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Plastic Waste Management and Leakage in Latin America and the Caribbean

Water and Sanitation Division
Climate Change Division

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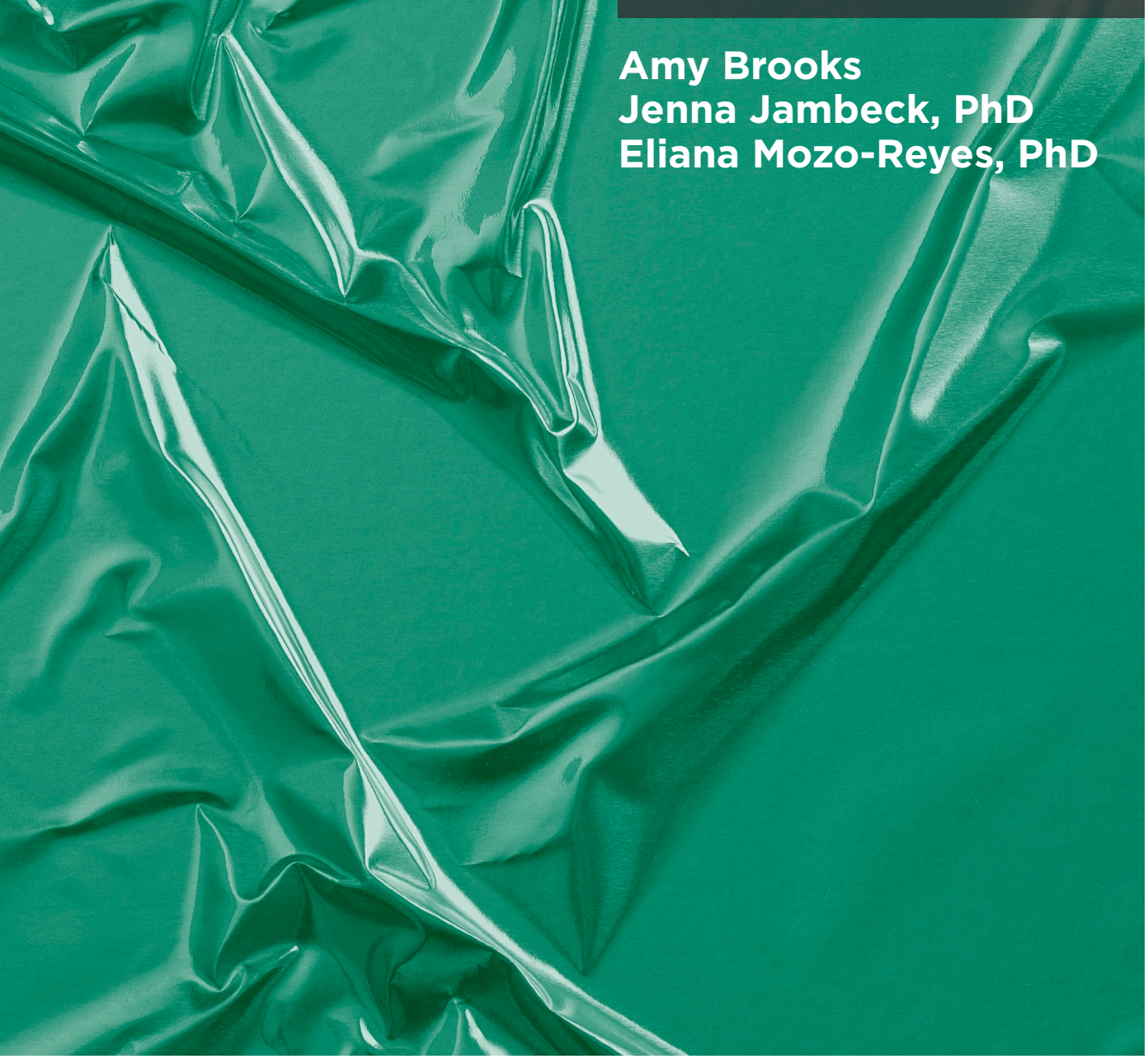

