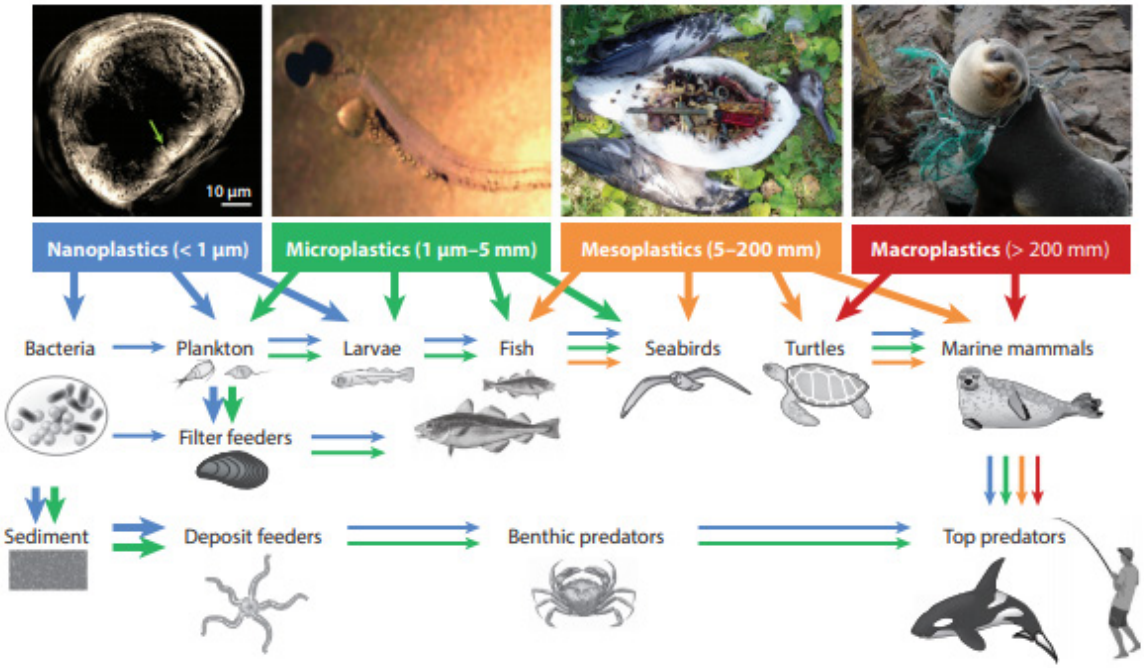

Figure 3 Plastic pollution uptake and trophic transfer in marine food webs (Worm et al., 2017).

The main cause of ingestion is that marine animals are **mistaking plastic for food,** which can either be a visual or a tactile misidentification, or the animals are attracted by the flavouring compounds on the plastic debris' surface (Saliu, Montano, Leoni, Lasagni & Galli, 2019; Worm et al., 2017). For example, **sea turtles confuse floating plastic bags or sheeting with jellyfish,** because of the visual similarities and same texture between the soft plastics and these invertebrates (Santos, Andrades, Fardim & Silva Martins, 2016; Schuyler, Hardesty, Wilcox & Townsend, 2012). The ingested plastics **block the turtle's gastrointestinals and cause**

injuries and other impediments (De Carvalho et al., 2015). Especially in green turtles (*C. mydas*), which is the sea turtle species found with the highest rates of plastic in their digestive tract (Poli, Mesquita, Saska & Mascarenhas, 2015). On the other hand, in **seabirds' plastic consumption is related to the sense of smell.** They have a greatly evolved sense of smell and are attracted to the released chemicals of their planktonic prey. This prey is often absorbed by plastics floating at the sea surface, **causing entanglement and lethal and sublethal effects** caused by ingestion. It is likely that future studies will be able to demonstrate decreases in population sizes due to these accumulated impacts (Worm et al., 2017).

On Mallorca, Plastic Busters MPAs has been analysing gastrointestinal tracts, stomach contents and soft tissue of various coastal pelagic and benthopelagic species that are commonly found in the Cabrera National Park. For example the **Mediterranean mussel**, which is an important filter feeder that often can be found attached to rocky substrates feeding on both animal and plant material on the sea bottom. It is therefore of utmost importance to analyse the impact of plastic debris on these species (Plastic Busters MPAs, 2020a). In-laboratory experiments have shown that the Mediterranean mussel **ingests microplastics**, with ingestion rates ranging from 10 to 47.5%. These microplastics have been found in both native, cultivated and caged mussels. The mussel species *Mytilus edulis* has also been found to ingest microplastics. Both these two mussel species are used as **biological indicators in coastal pollution monitoring**, for example for monitoring and assessing marine debris and microplastic ingestion in the Adriatic and North Ionian Sea (Plastic Busters MPAs, 2020b).

Besides evidence of mussels ingesting microplastics, research has found evidence of **microplastic ingestion by stony sea urchins**. Experimental works on *P. lividus* embryos through chemical leaching showed that the ingestion of microplastic **changed postembryonic growth and development**, however this did not affect their survival rate. Another experiment investigated the toxicity of plastic nanoparticles in the embryos. Only after a certain dose of plastic nanoparticles embryotoxicity was observed, causing severe developmental defects (Plastic Busters MPAs, 2020c; Della Torre et al., 2014).

3.2 Impacts on habitats

Microplastics are a 'cocktail' of contaminants: it includes plastic additives and contaminants that have been absorbed by the environment, such as **heavy metals, PCBs and pesticides.** The microplastics release contaminants such as phthalates in marine environments and the marine food web (Saliu et al., 2019). These microplastics, and plastics in general are **negatively impacting the marine habits of Mallorca.** The persistence of these microplastics also **restricts gas exchanges** between the overlying water and the pore water, which may **result in hypoxia or anoxia**. This in turn can **change the structure of the macrobenthic community** and is likely to **interfere with the normal functioning** of the related marine ecosystems (Balestri, et al. 2017).

3.2.1. Posidonia meadows

Not much evidence regarding plastic impacts on seagrass meadows exist. One of the first studies to report on plastic impacts on *P. oceanica* was done by Pietrelli et al., (2017), to investigate whether this type of seagrass could **incorporate plastics during their formation.** They found that 91.71% of the *Posidonia* spheroids

contained at least one plastic item, of which the majority had a size of 1.0-1.5 cm. Nylon (derived from fishing line and nets), polyester and polyethylene were the most abundant polymers. The presence of these plastics in *P. oceanica* is likely to have **ecological implications** for their diffusion into other environments. Furthermore, these plastics might **enter the detritivorous food web** and reach to the **highest level** (Pietrelli et al., 2017).

3.2.2. Shallow sandbanks

In line with the EU habitat directive as mentioned in the previous chapter, other types of seagrass besides *P. oceanica* are associated with shallow sandbanks. The impacts of biodegradable plastic bags on seagrass has been studied by Balestri et al. (2017), however their study focussed on the *Cymodocea nodosa,* a widely-distributed seagrass species in the Mediterranean. Results showed that the **soft seabed floor of shallow coastal areas can act as bioplastic sinks,** as there are favourable microbial communities present that can biodegrade plastics in the marine sediment. However, the sediment possesses conditions that **hamper the degradation of plastic**, such as the lack of abrasion by waves in the sediment and the lack of UV-radiation. **Plastics** can therefore **easily accumulate in these environments.** The material can also act as a thermal insulator, because of less thermal conductivity. It furthermore can **enhance the magnitude of intra- and interspecific competition** of seagrasses; plastic particles affect the spatial distribution of seagrasses and the relationship with other seagrass species (Balestri et al., 2017). It is not unlikely that the previous mentioned impacts are also relevant for the shallow sandbanks around Mallorca. As to our knowledge, no evidence exists for the impact of larger plastics on seagrass meadows or shallow sandbanks around Mallorca (NGO-3).

3.3.3. Coral reefs

Coral reefs are **crucial for biodiversity, climate resiliency and providing natural resources.** It is estimated that ecosystem services related to coral reefs are worth $9.9 trillion per year. Evidence exists that coral reefs actually **incorporate, egest and retain microplastics.** A study by Saliu et al. (2019) detected phthalates, and plastic additives in general, in scleractinian corals. Microplastics and phthalates were found at all studied sites, particularly in the inner reef environment.

Corals are passive suspension feeders, feeding on plankton that passes by over their tentacles. They are **directly exposed to plastics and may ingest them in several ways** (Chapron et al., 2018; Worm et al., 2017):

- At low tide, **floating plastic debris** with a low density can **come into contact** with corals located on shallow reef-crests and flats;
- Deep water corals can be affected by **floating plastic debris** of a higher density that **sinks to the seafloor;** and
- When preyed upon, microplastic contaminated plankton can act as a carrier.

Corals can **decrease their autotrophic activities** and become more dependent on heterotrophic feeding activities to **maintain the same metabolism rates during stressful periods,** such as bleaching events. It is likely that exposure to plastic particles and their related effects will **increase in the future**, as these events will more frequently take place (Saliu et al., 2019). Up to day, no studies have been recorded on Mallorca researching the uptake of (micro)plastics by coral reefs, however it can be assumed that the effects will be the same.

The previous mentioned impacts are the most observed in Mallorcan marine and coastal ecosystems and species. However, other impacts (Appendix D) should also be taken into account when establishing an all-inclusive overview of plastic impacts.

4. Economic Impacts of Plastic Pollution

This chapter discusses the economic impacts of plastic pollution. Indirect and qualitative costs of plastic pollution relate to the harmful effect for the ecosystem, which has become evident in the previous chapters. This chapter will mainly focus on the quantitative, direct costs plastic pollution has on several sectors (based on Appendix E). In Europe alone, the estimated costs for cleaning shores and beaches reach €630 million per year, and studies suggest that the annual economic damage caused by plastics on the world's marine ecosystem is over 13 billion euros (Deloitte, 2019). More data will be presented relevant for Mallorca and the Balearic Islands. Firstly, an overview is given of Mallorca's local economy. Secondly, the costs are discussed for different sectors and lastly, costs are mentioned particularly relevant for Mallorca.

4.1 Local economy of Mallorca

Mallorca's economy is highly dependent on tourism. In 2018, the island welcomed around 12 million tourists. In total the island offers 300,000 beds to accommodate all tourists (Balearic Tourist Agency, 2018). The total GDP of Mallorca in 2017 was €30,436 million, of which 73.76% is originating from the tourism sector (European Commission, 2020). The tourism sector generated €22.45 million of income to the island in the form of overnight stays, drinking and eating and many different activities around the island. This makes the tourism sector the most important sector for Mallorca. The remaining GDP is obtained from the industry (17.85%), construction (5.65%) and the agricultural (2.77%) sectors. The industry consists of specialised traditional manufactures, such as footwear, furniture and custom jewelry (European Commission, 2020; UNI-1).

Fisheries are also an important source of income for the inhabitants of the island. They have been around for many years, but since the tourism sector started to take off, the fishing industry has decreased in size. Aquaculture is also present on the island in the capital city of Palma. The fish farm is a hatchery for juvenile fish of Sea Bream and Sea Bass. It is the only private aquaculture company in the Balearic Islands and the largest in Spain (Hatchery Culmarex, 2020).

4.2 Costs of plastic pollution on different sectors

Plastic pollution has different impacts on different sectors. In literature this is often divided in impacts on the hospitality sector, the fishery sector, and the maritime industry sector.

Hospitality sector

The hospitality covers tourism, recreation and also clean-up costs of beaches and shores. It is the largest affected sector regarding losses caused by plastic pollution (Dalbergs Advisors, 2019). The main problem is the loss of aesthetic environmental value (cultural service) (Newman et al., 2015; RO-2). For example, in Orange County, CA, marine debris had a significant impact on residents' beach choices. A 75 % reduction in marine litter at six popular beaches generated over €40 million in additional benefits to residents over 3 months (Newman et al., 2015). Additionally, the hospitality sector's reputation is improved when reducing plastics usage, whilst encouraging more customers with its sustainable practices (Sireyjol Trucost et al., 2014; BUS-1; BUS-8). Also, plastic pollution results in unpleasant experiences regarding human health and safety, as stranded or floating debris can cause direct injuries and long-term health concerns. Besides these costs, there are labor costs regarding clean-up efforts (often paid for by municipalities).

Fishing sector

Fishermen experience trouble with marine plastic waste as it can get clogged in their fishing nets and vessel engines. This damages the equipment and can lead to the disturbance of fishing activities as plastic is being caught instead of fish (NGO-1). Currently there is not enough data to measure the economic effect of plastic pollution on fisheries. However, plastic pollution does affect the Catch Per Unit Effort (CPUE), as fishermen spend more time cleaning out plastic from their nets than before, resulting in decreasing CPUE while total yield remains the same (NGO-1). One interviewee who works directly with fishermen mentioned that they regularly say they are "fishing more plastic than fish" (NGO-1) in recent years. Several experts stressed the danger for plastic pollution (UNI-1; UNI-2; RO-2), however stakeholders from within the fishery industry were hesitant to cooperate with the project.

Maritime industry sector

Transport in the form of shipping and yachting in the Mediterranean Sea is affected in several ways. This includes floating plastic debris getting entangled in the propeller blades of ships, or the piling up of waste within engines due to the collision with plastic objects. The costs can be incurred by e.g. delays (downtime of a vessel, unable to perform) and additional maintenance costs (e.g. divers needed to remove plastic). In addition, waterways and port facilities need to be cleaned to prevent clogging which also adds to the delay and clean-up costs (Deloitte, 2019).

A report of the WWF (Dalberg advisors, 2019) summarized the total costs for the 3 sectors above for all countries bordering the Mediterranean countries which are presented in Table 2 below:

Sector	Costs/year
Hospitality sector	€ 268 million
Fishing sector	€ 138 million
Maritime industry sector	€ 235 million
Total	€ 641 million

Table 2 Plastic pollution costs for the Mediterranean (Dalberg advisors, 2019).

Other sectors impacted by marine litter include aquaculture, agriculture and human health, however as discovered during expert interviews and literature studies these appeared to be less relevant, having a relatively minor impact compared to the other aforementioned sectors (Deloitte, 2019).

4.3 Costs relevant particularly for Mallorca

As mentioned before, the tourism sector is financially impacted by plastic debris, and this sector is the most important source of income for Mallorca. However, exact numbers for Mallorca remain unclear (such as tons of plastics coming from Mallorca) or are often integrated for all the Balearic Islands (Alomar et al., 2020). Therefore, examples of costs and calculations are given instead.

Mallorca owns at least 30 boats meant for cleaning purposes. The amount of money that the Government spends every year for coastal cleaning with boats is around €1 million per year (GOV-1). It is very complicated to estimate the exact costs of city council by city council of the collection of all the plastics items. Despite this, it is clear that local municipalities have to set up large waste managing infrastructure for the collection and treatment of debris, with high associated investment costs (GOV-1). During the summer, the waste on the Balearic Islands can increase up to 30% due to tourists. This results in a significant percentage of their budget being used for cleanup activities (Dalberg advisors, 2019). Local municipalities such as the ones on Mallorca, experience sudden increases of waste, making it difficult to effectively manage. Uncollected waste can therefore result in plastic pollution of beaches and shorelines.

Though voluntary actions of plastic clean-up are increasing, they are still sporadic, most of the clean-up costs are carried by municipalities, depending on the number of beaches (NGO-5). Average clean-up costs were estimated at €80,000 per year for a Spanish municipality with 30 beaches. The majority of Mallorca's hotels are located near beaches, and therefore are dependent on a cleaner environment to attract tourists to their hotels (BUS-1, BUS-8). Clean-up efforts specifically targeted at removing plastic pollution (e.g. increased beach cleaning, buying equipment/boats for removal) differ per year. Examples include a project for the winter of 2006 costing €600,000 and a 3-year project started in 2014 costing over €3 million. The latest project for the Balearic Island to clean the beaches as well as the shores cost an estimated €3.2 million, including maintaining and buying new clean-up vessels (UN Noticias Local, 2017). Looking a bit broader, a model made by Deloitte (2019) estimated average clean-up costs of plastic for Europe's shorelines at around €81.9 million and other economic losses at €542.5 million (these other losses include marine tourism, fisheries & aquaculture). Both values were calculated for the year 2018 (Deloitte, 2019).

4.4 Economic losses for ecosystem services

Besides clean-up costs, the losses of environmental value of the marine ecosystem can be considered (Atkinson & Mourato, 2008). A research by Beaumont et al. (2019) estimated each ton of plastic in the ocean having an annual cost, in terms of reduced marine natural capital (based on 2011 ecosystem services value), between $3,300 and $33,000. Globally this means that annual loss of ecosystem service is between $500–$2,500 billion. This is based on a plastic stock estimated between 75 and 150 million tons (Beaumont et al., 2019). When flows of plastics coming from Mallorca are clearer, calculations can be made specifically for the island.

5. Plastic Free Zones

In this chapter, the relation between the implementation of Plastic Free Zones (PFZs) and Mallorca's coastal and marine ecosystems and their related services are described. After that, the willingness to pay for single-use plastic free accommodations of consumers is discussed. Consequently, the hurdles and costs of implementing PFZs will be elaborated upon.

5.1 Definition Plastic Free Zones and Examples

Firstly, it is important to understand the concept of PFZs. It is relatively new and has not been defined yet with an exact definition in literature. However, since it has become clear plastics harm the environment, there is the need to reduce plastic use. The future costs of removing all single-use plastics that accumulate in the environment is estimated to be higher than the costs of preventing littering today. Via this way the PFZs were introduced. Within this report, PFZs are defined as a ***'zone where there is a significant amount of (single use) plastic reduction by either a reduction or a substitution with other materials, thereby decreasing the impact on the environment'***. An exact figure for the significant amount is still to be determined however, this should be at least a reduction of plastics of 80%. Thereby, the zones are implying to specific places where a plastic reduction is achieved. This can be for instance a hotel or a beach where plastics are not used or allowed and instead other materials may be used to replace the plastics.

5.2 Impact of Plastic Free Zones on the ecosystem services

With a significant reduction of plastic use (and plastic pollution) via PFZs, the negative effects which plastics might have can decrease to a certain extent. In this section the relation between PFZs and ecosystem services is explained with arrows. An upwards arrow means the ecosystem service improves, a downward arrow means that the ecosystem service decreases, and a straight arrow means the ecosystem service stays the same (Table 3). The different ecosystem services have been defined and described in section 2.3 of this report.

5.2.1 Cultural Services

As PFZs ensure that there is a reduction of plastic use, potentially less plastic litter will end up in the (marine) environment of Mallorca. The traditional activities are not impacted by plastic since those are not dependent on plastic pollution, making the impact of PFZs minimal. However, regarding recreation and education, the impacts of PFZs can be positive regarding these ecosystem services. The landscape and inspiration has much

plastic litter, making it unattractive and giving less inspiration to people. If the PFZs are effective, the plastic litter will reduce, thereby increasing the value of the landscape and inspiration. Tourism and leisure can also benefit from reduced plastic pollution. Tourists and locals do not want to see beaches full of plastic when relaxing or when going on a hike. By decreasing the amount of plastic, the people can relax in a cleaner environment and enjoy nature again. Since PFZs are a relatively new concept it can also function well for educational purposes. Mallorca can be used as an example and measures can be monitored in order to see if they are effective. If so, further research can be done to effectively implement PFZs elsewhere.

5.2.2 Regulating services

The plastic pollution does not affect all of the identified regulating ecosystem services in Mallorca, since those are independent from plastic entering the Mediterranean Sea. The PFZs would have minimal to no effect and stay neutral. Plastic pollution only impacts one regulating ecosystem service, namely the water quality. Much plastic enters the Mediterranean Sea in Mallorca, polluting the water and affecting the quality. If PFZs are implemented it can increase the water quality because less plastic is used and can potentially end up in the water.

5.2.3 Provisioning Services

In line with the regulating services, two provisioning services are not heavily impacted by plastic pollution. The raw materials and resources are not worsening or improving with more or less plastic in the ocean. However, the services food & fishing and transport & communication are affected by plastic pollution. The fishing sector especially has trouble with plastics. They lose time because they have to clean their nets from plastic, which is accidently caught when fishing. In addition, fish and other types of seafood can ingest plastics, accumulating in the food chain and pose threats to other animals. The transport sector also has problems with plastic, since it can obstruct the propellers resulting in damage to their ships. With the implementation of PFZs, less plastic enters the waters which can potentially end up in fishing nets, in the food chain or in engine propellers. This could increase the food & fishing and Transport & communication ecosystem services.

5.2.4 Supporting Services

Regarding supporting services, the implementation of PFZs does not seem to influence most of these either. Biomass generation and carbon sequestration are independent from plastic, so they do not change when PFZs are implemented. However, biodiversity and life cycle maintenance are ecosystem services which are heavily impacted by plastic pollution. The plastic causes entanglement and choking of species, which decrease and threaten the biodiversity of the ecosystems. They also disturb key habitats in Mallorca which acts as nurseries and spawning areas. In nurseries, the species are young and more sensitive to potential threats like plastic pollution. In spawning areas, the plastic might influence the mating process, causing stress and less reproduction of the species. By the implementation of PFZs less plastic will enter the water, and this can improve both biodiversity and life cycle maintenance of the ecosystem and its species.

	Ecosystem service	Impact of PFZs on ES
Supporting services	Biodiversity	↑
	Life cycle maintenance	↑
	Biomass generation	→
	Carbon sequestration	→
Provisioning services	Food & fishing	↑
	Raw materials	→
	Scientific & medical resources	→
	Ornamental resources	→
	Transport & communication	↑
Regulating services	Water quality	↑
	Climate regulation	→
	Oxygen release	→
	Beach maintenance	→
	Marine processes	→
	Temperature & salinity	→
Cultural services	Landscape & inspiration	↑
	Tourism & leisure	↑
	Education	↑
	Traditional activities	→

Table 3 Overview of the impact of PFZs on ecosystem services.

5.3. Willingness to Pay

Ecosystem services do not have a market value, hence one method to analyse the value of protecting such services is using the contingent valuation method: Willingness to Pay (WTP). The latter is an indicator "of the change in utility the person expects from the consumption of these increased ecosystem services" (Hattam et al., 2015, p.127). In this case, the measured willingness to pay for single-use plastic free accommodation comprises various ecosystem services and indicates the individual's non-use value for the protection of the marine ecosystem. Such data is useful in analysing the total hypothetical economic value the consumers give to protecting the marine environment as a result of plastic free zones (Atkinson & Mourato, 2008). The aim is to estimate whether individuals are ready to give a fraction of their wealth (and how much of it) to witness an improvement in the marine ecosystem.

A previous study in Spain focussing on the WTP of tourists for boutique hotels with an Environmental Management System, found that generally **travellers' were willing to pay more** and there was a positive correlation between WTP and the travelers' level of environmental awareness (Fuentes-Moraleda et al., 2019). Another study in Barbados, which similarly to Mallorca has a high dependency on tourism and where most

hotels are found near the coast, found that the **presence of litter was one of the most popular concerns from tourists** and hence visitors are willing to pay significantly more for accommodation that is near a beach free of litter (Schuhmann, et al., 2016). Similarly, in our study a survey was used to obtain data about the WTP more for a SUP free accommodation. From the **756 responses the majority (84%) were willing to pay more**, which should motivate the hospitality sector to move towards being SUP free. However, 39.15% were uncertain on the amount they are willing to pay whilst only 1.46% were willing to spend 20% or more. The survey was shared on social media in order to reach as many people as possible and to also reach different nationalities. The results of the survey question are shown in Fig. 4 below.

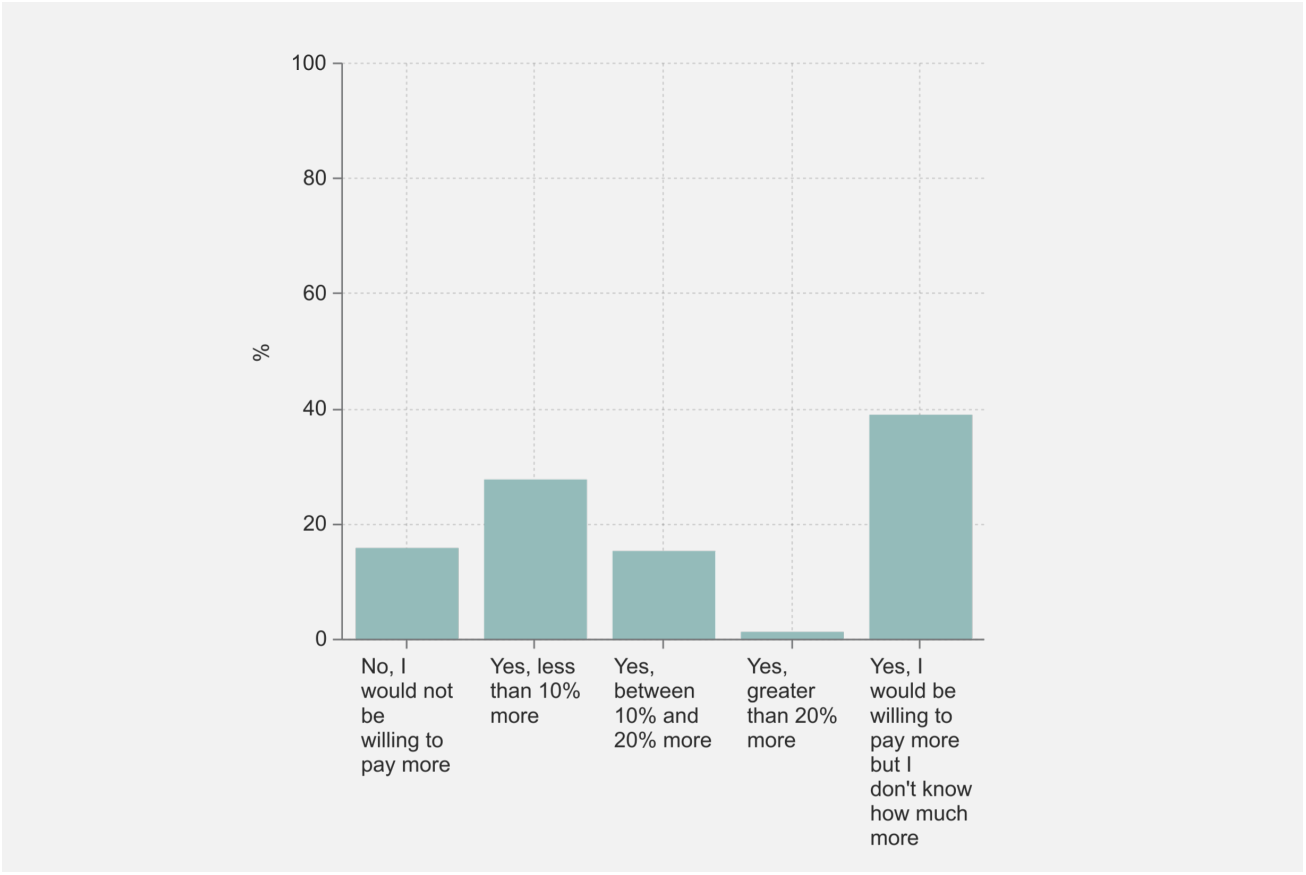

Figure 4 Responses to Survey Question: "Would you be willing to pay more for your accommodation knowing it is free of single-use plastics compared to an accommodation that does not promote this?"

