

ACTION PLAN ON MARINE LITTER FOR LANZAROTE, CANARY ISLANDS

**Massive Open Online Course (MOOC) on Marine Litter
Final Assignment Expert Track**

Autors

Nicole Andrea Ruckstuhl¹

Alicia Herrera Ulibarri²

Genís Mir Baigol³

1. COUP Cleaner Ocean Upcycling Productions
2. Microtrophic Project. University of Las Palmas de Gran Canaria
3. “Agüita con el Plástico” awareness campaign. Cabildo de Lanzarote

ACTION PLAN ON MARINE LITTER FOR LANZAROTE, CANARY ISLANDS

Summary

Plastics are synthetic polymers, being used in a wide range of products, due to their low cost and versatility. Plastic production is increasing since the 50s. In 1976 the global plastic production was about 47 million tons, while in 2013 was approximately 299 million tons plastic produced, according to Plastic Europe¹. Because of this rapid growth negative environmental impacts are occurring, due to the lack of adequate waste management leading to the pollution of the ocean. Already in the 70's several studies showed the risk of plastic accumulation in the oceans^{2,3}. In 2001 a study in the North Pacific Gyre conducted by Moore et al.⁴ showed that the abundance of plastic particles was six times greater than plankton. This alarming data attracted again scientific and political attention to the problem of plastic waste in the ocean and its possible consequences for filter feeders organism. From this study the accumulation of plastic has become one of the major research topics in the field of marine ecology. Recently Eriksen et al.⁵ estimated that the total number of plastic particles floating in the world's oceans is approximately 5.25 trillion particles weighing 268,940 tons.

Lanzarote is the easternmost of the Canary Islands, in the Atlantic Ocean and has a UNESCO Biosphere Reserve protected site status. In Lanzarote the first diagnosis of plastic pollution on coastal areas was conducted by Baztán et al.⁶. This study reveals that the beaches exposed to the prevailing winds and surface currents in the area are the most affected by microplastics pollution. The Canary Current brings plastic waste from other areas of the Atlantic and these are deposited on the coast of Canary Islands. However, the eastern part of the island where are located Arrecife, Costa Teguise and Puerto del Carmen that receiving large tourist and concentrate most of the residents, has other pollutants most related to human presence such as butts cigarette or plastic bags. In the cited study they found microplastic concentrations above 100gr/L in Famara beach and the resulting diagnosis is clear: "... in each of the protected islands studied found evidence of unacceptable amounts of plastic pollution⁶". From this first study the Biosphere Reserve office in Lanzarote began the awareness project "[Agüita con el Plástico](#)" that means something like "Beware of Plastic". The creation of an observatory was also raised to study the evolution of plastic pollution at Famara beach. At present there is a network involving NGOs, University, local administrations and local communities in the COASTAL consortium (Communities-Based Observatories Tackling Marine Litter). It proposes to involve the scientific community and the general population in data collection and in finding solutions to this problem. In the present report we propose an action plan based on the [Honolulu Strategy](#) framework, with three main objectives to reduce plastic pollution:

Objective 1: Determine the impact of plastic pollution in Lanzarote

Objective 2: Education and Awareness Campaign

Objective 3: Generate benefits from waste: to create a circular economy

1-PROBLEM DEFINITION

Marine litter is a global problem affecting the entire world. But some places are more affected than others, due to various reasons. The knowledge about the issue is still limited, only few studies analyse the problem and how it affects mankind and nature.

The consequences of marine litter can be distinguished between social, economic and ecological impacts. The importance of each impact seems rather subjective. Usually policy makers tend to focus more on the economic impact, whereas scientist assess the ecological impact as a priority. A ranking of the impacts seems obsolete because all are related. We can try to enumerate some impacts, for example ghost fishing nets kill millions of marine animals; and the ingestion of microplastic by zooplankton, fishes and filter feeders, causing microplastic introduction in the food chain, with all of their toxins and other pollutants. The contaminants are documented to cause hormonal endocrine disruption on humans, but we need to increase the investigation of these effects because still very little is known about them. There are several studies about how human health is affected by chemical compounds used in plastic fabrication, such as bisphenol-A and phthalates. This compounds are known to causes endocrine disruption, cancers and much more health problems⁹. Loss of health is uncountable, and to make a comparisons is difficult and an economic calculation impossible. If the action plan succeeds local population will have less diseases related to plastic toxicity.

Dirty beaches can causes loss of tourists and in near future, the economic sector will be very affected. At the moment economic loss is unpredictable for the case study of Lanzarote.

Sector	Impacts	Example of costs
Fishing	Marine litter can lead to the loss of output or loss of value in the sales of certain types of seafood and fish.	The loss of marketable lobster due to abandoned or lost fishing gear is estimated to lead to a global loss of US\$250 million per year. Microplastics are estimated to lead to a loss of up to 0.7% of annual income every year for the UK aquaculture sector.
Shipping	Plastic debris can foul ship propulsion equipment, disrupting operations, requiring clean-up, repair and rescue efforts, loss of life or injury.	In 2008, 286 rescues of vessels with fouled propellers in UK waters were carried out at a cost of between €830,000 and €2,189,000. Cost of removing litter and addressing damage in the Scottish aquaculture industry is estimated at €155,549/year.
Tourism	Polluted beaches can discourage visitors from certain beaches, leading to lost revenues for the tourism sector	In Goeje Island (Republic of Korea), marine debris led to lost revenue from tourists of between €29-37 million in 2011. In the Asia Pacific Economic Community (APEC) region, marine debris is estimated to cost the tourism sector approximately US\$622 million/year.