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Abbreviations

ANCAT	Associação Nacional dos Catadores e Catadoras de Materiais Recicláveis
ANLA	National Environmental Licensing Authority (Colombia)
COMUNA	Multi-sector Commission for Environmental Management and the Marine-Coastal Habitat (Peru)
COVID-19	SARS-CoV-2 coronavirus
DIRECTEMAR	General Direction of Marine Territories and Merchant Marine
EPR	Extended producer responsibility
EPS	Extended polystryene
GIRSU	Municipal Solid Waste Management with Recovery (Gestion Integral de Residuos Solidos Urbanos)
HDPE	High-density polyethylene
HIC	High Income
HS	Harmonized Commodity Description and Coding Systems
INP	National Institute of Fishing (Ecuador)
kg	Kilogram
kg/d	Kilograms per day
LAC	Latin America and the Caribbean
LCA	Life cycle assessment
LIC	Low Income
LMI	Lower Middle Income
MENA	Middle East and North Africa
mm	Milimeters
MMT	Million metric tonnes
MSW	Municipal solid waste
MSWM	Municipal solid waste management
MT	Metric tonnes
MT/yr	Metric tonnes per year
NGO	Non-governmental organization
ODS14	Sustainable Development Objective 14
PE	Polyethylene
PET	Polethyl terephthalate

Abbreviations

PHA	Polyhydroxyalkanoates
PLA	Polylactic acid
PNCLM	Fight Marine Debris Plan
PNGIDS	Waste Management National Program (Ecuador)
PNM- RESMA	Programa Nacional de Manejo de Residuos Sólidos en el Mar
PP	Polypropylene
PPE	Personal protective equipment
PS	Polystyrene
PVC	Polyvinyl chloride
RICV	La Red Iberoamericana de Ciclo de Vida
SEMARNAT	Secretariat of Environment and Natural Resources (Mexico)
SWM	Solid waste management
UCN	Universidad Católica del Norte
UMI	Upper Middle Income
UN	United Nations
UN Comtrade	United Nations Commodity Trade Database
UNESCO	The United Nations Educational, Scientific and Cultural Organization
USA	United States of America
USD	United States Dollars
VC	Vinyl chloride
W2E	Waste to energy

Introduction

Global Plastics Issue

As of 2017, 8.3 billion metric tons of plastic had been produced worldwide. Since about 40% is used in things that are thrown away relatively quickly (packaging and single use items), 6.4 billion metric tons had already become discarded materials needing to be managed [1]. Only 9% of these discarded materials were recycled globally, with the rest disposed of (12% was incinerated, and 79% ended up in our landfills or open environment) [1]. The annual estimate of plastic entering our oceans globally from the portion of this waste that is mismanaged on land is 5 – 13 million metric tons (MMT) per year [2], which is equal to about a dump truck of plastic entering the ocean every minute. This plastic input impacts our ocean, marine life, and even humans through potential health impacts [3-7]. There is now a strong global focus on the issue of plastics in our waste and our environment.

The end of 2019 and early 2020 brought COVID-19. This global pandemic changed not only our consumption habits of plastic, but how much we need it as well [8, 9]. Medical waste increased with more personal protective equipment (PPE) worn, as well as from the higher number of patients needing care. Residential waste also increased 15-25% with nearly every impacted country enforcing "stay-at-home" orders, people were consuming all food and conducting all activities (including work and school) from home [10]. People were also wearing PPE to leave home for essential food and other needs [9]. While at the same time, commercial waste from restaurants, stores, closed industries, and offices/places of work decreased by 16% [10]. This shift made formal collection, recycling and waste/plastic management more challenging and dangerous, with informal recycling workers having their own hurdles to circumvent as well [10, 11]. In addition, bans for single-use plastic that were in place have been lifted or stalled in some cases, and policies about using personal reusable mugs and bags have changed around the world [9]. While cleaning with soap and water does kill the coronavirus that causes COVID-19, the personal mixed with commercial use was considered too risky by some [9]. It remains to be seen whether changes from the pandemic are temporary or permanent.

Latin America and the Caribbean

This report focuses on municipal solid waste as a source of plastic input into the environment in Latin America and the Caribbean (LAC), which is comprised of 48 countries/economies. Waste that is discussed in this report is limited to municipal solid waste, and other types of waste including industrial, medical, electronic, etc. waste are considered outside of the scope of this report. While much of the attention regarding plastic inputs had been on other regions of the world, LAC has an extensive populated coast, 119,000 km of coastline and over 205 million people living within 50 km of that coastline [12, 13]. In addition, waste management infrastructure is still under development in some countries, and many (27) of the countries are of middle income status, where the highest growth in waste generation rates (related to increased consumption) and plastic in the waste stream often occurs [2, 14]. Economic growth without fully developed in-

frastructure can lead to increased leakage based upon global models. This report takes a closer look at the waste management infrastructure in the LAC region to better assess the following:

1. Virgin plastic production
2. Plastic Consumption
3. General and plastic waste generation
4. Plastic waste management
5. Plastic scrap trade
6. Plastic waste leakage (litter) quantity and characterization
7. Plastic waste future scenarios
8. Microplastic research, environmental and human health issues in the region
9. Focused case studies: Brazil, Chile, Colombia, Ecuador, Mexico, and Peru.