5.4. Hurdles and Costs of Implementing Plastic Free Zones

The implementation of plastic free zones in Mallorca's hospitality sector aims to reduce the amount of plastic pollution entering the Mediterranean Sea. The tourism sector may entail various costs in the implementation stage of the plastic free zones however, these are only in the short term (BUS-8). The reduction of plastic in the hospitality sector is a fairly new concept and not many concrete examples are available in literature. However, the founder of Travel without Plastic, highlighted that start-up costs to install new systems may be high depending on the particular hotel. However, in the long run there may also be savings, one hotel chain that removed all SUP bathroom amenities and left them available only on request, **saved around €5,000** in the summer season (BUS-7). Certain alternatives do cost more however savings are also made from eliminating other SUP (BUS-8).

The hospitality sector may encounter various difficulties to implement PFZs. One interviewee highlighted the **lack of knowledge** regarding the process of removing SUP and finding alternatives. It is a tedious task to choose alternate products to SUP when considering the entire lifespan of products. In fact this calls for **clear rules and regulations** (BUS-1) and more specialists with an environmental sciences background to help implement PFZs in the hospitality field (NGO-2). Another issue is **branding standards and local standards** (BUS-7). Moreover, there is still strong **lobbying** from the plastic industry including companies that heavily rely on SUP that hinders the process for the hospitality sector to make such a change (Dauvergne, 2018; NGO-2).

6. Conclusions & Limitations

After having performed this analysis, the main research question "*How will the implementation of Plastic Free Zones as a strategy for reduction of SUP impact the coastal and marine ecosystems, their services, and local economy of Mallorca"* can be answered. First, **six marine-coastal ecosystems** were identified for Mallorcan waters. However, there was **no agreement between stakeholders** about them, because they are **used to talk about habitats, not ecosystems.** Concerning **ecosystem services, provisioning** (food and fishing), **regulating** (coastal protection and beach maintenance) and **cultural services** (tourism and leisure) are **the most important** ones for the **Island's communities**. Secondly, the impacts of plastic on the coastal and marine ecosystems, their species and services were identified. The **major impact of plastic** on marine **organisms** are **entanglement and ingestion**, which affected four major taxonomic groups (reptiles, marine mammals, seabirds and fish). Regarding the **ecosystems**, only a handful of studies have identified the **negative impacts of plastics**, of which the majority **focussed on microplastics**. No **much evidence exists** regarding the **impact of larger plastics,** especially on shallow **sand banks** and **Posidonia meadows.** The **most impacted ecosystem services** by plastic are the **cultural services**, particularly the aesthetic services. Besides this ecological damage, plastic pollution turned out to negatively affect the local economy of Mallorca, which answers the third subquestion. **Economic damages** result mainly from a **loss of aesthetic value by less attendance from tourists**. As the **hospitality sector** is the **main** sector of **Mallorca**, it is **logically most affected by plastic pollution**. This led to the necessity of a large waste management system on the Island, with **high associated costs** related to **coastal and marine clean-ups**. **Other monetary losses** include **extra work** due to **maintenance** for the **fishery** and **maritime sector**. Overall, the **prevention of littering would financially be beneficial,** since it will **cost less money compared to clean-up** and **maintenance activities**. Finally, the **implementation costs and benefits of PFZs** in Mallorca by reducing SUP-usage in the hospitality sector may have **high initial costs**, as it is dependent on each business and location. However, in the **long run, savings are made** and the **sector also benefits from a better reputation.** Not to mention, **the positive effect on ecosystem services that the tourism sector** is reliant on.

The following **limitations** have been identified during this study:

- **No actual data from fishermen** and how the fisheries resources are affected by plastic pollution in Mallorca, due to the **unwillingness of them to participate** in a project with **Oceana.**
- **No data** about the number of ingestions and entanglement in the Island, as **rehabilitation centers** did not want to participate, even though at the beginning they agreed on this.

- **No field work** in Mallorca itself.
- **Limited estimates for costs & benefits** of implementing PFZs, since it is a new concept.
- **Limited data** from **hotels,** since not many hotels were able to participate considering the time frame of the research.

7. Recommendations

After having performed the research, several recommendations can be made to Oceana:

- It is recommended to **establish a network on Mallorca** and **collaborate** with local **NGOs** that have in-house and Mallorca specific knowledge, such as the director of science at **La Asociación TURSIOPS Marine Research** (NGO-1) and the co-founder of **Save the Med** (NGO-2). This last NGO already has a campaign called **Plastic-free Balearics** with **120+ local businesses** involved, and they already developed a **SUP-index** with **15,000 registered SUP items**. Additionally, various researchers already have gathered a substantial amount of data. **Dr. Amores Maimó** is a marine scientist at **Universitat de les Illes Balears** (UNI-1) and dr. **Ruiz-Orejón** Sánchez-Pastor (RO-2) is a post-doc researcher at Balearic Islands Coastal Observing and Forecasting System (**SOCIB**). They both can have valuable information about Mallorca.
- The **location of PFZs** should **primarily target the hospitality sector** since it is a large contributor of plastic pollution and also suffers great costs associated with plastic pollution.
- The **PFZs should be cost-effective,** so as to be **convincing for CEOs and directors** who are interested in having **a clear cost advantage**. In fact, this research highlighted the costs and negative impacts plastic pollution may have on businesses, whilst the **positive response regarding WTP** highlighted that there is potential for SUP free accommodations.

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Appendices

Appendix A
Marine target species for Mallorca in concordance with the EU habitat directive

Marine target species of the Habitat directive for the EU presented in Mallorca					
Group	Common name	Specie	Conservation status IUCN Red List	Ecosystem/ Habitat	Reference
Reptiles	Loggerhead	Caretta caretta	Low Concern in EU (LC)	Marine neritic, marine oceanic, marine intertidal	https://www.iucnredlist.org/
	Green turtle	Chelonia mydas	Endanger in EU (EN)	Marine neritic, marine oceanic, marine intertidal, marine/coastal supratidal	
Marine Mammals	Bottlenose dolphin	Tursiops truncatus	LC, in EU Data Deficient (DD)	Sandbanks, reefs, pelagic	
Fish	Marine lamprey	Petromyzon marinus	LC	Wetlands, marine neritic, marine oceanic	
	Sturgeon	Acipenser sturio	Critical Endanger EU (CR)	Wetlands, marine neritic	
	Shad	Alosa alosa	LC in EU	Wetlands, marine neritic	
	Twaite shad	Alosa fallax	LC	Wetlands, marine neritic	
Birds	Common murre	Uria aalge	LC, in EU Near Threatened (NT)	Marine neritic, marine oceanic, marine/coastal supratidal	https://www.seo.org/ave
	Common tern	Sterna hirundo	LC in EU	Marine neritic, marine oceanic, marine/coastal supratidal	
	Sandwich tern	Sterna sandvicensis	LC in EU	Marine neritic, marine oceanic, marine/coastal supratidal	
	European shag	Phalacrocorax aristotelis	LC in EU	Marine neritic, marine oceanic, marine/coastal supratidal	
		Larus melanocephalus	LC in EU	Marine neritic, marine oceanic, marine/coastal supratidal	
	Audouin's gull	Larus adouinii		Marine neritic, marine oceanic, marine/coastal supratidal	
	European storm petrel	Hydrobates pelagicus	LC in EU	Marine neritic, marine oceanic, marine/coastal supratidal	
	Balearic shearwater	Puffinus mauretanicus	CR in EU	Marine neritic, marine/ coastal supratidal	
	Scopoli's shearwater	Calonectris diomedea	LC in EU	Marine neritic, marine/ coastal supratidal	

Species source: Ayala Bonal et al. (2014).

Appendix B
Marine ecosystem services general definition

Marine Ecosystem Services		Marine specific component	General ES definition
Provisioning services	Food provisioning	1. Both industrial and artisanal fishing activities	The provisioning of biomass for human consumption and the conditions to grow it
		2. Aquaculture	
	Water storage and provision	1. Water abstraction for desalination plants (Lattemann, 2010)	Provision of water for human consumption and for other uses
		2. Marine water is used for coastal aquaculture	
	Biotic materials and biofuels	1. Biotic materials: drugs, cosmetics, ornamental resources (shells), commercial or industrial resources (algal or plant fertilizers, fishmeal?)	Provision of biomass for non-consumptive purposes
		2. biofuels: liquid (fuels extracted from algal lipids) or biogas (from decomposing material)	
Cultural services	Symbolic and aesthetic values	Strong bonds of coastal communities to the sea due to the local identity. Sense of place. Can be linked to tradition and culture. Valuation of existence and beauty of charismatic species and habitats (marine mammals, coral reefs)	Exaltation of senses and emotions by landscape, habitats or species
	Recreation and tourism	1. Coastal activities: scuba diving, snorkelling, free diving sunbathing	Opportunities for relaxation and amusement provided by the natural environment. Social relations
		2. Offshore activities: whale/dolphin watching, sailing, recreational fishing	
	Cognitive effects	1. Inspiration for arts and applications	Trigger of mental processes like knowing, developing, perceiving or being aware resulting from natural landscapes/living organisms
		2. Material for education and research	
		3. Information and awareness (respect for nature through observation of wildlife)	
Supporting	Life cycle maintenance	1. Seagrasses, coral reefs, coastal wetlands, mangroves	Maintenance of key habitats that act as nurseries, spawning areas or migrating routes
		2. Gene pool protection	
	Water purification	Sequestration, sedimentation, decomposition, oxygenation of dead zones, filtration and absorption, remineralisation	Biochemical and physicochemical processes involved in the removal of waste and pollutants from the aquatic environment
Regulating services	Air quality regulation	The open ocean absorbs air pollutants (ozone, particulate matter, sulphur dioxide)	Regulation of air pollutants in the lower atmosphere
	Coastal protection	Natural defence of the coastal zone against erosion and inundation from storms, sea level rise and waves.	Erosion protection and protection against floods, droughts, hurricanes and other extreme events.
	Climate regulation	Ocean is a sink for Green House Gases (GHGs)	Regulation of GHGs. Uptake, storage and sequestration of CO2
		Inorganic carbon dissolved into the seawater, uptake via photosynthesis from phytoplankton	
		Organic carbon is formed by primary producers	
	Weather regulation	Cloud formation	Influence of ecosystems and habitats on the local weather conditions
	Ocean nourishment	Natural cycling processes leading to the availability of nutrients in the seawater for production of organic matter	
	Biological regulation	Control of fish pathogens in aquaculture installations, role of cleaner fish (i.e. parrotfish) in coral reefs), control of potential invasive species, biological control on the spread of vector borne human diseases	Biological control of diseases

*A*cquaculture source: http://www.culmarex/com/en/culmarex

Appendix C
Plastic pollution effects on marine species

This Appendix provides an overview of the mechanisms through which marine species are affected by plastic pollution (Worm et al., 2017).

Species (category)	Plastic type	Mechanism
Seabirds	plastic bottle caps, fragments, straws, fishing line	Stomach perforation, gastrointestinal obstruction leading to starvation
Sea turtles (green sea turtle, leatherback turtle)	Plastic bags, balloons, strings, other plastic debris	Gastrointestinal distress and starvation, impediment of hatchling movement towards sea, exposure to predators, impediments to laying of eggs due to injured and blocked cloaca
Mammals (sperm whales, dolphins)	Plastic particles, bags, debris, fishing gear	Bioaccumulation of plastic, stomach rupture and starvation, mortality caused by entanglement
Fish	Plastic bags, particulate plastic, fragments and line, microplastic particles	Ingestion of plastic fragments, mortality caused by toxic leaching, inhibition of hatching, declined growth rate, changed behaviour
Invertebrates	Microplastic particles, strands, polyethylene pellets	Abnormal development caused by plastic leachates, bioaccumulation of plastic, interference with reproduction and energy uptake, ingestion of plastic in guts

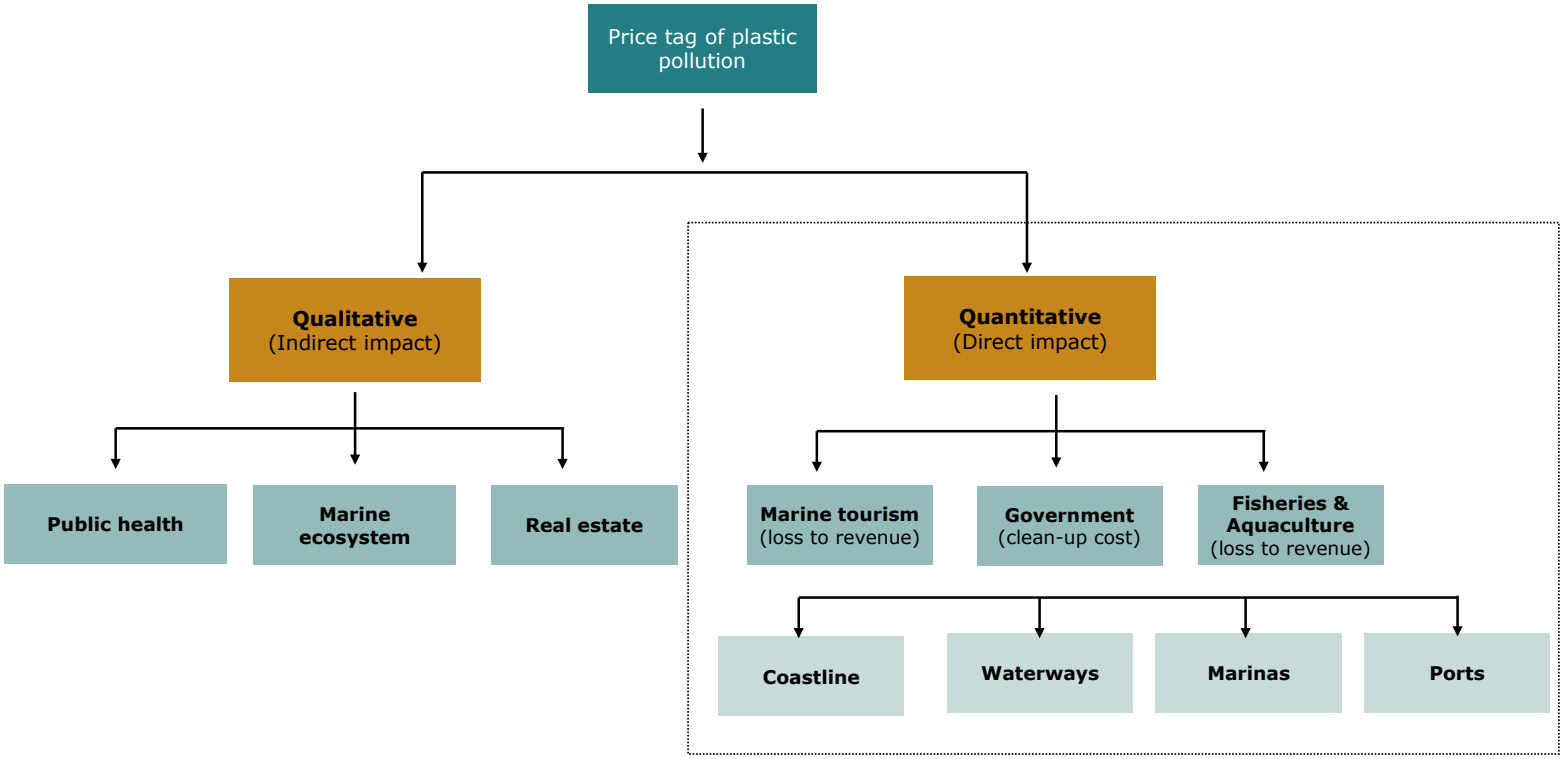
Appendix D
Other impacts of plastic pollution on species and habitats

Besides the mentioned impacts of plastic in chapter 2, plastic has more negative effects on both species and habitats. A first important impact to mention is the bioaccumulation and trophic transfer of plastic. There is significant evidence for bioaccumulation and trophic transfer of plastic and related chemical pollutants through marine food webs, a process shown in Fig. 3 (Saliu et al., 2019; Worm et al., 2017). For example, mussels accumulate plastic from the water column, transfer them to their benthic predators and human consumers of shellfish. Microplastic fragments have also been identified in larger cetaceans, which suggests prey to top predator trophic transfer. Moreover, plastics can create bioaccumulation of environmental pollutants, for example in fish, mussels and seabirds. The majority of the plastic types can absorb both metal and organic toxins from the surrounding. The concentration of these plastics can be up to one-million fold of the plastic concentrations identified in the seawater column. However, the effects of this bioaccumulation on human health remain uncertain (Worm et al., 2017).

Another impact of plastic is the toxic effects it has (Saliu et al., 2019). Toxic elements in plastic, such as flame retardants and monomer residues, can be released when ingested by animals and can accumulate in fatty tissues. Leachates from the plastic products (i.e. plastic bags) can cause an increased level of nonylphenol in fish, which enhances mortality rates. Other toxic effects include a reduction of feeding , decreased success of reproduction, survival reduction and alterations in gene expression and immune functions in a plethora of species. These effects have been found in a wide range of species, including fish, seabirds, crabs and mussels, even if the concentration of plastic was as low as 1% (Worm et al., 2017).

Furthermore, plastic debris provides an extra surface where species can raft on and can therefore introduce non-native species to the area. It also can provide new habitat for colonization by adding hard substrate into habitats that previously have been dominated by only soft substrate (Gall & Thompson, 2015).

Appendix E
Costs of plastic pollution framework



Source: Deloitte (2019).

Expert Report 3

Environmental Consumer Behaviour Analysis

Written by

Channah Barneveld | Larissa Dorrestijn | Anna Kiers | Nina Ommerborn | Elena Peeters

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List of Abbreviations

SUP	Single-Use Plastic

List of Interviews

NGO-2	Philipp Baier - Cleanwave
RO-2	Luis Fransisco Ruis-Orejón Sánchez-Pastor - Balearic Islands Coastal Observing and Forecasting System (SOCIB)
UNI-2	Frey Higgins-Desboilles - University of South Australia
UNI-5	Brian King - The Hong-Kong Polytechnic University
UNI-8	Pau Obrador Pons - Northumbria University - Newcastle

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Main Findings

To change tourists' behaviour towards reducing their SUP use, it is important to:

1. Personalise the SUP problem for tourists through education

2. Emphasise the importance of the environment

3. Increase the visibility of actions against SUP pollution that have already been taken by the government

4. Target tourists specifically in campaigns focusing on their nationality

5. Trigger tourists' empathy by using animals in campaigns

6. Make alternatives for SUP accessible and cheap

1. Introduction

This report provides an insight on tourists' behaviour surrounding the use of single-use plastic (SUP). When on holiday on destinations such as the island of Mallorca, tourists are known to use large amounts of SUP. In this context it is often argued that after the holiday destination is reached, an individual's self-proclaimed sustainable behaviour is left at home (Mehmetoglu, 2010). For Mallorca, it is especially important to reduce the amount of SUPs as it is an island. As a result, plastic which is not recycled or managed properly could relatively easily end up in the ocean.

There is a potential gap between a consumer's positive attitude towards the natural environment and their everyday behaviour in practice (Juvan & Dolnicar, 2014). As consumers are part of the supply chain, they have an influence on the reduction of SUPs by decreasing the demand for them. Therefore, studying the environmental behaviour of tourists is important, especially focussing on the difference between self-declared sustainable behaviour and actual behaviour. If motivations for and resistance against sustainable behaviour are understood, it becomes possible to guide tourists towards reducing the use of SUP.

To understand the reasoning of different tourists with regards to sustainable behaviour, the main research question is:

How can environmental behaviour of tourists be influenced to reduce single-use-plastic in the hospitality sector of Mallorca?

For this research, environmental behaviour is defined as behaviour that is undertaken to harm the environment as little as possible or even benefit it (Steg & Vlek, 2009). To answer the main question, the following sub (research) questions were formulated:

- *What factors affect the environmental behaviour of tourists?*
- *How can these factors be influenced?*
- *Which recommendations can be given to influence the main factors that affect the environmental behaviour of tourists on Mallorca?*

Several research methods have been used to answer these questions by identifying the main factors that influence the environmental behaviour of tourists. A broad literature search was done to gain insight into the factors that influence environmental behaviour of tourists while on holiday. Many different factors influence environmental behaviour, including factors that are either easy or difficult to influence. Several theories were researched and put together to create a relevant framework. This framework will be further explained in the next section. Additionally, a survey was created and distributed among tourists through social media and by tour organizations. This survey provided a better insight into environmental behaviour of tourists during their holiday. The survey has been made up of 12 questions, of which the answering options vary, and some have sub-questions. The survey questions can be found in Appendix A. In total, 756 respondents from 53 different nationalities completed the survey.

To better understand the perspective of some experts on the use of SUP in the hospitality sector, five interviews were conducted. The interviewees are professionals working for a NGO's, research organisation or university. In these interviews, considerable experiences with tourists' behaviour came to light.

Lastly, more information on environmental behaviour was gathered through a content analysis of campaigns of NGO's and other organisations that aim to reduce plastic pollution. Through coding the textual and visual aspects of these different campaigns, overlapping strategies and information have been found that helps to give advice for successful campaigns in the future.

2. From factors to recommendations

2.1 What the literature says

Environmental behaviour of tourists is influenced by many factors. Appendix B shows a list of factors that were found in the literature. Besides these factors that influence environmental behaviour, the literature search also revealed several theories on this behaviour. The first is the Theory of Reasoned Action which focusses on the relationship between norms, intentions, attitudes and behaviour. However, as identified by Ajzen (1991), one of the problems with this model was the fact that there are many more variables that could influence the intended behaviour of an individual. A second recurring topic in the literature is the value-action gap whereby there is a difference between intended and actual behaviour. The framework by Barr (2007) combines these theories while also considering additional revised situational and psychological variables that lacked in previous models. Figure 1 shows the relationships between variables that influence environmental behaviour. These variables are then broken down into measurable factors that are questioned in the survey. As shown in the figure, environmental values have an indirect influence on environmental behaviour, while having a direct effect to situational variables, behavioural intention and psychological variables. An overview and definition of the tested variables and factors are given in the next section, in accordance with the research by Barr (2007).

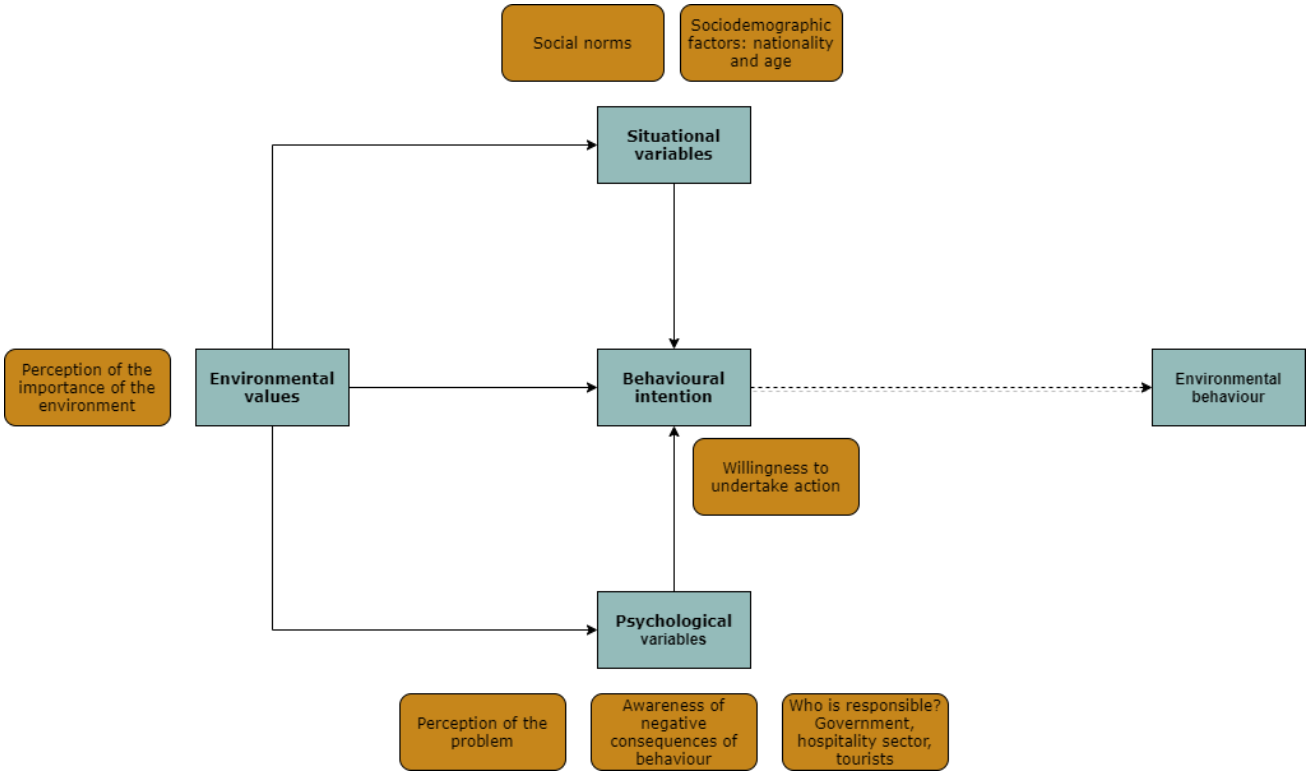

Figure 1 Conceptual diagram of this research. It is adapted from Barr (2007) but only includes factors that were tested for in the survey. Dark green boxes indicate variables tested and the light green boxes indicate specific factors tested. Black lines show the relationships that were tested, and the dashed line represents a relationship examined through literature.

2.1.1 Environmental Values

In this research, environmental values are defined as underlying orientations held by individuals towards the physical environment. Although this variable consists of multiple factors in Barr's (2007) framework, we use the factor 'perception of the importance of the environment' to measure this variable due to practical considerations. This factor examines the perspective that tourists have on the importance of the environment for human life as well as for greater earthly systems. Environmental values are seen as a variable that influences situational variables, psychological variables and behavioural intention, as shown in Figure 1.

2.1.2 Situational Variables

Situational variables are defined as the personal situation concerning behavioural context, individual characteristics, individual knowledge, experience of the behaviour and the person's relationship to their surroundings. Situational variables consist of a great range of factors. For this research specifically, the main factors that make up the situational variables are age, nationality and experience of social norms. Tourists from different nationalities or ages groups could each have a specific perspective on the importance of, for example, reusing a shopping bag when on holiday. Situational variables are influenced by environmental values and, in turn, influences behavioural intention.

2.1.3 Psychological Variables

Psychological variables are an individual's personality characteristics and their perceptions toward the actions that they are undertaking. Possible factors of psychological variables are perception of a problem, responsibility to act and awareness of negative consequences of behaviour. In this research, tourist's perception of plastic

pollution, their own behaviour and their vision of who is responsible to reduce such pollution have been questioned. Each individual tourist might have a different perspective on the severity of the consequences that plastic straws have on marine life for example. As shown in Figure 1, psychological variables are influenced by environmental values and influence behavioural intention.

2.1.4 Behavioural Intention

Another variable is behavioural intention, which is the willingness of tourists to undertake action towards behaving more sustainably. This is aimed at getting an insight in the perspective of the tourists on their own behaviour in relation to the environment. Tourists might have the intention not to buy SUP water bottles when on holiday but might easily give up on their intention once it gets a bit more challenging to refill their reusable bottle (NGO-2). This variable is influenced by environmental values, situational variables and psychological variables and has an influence on environmental behaviour.