Table 1. Some examples of marine litter impacts/cost⁷.

If we focus in a particular area, such as Lanzarote, it is visible that local solutions will not solve the problem as part of marine litter is coming from international waters. So the scope

of local action to reduce microplastic is limited because every tide brings and takes a lot of microplastic. International effort are needed for reducing the marine litter in the North Atlantic Ocean. But also island derived plastic pollutes local shores and waters. There are infinite local actions we can do, but all require political support and also financial contributions to realise more actions and deepen the investigation.

Every gram of plastic that is no recycled, is a loss of money. But not only a loss of money, it increases the economic impact heavily. In the table 1 some examples of costs of marine litter are listed.

Both local fishing and tourism activities are the economic pillars of Lanzarote. Looking at the previous boxes, we see some examples that could affect directly the economy of the island. How much money local governments spend on the maintenance of clean beaches is unknown. A socio-economic study to evaluate the costs of marine litter for a local entities seem promising. How much money is lost by a poor waste management? How much money costs marine litter local fishermen? How much money could be lost by the decrease of tourism? However, the indirect costs are negatively impacting local economies. How much money is spent on medical services? The diseases of plastics compounds have very expensive treatments. And still very little is known, so it is difficult to calculate the costs of the long-term effects.

Costs of non-action are very high. If no measures are taken for solving the problem, its negative impacts on human, nature and economy will increase and the costs augment. Consequently, when we succeed with the action plan, local government will save money, business will create new employment and the society on general will profit.

With research and information campaigns people are aware about the issue of marine litter, consequently less plastic bags and less plastic litter in general is generated in Lanzarote. This can result in an increase of tourism revenues and in a quality intensification of tourism products.

However most of the action depends on political decisions. There are several fairs organized by the local government which aim to reduce the single-use plastic such as throw away cups and plastic bags. It seems necessary that real and feasible alternatives exist. If we sale reusable cups but single-use cups are free, population tends to use the cheap way and consequently the intentions are failing. The reduction of plastic bags also requires economic incentives, a competitive price with non-plastic bags is needed and this only is achieved if economic incentives are supported by the government.

Lanzarote as Biosphere Reserve furthermore has a moral obligation to protect an intact environment. Lanzarote is surrounded by an ocean full of life, with animals like marine turtles and a lot of species of cetaceans. We have to protect them from marine litter. However how to protect an area from external waste, is a difficult task.

Waste of concern in Lanzarote

Three types of waste of concern have been identified using various citizen science protocols – fishery derived waste, single use plastic and microplastic. The protocol of [Ocean Conservancy](#), [Marnoba](#) and [Observadores del Mar](#) have been applied during various beach cleanups. It has been registered that there is a high competition between these institutions and a lack of networking and synergies is occurring.

Fishery derived waste are fishing gear, mainly fishing nets and ropes, and solid fuel. Solid fuel lumps are vastly accumulating at the Northwest shore of the island. Its origin is not

totally identified. But the common practices of offshore oil changes of boats seem a realistic, but not the only source of the locally called “piche”. Furthermore does the poor waste facilities infrastructure in ports increase this problem.

Single use plastic is mainly referring to the packaging of goods and food. Due the heavy winds single use plastic is delivered over the island, not only deliberately about also accidentally. Open waste bins and the collection and transportation of waste are the major sources of accidents. Insufficient number of waste bins may alter the deliberate littering behaviour, especially at public events. Another important fact is the high consumption of bottled water, which leads to a high rate of plastic bottle consumption (see objective 3).

Lanzarote is a hot spot of microplastic (see figure 4). This is due to Lanzarote’s exposition to the global ocean currents, gyres, which accumulates international microplastic at its Northwest shore. However also insular derived microplastic, mostly on form of fibres and microbeads from cosmetic products, textiles and boat maintenance does enter into the ocean, even though it is not visible. In the figure 1 the Driver - Pressure – State- Impact – Response – Scheme is elaborated for reducing the complexity of marine litter in Lanzarote, building the base of this report.