Virgin Plastic Production

Latin America encompasses approximately 4% of global virgin plastics production, which in 2018 was equal to about 14.4 MMT of 359 MMT [15] (Figure 2). The annual production in LAC has grown steadily with global production, with LAC remaining at about 4% of the total produced worldwide (Figure 1) with a cumulative virgin plastic production of 177 MMT (from 2005 to 2018). While plastic sectors are not described regionally, the largest global sector of plastic production is packaging at nearly 40%, followed by the building and construction sector (19.8%) and others (16.7%), which includes appliances, furniture, medical plastics, etc. [15]. Since at 4% of the total production of the world, the LAC is not a large producer of virgin plastic on a global scale, it is likely that the majority of plastics produced in the region are used within the region[1].

Besides traditional plastics that are made from fossil fuels, bioplastics (defined by European Bioplastics as plastics that are either biodegradable, biobased, or both) are also in production globally, and in the LAC region as well. In 2018, 2.11 million metric tons of bioplastics were produced worldwide, representing only <1% of total plastic production [16]. However, this is a rapidly growing industry driven by demand for alternatives to traditional plastic products. Therefore, global production of bioplastics is expected to continue increasing, with expected growth of 3.7% per year between 2018 and 2023. In comparison to traditional plastics, the LAC region shares a higher percentage of global production of bioplastics at 9%, representing 189,000 metric tons produced in the region in 2018 (Figure 2) [16]. This could be a result of the ethanol production in Brazil (second highest in the world [17]), facilitating the production of biopolymers from similar feedstocks.

Bioplastics and biodegradable plastics do not always represent the same material. Bioplastics are plastics made from non-fossil fuels and plant or other organic matter. They may or may not be biodegradable; some are, and some are not. Polylactic acid (PLA) is an example of a bioplastic typically made from corn (similar feedstock as ethanol). PLA is compostable in industrial settings (has to reach high temperatures to hydrolyze and begin biodegradation), but it is not biodegradable in any setting (e.g., in home composting or in natural soil) [18]. On the other hand, biodegradable plastics can be made from both biopolymers and traditional fossil-fuel based polymers (a good overview of the different biopolymers versus traditional polymers, as well as an overview of new and alternative materials is presented in A Sea of Opportunity [18]). Polyhydroxyalkanoates (PHAs), for instance, are a biodegradable polymer that can biodegrade in home compost systems and natural soils, but could be impacted by the different microbial systems on the ground or in waterways and the ocean which could slow or prevent complete biodegradation [19]. Issues with non-biodegradable plastics that contain

1 **While Mexico does export some virgin plastic materials to the USA (documented by trade value), more detailed publicly available data regarding the use of plastic resin, fibers, and products in the region are lacking, as much of the information is proprietary. Improved reporting of plastic within virgin production and manufacturing in the region would help with tracking.**

oxo-degradable additives (which fragment the material faster into microplastic) being labeled as biodegradable led to the UN's negative opinion on biodegradable polymers, with additional concerns also around the fact that they can perpetuate a single-use lifestyle [20]. Nonetheless, it is very likely that biopolymers and biodegradable polymers will be a part of integrated solutions to plastic pollution. However, plastic production and consumption, including bioplastics, are dynamic and will vary with the economy and other influencing factors like convenience, price points, marketing, social norms, logistics and distribution systems, as well as rapidly changing global scenarios such as climate change impacts and health crises like COVID-19.