2.1.5 Environmental Behaviour

The final variable is environmental behaviour. This is defined as behaviour that is undertaken to harm the environment as little as possible or even benefit it (Steg & Vlek, 2009). Measuring actual behaviour is difficult due to the value-action gap whereby the intention of individuals is often different than their actual behaviour when it comes to environmental behaviour (Barr, 2007). One way to say something about actual behaviour would be through observations. However, due to the current situation we were not able to observe the actual environmental behaviour of tourists on Mallorca. Therefore, we partly rely on Barr's (2007) theory which states that behavioural intentions lead to environmental behaviour, as seen in Figure 1. Therefore, this research will focus on the intention of tourists to behave environmentally friendly, but no conclusions can be drawn on how this relates to their actual behaviour.

2.2 The relationships between the variables found in our research

2.2.1 Environmental values influencing behavioural intention

When examining the relationship between environmental values and behavioural intention, the results of the survey show that environmental values influence behavioural intention. Specifically, when tourists' environmental values increase, their willingness towards reducing SUP also increases. This result is encouraging as it backs up the assumptions made in Barr (2007). The statements used to test the willingness to undertake action are directed at behaviour while on a holiday. Therefore, it is possible that increasing environmental values can affect the behavioural intentions of tourists. This is a finding that resonates with what is argued in an interview (NGO-2) that discusses the NGO's work on Mallorca to reduce the use of SUP water bottles. It is explained that using educational tools and beach clean-ups can affect children's understanding of the effect of SUPs on marine animals,

> "it transports to message home. And it's been very successful. I never expected that, but I mean, we have parents who are calling and say 'what did you do to my children, they refuse to drink their water, now what must I do?'"
>
> *(NGO-2)*

2.2.2 Situational variables influencing behavioural intention

The situational variables are included in the survey through the age of the respondents, their nationality and their experience of social norms. For each of these three factors, the results of the survey show that there is a relationship between them and the willingness of someone to take action in terms of reducing their use of SUP when on holiday.

The results show that there are two age groups where there is a higher willingness to take action compared to other age groups. These are the tourists that are between 18 and 35 years old, and tourists that are between 56 and 65 years old. A potential explanatory factor for the young age group is identified through literature where several studies have found that young people are generally more concerned with the environment compared to older people (Gifford & Nilsson, 2014). However, the question remains what causes this distribution among age groups. The literature is inconclusive about this, so further research would need to be conducted to understand this better. Table 1 shows whether being in one of the age groups that we analysed influences willingness to take action.

Age group (in years)	**Does being in this age group influence willingness?**
18- 25	Yes
26 -35	Yes
36 - 45	No
46 - 55	No
56 - 65	Yes
66 - 75	No
76+	No

Table 1 Indication of which age groups influence willingness to take action

Analysing the data revealed that the nationality of a respondent can be related to their level of willingness to take action. Specific attention was paid to respondents from Germany, United Kingdom, The Netherlands, Spain, Italy and France as these are the main nationalities that visit Mallorca for a holiday (Statista, 2018). For tourists with the majority of these nationalities, it can be concluded that they are willing to take action to change their behaviour to reduce the use of SUP. Only for tourists from France it can be said that they are relatively unwilling to engage in such behaviour change.

The third factor of the situational variables was social norms. This considers whether respondents felt they should not use SUP due to friends or family judging them, whether most of their friends and family try to limit their plastic use, and lastly whether they get a bad feeling when they use a SUP cup instead of a reusable cup. For each of these points there is a relationship found between how much tourists agree with them and how willing they are to take action. Specifically, when, for example, a respondent has friends and family trying to limit their plastic use then they will also be more likely to be willing to take action themselves. Thus, good examples can help change the behaviour of peers. The literature on the topic of social norms indicated that one of the factors that affect a change in behaviour is the comparison to others (Gifford, 2011).

The situation determines how this relationship functions. The comparison to others and the experience of social norms to which this leads, either enhances a change in behaviour or it does not. From the results of this survey it can be concluded that the comparison of tourists to others will result in an increase of their willingness to change their behaviour.

2.2.3 Psychological variables influencing behavioural intention

Both perception of the problem and ideas on who is responsible for reducing the use of SUP influence behavioural intention. The perception of the problem measured how aware tourists are of SUP pollution and if they perceive such pollution as an actual issue. Specifically, to test this, four different statements were used to test the different dimensions of this question. For example, one statement used was: '*I am aware of the negative consequences that plastic has on life in the ocean'*, where tourists could indicate to what extent they agreed or disagreed. From the survey, it can be concluded that perception of the problem predicts how willing tourists are to undertake action towards reducing SUP. If tourists become more aware of the problem, it can lead to a higher willingness to change their behaviour regarding the use of SUP. In turn, such willingness to change can lead to an actual change in their behaviour.

Regarding responsibility, the feeling of being responsible for reducing SUP was tested. Here, both the responsibility of the respondent themselves and whether the respondents saw the responsibility being with the government and hospitality sector is taken into account. This is done with statements such as '*I feel responsible for reducing the use of single-use plastic when on holiday*' and '*The government plays an important role in minimising the use of single-use plastics*'. It was found that when the overall feeling of responsibility was higher, the willingness to undertake action was also higher. Most respondents indicated that the main responsibility to undertake action to reduce SUP lies with the government, followed by the hospitality sector and lastly with the tourists themselves (see Figure 2).

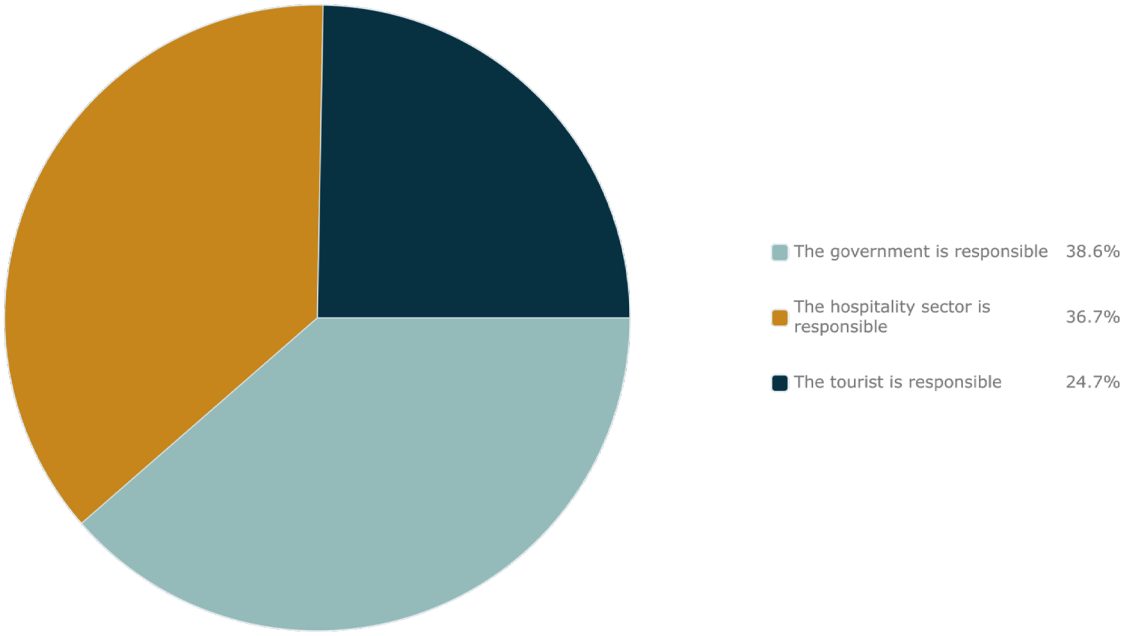

Figure 2 Responsibility that the respondents ascribe to the government, hospitality sector or tourists for reducing the use of SUP

2.2.4 Perception of the importance of the environment influencing everything

As mentioned before, tourists' environmental values influence their intention towards using less SUP. In addition to this direct influence, there is an indirect impact of these environmental values on tourists' behavioural intention through the situational and psychological variables.

In determining the impact of environmental values on situational variables, the focus is on tourists' experience of social norms. The survey has shown that those tourists that feel the environment is of relatively high importance, will also feel more pressure from social norms through friends, family and society as a whole. In turn, as mentioned, an increase in tourists experiencing pressure through social norms will increase their willingness to act towards reducing SUP.

The impact of tourists' environmental values of psychological variables can be seen in the relation to their perception of the problem of SUP. The survey has shown that tourists that feel the environment is of relatively high importance also believe they are aware of the negative consequences that plastic has on the oceans. These tourists additionally are more aware of the existence of the UN Sustainability Development Goals. The tourists that do not think the environment is of such high importance feel that oceans might be large enough so that humans are unable to cause permanent damage.

Moreover, the impact of tourists' environmental values on psychological variable can be determined through the degree of responsibility that tourists ascribe to the various involved actors to reduce SUP. The survey has shown that tourists that feel the environment is of relatively high importance also ascribe relatively high responsibility to the governments, the hospitality sector and tourists to reduce the use of SUP. As shown before, both the perception of the problem and the degree of responsibility have a direct influence on tourists' willingness to adapt their behaviour to reducing SUP.

A schematic overview of all tested factors and the relationships found between the variables is shown in Appendix C.

2.3 Factors that can be influenced and how this can be done

This section will examine the more practical side to the factors and relations that have been analysed. What will follow is a description of how environmental values, situational variables and psychological variables influence the willingness of tourists to take action regarding the use of SUP.

2.3.1 Age

As stated, age has a significant influence on the willingness of tourists. It is found that especially people in the age of 18-35 and 60-70 are more willing to change their behaviour to more environmentally friendly behaviour. Age cannot be influenced by a campaign, but this is an interesting topic to help define the age of the public to target with a possible campaign.

2.3.2 Perception of the importance of the environment

The survey results show that tourists' environmental values (perception of the importance of the environment) directly and indirectly influence their willingness to adapt their behaviour towards reducing the use of SUP. The perception that tourists have of the importance of the environment is a factor that can be impacted and thus increased. To do so, tourists should be made aware of the value and the impact that the natural environment has on human life. Also, tourists should be made aware that they can make a difference by changing to more sustainable behaviour. Specifically, it should be emphasised that even as an individual a difference can be made. This could for example be done by promoting the existing alternatives to SUP and the amount of plastic that they would save annually if they were to use the alternatives. In doing so, tourists' environmental values would be an effective way to, directly and indirectly, increase their behavioural intentions.

2.3.3 Social norms

Social norms are not easily influenced directly but will rather change naturally when reducing the use of SUP becomes more normal. This again highlights that tourists should be made aware of the importance of the environment, because as this realisation grows it is likely that more tourists will reduce their SUP consumption. This could eventually make alternatives for SUP the new social norm.

2.3.4 Nationality

Though it is not possible to change the nationality of tourists visiting Mallorca, it may be possible to target various nationalities, for example in campaigns. The results of the survey show that Dutch, Italian, Spanish, UK and German respondents are willing to undertake action to change their behaviour. However, the question remains how the respondents of each of these nationalities score on perception of the importance of the environment, social norms, responsibility of tourists versus responsibility of the government and hospitality sector, and perception of the problem. This would determine how to best target each nationality. Figure 3 shows the extent to which respondents from these nationalities on average agree with the underlying statements for these five factors. It can be concluded that there is room for improvement concerning the way people look at the responsibility of tourists in reducing the use of SUP. For each of the nationalities, apart from the UK, the responsibility of tourists is indicated as being lower compared to the responsibility of the government and hospitality sector. At the same time, respondents from all nationalities do score their perception of the importance of the environment and the perception of the problem to be high.

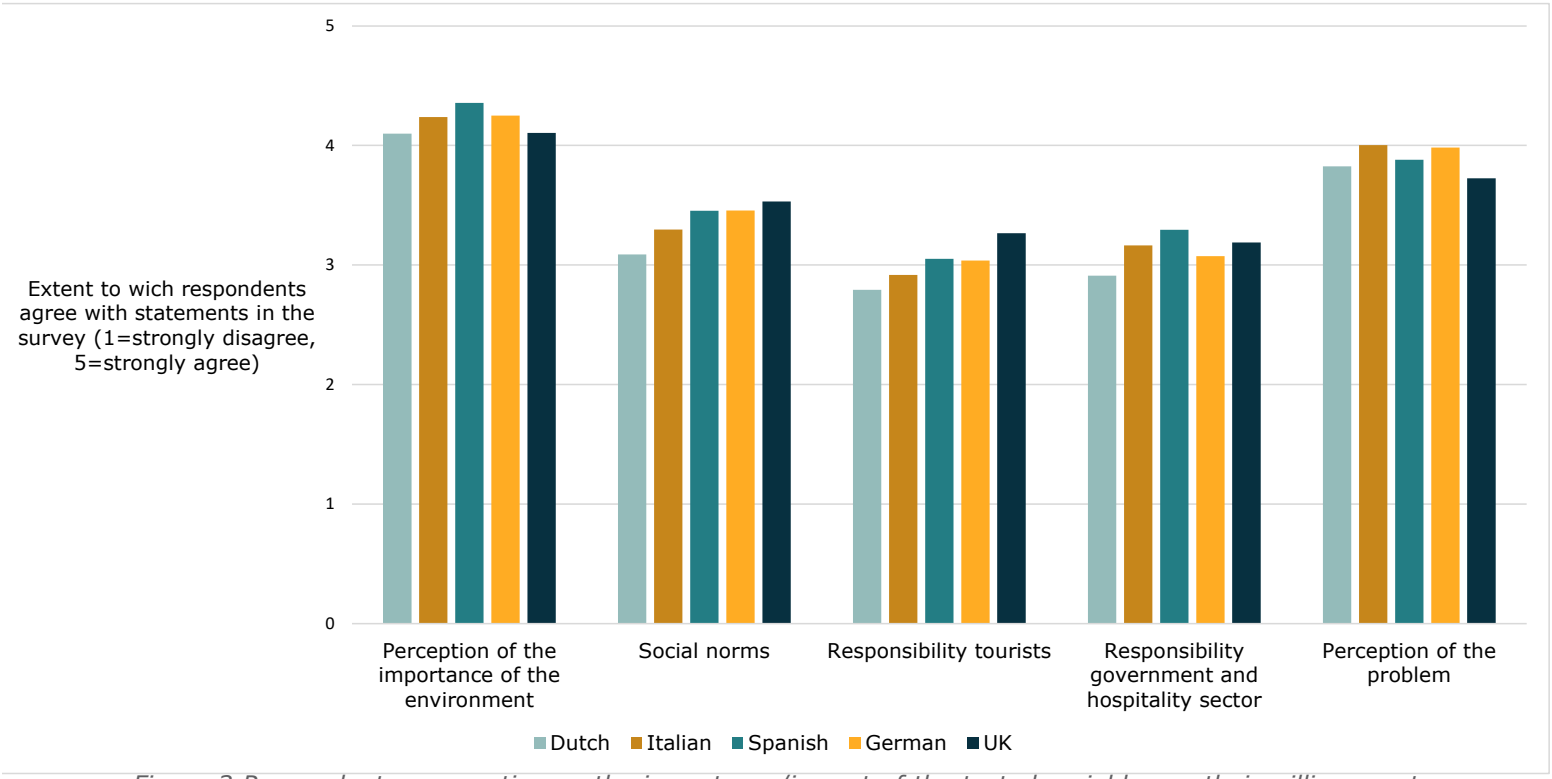

Figure 3 Respondents perspective on the importance/impact of the tested variables on their willingness to change their behaviour towards using less SUP

2.3.5 Perception of the problem

The survey results show that tourists' perception of the problem of SUP use and pollution impacts their intention of behaving more sustainably concerning SUP. Tourists perception of the problem is a factor that can be influenced and thus increased. To do so, tourists should be further educated on SUP and related consequences on personal and global level. If tourists better understand the problem, they would also be more willing to adapt their behaviour to reduce their use of SUP.

2.3.6 Awareness of the negative consequences of behaviour

In several interviews, it was mentioned that awareness plays an important role in influencing environmental behaviour positively (UNI-2, UNI-5, UNI-8, NGO-2, RO-2). The survey has shown that respondents are not always aware of specifics of plastic pollution. For example, only 40.5% of the respondents was aware that most plastic in the ocean has not been dumped in the water directly. Additionally, only 44.7% of the respondents thinks that plastic is a major aspect of global marine pollution. However, the negative consequences of behaviour can be explained to tourists. An efficient way would be for them to learn about the consequences of SUPs in school. If tourists are not aware of the problems caused by SUPs, they will only experience the benefits of using SUP and will not act in an environmentally friendly way. An interviewee (NGO-2) explains this as follows, «Once people get exposure to it [reducing SUPs] and they understand it, they are very happy and kind to take it on». Another important factor from awareness is the additional responsibility that comes with it. If tourists are aware of the problem, they are aware of their responsibility concerning the reduction of SUPs as is explained, "People need to understand that they are responsible to act and need to change something... once someone sees understands the problem, they can no longer accept it. Awareness and education are incredibly important" (NGO-2).

2.3.7 Degree of responsibility towards the environment

The feeling of responsibility that a tourist has towards the environment and changing their actions can be influenced by local initiatives and policies of the destination. For example, the government of the Balearic Islands has already implemented a SUP plastic reduction policy, ahead of the federal Spanish government. In addition, larger hotel chains on the island of Mallorca have started to reduce their SUP plastics in their hotels (see Annex 4, section 3). Thus, the response that was received from tourists stating that it is mostly the responsibility of the government and hospitality sector to reduce SUPs, is already being acted upon. This leaves the tourists; tourists need to be made aware of the possibility of their contributions in reducing SUPs and the contributions for the surrounding institutions. NGO-2 explains nicely the responsibility of all sectors,

> Everyone needs to be engaged. It needs to be the consumer, it needs to be the business owner, and it needs to be the government. We're slowly getting there. It's certainly much better than it was three years ago, that's for sure.

Additionally, another interviewee (UNI-5) shares a similar opinion

> Look, I think it's a multilateral thing here. You've got individual governments, you've got collaborations internationally, regionally, etc. NGOs, corporates, educational institutions, you know, the list goes on. I think everyone's got some responsibility here. But we cannot let government's off the hook. We can't say oh, well, let the NGOs do it or let the voluntary or welfare that that's not good enough.

2.3.8 Willingness to take action

All the factors that have previously been described influence the willingness of tourists to take action to behave more sustainably. Willingness can, therefore, change if the degree of responsibility towards the environment and perception of the problem are targeted through, for example, the policy of the destination. The results have shown that tourists express themselves as very willing to take action and as very aware of the environmental problems that SUP cause. However, there continues to be widespread use of SUP's. This confirms that there is an ongoing gap between the attitude of tourists and their actual behaviour which is discussed further next.

2.3.9 The attitude-behaviour gap

The theory of planned behaviour, a widely accepted theory in psychology research which explains why people behave the way they do, proposes that attitudes (among other factors) influence behaviour (Ajzen, 1985). However, in environmental behaviour, a positive attitude towards the natural environment does not seem to be a good predictor of making sustainable choices both at home and on holiday (Juvan & Dolnicar, 2014). When it comes to sustainable behaviour, such as the purchase of ethical or organic products, there is an inconsistency with the attitude of people towards sustainable choices and their actual behaviour (Terlau & Hirsch, 2015). This difference is called the attitude-behaviour-gap.

From the survey, it was found that tourists generally have a positive attitude towards the natural environment and are also willing to behave sustainably, for example by re-using their plastic bags. This indicates that

tourists, at least the survey respondents, are willing to take action to adapt their behaviour. However, SUPs are still widely used (see Annex 1, Table 1). Therefore, these findings are in line with previous studies about sustainable consumption behaviour and are likely to confirm that there is an attitude-behaviour gap. But what are the reasons for this attitude-behaviour gap?

Part of this gap could be explained by the social desirability which is often unintentionally implied in surveys concerning human behaviour. This could also be the case for the survey that has been shared for this research. When there is a social desirability bias, consumers would indicate they are more willing to behave sustainably than they actually would, which will lead to an exaggerated attitude-behaviour gap. Carrington, Neville and Whitwell (2010) accept the bias as a partial explanation of the gap, but they argue that many people intend to consume more sustainably than they end up doing because they are held up by different constraints and demands. There are personal, societal, economical and other barriers that can restrain people to behave sustainably. One of the main barriers is the lack and abundance of information. If there is too little information (on products), consumers state there is not enough information to make a sustainable decision, and when there is too much information, people tend to be overwhelmed (Papaoikonomou, Ryan & Ginieis, 2011). Furthermore, people tend to be sceptical of where the information comes from and question the credibility of the sources. Another explanation consumers give for the gap is the lack of availability of sustainable (e.g. plastic-free, or no SUP) alternatives, and that priority is often given to the traditional purchasing criteria such as price, quality and availability, over sustainability (Papaoikonomou, Ryan & Ginieis, 2011; Terlau & Hirsch, 2015).

Moreover, personal views, thoughts and behaviour explain part of the attitude-behaviour gap. While people indicate they are willing to act more sustainably, there are different reasons/excuses mentioned why the positive intentions were not realised. Consumers tend to opt for the easy and accessible choice, deny their responsibility towards the environment and claim to be too busy to change their behaviour (Juvan & Dolnicar, 2014; Papaoikonomou, Ryan & Ginieis, 2011). Furthermore, behaving environmentally friendly back home seems to be a reason for tourists to not act sustainable when on holiday while the positive attitude is present (Juvan & Dolnicar, 2014). Finally, it is thought that consumers' efforts and individual behaviour have little effect on solving a larger environmental problem. These arguments might not offer space to improve the behaviour of tourists regarding the use of SUP, but some recommendations can still be offered.

3. Conclusion

Environmental behaviour of tourists is influenced by a wide range of factors, of which some are easier to influence than others. This research has identified the main factors that will help encourage tourists on Mallorca to change their behaviour and reduce the use of SUP.

Increasing tourists' environmental values through educating them on the importance of the environment will increase their willingness to change their behaviour. Also, making these tourists more aware of the scope of the problem of plastic pollution is important. This can be done by emphasising the consequences that plastic pollution has on humans and life in the ocean. Another strategy to get tourists to be open to make their

behaviour more environmentally friendly and reduce SUP is to make them aware of their role in polluting and consequently their responsibility of reducing SUP use. Using specifically targeted campaigns to communicate to tourists correctly can be helpful. However, simply addressing these factors is not enough as the tourists' attitude-behaviour gap should also be overcome. Making alternatives to SUP accessible and cheap would be a strategy address this gap. Eventually, if the number of tourists that do not use SUP increases, it might become the new social norm.

More elaborate and specified ways to impact tourists' behaviour and encourage them to reduce their SUP use can be found in the recommendations section.

4. Limitations

Due to the current COVID-19 situation, some parts of the Terms of Reference were a challenge to adequately respond to. What will follow is a description of some of the limitations of this research so that these can be considered for future studies on this topic.

Due to the travel restrictions, it was not possible to travel to Mallorca. This means that it was not possible to observe the actual behaviour of tourists or to see what kind of information is currently shared with tourists on reducing the use of SUP. As a result, these above-mentioned recommendations are geared more towards targeting the behaviour of tourists in general and not specific to the location of Mallorca.

Another consequence of the current COVID-19 situation is that the survey was distributed online instead of in-person on the island of Mallorca. As a result, the target population of the survey was broadened from tourists on Mallorca to general tourists. The survey was distributed online through the students and lecturers that took part in the EUW, which means that it was potentially distributed among tourists who are already environmentally inclined. Thus, the results of the survey may potentially be skewed. However, given the large number of respondents (756), it is also possible that the sample may be more representative of a more general population.

Though the results have found a positive directional relationship in some of the variables tested in the survey, there is a possibility that there may be unknown confounding variables that affect the relationships between measured variable, causing the assumption of a relationship that may not exist.

Lastly, the behaviour of individuals has again proven to be difficult to measure, particularly since individuals might give the desired answers to a survey while this intention might not match their actual behaviour.

5. Recommendations for influencing the environmental behaviour of tourists on Mallorca

The results that we have gathered from the survey, campaign analysis and interviews have led to several recommendations. These recommendations can be used by Oceana to target tourists' behaviour concerning more sustainable resource use. Given the general observations of tourists' willingness to act sustainably when it comes to SUP use, these recommendations may also be of interest to other marine conservation NGOs in the context of Mallorca. These recommendations address strategies that can guide in targeting the factors that play a role in explaining sustainable behaviour of tourists. A summarised overview of these recommendations can be found in Appendix D.

Personalise the consequences of SUP

Personalise the consequences of SUP pollution for tourists through education. It is important to make tourists aware of the negative consequences that SUP pollution has on human life. Personalising SUP pollution can make the problem seem closer to home for tourists and help them realise that their behaviour can have an impact. The focus should not only be on the problem but also on possible solutions. By highlighting their individual contribution to the problem and showing their behaviour can have a positive effect, part of the attitude-behaviour gap can be overcome. Through this, there is a chance to create a bigger sense of responsibility in tourists to engage in reducing SUP. Personalising SUP pollution should not overwhelm in terms of information that is provided. Rather, the use of information should be limited yet effective. How this could be achieved effectively is unknown and it is therefore recommended to study this further.

Make the environment great again

Make tourists more aware of the importance of the environment. Tourists should learn about the need for a healthy environment in relation to sustaining life on earth. This is important because the results of the survey show that a better understanding of the importance of the environment can result in more sustainable behaviour in many different ways. To educate tourists on the environment surrounding them, suitable information and education needs to be provided. This can be done in various ways, like putting up signs with short but catchy information in parks, nature reserves and alongside the beaches. Different routes connecting several information signs can be made, so tourists can have a self-organised walk, run or treasure hunt following the 'environmental routes' on the island. In this way, they can explore the island while in the meantime learning more about the importance of the environment.

Visualising actions

Work with the government on increasing the visibility of the SUP restrictions that have already been implemented. As tourists feel the government is mainly responsible for reducing SUP, it would be helpful for them to be able to notice and experience the actions of the government. In realising that responsibility is taken on a higher level, tourists can no longer deny that their behaviour and responsibility for reducing SUP. Campaigns at the destination can help to highlight the government's actions and what is expected of the tourists themselves. However, future research would have to focus on whether limiting tourist behaviour through enforcement will have negative consequences for tourism on the island.

Target nationalities

Use nationality to create more specific campaigns and education. Since the results of our research show that nationality can be a factor that determines how willing tourists are to take action in reducing the use of SUP when on holiday, it could be important to consider this factor when educating tourists. Budeanu (2007) states that nationality affects the kind of information that tourists wish to receive about a destination, particularly the environmental status of the location and the sustainability of the services that are offered. Therefore, it is recommended that nationality should be considered in education as it is easier to change the behaviour of those that are open to it. The survey results indicate that respondents see the responsibility of tourists to reduce the use of SUP as being lower compared to the responsibility of the government and hospitality sector. Therefore, targeting the Dutch, German, Italian, UK and Spanish nationalities can best be targeted on making them aware of the responsibility that tourists have. These nationalities do indicate to be aware of the problem and the consequence of using SUP on the state of the environment. However, they score low on their agreement with the responsibility of tourists in this issue.

A touch of emotion

Use emotion to trigger tourists' empathy. A repetitive element of the plastic reduction campaigns was the emotional undertone that makes tourists empathise with the animals in the ocean that suffer from plastic. This was also confirmed in an interview (UNI-2), that elaborated on the fact that tourists should feel the guilt of the stupidity with plastic. Long term statistics and numbers are not enough to elicit a response. Therefore, it is recommended to try to trigger tourists into feeling responsible and empathise with the animals in the ocean in a campaign.