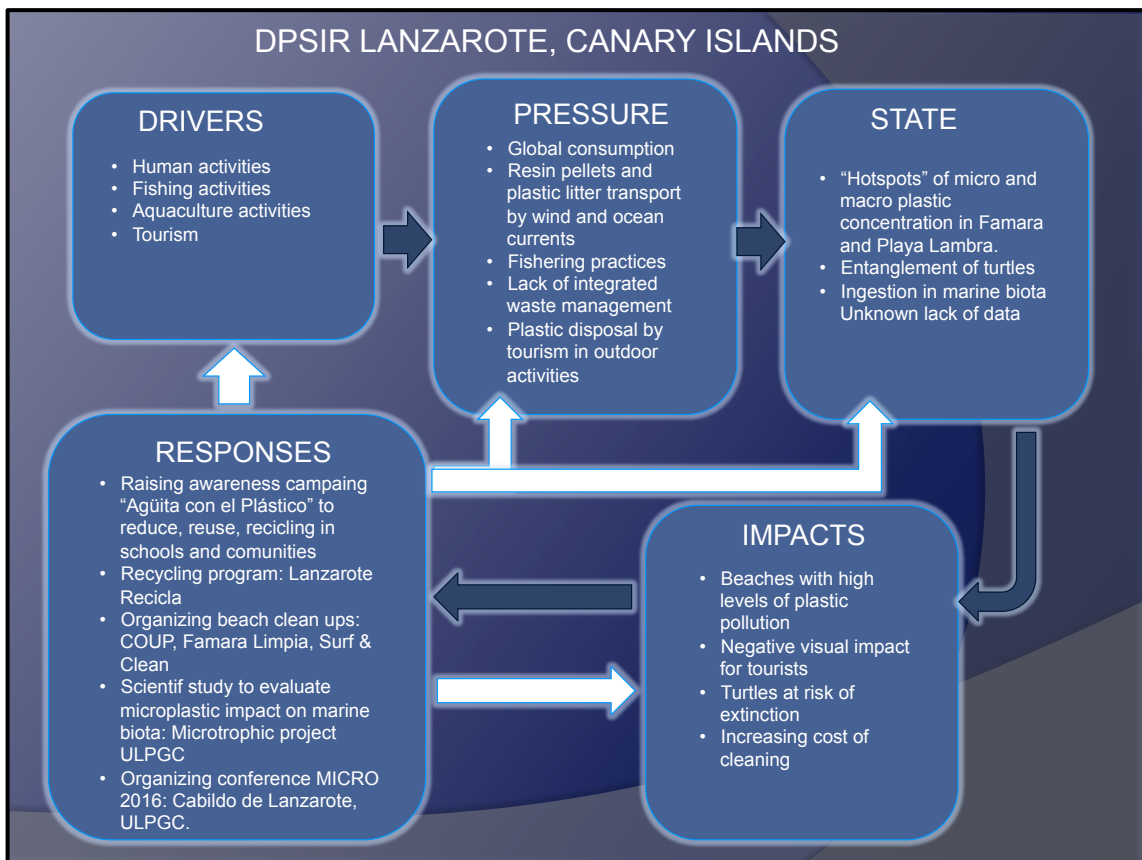


Figure 1. DPSIR (Driver - Pressure – State- Impact – Response).

2- STRATEGY

The creation of a marine litter network seems essential to coordinate all the efforts dealing with marine litter. So far the efforts are diverse, but cooperation could be augmented.

Stakeholder

The stakeholder mapping indicates that a variety of institution, both public and private are affected by the problem of marine litter (see figure 2). The three entities, administration,

industry and society are distinguished.

Lanzarote's Administration has different levels of operating ranges. The local municipality provides the general management of its area. The waste management and beach management of a municipality aim to maintain the environment clean. So, beach cleanups, as a symptom solution as well as maintenance of adequate waste bins for reducing the waste entering in the environment, are in their scope of action.

The insular administration of Lanzarote, the Cabildo, governs the whole island strategically and a variety of departments are elaborating strategies for a prosperous future of the island. Many departments such as tourism, fisheries, transport, technical office and environment, are part of marine litter dialogue as the problem is very complex and multi layered. For example tourism does negatively affect marine litter as a source, in the case of Lanzarote with its many outdoor activities and mega sport events like the annual Ironman. However also a potential of negative reverse impacts may occur as the attractiveness of a destination declines with littered beaches. Two campaigns are currently dealing direct or indirect with marine litter. The campaign "Plastico Cero" of the project "Agüita con el plastico" raises awareness about the negative impacts of plastic overuse nowadays. This campaign is organised by the office of the Biosphere Reserve of Lanzarote, which belongs to the area of the President of the Cabildo. Another important initiative is "Lanzarote recicla" (Recycle Lanzarote) of the Waste Department of the Cabildo. Educational programs and other campaigns, such as "De residuo a recurso" (from waste to resource) or "escachar y reciclar" (crush and recycle) are elaborated for increasing the recycling rate of the islands.

The regional Government of the Canary Islands provides strategic planning for the whole archipelago. Two areas address partially the problem of marine litter the GESMAR, Sustainable Use of marine resources and energy, as well as the SIMAC, an environmental information system for the canary islands.

The article 45 of the constitution of Spain addresses the need of a healthy environment. So every entity of the public administration should do so. The Spanish law of Marine Environment Protection (Law 41/2010) indicates that marine litter affects the ocean health negative and recommend research for further actions. Also the MARPOL protocol is ratified by Spain for reducing marine debris from sea-based sources.

As Spain is belonging to the European Union, also European norms need to be complied. The European Union has identified the environmental effects of microplastic as one of the main issues of concern within the framework for the conservation of marine ecosystems, the Marine Strategy Framework Directive (MSFD: 2008/56/EC). The Decision of European Commission (2010/477/EU) on criteria and methodological standards on good environmental status of marine waters recommends the study of quantity and composition of marine debris ingested by marine biota. In Canary Island a lack of information of these topic was attested and the need to research is highly recommended by the Spanish Environmental Agency.

The industry can be categorised in the groups: Shipping and fisheries; Retailers; and tourism. Shipping and Fisheries are combined as partially the same infrastructure is used, namely ports, including their waste facilities. Ports can be divided on the basis of their function. Marinas offer space for private yachts. In Lanzarote four of these are allocate in Arrecife, Puerto Calero, Puerto del Carmen, and Marina Rubicon in Playa Blanca. The two industrial ports, Puerto Naos and Puerto de los Marmoles, lie in the capital, Arrecife and provide services for cargo transport. With artisanal port it is referred to small ports, that

mainly provide access for local fishermen such as La Santa, Punta Mujeres and El Golfo. Recreational ports, lying in Orzola, La Graciosa and Playa Blanca offer transport facilities for tourists as well as fishing activities for guests and locals. The fishery school, educating local seamen, is an important stakeholder, as they are the direct link between the local fisherman and the administration with their legislation. Also fisherman associations should be integrated in future actions addressing marine litter.