Make it easy!

An important factor in determining behaviour is accessibility. Tourists are more triggered to behave in an environmentally friendly way if it is easy, cheap, or if they are stimulated by certain incentives (Jacobs, 2019). Practical examples are the frequently placed charging stations for electrical cars along the highway, or a discount if you bring your own cup to a coffee shop. To reduce SUP hotels could, for example, give tourists one reusable bottle to refill water instead of providing plastic water bottles every day. Restaurants could, as a standard, serve drinks without a plastic straw and only provide one when specifically asked for it. Or in a supermarket, where items without a plastic wrapping are cheaper than the same item wrapped in plastic. In this way, it is easy and comfortable for a tourist to choose environmentally friendly options.

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Appendices

Appendix A
Survey questions per factor

Variable	Factor	Survey question	Answer options
Environmental values	Perception of the importance of the environment	Please indicate the extent to which you agree with the following statements: 1. I believe that people should care for the natural environment 2. I feel connected to the natural environment 3. I feel the natural environment is of crucial importance in contributing to the quality of human life. 4. Human beings are affected by the plastic pollution in the ocean 5. I feel that the health of the ocean is important 6. I feel that single-use plastic in the ocean affects the quality of human life 7. I think that the health of the environment is not important 8. Humans are not really affected by the plastic pollution in the ocean	Likert scale (5 point) 1: Strongly disagree 2: Disagree 3: Neither agree nor disagree 4: Agree 5: Strongly agree
Behavioural intention	Willingness to undertake action	Since increasing amounts of plastic are found in the ocean.... ....I feel it is important to use less single-use plastic when I am on holiday. ...I feel it is important to reuse plastic shopping bags when I'm on a holiday ...I feel it is important to bring my own reusable shopping bag when I am on holiday	Likert scale (5 point) 1: Strongly disagree 2: Disagree 3: Neither agree nor disagree 4: Agree 5: Strongly agree

	Willingness to undertake action	Would you be willing to pay more for an accommodation knowing it is free of single-use plastics compared to an accommodation that does not promote this?	Choose one option: - No, I'm not willing to pay more - Yes less than 10% - Yes between 10% and 20%, - Yes, more than 20% - Yes, but I don't know how much more
Situational variables	Preferred accommodation	Thinking about your most recent holiday, which accommodation type did you book most often? Please select one of the options.	Choose one option: - Apartment - Bed & Breakfast - Campsite - Couchsurfing - Holiday home - Hostel - Hotel (2 or 3 stars) - Hotel (4 or 5 stars) - Other
	Sociodemographic factors	Age What is your age?	
	Sociodemographic factors	Gender What is your gender?	Choose one option: - Male - Female - Other - Prefer not to say
	Sociodemographic factors	Nationality What is your country of origin	List of all countries
	Sociodemographic factors	Travel companion Thinking about your most recent holiday, with whom did you travel?	Multiple options possible: - Alone - With my partner - With friend(s) - With family - Other
	Sociodemographic factors	Tour group Thinking about your most recent holiday, was it self-organised or with a tour group?	Choose one option: - Self-organised - Tour-group

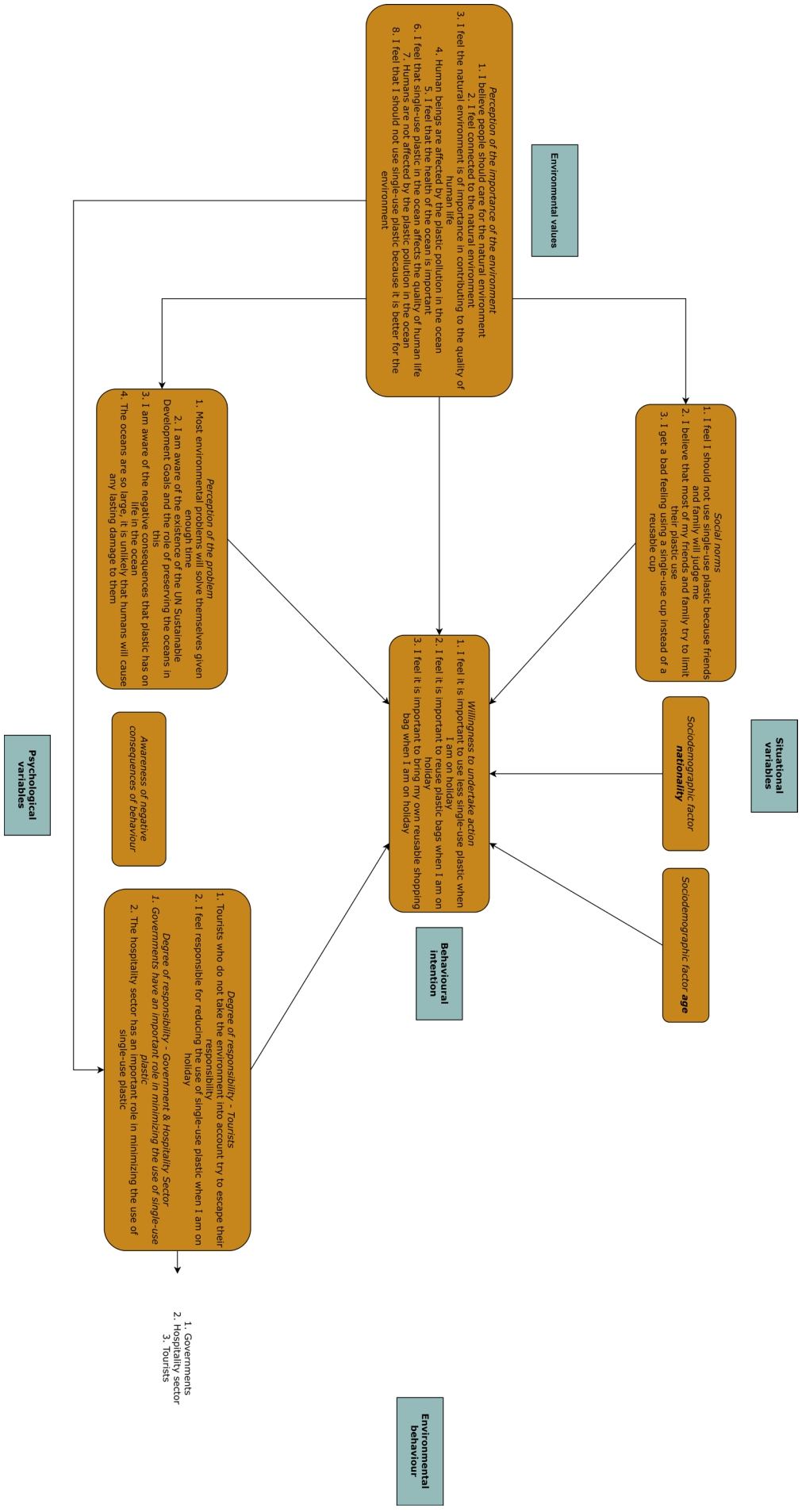
	Social norms	Please indicate the extent to which you agree with the following statements: 1. I believe that most of my friends and family try to limit their plastic consumption. 2. I get a bad feeling when I use a single-use plastic cup instead of a reusable cup. 3.I feel that I should not use single-use plastic for the sake of friends and family judging me. 4. I feel that I should not use single-use plastic for the sake of the environment 5. I feel that tourists can use single-use plastic if the local inhabitants do it	Likert scale (5 point) 1: Strongly disagree 2: Disagree 3: Neither agree nor disagree 4: Agree 5: Strongly agree
Psychological variables	Perception of the problem	Please indicate the extent to which you agree with the following statements: 1.Most environmental problems will solve themselves given enough time. 2. I am aware of the existence of the UN Sustainable Development Goals and the role of preserving the oceans in this. 3. I am aware of the negative consequences that plastic has on life in the ocean. 4. The oceans are so large, it is unlikely that humans will cause any lasting damage to them	Likert scale (5 point) 1: Strongly disagree 2: Disagree 3: Neither agree nor disagree 4: Agree 5: Strongly agree
	Awareness of negative consequences of behaviour	Please indicate if you think the following statements are true, false or if you don't know: 1. Plastic does not decompose (true) 2. 9% of plastic waste is recycled (true) 3. Most plastic in the ocean has been dumped directly into the water (false) 4. A garbage truck full of plastic enters the ocean every minute (true) 5. Plastics is only a small portion of marine pollution globally (false) 6. The plastics in the ocean concentrate in far off-shore regions instead of near the coasts (true)	Choose one option: - True - False - I don't know

	Degree of feeling responsibility	Please indicate the extent to which you agree with the following statements: 1. I feel responsible for reducing the use of single-use plastic when on holiday 2. Tourists who do not take the environment into account try to escape their responsibility. 3. The hospitality sector has an important role in minimising the use of single-use plastics. 4. The government plays an important role in minimising the use of single-use plastics.	Likert scale (5 point) 1: Strongly disagree 2: Disagree 3: Neither agree nor disagree 4: Agree 5: Strongly agree

Appendix B
Factors found in literature that are said to influence consumer behaviour

Factors that cannot be influenced	Factors that can be influenced
Age	Awareness of negative consequences
Gender	Emotional affinity towards nature
Nationality	Sympathy for others/altruistic values
Financial resources/situation/income	Prosocial values
Level of education	Entitlement (leading to responsibilities)
Political orientation	How much the environmental alternative costs in terms of time, money and comfort
Religious values	Setting a good example
Occupation (student, professional, retired)	Information provision/guiding
Past behaviour	The idea that every bit helps/every person can make a difference
Demographics	Changing habits
Culture	Creating a sense of responsibility
Personality, mood and emotions	Media exposure
Skills	Attitude
Stereotypes and stigmas	Place attachment
Social norms	Motivation
Environmental factors	Environmental factors
Financial restraints	

Appendix C
Overview of the relationships between the variables found through the survey



Appendix D
Summary of the recommendations

Recommendations
Environmental Consumer Behaviour Analysis

Recommendation 1

Personalise the problem through education.

Recommendation 2

Educate tourists on the importance of the environment.

Recommendation 3

Work together with the local government to increase the visibility of SUP restrictions that are already implemented.

Recommendation 4

Take nationality into account when educating tourists.

Recommendation 5

Trigger empathy with ocean animals in campaigns.

Recommendation 6

Make it easy, accessible and cheap for tourists to choose the environmentally friendly option.

Expert Report 4

Policy and Practice Analysis

Written by

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Pauline Olivier | Joep van Zuijlen

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GOV 2	Anonymous - Insular Council of Mallorca
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NGO-3	Silvia Garcia - Oceana
NGO-4	Fernando Cevignon - TODARUS
BUS-2	Cloé Ragot - Plastic Energy
BUS-3	Saskia Pepping - MVO Nederland
BUS 7	Jo Hendrickx - Travel Without Plastic
BUS 8	André Gerondeau - Melià Hotels International
RO-1	Kirana Augustina - World Resources Institute

Main findings

1. Some **gaps in the legislation** were noticed. Indeed, certain SUP items are not covered in *Ley 8/2019*, which are an important area of focus for future regulations, such as:

- bottles larger than 200ml,
- products offered by the minibar service in the hotel rooms, and
- hotel welcome products or amenities.

2. **The water system** in Mallorca affects the taste of the tap water too much and causes tourists and locals to buy water bottles instead. Fixing this, as well as adding refillable water stations in public places could already lead to a huge impact in SUP reduction.

3. **Lack of knowledge** of how to reduce SUP and what alternatives are available was found to be a key barrier for the implementation of SUP reduction strategies. A guideline would be an important tool to provide information for hotels on the easiest and cheapest way to reduce SUPs, including to cover the gaps in Ley 8/2011 as mentioned above. This guideline could be based on the UNTWO and WWF frameworks.

4. **Collaboration** is the key factor to reach more people and have a bigger impact

- with hotel representatives: contact the Federation first, then the hotel Associations
- with other NGOs: see Table 1 to determine which one could help on which regard

5. Tourist and hotel staff **awareness** are essential to spread environmental-friendly practices and enhance global good behaviour. Awareness campaigns, beach cleanups and other local projects are great tools to share the responsibility and reduce SUP, therefore, should definitely be considered.

1. Introduction

Plastic pollution has been a widely recognized problem across the world for many years now (Rajendran et al., 2012). To combat this issue, different types of national and international policies have been developed over time. This most notably started in 1978 with *"The International Convention for the Prevention of Pollution from Ships"* (MARPOL) (Derraik, 2002). This convention, headed by the International Maritime Organization, was a big step up in recognizing and acting on plastic pollution. In 1972 the *"Convention on the prevention of Marine Pollution by Dumping of Wastes and Other Matters"* was also signed by a total of 87 countries, but this had a lesser impact than the MARPOL convention, which has been seen as the biggest contributor. Many policies have since been developed and implemented to prevent pollution and safeguard marine ecosystems; however, plastic pollution is still a relevant and pressing problem to this day.

This expert report expands on policies and best practices to reduce Single-Use Plastic (SUP) in the hospitality sector in Mallorca, to contribute to plastic-free oceans and healthy marine ecosystems in the Balearic Islands. This report answers three main questions:

1. *What is the current context of policy in Mallorca regarding SUP in the hospitality sector?*
2. *What are the practices currently implemented to reduce SUP usage in the EU hospitality sector and their advantages and disadvantages?*
3. *What are the recommendations for implementing SUP reduction practices in Mallorca?*

The first part of the report covers the current context of policy and practice in Mallorca, including the national and international legislative framework. In the following chapter, an analysis is done on the current best practices globally and discusses the plastic reduction frameworks that specify steps to achieve this. The fifth and final chapter discusses the most suitable policy strategies for implementing plastic-free zones specifically in Mallorca and the possible impacts of those policies.

Methodology

Different data collection methods have been used during this 8-week study for the analysis of the policies and best practices aiming at reducing SUP. In order to give context and understand the legislative structure and framework of the Balearic Islands, a document analysis was carried out. The most used documents for the policy analysis were the documents of the European Directives from the website of the European Commission, Spanish Constitution and legislation and other specific environmental laws of the Balearic Islands, such as Ley 8/2019, *de residuos y suelos contaminados de las Illes Balears*, from the Spanish government website. In order to identify the implemented practices by hotels and current guidelines from hotels and NGOs to reduce SUP in the hospitality sector, official NGO and hotel websites as well as published scientific articles were used, found through Google Scholar and the WUR Library.

Interviews were also done. Some stakeholders and experts were identified from the initial document analysis and others through NGO websites and LinkedIn. Due to the impossibility to travel and meet personally with the stakeholders, the interviews were done through video calls. These conversations were carried out in English or Spanish, depending on the preference of the interviewee. All of the conversations were recorded

in order to facilitate their transcription through the program Otter for the English interviews and Sonix in the case of those spoken in Spanish. All the relevant information from the transcripts were then coded in the program MAXQDA. In total, 10 interviews were realized for this expert report, including the Government of the Balearic Islands, other (policy) experts and NGOs.

To study the current practices implemented by the hotels in Mallorca, an anonymous survey was created that was forwarded directly to the email addresses found in the hotels' official websites and through the 21 hotel associations located in Mallorca. The results of the survey, filled out by 30 hotels in Mallorca, were analysed using the SPSS statistical program. No observations, interviews and surveys were made in person due to the impossibility to travel to the area of interest.

2. Context of environmental law implementation, policies and frameworks in Mallorca

This first chapter aims to establish the general insight into the environmental law implementation in Spain, moving on to focus on the current waste legislation (Ley 8/2019) in the Balearic Islands and the responsibilities behind the legislation. The data gathered for this section originates from a document analysis of the governmental legislations supported with interviews with the Waste Management Service of both the Balearic Islands Government and the Insular Council of Mallorca (referred to as GOV-1 and GOV-2, respectively).

2.1 Environmental laws implementation system in Spain

At the State level, the basic environmental legislation will be implemented and controlled when more than one autonomous region is affected. New laws can be proposed by the central government through a *Proyecto de Ley*, that must be approved by the *Consejo de Ministro*. A Law can also be presented by the Congress of Deputies and the Senate (*Proposición de Ley*), by autonomous communities' assemblies or by citizens (for more information about environmental law implementation in Spain read Appendix A). Therefore, the autonomous communities can organise their own environmental strategy, implement new regional legislation, but will be fully in charge of the enforcement of those legislations. In this line, the legislation Ley 8/2019 was created by the Balearic Islands Government and accepted in the Parliament (GOV-1). At the local level, the Municipality is the most basic entity, and, in respect of the law, they can manage their own administration in every matter of concern that is not excluded by higher authorities (Art. 75 of the Ley Orgánica 1/2007). In addition, they have environmental protection power. The 52 municipalities of Mallorca focus on the living conditions of the populations, grant environmental permits, organise the urban waste treatment and limit noise pollution. However, the regulations implemented at the local level need to follow those issued by the state and the autonomous regions (Almenar et al., 2019).

2.2 Legislative framework on SUP reduction impacting Mallorca

2.2.1 EU level

The 2020 European Green Deal urges the Commission to improve the EU measures against plastic pollution further, focusing mainly on the marine environment. It calls for larger restrictions on SUP items and supports the development of legislation to address over-packaging to ensure that all packaging that is not reusable or recyclable in an economically viable manner is not allowed on the EU market by 2030 at the latest while ensuring food safety. This initiative also notes that the Commission intends to develop a regulatory framework for biodegradable and bio-based plastics and highlights the need for a fully circular plastics economy (EU Parliament, 2020).

2.2.2 State and Regional levels

In line with the 2018/851 European Parliament law, the Balearic Islands legislation has chosen to complete the basic Spanish State legislation (Ley 22/2011) and improve the level of environmental protection (Ley 8/2019 - page 1). Since the only objective focused on reducing SUP in the national legislation, is to reduce the amount of shopping bags (Ley 22/2011 - page 38). This new regional legislation is a result of a participatory decision-making process where public administrations, citizens, social entities and private sector companies were involved in all stages, from the beginning to the final proposal (Ley 8/2019 - page 2, GOV-1).

The objective of the new regulation (Article 2) is not specific to SUP but relates to the hospitality sector by aiming at reusing beverage containers by 2030. Indeed, the goal is to reach a reuse of 40% of water bottles, 80% of beer packages and 70% of refreshing drinks packages by the hospitality industry: HORECA (Hotel/ Restaurant/Catering).

The legislation states (Article 23) the following relevant regulations regarding the SUP, to be applied by 1st January 2021 (although delay expected to March-April 2021 due to Covid-19 crisis (GOV-1)):

- Light or very light plastic bags will not be free of charge anymore, and priority to the use of materials and plastic made of natural polymers - 50% of recycled and non-fragmentable plastic (to 70% by 2024), and no distribution of light plastic bags by commercial establishments will be allowed.
- Sale, distribution and use of single-use food plates, cutlery, glasses, cups and trays made of plastic that do not fall within the scope of Directive 94/62/EC on packaging will not be permitted (except for those that are compostable).
- No single-use food products and utensils can be used (exception of those restrictions established by Royal Decree 895/2013).
- In the Balearic Islands, only beverage straws, cotton buds and candy sticks made of compostable materials may be distributed.
- The single-use coffee capsules, infusions, broths and others used in coffee machines for sale in the Balearic Islands, will have to be made with compostable materials or to be easily recyclable, organically or mechanically.
- Other restrictions concerning the market of wet wipes in the Balearic Islands have also been included.

The monitoring of this legislation (Articles 71 and 72) referring to the surveillance, control and inspection of the regulations could be added to the work of the current inspectors in charge of food and health and safety (GOV-1) and could be organised without prior notice. The non-compliance with the regulations concerning the marketing, distribution, sale and usage of SUP is considered as a severe infraction, has been set to be reprehensible by fines from €9,001 to €300,000 (Articles 77 and 78).

However, there are notable gaps in the legislation. Indeed, bottles larger than 200ml, products offered by the minibar service in the hotel rooms as well as hotel welcome products or amenities have been left out of the legislation (GOV-1). In order to incentivise the reduction of these SUP items not included in the legislation, the government of the Balearic Islands gives subsidies to municipalities and private companies that implement circular economy initiatives (GOV-1). Moreover, the ECOTUR program implemented by the Ministry of the Environment and Territory of the Balearic Islands, promotes the implementation of voluntary measures to enhance environmental quality. This includes the EMAS (Eco-Management and Audit Scheme) and EU Ecolabel certifications. These two certifications set guidelines for general waste management and other practices in general (ECOTUR, 2017). Whereas Ley 8/2019 introduced "pay as you throw" fees, that will be submitted for the various waste categories along with a bonus system for best practices (WWF, 2019).

On the other hand, it is important to use proper waste management and for the government to coordinate and help the different municipalities in that regard to ensure the correct collection and sorting of plastic (RO-1). Indeed, waste management plans are an important instrument to limit the negative impacts of waste generation and management on the environment. Plus, they are also necessary for transitioning to a circular economy and are one of the most important tools for reaching the goals of the EU Waste Framework Directive (WWF, 2019).

The National Master Plan for Waste Management - *Plan Estatal Marco de Gestión de Residios*, is Spain's waste legislation that transposes the EU Directive into national law. The 17 autonomous regions follow it with their own waste management plans. However, with disposal and recycling being decentralised and with the high level of autonomy of the regions making uniform enforcement is difficult. This explains that the amount of waste collected for recycling varies widely, with a low 18% recycling rate in the Balearic Islands (WWF, 2019).

2.2.3 Local level

At the island level, the Council of Mallorca has no regulatory power (GOV-2), and thus the regulations that are implemented for the Balearic Islands are the ones that are in place in Mallorca. The Council of Mallorca is only competent for the treatment of all kinds of waste in Mallorca, and their treatment plants (GOV-2). Currently, in Mallorca there are 5 composting treatment plants and one methylation plant.

On the other hand, the municipalities are responsible for the collection of waste and thus responsible for creating policies and agreements with hotels (GOV-2). Those policies can be rewarding, some hotels (implemented in the municipality of Sant Llorenç des Cardassar) use waste containers with chips that can track and monitor the waste management from Hotels, which can lead to tax reduction from the municipality (GOV-1; WWF, 2019). However, these policies can also be under the form of taxes. The producer's responsibility (SCRAP) has been modified in order to make them participate in the extra costs to the municipality for daily collection and collection in the natural environment. These measures are not yet implemented in Mallorca but could be an efficient way to create accountability (GOV-1).

3. Current practices and guidelines to reduce SUP usage in the hospitality sector

The next chapter will cover best practices that have been implemented in hotels all over the world. Best practices can be defined as "*anything to help the hotel in reaching sustainability goals in an efficient way, including regarding the learning processes in its general business operation*" (Cuthbertson, 2010). It discusses some notable best practice frameworks or guidelines for plastic reduction in hotels, specifically focusing on the frameworks provided by the WWF and the Global Tourism Plastic Initiative (GTPI), supported by data from the conducted interviews. To support the best practice analysis and check for actual implementation examples, a survey of hotels based in Mallorca was conducted. A web-based search was also carried out to check for implemented measures in hotels all over the world (see Appendix D). The key trends found in best practice analysis were heavily revolved around the elimination of plastic through substitution or re-use models.

3.1 Discussion of frameworks

When looking at the different guideline frameworks, the WWF guidelines (WWF, 2019) are targeted specifically at hotels, while the Global Tourism Plastic Initiative (GTPI) from the United Nations World Tourism Organisation (UNWTO, 2020) provides more of a systematic perspective on developing a circular economy (See Appendices B and C). Both were used to develop a more holistic view and discussion on best practices. They generally follow the same priority in the waste hierarchy, which is visualised in Figure 2.

From guidelines of both the WWF and the GTPI, we have adapted the key points into a number of overlapping themes, summarised in Figure 1. These include;

(b) elimination of unnecessary plastic

(c) reuse models

(d) all plastic is 100% recyclable or reusable

(e) all plastic is sorted and recycled

Additional points from the WWF guidelines, which are more specific to hotels, were;

(a) monitor and document all single-use products

(f) communication and integration of staff and guests

(g) collective collaboration.

The general reflection from both frameworks was that elimination of unnecessary plastic was the most impactful action, which could in part be accomplished by implementing reuse models. However, the WWF additionally recommended, in regard to hotels, to document all SUP use before this step to understand which items constitute the bulk of the plastic volume. Furthermore, if any plastic is purchased and used, it should comprise of 100% recyclable or reusable plastic, which should then be properly sorted and recycled when

it can no longer be used. Finally, communicating the awareness well towards staff and guests to create the right habits was important to sustain change while collaborating on a regional level to create synergies and transition easily was seen to be important to implement change.

Figure 1 Overlapping themes of guidelines.

3.2 Overlapping themes and best practices from literature and interviews

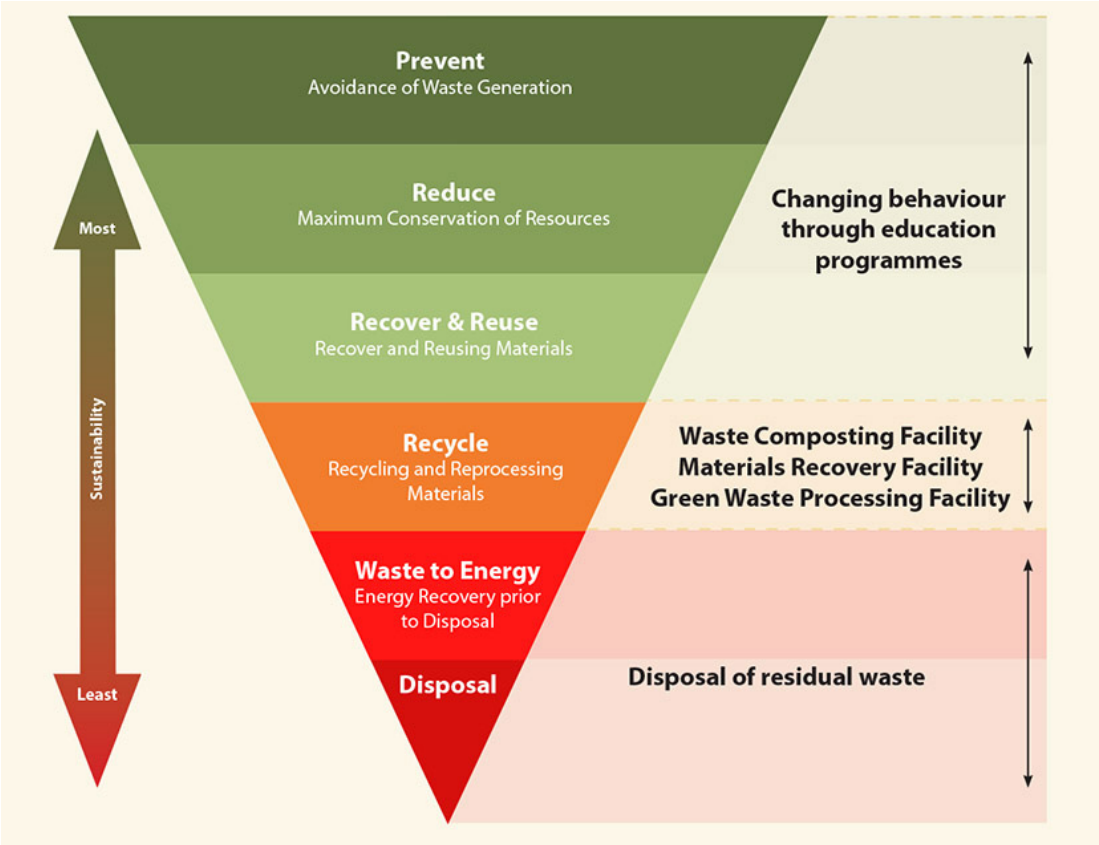

Figure 2 Depiction of the sustainable waste hierarchy. Retrieved from: http://smrc.com.au/wp-content/uploads/2014/03/Waste-Hierarchy.jpg

a. Monitor and document all single-use products

Many hotels have little knowledge on the exact amount of SUP they're consuming, where and how much it's costing them (BUS-7). Monitoring and documenting the purchase and use of all SUP is an important first step to create a baseline and examine what the biggest plastics are by volume and cost, to then decide what to replace/remove (BUS-7; Futouris, 2019; TUI Group, 2018). By doing this, hotels can examine the top five or ten items that they think they could reduce or eliminate before implementing certain practices. Monitoring and documenting are also useful to do as a first step as many hotels can become aware of the money that can be saved by not purchasing items that are only used once and not necessarily needed by guests (BUS-7).

b. Elimination of unnecessary plastic

In line with the EU Directive 2008/98/EC on waste, elimination of plastic aims at having the most impact in the total reduction and the most desirable action to reduce waste. Plastic packaging in many instances can be removed from products while maintaining its utility. Slippers provided to guests when they arrive in their hotel room are frequently wrapped in plastic, which is also often the case for coffee/tea stations in the room, the coffee, tea, milk and sugar (Futouris, 2019). This is without counting the amenity kits many hotels provide in their bathrooms that include plastic shower caps, toothbrushes, shoeshine and combs, which are then further individually wrapped in more plastic. The biggest volume of SUP was quoted to come from bottled water and bathroom amenities and food packaging (BUS-7). Most of the hotels that provide these amenity kits do so as a requirement to receive their 4* recognition (Futouris, 2019). Thus, as part of overcoming this problem, as each autonomous region sets its own requirements for hotel ratings, a dialogue is needed with the Balearic Islands government to implement amendments to these standards. Many guests bring their own products, such as toothbrushes and slippers (BUS-7; Futouris, 2019), thus making it easier to offer amenity kits only on request of the guest without reducing their standards.

Improvements are being made in terms of redundant plastic packaging in many hotels. In a study done by Futouris (2019) in the Balearic Islands, almost none of the visited hotels were using plastic-wrapped single portions on the buffet, i.e. for jam, butter or ketchup. They also found that rarely did hotels use plastic cutlery and crockery or plastic lunch boxes and if the hotels did, they used cutlery made of wood or biodegradable/compostable material for take-away boxes. Furthermore, almost all hotels had banned the use of hygiene plastic banderoles around the toilet.

This first, fairly easy and efficient step for reducing SUP of complete elimination, however, cannot be a one-stop solution. Even though hotels have implemented such schemes, many have reached a dead end by merely replacing SUP with disposable products produced from other materials. This approach may comply with the EU's Single-Use Plastics Directive but risks encouraging the belief that other materials such as bioplastic, wood and metals are inherently more environmentally friendly than plastic (WWF, 2019). In fact, biodegradable plastics are still difficult to recycle, cannot be put with the compost and are usually ultimately incinerated (NGO-2). Products made with more renewable raw materials still need water, land and fertiliser. Many of these short-term measures of replacing plastic items with alternatives may reduce plastic pollution but in the long run, do not alleviate wider waste problems and pollution. There is often insufficient knowledge about the actual impacts of these materials on nature and the environment (WWF, 2019), and thus advisable to consider eliminating certain SUP amenities rather than replacing them (BUS-7). More information on the analysis of plastic alternatives can be found in Annex 1, Table 2.

In our document analysis, **elimination of plastic measures was by far the most implemented option to reduce SUP,** done by a total of 15 different chains. These included *Garden Hotels* with 9 hotels in Mallorca and *Marriott international Hotels* with 6 hotels in Mallorca (7,000 hotels total worldwide). For a full list of the 15 hotels chains, see Appendix D. This option was more prevalent as many hotel chains implemented common practices such as banning or substituting plastic straws, cutlery and amenities. However, for most hotels, the measures were not complete bans of SUP.

Three hotel chains found in the document analysis claimed or aimed to be completely SUP free. These three included Edition Hotels (EU) from 2019 onwards, *Iberostar Hotels* (Mallorca) from 2020 onwards and Accor Hotels (EU) by 2022 onwards.

c. Reuse models

Plastic water bottles, small individual shampoo and body wash plastic bottles are widespread across hotels to welcome guests when they enter their room (Futouris, 2019), and plastic water bottles are still offered for sale in hotel bars. **The use of bottled water is particularly prevalent in Mallorca where the quality of the tap water has been quoted to be debatable** (NGO-2; GOV-1), pushing people to buy bottled water. Plastic water bottles and shampoo bottles collectively amount to a huge amount of plastic waste but something that can ultimately be easily solved through reuse models.

Initiatives for installing refill stations and providing reusable cups or refillable bottles have cropped up across the island. The study by Futouris (2019) in the Balearic Islands found that this was being done in many of the hotels they visited, providing reusable glasses or hard plastic cups in areas such as the restaurants, pool spaces and bars where guests can freely refill. WWF (2019) also found **hotels, while still a minority, who provided their guests with unlimited free water in refillable containers successfully managed to reduce plastic waste considerably.** Futouris (2019) also saw a significant reduction of plastic waste in one particular hotel which, before changing to reusable cups, was using 800,000 plastic cups per year. Cleanwave (NGO-2) has successfully provided refillable bottles to both the Iberostar and TUI headquarters in Mallorca, which contain 1,200 and 900 people, respectively. Previously having used plastic bottles daily, they reduced their plastic bottle consumption dramatically. These refill stations use tap water but use a carbon active filtration or an osmosis system, to ensure the water quality is good with no chlorine, making it taste the same as bottled water. These filtration stations have also been set up in restaurants and public spaces throughout Mallorca, including events. Tourists were seen as very open to using their own water bottles and water dispensers, as long as the water is of similar quality to bottled water (Futouris, 2019).

To replace the colossal number of soaps, shampoo and shower gel bottles in hotel bathrooms, some hotels have installed dispensers. Not only is this beneficial in reducing the amount of plastic waste, it saves money and time for the room maids who merely need to refill them.

Reuse initiatives, as discovered in the document analysis, was the second most implemented option to reduce SUP, done by a total of 8 hotel chains. These included *Iberostar Hotels* with 10 hotels in Mallorca (110 in total) and *Garden Hotels* with 9 hotels in Mallorca (for the full list of the 8 hotel chains, see Appendix D).

d. Requesting 100% recycled/compostable plastic from suppliers

The WWF and GTPI guidelines primarily push towards avoiding as much plastic as possible and feasible. For the plastics that cannot be eliminated or avoided, it should be 100% recycled as to not use virgin materials and stay within the cycle of the circular economy. **For hotels, their role for using only 100% recycled plastic primarily revolves around the plastic that they request from suppliers (BUS-7).** Requesting that suppliers use 100% recycled plastic or switching to another supplier if they do not offer or are not willing to offer such options. Most of the hotels can see that the main proportion of plastic in volume, but also in costs, come from water bottles, bathroom amenities, and food/drinks packaging for deliveries (BUS-7; Futouris, 2019). It is important to address this issue with the suppliers and require from them a reduction of these methods, allow for the return plastics to them, or adopt alternative methods of delivery (BUS-7; Futouris, 2019; TUI Group, 2018).

No hotel chains were found that mentioned measures of purchasing or requesting 100% recycled plastic to use within their establishment.

e. All plastic is sorted and recycled

For the recycled plastic that is used and is then needed to be disposed of, it is necessary for the plastic to be correctly separated and recycled (GOV-2). This prevents plastic from being disposed of with residual waste or leaking into the environment and potentially in the sea. For this to happen there first needs to be separate waste bins. Unfortunately, this isn't the case in many hotels in Mallorca, at least not available for the guests. **In most hotels surveyed by Futouris (2019), there were few, if not no possibilities for the guests to separate their waste in their rooms or food & breakfast areas.** No recycling bins in guest rooms were seen to be mainly due to the fact guests having little recycled waste in their rooms and thus deemed not necessary. Sorting was left to the cleaning staff afterwards. Minimal waste separation opportunities in restaurant and food & beverage areas were seen to be due to little sufficient space. It seems here that waste separation largely depends on the hotel staff with little opportunities for guests themselves. Hotels should provide the separation bins needed for the guests and install any additional separation bins for the staff where needed, for plastic to be properly sorted and recycled.

In regards to waste collection in containers that are picked up by waste management authorities, some municipalities in Mallorca, as mentioned in the previous chapter, have started using waste bins that monitor weight with intelligent chips, where if hotels sort correctly and avoid waste, they pay less (WWF, 2019). However, a problem with waste collection in Mallorca is that different municipalities do not all share the same collection requirements, and sometimes do not all accept certain specific waste or plastics (BUS-7).

Only *MGM Resorts International*, with a total of 18 Hotels in the EU, mentioned measures to ensure better waste separation and management.

f. Communication and integration of staff and guests (awareness)

Raising awareness and communication is an action that crops up time and time again as something essential in reducing the usage of SUP. Both in terms of getting hotels and companies to act in the first place and then to do it right. In terms of overall pressure to reduce plastic marine pollution in Mallorca, the last three years

have seen a much bigger movement and voice for plastic reduction which has in turn been taken up by the government (NGO-2). Companies and hotels would not have made such commitments either if they would not have seen strong public awareness and pressure to do so (BUS-2). **Conducting awareness and educational campaigns are said to be essential to get hotels and companies to introduce more environmentally friendly measures** (NGO-4).

Even when hotels have implemented measures, it is just as important to clearly communicate what has been done and why. Futouris (2019) found that many hotels in the Balearic Islands, though having implemented measures, did not integrate their guests or communicate well the background, reasons or how the guests can support these practices. Concerning the recycling practices in Mallorca, for instance, guests seem to not notice the provision of recycling bins. Therefore, in order to make it easier for the guests to recycle, it is necessary to make the separation stations more apparent in the hotels as well as in the streets and on the beaches (Futouris, 2019).

As the first line of interaction with guests, staff can easily explain the reasons for the environmentally friendly measures taken by the hotels and help the guests understand how they can be part of their reduction initiatives, therefore having an important role for successful plastic reduction (NGO-2, TUI guideline). The WWF (2019) saw that the more communication there was, the more environmentally aware the guests were and the easier it would be to switch to dispensers. Greater communication also improved waste separation rates, and not only by guests but also by the staff. However, with a lack of proper training, waste is not always separated properly by staff (Futouris, 2019). One hotel was mentioned to have provided written information on the reusable cups to guests at check-in. Other establishments not only informed guests about their waste avoidance policy upon arrival but also as soon as they booked before arriving, encouraging them to bring their own reusable item in order to reduce plastic waste (Hotel Luz de Mar, Tenerife - WWF, 2019).

NGOs such as Cleanwave (Mallorca) also organize events and school programs with children to educate the younger generation, by getting to them from an emotional level through demonstrating the damage of plastic done to marine animals and ecosystems, so they could become more careful and respectful with the environment (NGO-2). However, as indicated in Annex 3, when there is too much information, people tend to be overwhelmed and furthermore tend to be sceptical of where the information comes from and start questioning the credibility of the sources. The volume and manner in which the information is communicated, thus, must be taken into account and a balance should be struck.

Only *TUI Blue Hotels* (*'Blue'* hotels indicate the hotels directly owned by the TUI travel agency) with 3 hotels situated in Mallorca (the hotel chain owns 400 hotels in total) had explicitly stated whether they heavily involve their staff in their plastic reduction measures. Not only did they work to raise their staff awareness around the issue but also initiated beach clean-ups and awareness-raising with guests.

g. Collective collaboration

A successful sustainability strategy cannot be implemented well without the support of the most important stakeholders who are playing a part in the process of plastic reduction. This includes hotel staff, hotel guests, suppliers, local government, waste collectors and other NGOs. Many NGOs are working on reducing SUPs,

many specifically in Mallorca (Table 1), therefore combining the knowledge and efforts is essential to make a difference (BUS-7). It is important for staff to know why and how they can implement plastic reduction initiatives, and how to correctly communicate this with guests. Guests need to understand reasons for SUP reduction and be provided with the right alternatives. **It has been stated that many hotels, although willing to reduce their plastic usage, do not know how and what alternatives are available** (NGO-2; NGO-4; BUS-7). Thus, it is extremely important to provide the tools/framework and instruction manual of what hotels can do. For example, the NGO *Travel Without Plastic* has developed a toolkit that hotels can use as a guide.

As every municipality will be dealing with waste collection and recycling differently, it is important to contact them in order to discuss the most relevant strategy regarding the materials that can be recycled (BUS-7; TUI Group, 2018). Synergies between the industries are necessary to avoid the relocation of the plastic reduction issue to a recycling issue (BUS-2). Only a multi-stakeholder approach, of government, private industry and civil society, can be successful in order to significantly reduce SUP (RO-1). Working together with tour operators is important as well, to combine good practices, learn from each other and sustain continuity (BUS-3).

Only the hotel chain *Six Sense*, which has 11 hotels and 31 spas in the EU, explicitly stated that they actively worked with other stakeholders to reduce their plastic consumption, such as reaching out to their supplies asking to deliver without plastic.

Table 1 NGOs and companies working on reducing SUP in Mallorca and their area of operation.

NGO	Aim
Cleanwave Balearic Islands	To provide sustainable alternatives to single-use disposable plastic bottles on the Balearics. Cleanwave sets out to make drinking water freely accessible, and minimizing plastic waste through the provision of stainless steel bottles (Cleanwave, 2020).
Save the Med Balearic Islands	To create an effectively managed network of Marine Protected Areas around the Balearic Islands, allowing marine ecosystems to recover and thrive together with prospering local communities and industries (Save the Med, 2020).
Futouris European Union	To develop and implement pilot projects and innovations (such as Plastic-free holidays on the Balearic Islands) which enable more responsibility and sustainability in destinations in tourism companies (Futouris, 2020)
Company (non-NGO)	**Aim**
Travel Without Plastic Balearic Islands	To support hotels large and small in reducing or even eliminating single-use plastic from their operations (Travel Without Plastic, 2020).

3.3 Survey Results

The majority of the hotels surveyed in the document analysis were found to be part of big hotel chains. This instance was mainly due to bigger chains having more visible commitments due to their strength in marketing resources. In order to avoid this limitation, a survey was developed and shared through the hotel associations and direct hotel emails to get local information about these practices and to reach the smaller hotels. The bigger hotels, with room for more than 200 guests, were also represented the most in the hotel survey, representing 53.3% of the respondents (Appendix E, Table 3).

Our anonymous survey, filled out by 30 hotels, shows some of the measures that have already been implemented to reduce SUP within hotels in Mallorca:

- A total elimination of plastic
- Usage of reusable cups, plastic plates and cutlery made from sugar cane or bamboo
- Reduction of the consumption of individual containers for breakfast and substitution of them with block butter, sugar bowls in bulk, jam in a jar
- Replacement of the coffee capsules by coffee machine using coffee beans
- Provision of a refillable water bottle to guests and access to glasses in glass or refillable bottle in the restaurant
- Elimination of supplies with packaged goods (policies with suppliers, buy in bulk)
- Enhanced recycling

The hotel survey further shows that environmental concern is the main indicator for reducing SUP in Mallorca, with 88.9% of hotels mentioning it as a motivator. Other important indicators were improving business reputation and attracting more customers, mentioned respectively by 37% and 22.2% of respondents (Appendix E, Table 5). It is furthermore important to note that very few hotels mentioned that they were *not* reducing SUP currently (Appendix E, Table 4). Those hotels nevertheless indicated their willingness to do so, but they identified one main barrier: lack of knowledge. More precisely on how to approach the problem, identifying the gap between the willingness to reduce SUP and the actual reduction of it, which is often an occurring problem. However, the low number of hotels that are not reducing SUP could be affected by a response bias within the survey, as it is a fairly small sample size. In the hotels that did implement SUP reduction measures, a range from low to high interest was shown by guests. The greater part of hotels have reported interest in environmental practices from their guests; in particular, for about half (52.2%) of the hotels, this interest was only shown by *some* of the guests, and in the other half (41.7%) of the hotels this interest was shown by *most* of the guests (Appendix E, Table 6). In general, 82.6% of the hotel respondents reported positive results after the implementation of plastic reduction measures.

4. Advantages and disadvantages of SUP reduction practices in Mallorca

In this chapter, the effects of the practices suggested in the previous chapter are analysed. In particular, the next section will discuss the disadvantages and the advantages that have been highlighted by document analysis and interviews. In particular, disadvantages are considered by the negative impacts the implementation of practices can have on hotels and/or guests. The advantages focus on the positive effects that represent the main motivations and successes for implementing SUP reduction policies. Finally, the barriers of practices are reported to provide an overview of the main issues that hinder the reduction or substitution of SUP in hotels.

4.1 Disadvantages and barriers of practices

a. Straws

Many hotels have already banned plastic straws from their venues, though, these items only account for 4% of the plastic waste, which indicates the need to enhance recycling or elimination of other goods for a total reduction in plastic pollution (Ramirez & George, 2019). Besides, paper alternatives quickly soften in the drink and release a paper taste which can hinder the quality of the drink. Other reusable versions like metal and glass are not well received by customers because of hygiene concerns (BUS-3; Futouris, 2019). In addition, the cost for these alternative materials is not a source of motivation either, as they can be twice as expensive as the original plastic product (BUS-7). However, plastic straws will be banned with the new legislation, Ley 8/2019, in Mallorca in 2021.

b. Water bottles

Single-use plastic bottles are very cheap, easy to hand in and carry on trips. Plus, the tap water having a strong chlorine taste in Mallorca (NGO-2; BUS-3), causes a lower willingness among tourists to refill their plastic bottles, even though reusable plastic bottles are seen as the best alternative. Other alternatives, such as glass bottles, are too heavy for trips, difficult to find and considered as very inconvenient because they can break easily (Futouris, 2019; NGO-2). Other materials such as stainless steel and aluminium can also be considered as good replacement alternatives for plastic bottles. Though aluminium containers require an extra plastic layer in order to allow contact with food or beverage and therefore does not entirely fix the issue of plastic pollution (NGO-2).

On the other hand, in restaurants, using glass bottles is an efficient and welcomed alternative to plastic bottles, as it shows transparency on the hygiene/cleanliness of the container (NGO-2). Public places like restaurants usually prefer using glass water bottles instead of alternatives made of aluminium or stainless steel, since they are not well perceived by consumers due to hygienic reasons, considering that they cannot see the inside (NGO-2). Lastly, there is no good deposit system for recycling reusable plastic bottles in Mallorca. This makes recycling a lot more expensive since it has to be shipped to the mainland (NGO-2). This would mean that hotels need a lot of storage space to store both full and empty bottles, which would not be possible in most cases (NGO-2).

c. Water dispensers and reusable items

Hotels report that dispensers are difficult to clean due to the high calcium content of the water, which slowly affects the water quality and taste over time, and that might lead to guests having safety concerns about those dispensers (NGO-2). Furthermore, some hotels claim that installing them is often a financial burden which leads them to charge guests for the water to level the expenditures, although, some costs may be recuperated from the money saved from the elimination of SUP bottles.

On the other hand, it seems that small hotels and all-inclusive hotels have less trouble installing them, while other hotels might face too high costs (WWF, 2019). In addition, guests may not understand that the cup provided is reusable, and they may throw it away after one use only, thus increasing awareness is important in this regard, in order to avoid higher costs for hotels. Furthermore, polycarbonate glasses can become quickly cloudy due to frequent cleaning, lose their shine and therefore look dirty to guests (WWF, 2019). So in general, reusable items require more work from staff and higher hygienic standards are necessary (Futouris, 2019).

d. Plastic substitutes

Hotels tend to prefer replacing products with alternative materials instead of eliminating items. But, some alternatives such as biodegradable alternatives are also harmful to the environment (WWF, 2019). The problem is that consumers feel that it is okay using bioproducts because they are compostable. However, bioproducts are not by definition good for the environment and sometimes even have a similar impact on it as normal plastic and in many cases end up being incinerated anyhow. This is where hotels can help fill the gap of the guests' knowledge, by communicating through their staff or information brochure in order to raise their awareness regarding the biodegradable items. (NGO-2). There is currently no legislation that regulates bioplastics, however, with the implementation of the new legislation, Ley 8/2019, compostable alternatives might become more used than before, and therefore, new policies will have to be made to complement and include bioplastics. This is something to consider as not all items that state that they are compostable actually are. In this regard, the Council of Mallorca is planning to meet with stakeholders in order to guide them in the selection of the alternatives and thus avoid a negative impact on the composting treatment plants (GOV-2).

e. Implementation and control

On the governmental level, it is not easy to control the laws implementation. This is often because of human and economic resources scarcity. The inspector of Health and safety could additionally be in charge of monitoring the SUP regulations in hotels, which could be an efficient and rather cheap solution (GOV-1). Besides, plastic producing companies seem to be involved in strong lobbying to lessen plastic regulation (NGO-2).

On the other hand, elected officials are cited to often not have the right background or experience for their position and thus do not always respond adequately towards certain issues (NGO-2). Furthermore, the law implementation from the EU to the local level is known to be time-consuming, (NGO-2).

f. Beach cleaning

This practice is often considered as not efficient in terms of clearing plastic pollution as, depending on the wind and wave patterns, the amount of pollution on the beach is washed out again on the shore (NGO-2). However, beach cleaning programs can help raise awareness about the problem and can therefore be a valuable addition in regulating/reducing SUP use (NGO-2, see Annex 3).

g. Staff training

Hotel staff are often trained only at the beginning of the season, which is commonly done in a rushed manner as little time is provided for training (WWF, 2019). Attributing more time for training and getting staff familiar with new measures would be extremely helpful in most cases, but this can increase costs and therefore is harder to incentivise.

Barriers to change

Some barriers have been identified that hamper the implementation of SUP reduction practices. Issues such as those represented by high costs, inadequate products and services and rigid guest expectations, insufficient knowledge about environmentally friendly alternatives and SUP impacts on ecosystems can pose a threat to those practices. Hotels usually only think about how to replace plastic items rather than how to eliminate it entirely (WWF, 2019; NGO-2). Moreover, some of these practices require a high initial investment, and with uncertainty about financial returns in the long term, it does not help the hotels that are willing to reduce their environmental impact (Ramirez & George, 2019). In particular, hotels associate the switch to reusable productions as a high financial burden (WWF, 2019; Futouris, 2019; Ramirez & George, 2019). However, this perception is not always true; in fact, hotels need to consider that when the switch to these alternatives is followed by the correct use of reusable items or the elimination of unnecessary products, the final outcome is worthwhile (BUS-7).

Tourists behaviour also represents a barrier to some practices. For instance, they also have concerns about water quality, even if it is drinkable (WWF, 2019) and they have hygiene standards that might require plastic wraps and plastic water bottles to ensure that the items haven't been used before (Futouris, 2019). Finally, foreign guests often act less responsible and are less willing to cooperate when on holidays (BUS-3, see Annex 3). Another problem lies in the lack of deposit systems for reusable containers, making it difficult to use them on a continuous basis (WWF, 2019).

Finally, hotels' habits play a crucial role in the reduction of SUP, since they often buy large quantities of products because it is more convenient; so, before moving to more environmental practices they have to consume their stocks (WWF, 2019). Changing habits in general will be one of the biggest challenges for hotels to reduce SUP (BUS-7). Furthermore, selling plastic water bottles is profitable for hotels, thus, the legislation is confronted with several barriers and negotiation with hotels is needed (GOV-1).

4.2 Advantages of practices

The main advantage of reducing, replacing or banning SUP in the hospitality industry are the long-term financial benefits (BUS-7). Indeed, strategies such as "available upon request" can lead to a diminution of the SUP use, without reducing the quality of the guests' experience. For example, by having bathroom amenities available upon request, one hotel managed to save €5,600 over the course of one summer (BUS-7).

Carbon active filters and osmosis systems with reusable bottles are a good replacement for SUP water bottles; in fact, in the long term, a system like this will be cheaper than a traditional way of serving water where the hotel has to buy the bottles (NGO-2), another financial benefit. Moreover, it has been reported by many hotels that the investments in introducing reusable items are quickly amortized through their continuous reuse and reduced storage requirements (BUS-8; NGO-2; Futouris, 2019). In addition, space usually reserved to store plastic bottles, before and after their use, becomes available for other products (NGO-2).

Concerning plastic wrappings, no hygiene regulation or law require hotels to use pre-portioned packaging. Indeed, it gives the possibility for hotels to implement alternative solutions without hindering hygiene conditions and guests' expectations. In fact, reducing SUP use has shown to increase competitiveness and enhance the image of companies and hotels, increasing their competitive advantage (Ramirez & George, 2019).

It is also important to note that hotels benefit from the environment itself. A good destination image is more attractive to tourists and therefore, is an incredible asset for the tourism industry, including hotels (NGO-2, NGO-3, RO-1). Enhancing environmental public commitments even leads hotels to feel more involved in these projects (BUS-8).

Moreover, the adoption of environmentally friendly behaviour helps to involve more stakeholders, reinforcing the company's role as a key actor in sustainable tourism. When hotels show commitment in SUP reduction, supply chains will follow to provide the new alternatives to the plastic products (BUS-8).

5. Recommendations for Oceana

In the following chapter, a list of recommendations to Oceana is proposed. The aim of this section is to suggest possible solutions, considering the context of Mallorca and the information provided in this analysis. The recommendations are divided into short-term, long-term and general solutions.

Short term solutions

Create a short and easy guideline

This should be based on the UNWTO/WWF guideline (see Appendices B & C) specific to Mallorca and the hotel industry. Specific focus should be on how to reduce SUP within Mallorca's existing waste management system with consideration especially on the types of SUP that are not covered by the new legislation as outlined in section 3.2. Instructions on how to effectively reduce SUP was seen as one of the biggest obstacles for hotels. This guideline would be mostly focused on initial SUP reduction.

Important aspects

These aspects should be emphasized to convince hotel managers to voluntarily reduce SUP usage:

1. Risk of losing customers if the destination's image decreases (e.g because of plastic pollution on the beaches and in the ocean)
2. Cost savings by using reusable materials and other SUPs alternatives that have lower long term costs than SUPs
3. Increased reputation as a business
4. More space for storage

Distribute guidelines

Provide guidelines through the hotel representatives: "*Federación Empresarial Hotelera de Mallorca*" (directly linked with the 21 hotel associations). This would be the easiest way to contact all the hotels in Mallorca at once in a way that ensures trust, as it would come from a familiar source.

SUP awareness

Connect with the tour operators that bring tourists in Mallorca, and send them the awareness poster, such as the provided outreach item, to hang in their office, but also an awareness "good behaviour brochure" to attach in booking emails to their customers. Make them understand that it is in their best interests to educate their customers about good behaviour for SUPs reduction in Mallorca. Posters should also be distributed to ferry and airport terminals in Mallorca to raise awareness among incoming tourists.

Involve locals

This can be done through schools for example, with beach cleaning projects. This would help to raise awareness about the threats of SUP among kids from a young age but also other local inhabitants.