Retailers provide food, mainly imported from elsewhere, for the citizens. So they play an important role on which products are consumed and consequently how much waste is produced respectively imported. Some supermarkets started to tax plastic bags, however especially in the fruit and vegetable shelves no alternatives for plastic packaging is offered. Some wholefood stores started to sell their products without packaging, so called bulk stores. Due to the high prices of these products, it does not seem as a real alternative at this point in time.

Tourism as a source of marine litter can also be negatively affected by marine debris, so the whole industry is asked to participate in solving the problem. Many tourism associations are active on the island, ranging from private to public interest. Tour operators of nature experience, such as surfing, hiking, diving, are affected by marine litter. Some of these are however actively fighting the problem, mainly with cleanups. The diving club C.A.S Pastinaca regularly cleans the subtidal zones from man made waste. Senderismo Lanzarote, a hiking tour operator, cleans up the landscape and surf schools, such as Clandestino, tidy beaches regularly.

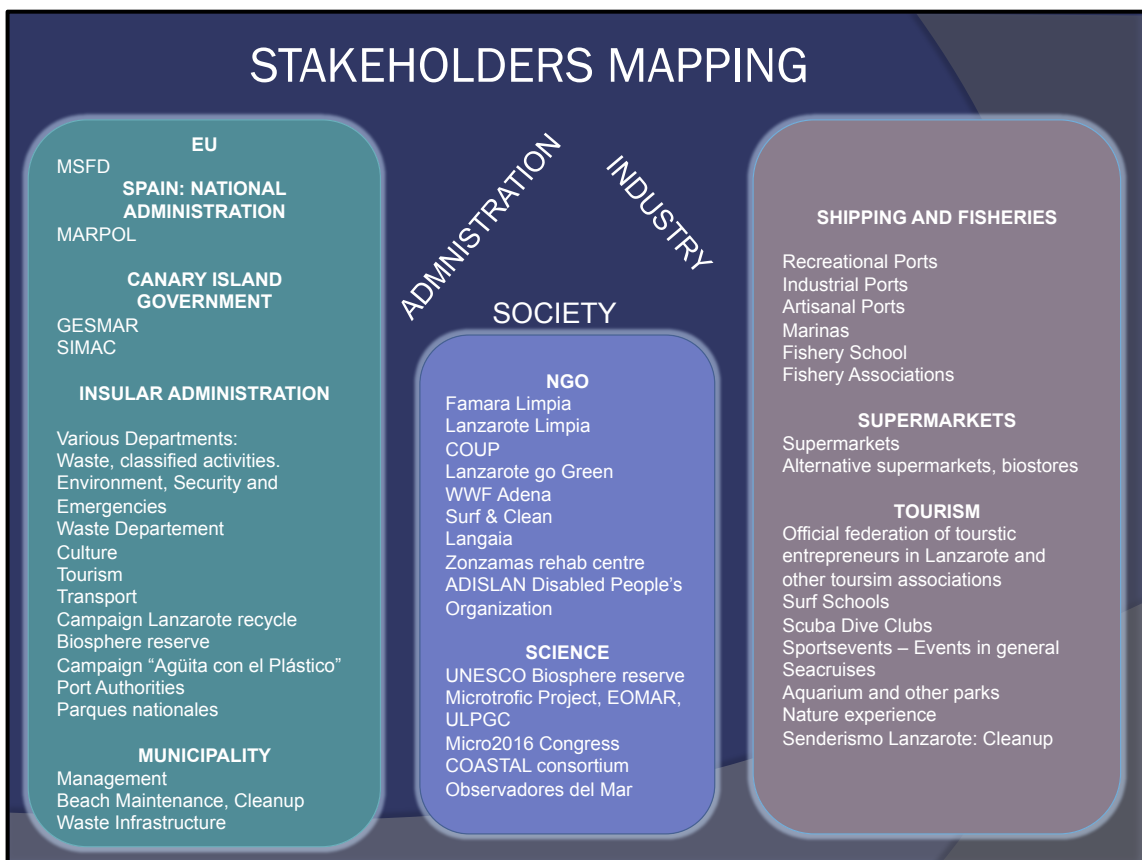


Figure 2. Stakeholders diagram.

The society is divided into science and non governmental organisation (NGO), mainly environmental activists. In the science settings, the Biosphere Reserve of Lanzarote plays an important role as the man and nature relation is studied for optimising the ecosystem services for both man and nature in general.

In cooperation of the Biosphere Reserve and Marine Science for Society an international conference about microplastic ([MICRO2016](#)) is organised on May 2016. Both partners are part of the COASTAL consortium. In the present the COASTAL consortium aims to (1) integrate technical and scientific knowledge of local communities and stakeholders; (2) improve awareness through increasing ocean literacy; and (3) implement pertinent local, regional, and transnational action plans.

In 2015 the University of Las Palmas (ULPGC) launched the [Microtrophic project](#) by the research group of ecophysiology of marine organism (EOMAR) studying the impact of microplastics on the food chain.