Long term solutions

Develop a toolkit

Create a toolkit for hotels to use, outlining specific implantable actions and steps to take in the process of reducing SUP. This can be done in collaboration with TravelWithoutPlastic, a company that provides such a toolkit but in a more general context, which can be better adjusted to the Mallorca situation. Another option would be to create a toolkit from scratch, but this may take more time, expertise and resources.

Policy lobbying

Convince the Ministry of Ecological Transition to implement policies to improve drinking water quality in Mallorca, to incentivise drinking from the tap rather than SUP water bottles. Doing this would increase the trust in water dispensers and diminish one of the main barriers for implementing refillable water stations in hotels and across Mallorca. This would be attractive for the ministry because it would reduce the environmental impacts of SUP.

Waste management collaboration

Contact the Waste Management Organisation in Mallorca in order to organise a recycling project, including regular pick up, to make sure the litter will not stack up on the bins near the beaches.

Local plastic flow

Working closely with the Balearic Islands Government and Insular Council of Mallorca and Municipalities to try and set a standard for recording the flows (in and out) of plastic for every hotel, and other private SUP users, in Mallorca.

Collaboration in general

Collaboration with other NGOs to tackle the issue from every angle, and combine resources, knowledge and expertise.

Extension of focus

Guidelines and focus could shift to other locations such as the rest of the Balearic Islands, but also on different private and public instances such as restaurants, bars, offices, schools and beaches.

6. Conclusions

Many things have changed over the past few years in terms of plastic policy and thus to answer our first research question; *'What is the current context of policy in Mallorca regarding SUP in the hospitality sector?'*, these new policies have been analysed. Concluding this analysis, the most notable laws that are (in)-directly applicable in Mallorca is the 2020 European Green Deal, the state legislation Ley 22/2011 and the much more advanced plastic legislation from the Balearic Islands, Ley 8/2019. Ley 8/2019, particularly, is of great importance, as it is focused around SUP reduction in the HORECA sector on the Balearic Islands, and therefore

directly relates to our research. The analysis discovered some SUP items that were not covered in Ley 8/2019, which is an important area of focus for Oceana's next steps.

To analyse measures that could be implemented to reduce SUP use, best practices across the EU were analysed. This was done to answer the second research question: '*What are the practices currently implemented to reduce SUP usage in the EU hospitality sector and their advantages and disadvantages?'.* This resulted in a long list of possible implementable measures, but most importantly analysed the SUP reduction frameworks by the UNWTO and WWF (Appendices B & C). These frameworks provide a good base for making guidelines for the hotel sector, as well as organize the best practices in a clear overview. The most important themes in these frameworks were the following: 1) elimination of unnecessary plastic, 2) reuse models, 3) all plastic is 100% recyclable or reusable, 4) all plastic is sorted and recycled, 5) communication and integration of staff and guests, 6) collective collaboration.

The analysis above was used to answer our third research question; '*What are the recommendations for implementing SUP reduction practices in Mallorca?'*. The main recommendations that were developed for Oceana are: 1) Creating a guideline for hotels on how to reduce SUP, with consideration of Ley 8/2011 and its gaps, 2) Collaborating with hotel representatives to increase the reach and reliability of the guidelines, 3) Create awareness about the SUP problems amongst locals and tourists through awareness campaigns and projects.

7. Limitations

Due to COVID-19, certain limitations were put on this research. Because of the travel ban, it was not possible to go to Mallorca to observe how things work in practice. This resulted in less concrete knowledge of the current context and also greater difficulty to gather data on hotel practices such as through the hotel survey by not being able to visit on site. The lockdown was planned to be lifted during the project, which caused hotel owners/managers to be extremely busy to be ready to open with stricter regulations. This overload of work made it a lot harder to contact people within the hotel sector, which reduced the amount of available expertise and experiences specific to Mallorca as well as responses to the hotel survey. To further this research, it would be useful to spread the survey across hotels again once the high season is over when the hotel sector in Mallorca may have more time to provide insights. It would also be worthwhile to interview hotel managers at that time also.

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Appendices

Appendix A
Environmental law implementation in Spain

At the State level, the basic environmental legislation will be implemented and controlled when more than one autonomous region is affected. New laws can be proposed by the central government through a Proyecto de Ley, that must be approved by the Consejo de Ministro. A Law can also be presented by the Congress of Deputies and the Senate (Proposiciòn de Ley), by autonomous communities assemblies or by citizens. Afterwards, the proposed Law reaches the Congress of Deputies, who decides whether or not to accept it through a bureaucratic procedure. Finally, the senate does the same. The entire process ends when the law is ratified and the King accepts the Law approved by the Cortes Generales (Law School Program, 2019).

As the Article 1.1. of the Spanish Civil Code states, there are different forms of law which are statutes (written laws passed by a legislative body - can be regulations or directives), custom law and general principles. These primary source laws come from official bodies and they cannot be overridden by a lower rank of law. In particular, the same article defines a hierarchy between these laws; the most powerful forms of law are Statutes, while the general legal principles are the least important.

The article 39 of the Spanish Civil Code delineates legislative bodies like the Parliament, the Government, the President of the Autonomous Community and the Island Councils of Mallorca, Menorca, Ibiza and Formentera. In the same document, are expressed their powers and responsibilities summarised as follows:

- The Parliament represents the legislative power and it has the power to delegate the Government of the Autonomous Community the faculty of dictate norms (Art. 48 of the Ley Orgánica 1/2007).
- The Balearic Islands Government's responsibility is to enforce the executive and administrative powers (Art. 57 of the Ley Orgánica 1/2007).
- The current governing body of Mallorca is the Island Council, Consell Insular de Mallorca. In respect to the Constitution and the Statutes, it is in charge of the interests of the island (Art. 61 of the Ley Orgánica 1/2007). In Mallorca, the Council bodies are el Pleno, the President and the Executive Council.

The general environmental issues such as greenhouse gas regulations, climate change mitigations, or environmental assessments regarding certain types of activities with interregional impacts, will be treated at the State level (Thomson Reuters, 2019). The basic legislations is prepared by the 3 different ministries working in their own domain:

- Ministry of the Environment (Ministry for Ecological Transition and Demographic Challenge - MITECO)
- Ministry of Industry
- Ministry of Health and Consumer Affairs

The Ministry of Ecological Transition is the main regulatory authority for environmental laws (Table 2). Their main focus is on energy, biodiversity, pollution prevention, quality & environmental assessment, coast

and marine environment, climate change etc. Environmental sectoral conferences are regularly organized to coordinate the environmental powers, policies and set the objectives, priorities and strategies. These conferences are attended by the minister and the environmental representatives of each Autonomous Region. Recently, a new set of regulating crimes against nature have been added to the environmental crime directive. Now crimes against the natural resources and the environment, fauna, flora & domestic animals will be punishable with imprisonment and fines (Thomson Reuters, 2019).

In general, once the environmental law is set, non-compliance will lead to an administrative or a criminal sanction. The enforcement is compulsory, but unfortunately not all the cases are enforced. Indeed, in practice, many breaches occur, and the lack of resources, along with the difficulty of finding them makes it hard to monitor and prosecute them. In addition to the State regulatory authorities, certain environmental NGOs have legal right to initiate lawsuits if the environment is considered at risk by certain practices. They also have a role in implementing and monitoring the policies in place. So far in Spain, some lawsuits already led to cancellation of certain projects due to their controversial aspect (Reuters, 2019).

At the regional level, the formation of Autonomous Communities (Comunidades Autónomas) is regulated by Article 143 of the Spanish Constitution. These 17 autonomous regions are present and are able to implement additional rules, and implement stricter policies and practices. They can organise their own environmental strategy, implement new regional legislations, but will be fully in charge of the enforcement of those legislations. Furthermore, they are also in control of granting different permits, coordinating environmental impact assessments, running inspections and sanctioning if the laws are not respected (Reuters, 2019).

However, in comparison to other federal systems the powers of Autonomous Communities are not guaranteed; rather, the task of conceding any Statute of Autonomy is up to the central Government; the Parliament in fact can even change the Statute and every amendment must be approved by it (Gardner & Ninet, 2011).

The organization of autonomous communities follows a parliamentary system, with their own executive and legislative powers according to their own Statute of Autonomy. The *Ley Orgánica 1/2007* describes in depth the legislative bodies and their powers of the autonomos institutional system (Ley Orgánica 1/2007).

At the local level, the Municipality is the most basic entity and, in respect of the law, they can manage their own administration in every matter of concern that is not excluded by higher authorities (Art. 75 of the Ley Orgánica 1/2007). In addition, they have environmental protection power. The 52 municipalities of Mallorca will focus on the living conditions of the populations, grant environmental permits, organise the urban waste treatment and limit the noise. However, the regulations implemented at the local level need to follow those issued by the State and the Autonomous regions (Thomson Reuters, 2019).

Table 2. Environmental laws in Spain.

Text	Article/Law	Description
Spanish Constitution	Article 45	"Everyone has the right to enjoy an environment suitable for the development of the person, as well as the duty to preserve it." Also directs the public authorities to watch over use of natural resources, and allows for sanctions for those who break the duty.
	Article 132	Establishes public property including beaches and the EEZ (Exclusive Economic Zone).
	Article 148	Delegates forestry, agriculture, hydraulic and environmental management to self-governing communities.
The Spanish Penal Code	1995	Was modified to transpose Directive 2008/99/EC on the protection of the environment through criminal law (Environmental Crime Directive) adding crime on natural resources, fauna and flora, and domestic animals.
Spanish criminal code		Criminal offense for direct or indirect serious damages to the environment, here: deposits in the surface water, ground water or sea water (including the high seas, even if they affect cross-border spaces).
Other Spanish laws	Law on Waste (1999)	Covers urban and hazardous wastes, and implements the obligation on a holder of waste to give it to a waste manager or the local authorities, unless legally processing the waste themselves.
	Law 16/2002	The integrated permitted regime: introduced in Spain by the Integrated Pollution Prevention and Control (IPPC): aims to avoid and, whenever possible, reduce and control contamination of the atmosphere, water and land by means of an integrated prevention system based on Directive 96/61/EC concerning integrated pollution prevention and control (IPPC Directive). Under this regime, a single environmental permit is required for industrial activities included in Annex I of Royal Legislative Decree 1/2016.
	Coastal Law (1988) last modified by Law 42/2007	Provides that the sea, the coastline and the sea resources constitute the maritime public domain.
	Law 22/2011	Waste and contaminated soil.
	Law 7/2018	Modifying law 42/2007 of natural heritage & biodiversity.
	Law 9/2018	Modifying law 21/2013 on Environmental Assessment.
	Law 9/2018	Modifying law 12/2016 of environmental evaluation of the Balearic Islands.
	Law 8/2019	In January 2019: La nueva Ley de residuos y suelos contaminados de Illes Balears, banning SUP, one step ahead of the similar EU Directive.
National Energy and Climate Plan (NECP)	2021 to 2030	To meet the EU's energy and climate targets for 2030.
Directive (EU)	2019/904	Reduction of the impact of certain plastic products on the environment: full ban of plastic in the EU "Single-use plastic cutlery, cotton buds, straws and stirrers to be banned by 2021".

Appendix B
Summary of the WWF's plastic reduction guidelines from Stop the flood of plastic (WWF, 2019) - targeted at hotels

1. Monitor and document all single-use products: Create a waste inventory in your hotel and list exactly which plastic packaging and single-use products are found in the individual areas of the hotel, how they are used and what waste is generated from them.

2. Waste is separated and collected: Find out which possibilities for waste separation exist for your hotel and separate waste accordingly

3. Avoid SUP products and packaging: Reduce all one-time consumption products and use reusable alternatives for dishes, cutlery, cups, lunch boxes or disposable toiletries.

4. Reusable returnable containers for beverages: prioritise beverages in reusable containers, both when buying and serving drinks

5. Make drinking water available and communicate effectively with guests: Incentivise the use of tap water. If the tap water quality does not meet the quality standards, install a water treatment system or water dispensers.

6. Target single-use packaging in purchasing and procurement processes: Require low-waste or reusable returnable transport packaging when buying products. Ask suppliers to take back single-use packaging or if they are not willing, use bulk containers for food.

7. Staff training: Inform employees regularly about which measures are implemented to reduce plastic waste. Train them in the correct use of packaging/disposable products, avoidance and waste separation.

8. Information and integration of guests: Communicate to your guests which measures have been undertaken in the hotel to avoid waste and how they can contribute. Share information with your guests about environmental protection measures and waste management in the region. Involve guests in projects and initiatives.

9. Collective action and cooperation in the region: With alliances, partnerships and collaborations, pressure on municipal and supraregional decision-makers as well as on suppliers can be increased.

Appendix C
The Global Tourism Plastic Initiative (GTPI, 2020) - framework targeted at the tourism sector in general

1. Elimination of problematic or unnecessary plastic packaging (through redesign, innovation, and new delivery models) is a priority: there are some problematic items on the market that need to be eliminated to achieve a circular economy, and sometimes, plastic packaging can be avoided altogether while maintaining utility.

2. Reuse models are applied where relevant: While recycling is crucial, we cannot recycle our way out of the plastics issues we currently face. Reuse business models must be explored as a preferred 'inner loop', reducing the need for SUP packaging.

3. All plastic packaging is 100% reusable, recyclable, or compostable: This requires a combination of redesign and innovation in business models, materials, packaging design, and reprocessing technologies.

4. All plastic packaging is reused, recycled, or composted in practice: Businesses producing, using and/or selling packaging have a responsibility beyond the design and use of their packaging, which includes contributing towards it being collected and reused, recycled, or composted in practice. Governments are essential in setting up effective collection infrastructure and providing an enabling regulatory and policy landscape.

5. The use of plastics is fully decoupled from the consumption of finite resources: This decoupling should happen first and foremost through reducing the use of virgin plastics (by way of dematerialisation, reuse, and recycling). Using recycled content is essential (where legally and technically possible) both to decouple from finite feedstocks and to stimulate demand for collection and recycling.

6. All plastic packaging is free of hazardous chemicals, and the health, safety, and rights of all people involved are respected: Elimination of hazardous chemicals in packaging and its manufacturing and recycling processes should be eliminated.. It is also essential to respect the health, safety, and rights of all people involved in all parts of the plastics system, and particularly to improve worker conditions in informal (waste picker) sectors.

Appendix D
Full list of hotel chains that implemented SUP reduction actions

1) Elimination/Replacement of unnecessary plastic (packaging)
Iberostar Hotels (110 hotels, 10 in Mallorca)
TUI BLUE Hotels (400 hotels, 3 in Mallorca)
Garden Hotels (9 hotels, all in Mallorca)
Marriott international Hotels (7000 hotels, 6 in Mallorca)
Hyatt Hotels corporation (860 hotels, 1 in Mallorca)
IHG Hotels (5500 hotels, 1 in Mallorca)
Accor Hotels (5000 hotels)
Edition Hotels (11 hotels)
InterContinental Hotels Group
Hilton Hotel (650 hotels)
Six Sense (11 hotels + 31 spas)
Paphos, Protaras and Ayia Napa Hotels (28 hotels)
1Hotels (14 hotels)
Oetker collection (9 hotels)
Raddison Hotel group (110+ hotels)
Meliá Hotel International (380+ hotels, 23 in Mallorca)
2) Reuse models
Iberostar Hotels (110 hotels, 10 in Mallorca)
TUI BLUE Hotels (400 hotels, 3 in Mallorca)
Garden Hotels (9 hotels, all in Mallorca)
Hyatt Hotels corporation (860 hotels, 1 in Mallorca)
Edition Hotels (11 hotels)
Six Sense (11 hotels + 31 spas)
Paphos, Protaras and Ayia Napa Hotels (28 hotels)
Raddison Hotel group (110+ hotels)
Meliá Hotel International (380+ hotels, 23 in Mallorca)
3) All plastic is 100% recyclable or reusable
None.
4) All plastic items/packaging is sorted and recycled
MGM Resorts International (18 Hotels)
5) Communication and integration of staff and guests
TUI BLUE Hotels (400 hotels, 3 in Mallorca)
6) Collective cooperation in region
Six Sense (11 hotels + 31 spas)

SUP free
Iberostar Hotels (110 hotels, 10 in Mallorca) (by 2020)
Edition Hotels (11 hotels) (by 2019)
Accor Hotels (5000 hotels) (by 2022)

Appendix E
Survey

This brief survey is part of a project developed by Oceana in collaboration with Wageningen University & Research in the Netherlands, that focuses on the reduction of the single-use plastic use in the tourism sector, specifically on the island of Mallorca. We are interested to hear if your hotel has or has not implemented strategies to reduce the use of single-use plastic, what motivates this choice and whether your attitude on this subject has changed due to the current COVID-19 crisis. The scope of our research is to contribute to significantly reduce the plastic pollution in the sea, restoring a cleaner and healthier environment and assisting the tourism sector to do so. The estimated duration of this questionnaire is 3-4 minutes and it is completely anonymous. Thank you very much for your help!

1. How many guests can your hotel accommodate? Please select one of the options.

- Less than 50 guests
- 51-100 guests
- 101-200 guests
- More than 200 guests

2. Who is the main target group of your hotel? Please choose the answer that fits best.

- Families
- Young adults
- Couples
- Retired people
- Business guests
- Our hotel does not have a specific target group
- Other ____

3. Is reducing single-use plastic (plastic used only once and then thrown away or recycled) an issue that you, as a hotel, have thought about?

- Yes (1)
- No (2)

3.1 If yes, what is your main motivation for wanting to reduce single-use plastic? Please select the answer(s) that best describe(s) your main motivation.

- Environmental concern
- Financial reasons
- Attracting more customers

- Subsidies and other governmental support
- Reputation of the business
- Other ___

4. Has your hotel implemented certain practices to reduce the use of single-use plastic?

- Yes (1)
- No (2)

4.1 If no, could you specify why not? Please select the option that best explains the main reason.

- Our hotel does not know much about the options available
- It would not be financially feasible
- It would take too much time to implement
- It would make the hotel lose customers
- As a hotel we are generally not interested

4.2 If yes, could you describe what you, as a hotel, have done to reduce the use of single-use plastic?

5. Have you seen positive results from the strategies that you have implemented?

- Yes (1)
- No (2)

5.1 If yes, could you describe some of these results?

6. If "Is reducing single-use plastic (plastic used only once and then thrown away or recycled) an issue..." = No

Could you specify why reducing single-use plastic may not have been considered? Please select the option that best explains the main reason.

- Our hotel does not know much about the options available (1)
- It would not be financially feasible (2)
- It would take too much time to implement (3)
- It would make the hotel lose customers (4)
- As a hotel we are generally not interested (5)

7. Have you noticed if your guests are interested in reducing the use of single-use plastic?

- No guests have shown interest
- Some guests have shown interest
- Most guests have shown interest

8. Could you describe how guests have shown interest in reducing the use of single-use plastic?

_____

Survey results summary

Table 3 Distribution of hotel size.

Hotel size	Number	Percentage
Less than 50 guests	8	26,7 %
51-100 guests	3	10 %
101-200 guests	3	10 %
More than 200 guests	16	53,3 %
Total	30	-

Table 4 Awareness of SUP reduction.

Awareness	Yes	No	Total
Numbers	27	2	29

Table 5 Main motivators for reducing SUP.

Motivation	Number	Percentage
Environmental concern	24	88,9 %
Financial reasons	2	7,4 %
Attracting more customers	6	22,2 %
Subsidies and other governmental support	0	0 %
Reputation of the business	10	37 %
Other	2	7,4 %

Table 6 Guest interest in SUP reduction measures by the hotel.

Guest interest	Numbers	Percentage
No guest have shown interest	1	4,3 %
Some guests have shown interest	12	52,2 %
Most guests have shown interest	10	43,5 %
Total	23	-

Expert Report 5

Sustainable Recovery Analysis

Written by

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List of Abbreviations

CSR	Corporate Social Responsibility
DMO	Destination Management Organisation
FMT	Fundació Mallorca Turisme
NGO	Non-Governmental Organisation
NPAP	National Plastic Action partnership
SARS	Severe Acute Respiratory Syndrome
SUP	Single-Use Plastic
TUI	Touristik Union International
UNWTO	The World Tourism Organisation

List of Interview Codes

BUS-1	Large hotel chain employee
BUS-3	Saskia Pepping-MVO Nederland
BUS-5	Founder/CEO & Sustainable Tourism- Sea Going Green
BUS-7	Jo Hendrickx-Travel Without Plastic
GOV-1	Sebastià Sansó i Jaume - Government of the Balearic Islands
RO-1	Kirana Augustina - World Resources Institute
UNI-2	Freya Higgins- Desboille - University of South Australia
UNI-3	Edward Huijbens - Wageningen University and Research
UNI-4	Joseph Cheer - Wakayama University
UNI-5	Brian King-The Hong Kong Polytechnic University
UNI-6	Macià Blázquez-Salom - Universitat de les Illes Balears

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Main findings

1. The impacts of COVID-19 have led a minority of stakeholders to form a sustainable "green bubble". They see COVID-19 as an opportunity to make tourism more sustainable. Whereas the majority of the tourism industry is only focusing on "going back to business as usual", and economic recovery. Due to shifting priorities, there are concerns that COVID-19 will set sustainability and SUP reduction efforts back a considerable amount.

2. There are numerous organisations, businesses, and individuals that are open to SUP reduction, even if COVID-19 has impacted their means to do so. Many are aware of the negative impacts that the pandemic will have on SUPs reduction. Businesses are willing to continue SUP reduction efforts, as long as these do not interfere with their survival or will not negatively affect tourists' perceptions.

3. Mallorca has already conducted a series of post-disaster strategies to guarantee public safety and recovery of the economy, including funding projects, unemployment protection of workers, and promotional plans to relaunch tourism in Mallorca. The plans focus on getting tourism back to normal as soon as possible, and include marketing Mallorca as a safe destination, but largely leave out alternative business models.

4. COVID-19 has direct implications for the use of SUPs in hotels. Notably, protective gear (including masks and gloves) will be hard to get rid of for now as they are central in COVID-19 prevention at the moment. However, tourists don't always require SUPs to feel safe. As such, some non-essential SUPs could be reduced, especially in the context of improving hygiene measures.

5. Building a communication network to integrate stakeholders is essential, not only in terms of COVID-19 recovery, but also to implement projects in a more sustainable way. COVID-19 has created a common goal for the tourism industry: its own survival. In the future these networks could be used to advance sustainable practices. Both networks inside different stakeholder organisations, and overarching stakeholder networks are points of entry for Oceana.

1. Introduction

COVID-19 is an unprecedented global event with severe consequences for the tourism industry. Also, it has revealed some of the tourist industry's major vulnerabilities. At the time of writing, the end of COVID-19 is not in sight. Similarly, there is no coherent "post-COVID-19" vision foreseeable (Haywood, 2020). Tourism is a complex industry, and all parts of the supply chain have been affected, though the lack of tourists presents the biggest impact on the industry. With many businesses losing their income, increasing unemployment, and foreclosures, the focus has been on mitigating the immediate impacts of the crisis (UNWTO, 2020). Subsequently, short term responses such as the immediate recovery of tourism and the reinstating of livelihoods were prioritized. However, often these strategies are lacking in long term vision (Crossley, 2020). When it comes to the long-term vision of post-COVID-19 tourism, opinions and predictions are highly divided, among academics as well as industry insiders. Having said this, COVID-19 does represent an opportunity to examine the past and strive to create a more sustainable future (Haywood, 2020).

As Oceana's project will take place in the context of COVID-19, SUP reduction efforts will have to account for these unique circumstances. In order to investigate the potential limits, as well as opportunities created by COVID-19, the following research question was investigated:

How can the hospitality sector of Mallorca recover from the COVID-19 crisis in a more sustainable way with regards to SUP use?

For Oceana to make plans for SUP reduction for the next few years, it is important to understand both the short-term, and long-term implications COVID-19 has for the hospitality sector in Mallorca. The following topics have been investigated in order to gain a deeper understanding of the impact that the COVID-19 context will have on Oceana's project.

- *What consequences does COVID-19 have on the hospitality sector in Mallorca?*
- *How did other tourist destinations recover from disasters in the past?*
- *What are the current recovery strategies that stakeholders undertake on Mallorca?*

To investigate the topics, a triangulation of data sources was used. Qualitative methods include expert interviews and content analysis. For the expert interviews, a profile of potentially interesting interviewees was conducted. This included academics, representatives of NGOs, hotels, and policymakers. All interviews were conducted online and later on transcribed and coded with MAXQDA. For the content analysis, Google scholar and the WUR library were used to gather the literature which was subsequently coded as well. A survey was created to obtain more insights on SUP use and hygiene-related measures due to the pandemic. A total of 468 responses were collected, and the data was subsequently analysed in SPSS.

This report will first describe the impacts of COVID-19 on the hospitality sector, including long-term and short-term consequences, as well as the impact COVID-19 has had on Mallorca. This is followed by an examination of the impact that other disasters had on tourism destinations, and their recovery process in the past. The impact COVID-19 is having on SUP use will also be discussed, as well as the implication for the hospitality sector. Finally, the current and potential future recovery strategies for Mallorca's hospitality sector will be examined, followed by a conclusion and recommendations.

2. COVID-19 Impacts on Tourism

Tourism has long been criticized for its negative environmental impacts which range from emissions to SUP use. However, many see the current crisis as an opportunity to make changes to the industry, to create a "new normal" (Crossley, 2020). Arguments include that the COVID-19 pandemic shows the possibility of downsizing the economy, in the light of many destinations focusing on the "growth model". This model focuses on growing tourism by attracting more tourists, leading to a tourism-dependent economy, which makes destinations vulnerable to shocks like COVID-19 (Gössling, Scott & Hallo, 2020). The pandemic is also seen as a "wake up call", that shows the need for a more responsible way of conducting business, which requires companies, communities and citizens and their relations to be examined (Haywood, 2020).

However, many believe that the tourism sector will prioritize a back to business as usual approach. This implies that progress already made towards sustainability will either halt or even be undone for the sake of economic recovery (BUS-5). Furthermore, it was noted that some governments and corporations are using the crisis to serve their own political interests (Niewiadomski, 2020). It was also noted that there might be a minority of businesses that form a "green bubble", which sees the pandemic as an opportunity to transform tourism into a more sustainable industry. In practice, the majority of the working industry is focusing on "going back to business as usual" (BUS-3, BUS-2). However, there is no denying that the impacts of COVID-19 will be felt for a long time, as businesses struggle to survive the crisis.

2.1 Business Survivability & Employment

With the international standstill of tourism, many companies are facing a lack of income or even bankruptcy. Because the majority of tourism businesses rely on the high season, even missing out on one season can lead to massive income loss. Hence, the UNWTO noted that tourism "has been the sector hardest hit by the crisis'" (Higgins-Desbiolles, 2020). Subsequently, businesses with less financial security, especially smaller businesses, may not survive the crisis, which could lead to a shift of power towards the bigger players. Notably, businesses that provide alternative products to SUPs might disappear due to their smaller scale (BUS-5). This is a potentially troublesome development, as smaller businesses are often drivers of change as they promote new niche products or services. Regarding this, these businesses could initiate a bottom-up, grassroots movement that could transform the industry. With many businesses impacted, practices in the hospitality sector are likely to change for the time being. Unfortunately, it seems to represent a step backward in terms of sustainability (BUS-3).