Environmental activists are also making a lot of effort for keeping the island clean. Regular beach cleanups are happening all over the island on a voluntary basis organised by Famara Limpia and [COUP](#). Other organisation like the WWF Adena and SOS Lanzarote also actively keep the beaches clean.

Already in the 70's a prominent artist, called César Manrique, raised awareness about the need of managing the islands resource, such as land, sustainable. Currently César Manrique Foundation continue with this important task. The association Lanzarote go Green promote a sustainable future for the island in general. Langaia is a biannual festival for the environment, where awareness about sustainability is raised and also beach cleanups are conducted.

In December a project started for regulating plastic bags in one village, Famara. This process was initiated by Surf & Clean and supported by the local municipality, COUP and Microtrophic project.

The variety of stakeholders indicates that a network about marine litter needs to be established, where the interaction of these is fostered. It seems that the current activities are dispersed, so the impact of the actions could be increased by coordinating and communicating the undertaken efforts. The COASTAL consortium tries to concentrate these activities, however the establishment of collaborative participation seems rather difficult. Time, space and financial means seem important for creating a functioning network.

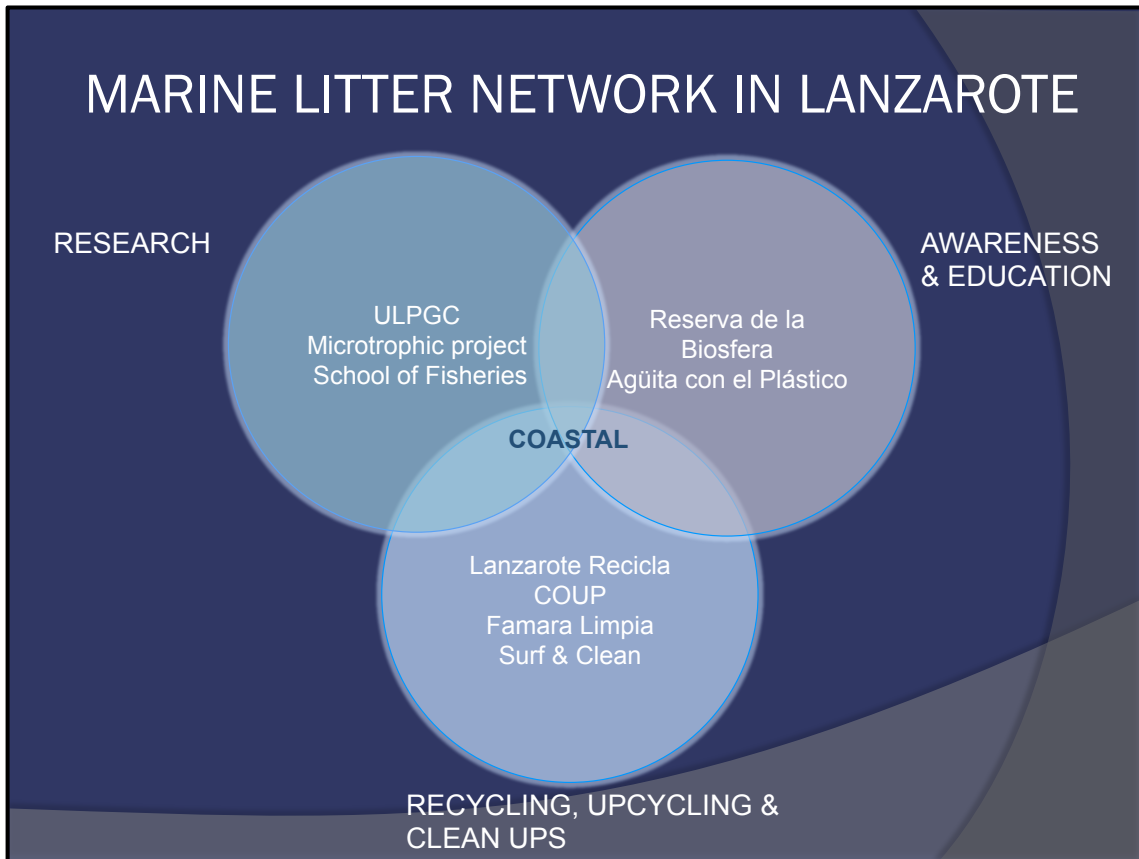


Figure 3. Marine litter network currently working in Lanzarote.

As described many activities aiming to reduce marine debris are conducted, however political commitment is needed for their success as a structural deficiency is observed. The legislation is not been practically implemented or not even formulated. In the case of microplastic a ban of products, mainly cosmetics with microbeads would be an answer. The installation of filters for washing machine that absorb synthetic fibres could be another act - however at this point in time, this seems as a rather expensive response (140\$/Unit), but in the long term, who knows? -. Providing adequate facilities at ports to catch also the plastic particles derived from sandblasting the hull during boat maintenance, seems as another feasible response. A catalogue of responses could be listed, however in the case of Lanzarote real political commitment is needed. How to increase the political will seems as a critical factor. This reports has the premises that through science, awareness and action, political commitment will augment consequently.

3-OBJETIVES AND ACTIONS

OBJETIVE 1: Determine the impact of plastic pollution in Lanzarote

Research to evaluate the impact on ocean health (ULPGC)

Activity 1.1 Study the impact of microplastics

Microplastics due its size, can be ingested by zooplankton and transferred up the food chain⁸. There are physical hazards associated with this ingestion, but in addition they pose a biohazard because microplastics absorb persistent organic pollutants (POP's), including polychlorinated biphenyls (PCBs). The POP's, because they are lipophilic, have a long half-

life, accumulate in the fatty tissue of organisms, and are biomagnified as they move up the food chain inexorably to humans. These chemicals can penetrate into the cells, chemically interact with important biomolecules, and disrupt the endocrine system⁹. In this regard, it is imperative to estimate the microplastic ingestion and egestion rates in zooplankton to determine the rate of incorporation and eventual transfer to their predators. Moreover, it is necessary to quantify the PCB absorption by microplastics and how it affects the organisms that ingest them. To date, there are no published studies on this topic in the Canary Islands. Accordingly, we propose four general coastal ocean research objectives including in Microtrophic Project by ULPGC:

- ✓ Assess the abundance and spatial variability of microplastic present in the intertidal and subtidal sediment, sea surface, water column and marine biota.
- ✓ Determine the rate of ingestion and egestion of microplastic at different concentrations in laboratory experiments in cultured coastal ocean zooplankton.
- ✓ Investigate microplastic transfer through the food chain in mesocosm experiments.
- ✓ Study the incorporation of PCB's in microplastic particles and their transfer to tissues of the zooplankton that ingest them and to determine the impact of these pollutants on the zooplankton physiological state.

Stakeholders: Microtrophic project ULPGC, School of Fisheries, Plástico 0.



Figure 4. Microplastic pollution in Famara beach. Photo by Microtrophic project. November 2015.

Activity 1.2 Study the impact of macroplastics

The impact of plastic waste on marine life is documented. They are responsible for the death and injury by entanglement, suffocation and ingestion. In Lanzarote no statistics exist on the number of deaths that occur due to plastics. The area of Environment of the Cabildo de Lanzarote has a Wildlife Service. The Program of Recovery in Damaged

Animals handles calls, collects and transports animals to the veterinary clinic and recuperative centres (Aquarium Costa Teguisse, Rancho Texas or Guinate Tropical Park) where due wildlife rehabilitation.

To study the impact of plastic on marine biota the following actions are proposed:

- ✓ Create a network to alert about dead or injured animals (birds, turtles and cetaceans) appearing at sea or in the coast by a telephone number (696 733 177 or other free call telephone).
- ✓ Publicize this number, especially in coastal areas, fishermen, diving centers, companies of sea-related activities (see stakeholder mapping).
- ✓ Create a single database with the registration of these animals and the possible causes of death (signs of strangulation, plastic in the stomach, fish nets entanglements, etc.).
- ✓ Conduct a study of the percentage of deaths and injuries due to plastics.

Stakeholders: Cabildo de Lanzarote, Biosphere Reserve, ULPGC, Aquarium Costa Teguisse, Rancho Texas, Guinate Tropical Park.

Activity 1.3 Socio-economic study

We propose a study to evaluate the impact of marine debris on tourism and economy in the island.

- ✓ Conduct a survey about the perception of pollution on beaches in tourists after their stay in Lanzarote.
- ✓ Conduct a economic study to evaluate the cost of inaction related to plastic pollution and compare it with cost of our action plan.

Stakeholders: Cabildo de Lanzarote, Biosphere Reserve, Lanzarote Recicla, ULPGC.

OBJETIVE 2: Improve education and awareness campaign

When we take a look at the oceans we can see that there are more plastic particles than zooplankton, so what can we do to solve it? We can do infinite actions, but if there is neither awareness nor education, it seems impossible to solve it.

To create awareness, we need however education. Who we will educate is an important aspect. During years people said that we need to clean up the world for our children. But what kind of children we leave to this world? It is essential to educate children to create a better world. However, the problem is upon us, so we cannot wait to educate children. It seems essential to educate the adults too, especially adults that educate children seem to play a critical role of raising awareness. We can summarize the objectives based on “investigate to spread” and “spread to create awareness”

First the problem and its impacts of needs to be explained to everybody. In the next words we try to enumerate some actions that the awareness project “Agüita con el Plástico” has done. Continue doing these actions is essential for a real behaviour change.

Activity 2.1 Continue and improve the awareness campaign “Agüita con el Plástico”

- ✓ Develop brochures explaining how plastic litter is affecting everyone. These brochures are distributed in street campaigns. It is an essential action because people can read the document at home and engross the thoughts about plastic pollution calmly.
- ✓ Organize street campaigns at events such as fairs, village celebrations, markets. The brochures are distributed for explanation the problem and promoting the project with personal interaction. How small actions already positively influences to reduce the plastic is shown. At these events it is very important to develop attractive acts for attracting the attention of the visitors. At the craftsmanship fair realized in a local village “Agüita con el plástico” had a hidden camera act. A bottle was placed on the floor in front of a recycling bin. The person who picked up the bottle and threw it into the recycling bin, was very surprised when a lot of people started to hail and they received an environmental guardian diploma.



Figure 5. Street awareness campaign by “Agüita con el Plástico”.