2.2 COVID-19 Impact on Sustainability

With the emphasis on economic recovery and public health, there is little focus on environmental issues. This suggests that the climate movement and progress towards sustainability could lose traction. The UN has already stated that the virus will have a negative effect on the 2030 sustainability goals (Higgins-Desbiolles, 2020). However, sustainability is still part of the long-term strategy for many hotels and other businesses in the tourism sector (BUS-5). Yet, as concerns over the immediate future currently dominate, these efforts are often side-lined. Even those actors that include sustainability and SUP reduction in their strategy have shifted

their priorities away from those efforts towards survival and keeping people on the payroll (BUS-1).

On the upside, there is still a commitment to sustainability from the hotels, even if health, safety, and business survivability are the priority for the time being. Many see sustainability as the future and have long term commitments. There is a desire to implement sustainable practices, and hotels are looking for best-practice examples, as well as leadership to follow (UNI-2). However, while ideas are circulating, there is a lack of progress in terms of implementation (BUS-3). The interview with Travel Without Plastics revealed that:

> Interestingly, since COVID kicked in, the inquiries that we've got have been much more serious businesses, let's say so that if they're operating now, and they're looking at doing this now, in times of COVID, when people are going back to single-use plastic, we've actually found it's helped us identify almost like your perfect customer, somebody that really wants to do things that doesn't want to take two steps back because of what's going on and that really wants to look at the longer-term.
>
> *(BUS-7)*

Consequently, it is important to prevent this temporary backlash to environmental issues from becoming a more permanent new normal by highlighting good practices. As COVID-19 is an evolving crisis, things might change, thus it is essential to follow along with the latest developments to be able to respond at a moment's notice.

2.3 Evolution of COVID-19 & Measures

A vaccine is key to move beyond the current state of things (Prideaux, Thompson & Pabel, 2020). With many countries, including Spain, adopting social distancing guidelines, hotels have to adapt their practices and run on a limited capacity. These guidelines will evolve with the circumstances, but what exactly this will mean is unclear. How long certain measures will remain in place is also unknown, as are the implications for the tourism industry. This could further increase operating costs and consumer prices and shrinking of the tourism sector. Social distancing measures are intended to prevent an increase in patients, but the effectiveness remains to be seen. Some speculate that there might be a "second wave". A second wave could exacerbate existing (financial) problems, and further, affect the survivability of the sector. While the future may remain unpredictable, Mallorca's tourism sector has already been heavily impacted by COVID-19.

3. Impacts of COVID-19 on Tourism in Mallorca

3.1 Travel restrictions

In Mallorca, the pandemic had affected both the local economy and society. One of the main impacts of the pandemic is the economic crisis, which is predicted to be the biggest recession in the history of the Balearic Islands (Sesay, 2020). Mallorca established its lockdown on March 15th, 2020 and lifted the travel

restrictions on June 21st for the Schengen-zone and EU countries (Hernández, 2020). During the lockdown, the government of Spain established border controls at ports, airports as well as on land borders, which effectively closed the borders for international travel (Turespaña, 2020). The population was asked to stay at home, flights were reduced, and major large-scale events were postponed or cancelled. With Mallorca being a tourism-dependent economy, this has had major implications for the economy of the island.

3.2 Impacts on GDP

The global travel restrictions heavily affected local tourism which accounts for 74 % of the GDP. As a result, local businesses were plunged into jeopardy as "the tourism industry right now is completely stopped" (UNI-6). Due to the high economic dependence on tourism, the brick-and- mortar businesses, as well as small-sized businesses dependent on the events and tourism are at serious risk (Kulick, 2020). As a result, many businesses have chosen to lay off employees and reduce pay for others. Since the lockdown was implemented in Spain, more than 2,000 companies have optioned to implement ERTEs (i.e. a temporary layoff of employees) (Sesay, 2020; Kulick, 2020). 40,000 people were predicted to be affected which represents 80% of the islands' labour market (Sesay, 2020). Generally, due to the region's high dependence on the tourism industry, the Fundacio Impulsa platform forecasted a €1.8 billion loss between March and May (Sesay, 2020). Also, the industry association forecasted that Mallorca would lose more than 95% of tourism revenue (i.e. €13.5 billion) this year due to the pandemic (Winterburn, 2020).

To assist business, and facilitate their survival, Mallorca's original timeline to adopt the ban of specific SUPs has also been affected. The implementation has been delayed from January 2021 to April 2021. This delay is intended to compensate for the "stop" businesses experienced during the state of emergency in Spain. These policies are still intended to go through, as well as other SUP related EU policies (GOV-1). Yet concerns remain, as one interviewee noted that

> "Perhaps they are going to make these measures more flexible with the excuse of let's say under the shock of the crisis"
>
> *(UNI-6)*

3.3 Government Management of COVID-19

The economic effects of the pandemic have also had effects on Mallorca's society. As a first result, people were afraid that the virus could reach the island and threaten the trade of spring and summer (Stephens, 2020). These tensions and concerns resulted in demonstrations that targeted the government's management of the COVID-19 crisis. This highlighted the critical reception of the social and economic impact of lockdown (Sesay, 2020).

The implementation of sustainable measures was also hampered by the pandemic, as the priority of Spanish tourism was expected to change after the crisis. A CSR manager of a large hotel chain said they weren't able to complete their sustainable plans which were put on hold because of the current situation (BUS-1). However,

after the crisis, the Balearics may become the hotspot of Spanish tourism because Mallorca was less severely affected than mainland Spain (Hernández, 2020; Mallorca Sunshine Radio, 2020). As such, both local and national governments are providing support geared towards reigniting tourism on Mallorca. While Mallorca is facing a new set of challenges, a lot can be learned from previous crisis, and how those destinations recovered.

4. Post-disaster Effects & Recovery Strategies

Tourism has been subjected to many crises in the past, yet the scale of COVID-19, and its global consequences are unlike any other crisis. However, previous disasters in tourism destinations and subsequent recovery can provide insights into future development of Mallorca's tourism sector as it recovers.

4.1 Post-disaster Effects

Events with similar consequences as the current COVID-19 pandemic were taken into consideration for experiences and lessons. Accordingly, past events in other locations worldwide were selected and investigated according to the effects on local tourism, the visitor industry as well as air traffic. The main categories of disasters that emerged from the review were economic crises events, terrorism attacks, political instability, other pandemics, and natural disasters.

Location		Type of disaster	Specficics	Reference
	Greece China	Economic	Global financial crisis Global financial crisis	Kapiki et al., 2011 Shina et al., 2010
	Toronto Hong Kong	Pandemic	SARS SARS	Johnson Tew et al., 2008 Lo et al., 2006; Leung et al., 2004
	Israel	Political/ terrorism	Political instability (2000-2002)	Israeli et al., 2003
	Wenchuan Japan	Natural disasters	Earthquake Tsunami	Song et al., 2017 Lin et al., 2018

Table 1 Examples of major disaster past events used in literature review

A frequent effect is a major economic decline as a result of a severe drop in visitor numbers, occupancy rates (Leung et al., 2004), and the restriction of (international) travel routes. As a consequence, tourism businesses are faced with an economic decline, as is the case on Mallorca.

Initially, the number of tourist arrivals drops for several reasons: Firstly, visitors from countries hit by economic crises refrain from traveling, and businesses who suffer from disasters are unable to host. Additionally, availability in accommodations is kept limited for hygiene, safety, and security measures from various hazards. The strategies that were identified by this research can be classified as short- or long term and reactive or recovery-oriented strategies.

4.2 Short-term Measures

Initially, most businesses rely on short-term reactive measures with a priority to prevent further economic losses. Hence, businesses often adopt cost-cutting measures, along with strategies to recover the money. The most common cost-cutting method is to lay off employees and to either entirely or partially close facilities (Lo et al., 2006; Alan et al., 2006; Johnson et al., 2008). Thereafter, businesses attempt to find creative solutions to offer an alternative marketing strategy to generate revenues (Lo et al., 2006).

In the case of pandemics and terrorism events, businesses are often focused on the health and safety of their employees and guests. In the case of COVID-19, hygiene and safety are extremely important, as there are a lot of concerns among tourists regarding their personal health (UNI-4). A finding from past events is that businesses often develop protective strategies to guarantee a safe stay and improve the visitors' experience. Measures include providing guests with useful information about the tourist sites, transparency about potential hazards as well as pointing out safe means of transportation, and the provision of sufficient hygiene safety measures (Sönmez, 1998). This can currently be observed for Mallorca and the COVID-19 crises: Mallorca's tourism businesses are prioritizing hygiene and personal health of staff and guests (BUS-1). Aside from the immediate recovery, long term recovery strategies also need to be considered. These strategies need to be constantly renewed and adapted to specific crises.

4.3 Long-term Measures

Shaping Public Perception

Long-term measures are mostly concerned with re-establishing the destination as safe and enjoyable. The media coverage plays a key role in shaping the image people have of a given situation in a destination (Sönmez, 1998). Oftentimes, the media highlights the severity of the disaster or the instability of the situation (Sönmez, 1998) and therefore provoking an exaggerated public reaction resulting from fears. Low hotel occupancy can also provide an advantage here, as it can be shaped to create a positive image for the hotel. For example, the current low occupancy due to social distancing provides a window-of-opportunity that can be used to improve the quality of infrastructures (creation of new spaces) or to launch renovation works (Kapiki, 2012; ShiNa et al., 2010; Lo et al., 2006). In the long run, the local hotels can promote utilization of the low-occupancy rate and shape the public's perception, notably concerning health and safety.

Marketing Strategy

As travel routes are restrained, a typical strategy is to strengthen domestic tourism which is done by offering package deals, discounts, or free tickets to domestic tourists (ShiNa et al., 2010; Israeli et al., 2003). By emphasizing domestic tourism, the economy becomes less dependent on international travel, and therefore less vulnerable to future crises. When it comes to international tourists, efficient marketing strategies can be helpful for a long-term recovery plan. In this context, campaigns that proved to be effective focused on promoting two key elements: new products and information (Mair et al., 2016). Also, new products and services can be developed while existing ones can be reinvented and tailored to the customer's demands (Israeli et al., 2003). But most importantly, successful campaigns were focused on improving the destination's image, often regarding the safety of the destination. Many factors contribute to the success of marketing campaigns, i.e. capitalising on emotions, influential celebrities' endorsement/testimonials, and strategically repeating a concise message that needs to be delivered to the visitors (Mair et al., 2016).

The Balearics have already incorporated COVID-19 measures into promotional strategies. There is an emphasis on the island being "a safe destination": this is a good first step (Majorca daily bulletin, 2020). To go further, the Balearics government can incorporate safety measures with sustainability, and move towards sustainable recovery. Early studies from China suggest that there is an increased desire for sustainable products due to COVID-19 (Gössling et al., 2020). Therefore, incorporating sustainability into marketing can contribute to the establishment of a healthier and more sustainable tourism sector on Mallorca. Yet COVID-19 does present some unique challenges to sustainability, SUPs in particular are in a unique position due to the use of SUPs for hygiene purposed.

5. COVID-19 & SUPs

5.1 COVID-19, Oil price & Plastic

The development and fluctuations of oil prices are an additional strain for efforts to reduce SUPs. As a result of the economic slowdown, oil prices are dropping - even below zero (Guardian, 2020). There are concerns that the low prices will lead to an increased uptake in plastics, as production costs decrease. The pandemic has already shown a general increase in the uptake of SUPs (Kalina & Tilley, 2020). The plastic uptake goes well beyond tourism; the World Bank (2020) has warned that COVID-19 could reset the clock on single-use plastics. It was noted that plastic recycling companies are also facing problems, as it is getting cheaper to buy new plastic products than it is to recycle plastics (BUS-5). Similarly, there are concerns that biodegradable plastics might get adopted even though they can negatively impact the environment (BUS-7).

The lack of knowledge and awareness regarding this issue might lead hotels to adopt practices they believe to be sustainable, even if they are not (BUS-3). Despite the lack of evidence regarding the safety of plastics and COVID-19 (some studies even suggest the contrary, see Annex 2), the pandemic has restored the legitimacy of SUPs. In combination, this could lead to a potential resurgence of SUPs, as the plastic industry might see COVID-19 as an opportunity to "rebrand", notably in terms of hygiene (BUS-5). Because plastic products are becoming more acceptable and cheaper again, it is crucial to raise awareness of the negative consequences of SUP and for possible alternatives.

5.2 Health, Sanitation & SUPs

The tentative reprisal of tourism and the parallel increase in both health and safety measures threatens the reduction of SUP. At this time, it is unclear how exactly hotels can achieve additional sanitation to protect themselves and their guests from COVID-19. For tourists especially, personal health is a bigger priority than environmental protection (UNI-5).

With concerns over a potential infection and uncertainty over how the virus spreads, hotels follow their own guidelines on how to adapt their practices to the situation (BUS-1). While there is no clear scientific evidence on whether SUPs limit the spread of the virus, in practice hotels are already adopting more SUPs accordingly. This includes the introduction of hygiene and safety products such as gloves, masks, and hand sanitizer. This also means that bulk products are now individually wrapped in SUP, which represents a step backward in terms of SUP reduction (BUS-1). It has been suggested that concerns around food safety are a major issue in increasing SUPs, notable through additional packaging (Bloomberg, 2020). This indicates that both, the hotel industry and tourists prioritize hygiene measures over environmental concerns, which comes with increasing SUP-use.

A survey was distributed to get a general overview of what people expect from accommodations in terms of increased hygiene measures, and whether they are aware of the relation between these measures and an increase in SUP use. See Appendix A for the survey questions, and appendix B for the full survey results.

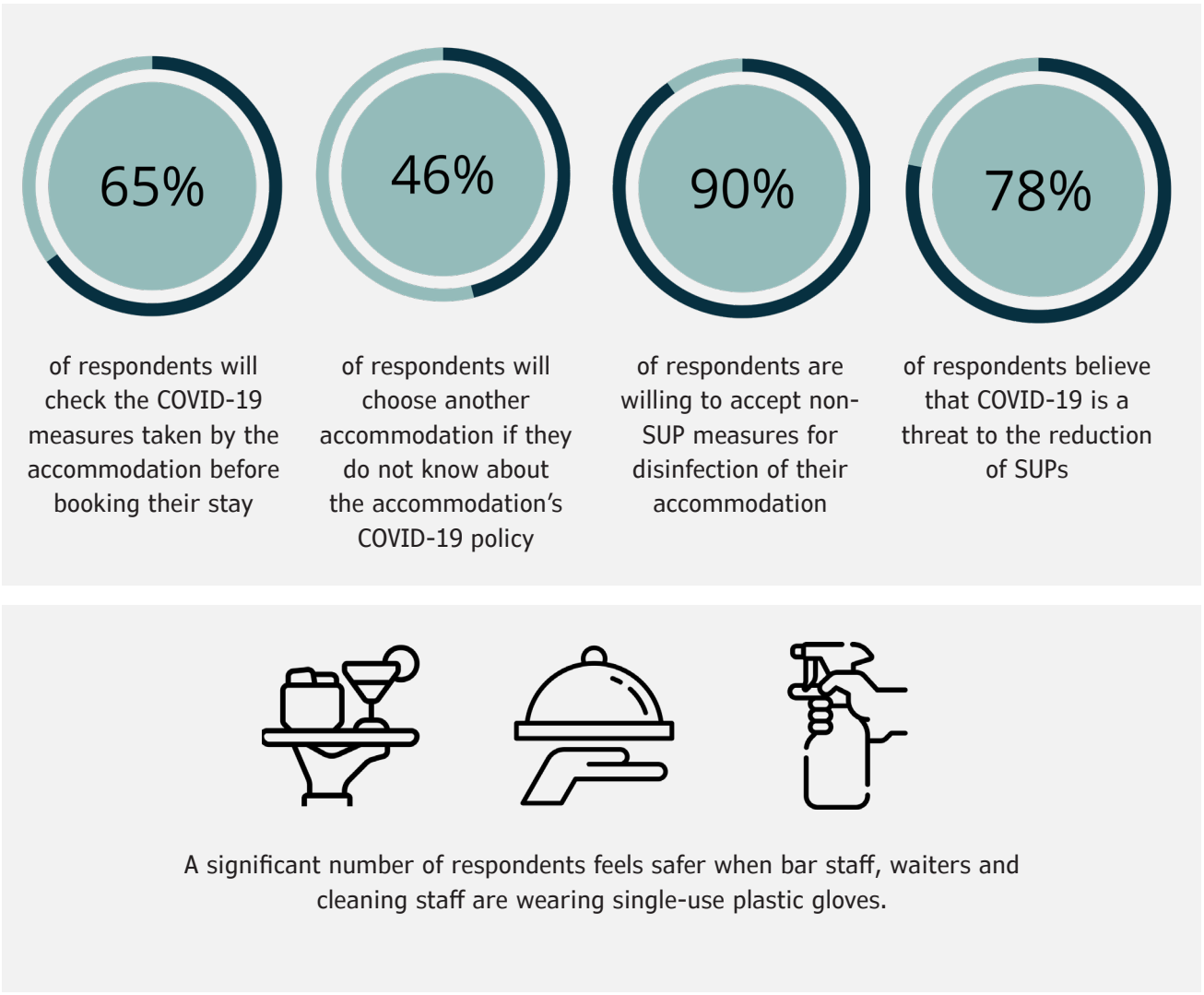

Figure 1 Key findings of the survey regarding COVID-19 & SUP use

The results of the survey show that the presence of COVID-19 measures is important in tourism decision making. As such, hotels are taking a step in the right direction by creating clear and accessible guidelines and policies. Plastic gloves worn by waiters, bar and cleaning staff positively affect tourists' perception of safety from COVID-19 infection. Both interviews with those working in the industry, as well as tourism experts, confirm these findings, as the use of masks and gloves is deemed an inevitable consequence (BUS-1, BUS-3, UNI-2, UNI-4). However, the survey does show that most tourists are willing to accept non-SUP measures for the disinfection of their accommodation.

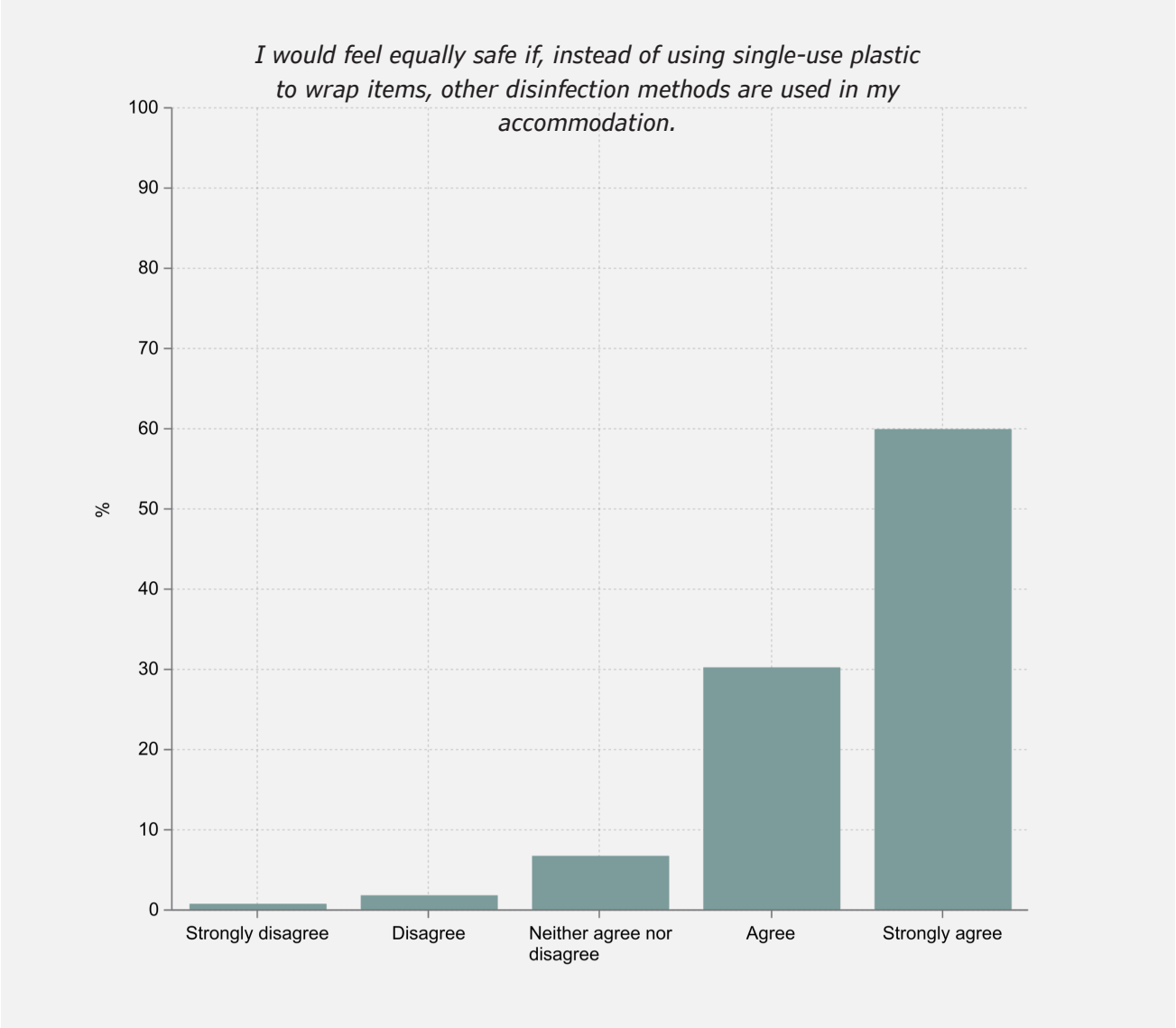

Figure 2 Consumers' preference regarding non-SUPs disinfection methods

According to the survey and interviews, while both health and safety are crucial to tourists, they are willing to accept non-SUP hygiene measures, meaning there is an opportunity for SUP reduction (BUS-3, BUS-5, BUS-7). With hotels wanting to provide a safe destination for their guests, it seems that they base their measures in part on what they think the guests expect (BUS-5). They are adopting measures even if they don't know what the best practices are, in order to meet expectations from tourists which may also be misinformed. In terms of the lack of clear information, media influence can play a role, as it was noted that

> a lot of tour operators and a lot of tourism publications are telling hotels that people need to be reassured without really knowing how far the people actually want to be reassured
>
> *(BUS-7)*

As such, there is a need to understand what makes tourists feel safe, what the role of SUPs is, and what alternatives are acceptable. The potential of eliminating certain SUPs, notably the amenities (i.e. shampoo, body wash bottles) was raised (BUS-3, BUS-7). These SUPs can be eliminated as part of COVID-19 measures, as amenities are touched by several people before reaching the guests. Eliminating these SUPs can be communicated to guests in terms of safety, and even be used to promote both sustainability and sanitation.

Furthermore, tourists acknowledge the fact that the COVID-19 pandemic is a threat to the reduction of single-use plastics. It seems like people do grasp that the increasing use of plastic supplements might be a danger to the accomplished efforts in the reduction of plastics so far, but might miss the link with the greater picture of the harm plastic does to the environment. Thus, educating people about the negative impacts of plastics is crucial to bridge this missing link (UNI-2). Currently, Mallorca is focused on economic recovery in their crisis response, though future strategies may provide more opportunities.

6. Current & Future COVID-19 Recovery Strategies in Mallorca

6.1 Current Strategies

Financial Measures and Support

To help tourism and the economy of Mallorca in their recovery, the tourism sector (including governmental bodies, private businesses, organisations) has undertaken or planned recovery strategies during the pandemic. First of all, the government has taken several measures to compensate for the exceptional effects of the pandemic on the economy and society. For example, the Balearic government created several funding projects (e.g. low-interest loans and grants). These are supposed to support companies to maintain their economic activities and provide support measures to guarantee social security and ease the financial stress (Govern Illes Balears, 2020). Besides, the hotel associations and unions of Balearic island[1] have signed a common document to call for the six-month extension of labour assistance, such as the specific unemployment protection of workers (Elelman, 2020).

Re-establishing Mallorca as a Core Tourism Destination

Several recovery plans were launched after the pandemic to bolster tourism. The government of Mallorca coordinated with the tourism sector of the island, including the FMT ("Fundació Mallorca Turisme"), Mallorca's Tourism Foundation Advisory Council. Together, they developed actions and promotional plans to relaunch tourism on Mallorca once the state of emergency came to an end. The advisory council proposed that the tourism promotional plan will be central, and the co-marketing will be strengthened with a minimum of €1.5 million on publicity, and of which the FMT will contribute €750,000 (Elelman, 2020). For specific tourism

1 The CEHAT Spanish Confederation of Hotels and Tourist Accommodation, the ACH Balearic hotel chain, and the FEHM Mallorca Hotel Business Federation

promotional plans, both the Balearic government and the associations of travel agencies and businesses have called for the Spanish government to reduce the flight and ferry travel prices (Cynthia, 2020; Elelman, 2020). For example, the Balearic president was asked to provide incentives in the form of assistance for airlines and ferry companies, direct subsidies to travellers and reduction of the port and airport taxes (Elelman, 2020).

In addition, to restart the tourism industry, the Spanish government proposed to open up travel routes within the regions of the European Union where the spread of the coronavirus has been under control. Once this proposal is adopted, the island could partly re-open the international tourism businesses before the country as a whole does so. The regional Balearic government has already been working for several weeks to make this proposal achievable so far and has contacted the major tour operators such as TUI. This measure could provide relief to the regions in Spain that are highly dependent on tourism, such as the Balearic Islands (Hernández, 2020). With Mallorca opening up to international tourists, COVID-19 is already being incorporated into the promotional strategies. Notably, Patricia Gómez, the Balearics health minister emphasised that they "have an excellent health system, thanks to which they are today a safe destination" (Majorca daily bulletin, 2020).

6.2 Future Strategies

Stakeholder Cooperation/Communication

Cooperation is fundamental in the long-term strategies; indeed working together with industry associations and governments is the most frequently used measure. The crucial point for successful cooperation is effective communication. Past recovery plans showed the importance of building network communication actions, in terms of various stakeholders joining forces to minimise the impact of the crisis (Johnson et al., 2008).

External Network (DMO & NANP)

The research revealed that no individual tourism industry stakeholders can single-handedly take the lead in steering the tourism industry towards more environmental strategies of tourism. Therefore, the findings support the need for a municipal level destination management organization (DMO) or a National Plastic Action Partnership (NPAP) that could provide leadership for the management of tourism in the destination (RO-1). They can provide guidelines and thereby facilitate the implementation of sustainable practices. That way, they can bring about and make changes to the tourism industry. These organisations can shift focus away from only marketing or commercial activities, to more sustainable practices (UNI-3; Bornhorst, Ritchie & Sheehan, 2010). This is currently an ongoing process, because of COVID-19, and the tourism sector has come together as a united front to face the crisis (BUS-5). Organizations such as the UNWTO, and the "Fundacio Mallorca turisme" are acting as middlemen, listening and speaking up for industry interests. There is an emphasis on collaboration, with many private-public partnerships (BUS-5) to recover from the crisis. There is the hope that these types of coalitions will stay around and collaborate for sustainable goals down the line (BUS-5).

Internal Network

The lesson learned from the SARS-pandemic indicates the importance of internal communication between the management and the staff for optimal coordination of efforts. (Lo, Cheung & Law, 2006). Therefore, it is essential for individual stakeholders (hotels, local businesses, etc.) to build corporate social responsibility (CSR) as an internal self-regulation network. These internally focused actions can shape common awareness and shared goals, and thus promote better internal communication. CSR is also understood as a strategic initiative that contributes to a brand's reputation. (Johnson et al., 2019). The CSR manager from a hotel noted that in many hotels, CSR is not being prioritised at the moment, yet within organisations many people are still committed to sustainability (BUS-7). These individuals can be key players in influencing hotels and their policy, a scientific approach was noted to be a successful strategy in the past. Internal communication regarding health and safety is also key, as personnel should be able to guarantee their own safety, while also being able to limit non-sustainable practices that are unnecessary (BUS-7).

7. Conclusion

The main objective of this report was to answer:

How can the hospitality sector of Mallorca recover from the COVID-19 crisis in a more sustainable way with regards to SUP use?

Through addressing the following questions:

- *What consequences does COVID-19 have on the hospitality sector in Mallorca?*
- *How did other tourist destinations recover from disasters in the past?*
- *What are the current recovery strategies that stakeholders undertake on Mallorca?*

In summary, COVID-19 will have long term effects, not only on a societal and economic level, but also in terms of sustainability. The local and global travel restrictions have heavily affected local tourism, not only for Mallorca but also on a global scale. Small businesses are facing a lack of income and even bankruptcy. Many companies claimed that they are not able to complete their sustainable plans, which were put on hold because of the current situation. Besides, in order to conduct recovery, many believe that the tourism sector will prioritize economics, and set aside sustainability. The current narrative and link between SUPs and health and safety is also a setback in terms of SUP reduction. However, some do want to progress in terms of sustainability by finding alternative ways to guarantee safety to their guests, without taking steps back in terms of sustainability. Finding a balance between the economic recovery of the sector, maintaining high health and safety standards, without compromising the environment is key.

Events with similar consequences as the current COVID-19 pandemic were taken into consideration for experiences and lessons; targeted disasters include SARS, global financial crisis, earthquake, tsunami, etc. So far, the impacts felt on Mallorca resemble the typical consequences of a crisis, including major economic

damages, and a focus on domestic tourism. As such, short term recovery measures on Mallorca are following suit in terms of crisis recovery. Short term measures including cost-cutting and developing protective strategies to guarantee safety. Based on precedent, long term recovery measures include the utilization of low-occupancy rates, shaping public perception, and marketing strategies that notably concern health and safety. Stakeholder collaboration also needs to be considered; times of crisis can provide a common goal to work towards. The networking and collaborations undertaken at this time might provide opportunities for further collaboration in the future.

Currently, the Balearic government is cooperating with local stakeholders and has launched several measures to compensate for the exceptional effects of the pandemic on the economy and society. Measures include the funding of projects and unemployment protection of workers by the FMT ("Fundació Mallorca Turisme"), in collaboration with the Spanish government. A tourism promotional plan was also established which is in the central position of the recovery process. The regional government also asked for the Spanish government to reduce the flight and ferry travel prices and provide assistance for airlines and ferry companies and reopening of borders with the EU to attract more tourists. As such, the government is focused on restarting tourism on Mallorca, and economic recovery. And while survivability and financial health remain a priority for hotels, there is a willingness to look for alternatives and to incorporate sustainable practices.

8. Limitations

As COVID-19 represented a major limitation for this study, this expert report is in a unique position, with COVID-19 also being the main subject of the research. The lack of on-site observations made it difficult to investigate the actual circumstances on Mallorca. Also, due to the lack of contact with on-site stakeholders, notably hotels, their perspective, and input are not well represented. Expert interviews were used to fill the gaps, yet this means that the research is not necessarily adapted to the exact context of Mallorca. The unique nature of this global pandemic also means literature is limited, notably regarding post-disaster and recovery literature. As this tends to focus on isolated destinations and crises, rather than a global event. Finally, as COVID-19 is an ongoing issue, some of the report is speculative, and might be outdated by the time this is published.

9. Recommendations for Oceana

SUP reducation through sanitation

The research suggests that there are discrepancies between different expectations regarding safety measures in hotels, notably what guests want, and what hotels think they want. While it is clear that COVID-19 measures are important in the decision-making process of guests, what these measures should be is unclear. By providing hotels with insights into what their guests expect in terms of SUPs and safety measures, Oceana can highlight which SUPs can be eliminated. The removal of these SUPs can be explained in terms of health and safety (i.e. many people touch these products, so eliminating them prevents the spread of the virus). By tying SUP reduction to guest expectations, hotels will both be able to implement more sustainable practices, while also getting tourists on board by communicating SUP reduction in terms of guest safety. In doing so, Oceana can bridge the gap between tourists and hotels, their different expectations, all while contributing to sustainable practices in hotels.

Building networks for the future

During COVID-19, there is a trend towards cooperation in the hospitality sector, in order to face the crisis together. On Mallorca, the FMT ("Fundació Mallorca turisme") might provide a good point of entry, as they hold a central position among tourism stakeholders. Joining this network can help establish connections with the private and public sector stakeholders and spread awareness. As there is a large knowledge gap when it comes to COVID-19 and plastics, so there is an opportunity for Oceana to share their knowledge and expertise through this network. Coming from a position of (scientific) legitimacy can create a platform to influence policy. Similarly, as part of this legitimate network, Oceana could approach hotels and provide assistance with their COVID-19 protocols, and thus impact SUP use.

Combining SUP reducation and industry priorities

As a tourism-dependent economy, Mallorca will feel the financial impacts of COVID-19 for a while. As such, it is crucial for Oceana to understand the main priorities of the hospitality sector, notably their own survival. Emphasizing the financial benefits of SUP reduction could provide a strong argument, as most hotels are prioritizing financial recovery. As small businesses that provide alternative, non-SUP products are hit hard, Oceana could act as a middleman between them and hotels. Oceana can help small businesses with their financial issues, by promoting their products as part of their networking activities. As previous disasters have shown, alternative marketing, and new products can be part of the recovery strategy, meaning there is an opportunity to integrate sustainable practices. By setting the example for hotels by providing them with legitimate, non-SUP options during COVID-19, Oceana could set the standard for sanitary and sustainable practices.

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Appendices

Appendix A
Survey Questions

1. Are you currently still considering going on a vacation this summer, despite the Coronavirus pandemic? Please select the answer that best applies.

- Yes
- No
- Undecided

1.1 If yes, please select whether your planned vacation is domestic or international.

- Domestic
- International

1.2 If no, did the Coronavirus pandemic play a role in the decision for you not to consider going on a vacation this summer? Please select the answer that best applies.

- Yes, the Coronavirus pandemic is the reason why I am not considering going on a vacation this summer
- I did think about the Coronavirus pandemic but it was not the main factor that lead to my decision
- No, the Coronavirus pandemic does not play a role in my decision
- Other _____

2. Which type of accommodation will you be staying in for most of your planned vacation? Please select one option.

- Airbnb/apartment
- Bed and Breakfast
- Hotel
- Hostel
- Cruise Ship
- Couchsurfing
- Other _____

3. Please indicate whether you agree with the following statement. *When thinking about your next holiday, whether that is this summer or later, will you check the accommodations' Corona policies and measures before booking your stay?*

- Yes
- No
- I don't know

4. Please indicate the extent to which you agree with the following statement. *If I do not know about the accommodations' corona-policy, then this will make me choose another accommodation.*

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

5. In the following questions, we would like to know about your attitude towards plastic wrapping everyday items and meals with single-use-plastic.
Meals are all meals that are served indoors in a closed environment, including breakfast, lunch, dinner, and snacks.

Bath supplies are i.e. shower gels, soaps, shaving cream, shampoos, moisturizers, etc.

Other everyday items include remote controls, charging stations, magazines and cups.

6. Thinking about corona safety measures taken in your holiday accommodation, please indicate which of the following measures you expect to be taken by the accommodation. Please select all that apply.

I expect that...

- ...each meal (breakfast, lunch and dinner) is individually plastic-wrapped before consumption
- ...each bath supply item is individually plastic-wrapped before use
- ...everyday items (remote control, magazines, etc.) are individually plastic-wrapped before use
- ...towels are individually plastic-wrapped before use
- ...magazines, coffee cups and minibar-supplies are plastic wrapped before use
- None of the above are important to me
- Other _____

7. Please indicate the extent to which you agree with the following statements.

If an accommodation...

	Strongly disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly agree (5)
...wraps items (eg. shower gel) in the bathroom in plastic and replaces these after every guest, then then this contributes to me feeling protected from a Corona-infection. (1)	o	o	o	o	o
...wraps items (eg. remote control) in the living room in plastic and replaces these after every guest, then this contributes to me feeling safe from a Corona-infection. (2)	o	o	o	o	o
...wraps individual meals in the dining room and elsewhere in plastic for every guest, then this contributes to me feeling safe from a Corona-infection. (3)	o	o	o	o	o

...uses new plastic covers for each individual table and seating in the dining room, then this contributes to me feeling safe from a Corona-infection. (4)	o	o	o	o	o

8. The following question concerns the use of single-use glove of the accommodation staff. Please indicate the extent to which you agree with the following statements.

	Strongly disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly agree (5)
If the waiters in the restaurant wear single-use-plastic gloves,then this contributes to me feeling safe from a Corona-infection (1)	o	o	o	o	o
If the bar staff wears single-use-plastic gloves,then this contributes to me feeling safe from a Corona-infection (2)	o	o	o	o	o
If the cleaning staff wears single-use-plastic gloves, then this contributes to me feeling safe from a Corona-infection (3)	o	o	o	o	o
If the reception staff wears single-use-plastic gloves, then this contributes to me feeling safe from a Corona-infection (4)	o	o	o	o	o
If the animation staff wears single-use-plastic gloves, then this contributes to me feeling safe from a Corona-infection (5)	o	o	o	o	o

9. Please indicate the extent to which you agree with the following statement.

I would feel equally safe if, instead of using single-use-plastic to wrap items, other disinfection methods are used in my accommodation.

- Strongly disagree
- Disagree
- Neither agree nor disagree
- Agree

- Strongly agree

The following questions are about your perception of the effects of the Corona-pandemic on the environment.

10. Please indicate the extent to which you agree with the following statements.

	Strongly disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly agree (5)
The Coronavirus pandemic is a threat to the reduction of single-use-plastic in the tourism sector. (1)	o	o	o	o	o
The Coronavirus pandemic is a threat to the environment. (2)	o	o	o	o	o

11. Please indicate whether you think the following statement is true or false.

The Coronavirus pandemic leads to a rise in the use of single-use-plastic in the tourism sector due to increased requirements for hygiene.

- True
- False
- I don’t know

Appendix B
Survey Results

An explorative survey was conducted that aimed at uncovering the perception of tourists on the use of SUP for the sake of increasing hygiene in accommodations. A total of 468 people responded to this survey, of which approximately 70% were aged between 20 and 30 years old and 36% were male respondents.

From the people who have decided not to go on a vacation, a significant amount explains that the COVID-19 pandemic is the main reason for not wanting to travel (question 1). Additionally, according to the respondents, COVID-19 measures can impact the choice of accommodation. Figure 1 shows the importance of the accommodations clarity with regards to the different hygiene measures they take (survey question 3). 65% of the respondents check the COVID-19 policies before booking the actual accommodation. As Figure 2 shows, the necessity is even stretched by the fact that 46% of the respondents choose to look for other accommodations when the measures are not clearly stated, whereas 25% is undecided on the topic (survey question 4).

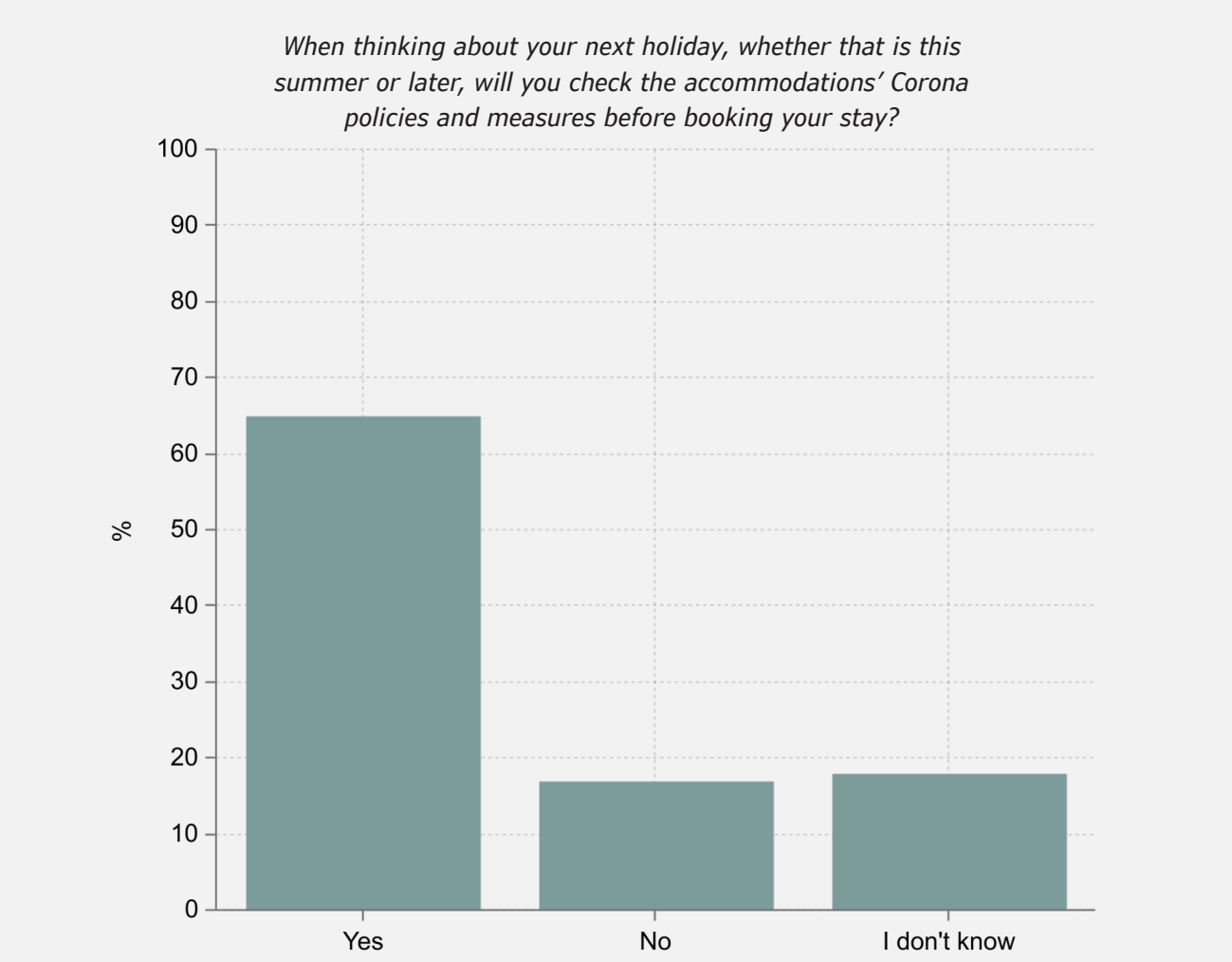

Figure 1 Respondents checking COVID-19 policy before their booking

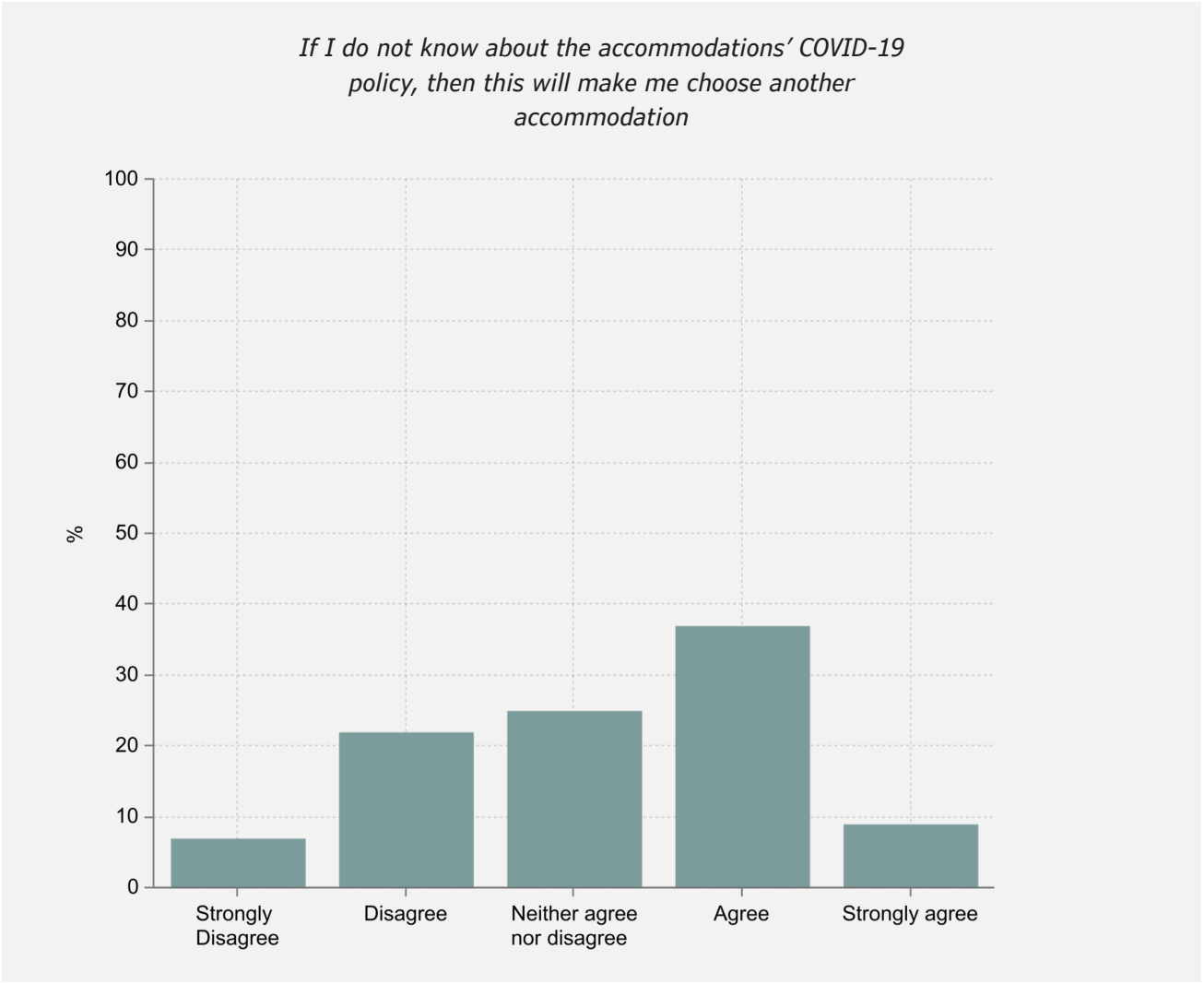

Figure 2 COVID-19 policy impact on accommodation choice

One question contained five different proposed COVID-19 measures about plastic wrapping (survey question 6). The question asked respondents to pick which plastic wrapping measures they expect accommodations to take, if any. As figure 3 shows, the results suggest that wrapping items in SUPs is not expected by respondents.

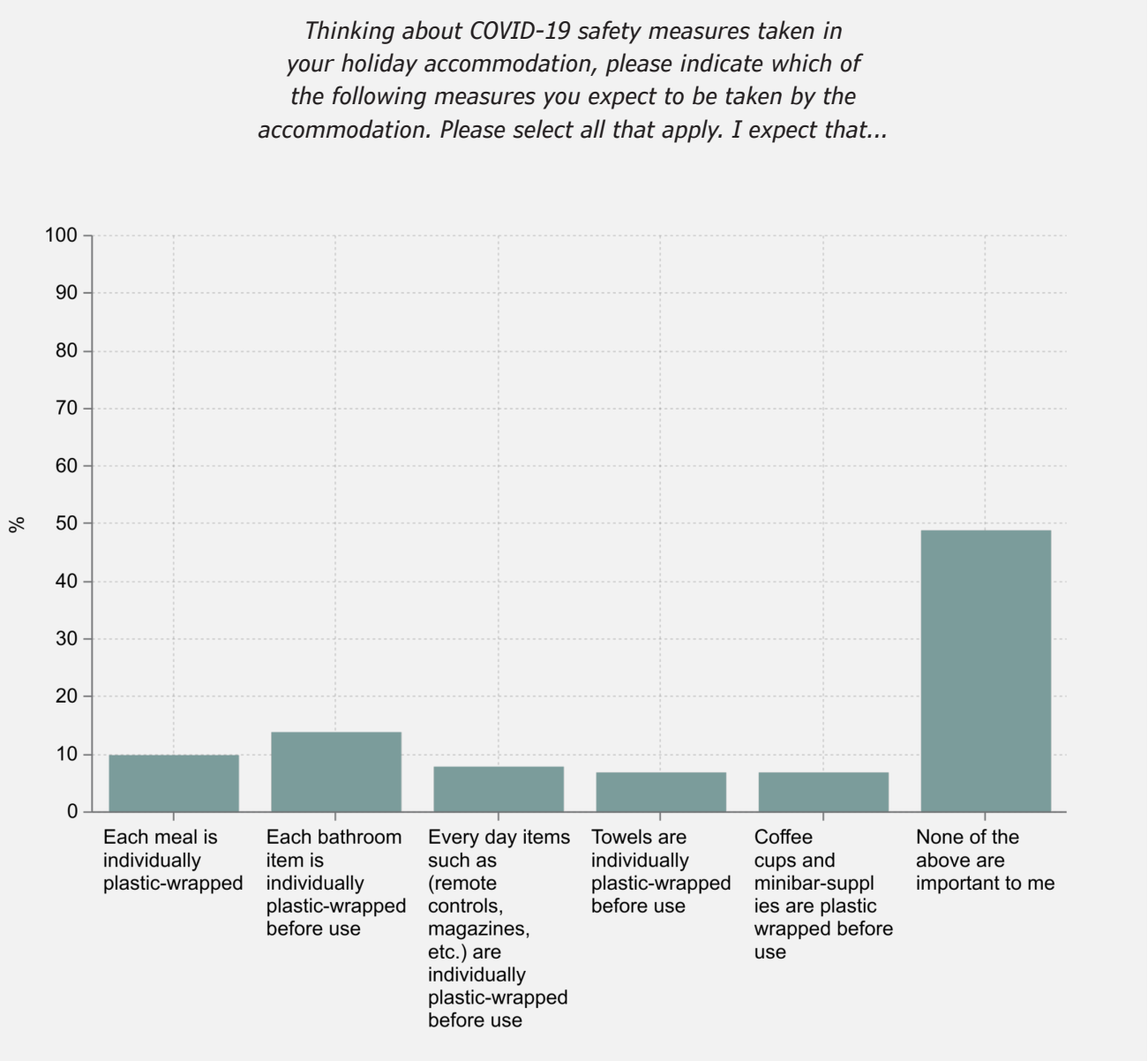

Figure 3 Expected plastic wrappings in accommodations according to respondents.

The results for the statements about the use of gloves are shown in Figure 4 the accompanying Table 1 (survey question 8). The respondents agree on waiters, bar staff and cleaning staff wearing gloves gives them a feeling of safety, whereas the opinions diverge on the reception and animation staff wearing gloves.

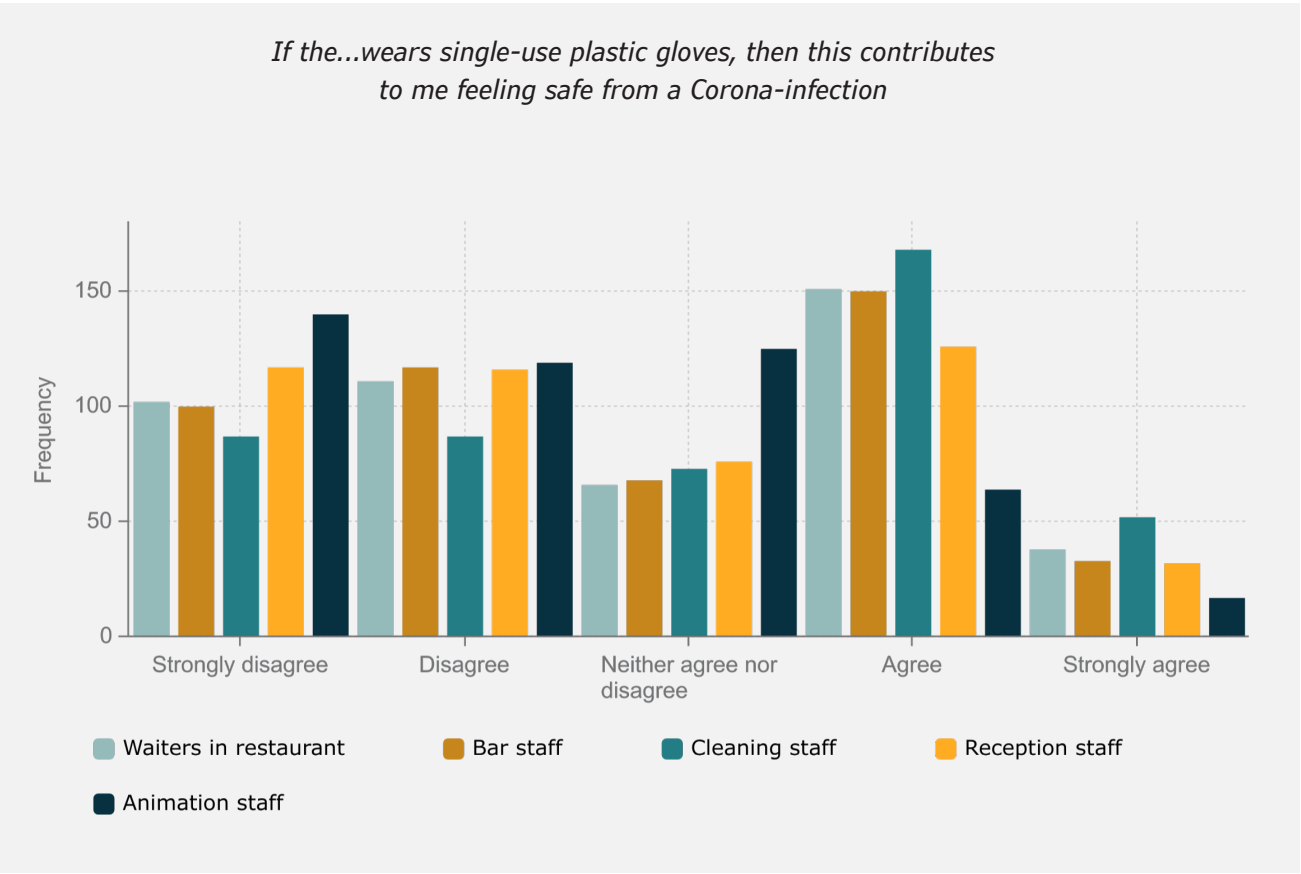

Figure 4 Masks and gloves' contribution to feelings of safety

Table 1 Masks and gloves' contribution to feelings of safety

If the ... wear single-use plastic gloves, then this contributes to me feeling safe from a Corona- infection	Significant?	Outstanding opinion
Waiters in the restaurant	Yes, p = 0.013	Agree
Bar staff	Yes, p = 0.043	Agree
Cleaning staff	Yes, p = 0.000	Agree
Reception staff	No, p = 0.564	All equal
Animation staff	No, p = 0.357	All equal

WAGENINGEN UR
For quality of life