- ✓ Create a news bulletin to merchants and restaurateurs. In this bulletin the problem, the responses and alternatives are explained.
- ✓ Build a social network page as [Facebook](#), Twitter or similar where people can ask their questions and formulate their concerns.
- ✓ Create a link to media like TV or Radio and make an attractive program to get more and more awareness. “Biosphera TV” broadcasts a program with environmental instructors from “Agüita con el plástico” to explain the problem. This channel has a significant influence to the local population.
- ✓ Give non-plastic bags with awareness message, as these bags neither kill sea turtles nor contaminate so heavily as their plastic alternatives. This bags are distributed during the street campaigns to people willing to start to reduce their personal plastic footprint.



Figure 6. No plastic bags campaign by “Agüita con el Plástico”.

- ✓ Arrange gatherings with organizations, councils, local governments and any kind of business to try to make a response, introducing step by step some actions reducing the plastic use. Aiming to integrate all stakeholders in a collaborative participation process.
- ✓ Organize beach cleanups and invite as many people as possible. When people clean up beaches instantly awareness about marine litter raises. They will share their experience with family and friends and “the message” will spread alone.
- ✓ Design talks to motivate workers to get better waste management on their workplace such as safety briefings at work. A meeting with the companies management is the first step. If a CEO is conscious about marine litter and some realistic alternatives are offered, surely the person in charge will improve the waste management in their business.
- ✓ Perform activities for children at school, summer camps etc..These activities should be designed by experts on infant education to assure that the message is understood by children. “Agüita con el plástico” has performed activities where children have received a talk followed by educational games.
- ✓ Get some local celebrities to support the campaign spreading the message. After a famous Spanish music band supported “Agüita con el plástico”, immediately the number of followers in social networks increased significantly.



Figure 7. Clean-up campaign organized by COUP and Famara Limpia.

Stakeholders: Cabildo de Lanzarote, Biosphere Reserve, Lanzarote Recicla, Biosfera TV, environmental activists (see stakeholders map Fig. 3).

OBJETIVE 3: Generate benefits from waste: create a circular economy

With the trash to treasure approach the use of waste as resource is proved. The behaviour of recycling will be positively influenced as it is seen that recycling/upcycling generates local profits. This is especially important due to the persistence of the insular/urban myth that all, also recyclable, materials are thrown into the landfill. So not only marine litter, but also potential marine litter will be reintroduced in to the economy.

Activity 3.1 Bottle fund scheme

Lanzarote is an island without fresh water, for this reason all potable water is from desalinate marine water, but most citizens do not drink it. People commented that running water has bad tastes due to its chlorine. Consequently people from Lanzarote drink from bottles, because it is perceived to be the only way to drink healthy water.

According to the Environmental Agency of the Cabildo, in Lanzarote are about 500mt of plastic recycled each year. This equals about 50 grams of plastic per person/day, which usually weighs one bottle itself.

Combining these two facts of the low recycling rate and high bottle usage and taking the high unemployment rate into account, a bottle fund scheme seems a suitable solution. A small deposit is added to the costs of drinks, which is refunded when returning the beverage container. These monetary incentives have had a positive impact on many countries so far and increased the recycling rate significantly.

For the elaboration of such a scheme a variety of stakeholders need to participate. As Lanzarote mainly imports beverage the producer has a secondary role, but the retailers are

more engaged. A variety of options of bottle deposit scheme seem feasible. In Germany bottles can be returned to the retailer directly, however also a mechanical solution like the reverse vending machine seems a good solution.

Stakeholders: Cabildo de Lanzarote, municipalities, retailers, beverage producers, local communities.

Activity 3.2 Plastic free festivals –Cup concept

There are several social events organized by governments which are trying to reduce the single use plastic such as cups, bags, etc. but is necessary to real alternatives to it.

We propose the use of reusable plastic cups in the festivals organized or sponsored by local governments (Municipality, Ayuntamiento and Cabildo de Lanzarote). The price of reusable plastic cup is 1€ and this money is refunded when returning the cup. The returned plastic cups will be cleaned and sterilized by NGO. This activity could create jobs for groups at risk of social exclusion.

Stakeholders : Municipality, Cabildo de Lanzarote, Turism associations, Sport associations [ADISLAN](#), Rehab Centre Zonzamas, COUP.

Activity 3.3 Trash to treasure for single use plastic – synthetic bio-diesel

Synthetic Bio-diesel contains both, plastic and organics residues. So a win-win situation is created as the amount of waste entering the landfill is reduced and an independent energy source is generated, creating local income and jobs.

The initial feasibility study costs roughly 170,000 Euros and the installation of the plant costs about 5 millions Euros. This is based on an estimation of such a technology producer.

Stakeholders: COUP, Recoopera, a local energy cooperative, Waste council, Energy council, Lanzarote Recicla, Fundacion Canarias recicla, Supermarkets and gastronomy (see stakeholders map in Fig. 3).

Activity 3.4 Trash to treasure for the fisheries residues – net recycling

Fishing nets containing nylon can be reintroduced in the production process. Econyl makes carpets and swimming wear from fishing nets from European waters www.econyl.com. Whereas Bureos create skateboards in Chile from used fishing gear www.bureoskateboards.com.

A recycling system, where the fishermen directly profit (\$\$\$), would positively influence their littering behavior. This seems important as solid oil is accumulating along the northwest shore of Lanzarote. A major source are the offshore oil changes of boats., Local network between Ports, Fishery associations, individual fishermen, fisheries council, Lanzarote recicla, and international networking entrepreneurs and designers access all the human capital that is available.

Various approaches of implementation are feasible. Conventional decentralized collection system appear not so efficient due to their high costs. When the money spent, directly be handed to the fisherman, when bringing the broken fishing gear, a centralized collection system seems promising.

In general local innovation can create positive impact on both economy and ecology. Space for innovative entrepreneurs will foster this process. So an [Impact HUB](#) may is a suitable solution, where working space is offered and subsequently synergies are created.

Stakeholders: COUP, Cabildo de Lanzarote, School of Fisheries, Shipping and Fisheries (see stakeholders map in Fig. 3).

4- IMPLEMENTATION PLAN

The viability of the action plan depends mainly of two factors: political decisions and funding.

Some of the activities of the action plan are working and only need continuity: research about impact of microplastics (Activity 1.1) and awareness campaign “Agüita con el Plástico” (Activity 2.1). Other actions need private or public financing, particularly activity 3.3 Trash to treasure for single use plastic – synthetic bio-diesel; and activity 3.4 Trash to treasure for the fisheries residues – net recycling. In the actions of activity 3.3 the principal stakeholders to provide financial support could be the Cabildo de Lanzarote, Biosphere Reserve, Reopera, Waste council, Energy council and Lanzarote Recicla. In activity 3.4 probably the main interested stakeholders to provide funding could be the Port authorities, Sport and Industrial Ports and the Fishery School.

The activities 1.2 and 1.3 are not expensive and very interesting for government in order to know the real cost of plastic pollution for the island. Therefore the activity 1.2 could be carried on by the area of Environment of the Cabildo of Lanzarote; and the activity 1.3 could be financed by Cabildo de Lanzarote in collaboration with social science students of ULPGC.

Finally activity 3.2 is not expensive and really interesting to the island government because it decreases the amount of waste, reduces the cleaning cost after the festivals and generates employment in risk social of exclusion population.

The deliverables and milestones that we expected for each objective are the following:

OBJECTIVE 1

D1: Scientific papers published about microplastic pollution in the Canary Current.

D2: Database with the registration of death and injured animals and the possible causes. Scientific paper published about death and injuries in wild marine biota because of plastics.

D3: Technical report about cost of plastic pollution in Lanzarote.

M1: Increase the knowledge about ecological, social and economic consequences of plastic pollution in Lanzarote.

OBJECTIVE 2

D4: Report about number of citizen reached by awareness campaign with data of social media followers, schools and communities visited, number of clean-ups organized and number of participants, etc.

M2: Increase the concern about plastic pollution and build awareness for the local population.

OBJECTIVE 3

D5: Implementation of a bottle fund scheme.

D6: Implementation of plastic free events organized by public institutions in Lanzarote.

D7: Installation of Bio-diesel plant.



D8: Installation of a centralized collection fishing-nets system.

M3: Reduce the plastic waste in the island in about 30% (plastic bottles and fishing nets).

The milestones of this action plan integrates the goals of the Honolulu strategy, reducing land-based and sea-based sources of litter and reduce the amount and impact of marine debris on marine environment.

SCHEDULE OF DELIVERABLES AND MILESTONES

	YEAR 1				YEAR 2				YEAR 3				YEAR 4				COST APROX.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
OBJETIVE 1																M1	
Activity 1.1															D1		100,000 €
Activity 1.2															D2		9,000 €
Activity 1.3				D3													9,000 €
OBJETIVE 2																M2	
Activity 2.1															D4		160,000 €
OBJETIVE 3																M3	
Activity 3.1															D5		120,000 €
Activity 3.2															D6		60,000 €
Activity 3.3												D7					5,170,000 €
Activity 3.4							D8										200,000 €
TOTAL COST																	

-  Tasks currently in progress
-  Tasks that need financial support

References

1. PlasticsEurope. Plastics the Facts 2014-2015. 1-32 (2014).
2. Carpenter, E. J., Anderson, S. J., Harvey, G. R., Miklas, H. P. & Peck, B. B. Polystyrene spherules in coastal waters. *Science* **178**, 749–750 (1972).
3. Colton, J. B., Burns, B. R. & Knapp, F. D. Plastic particles in surface waters of the northwestern atlantic. *Science* **185**, 491–497 (1974).
4. Moore, C. J., Moore, S. L., Leecaster, M. K. & Weisberg, S. B. A comparison of plastic and plankton in the North Pacific Central Gyre. *Mar. Pollut. Bull.* **42**, 1297–1300 (2001).
5. Eriksen, M. *et al.* Plastic Pollution in the World’s Oceans: More than 5 Trillion Plastic Pieces Weighing over 250,000 Tons Afloat at Sea. *PLoS One* 1–15 (2014). doi:10.1371/journal.pone.0111913
6. Baztan, J. *et al.* Protected areas in the Atlantic facing the hazards of micro-plastic

- pollution: First diagnosis of three islands in the Canary Current. *Mar. Pollut. Bull.* **80**, 302–311 (2014).
7. Watkins, E. *et al.* *Marine litter*: socio-economic study Scoping report. *Scoping report* (2015).
 8. Setälä, O., Fleming-Lehtinen, V. & Lehtiniemi, M. Ingestion and transfer of microplastics in the planktonic food web. *Environ. Pollut.* **185**, 77–83 (2014).
 9. Teuten, E. L. *et al.* Transport and release of chemicals from plastics to the environment and to wildlife. *Philos. Trans. R. Soc. Lond. B. Biol. Sci.* **364**, 2027–2045 (2009).