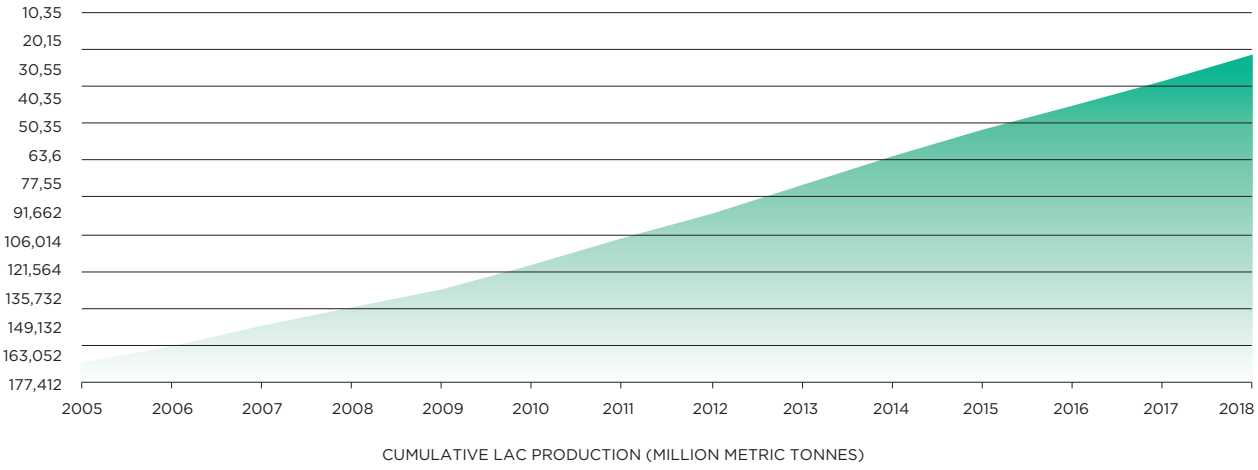

Figure 1. Cumulative Plastic Production in LAC Region (2005 – 2017) [15]

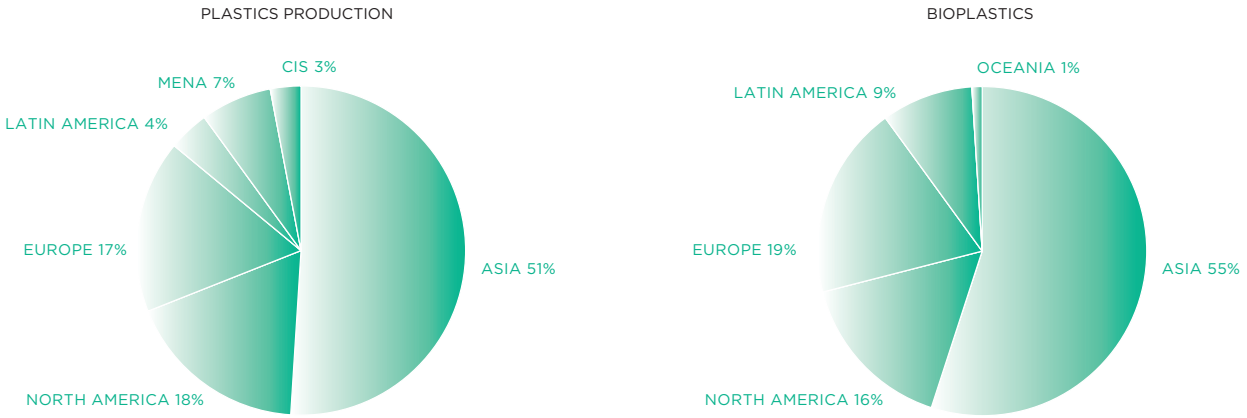

Figure 2. Plastics (2019) and Bioplastics Production (2018) in Global Regions [15, 16]

Export of virgin polymer and plastic materials does occur out of LAC, especially Mexico (but were not a large focus of this report). Exported materials have numerous categories including: polymers of aldehydes, ethylene, propylene, styrene, VC, halogenated olefin, etc. and also includes items like paints, natural polymers, [tubes, pipes, hoses (all in one)], [floor, wall, ceiling coverings], [plates, sheets, film, foil, etc.]. What seemed most pertinent to this report was data for virgin polymers of ethylene, vinyl chloride, styrene, and propylene. None of these polymers had quantities reported in mass in the UN Comtrade database, but did report a trade value. Based on the trade value data, in 2019, Mexico exported the four polymers outlined above to 33 different countries, totaling $1.04 billion USD. Primary destinations are USA (56%) and China (10%), followed by The Netherlands (5%), Brazil (4%), and Dominican Republic (4%). About 26% of these four polymer types go to other LAC countries.

Plastic Consumption

LAC ranks fourth (tied with the rest of Asia, excluding Japan, India and China) for quantity of plastic consumed as a region in 2016 with 8% of the global consumption (top ranked is NAFTA countries, including the rest of North America at 21%, followed by China at 20%, and Western Europe at 18%) [21]. In 2017, data on consumption of plastic in LAC was compared with Mexico on an annual basis. Mexico reported 48 kg of plastic was consumed per person in 2017, compared to the overall average for the region at 32 kg per person in 2017 [22].

General and Plastic Waste Generation

According to the World Bank [14], the LAC region generates 11% of the world's municipal waste (higher than Africa (6%) and Middle East (9%), but lower than North America, South Asia, Europe and Southeast Asia). On a per person municipal waste generation rate, according to the World Bank, the LAC region has the third highest per person waste generation rate at 0.99 kg/person/day, only less than North America, and Europe and Central Asia. This general generation rate is also higher than the global average of 0.74 kg/person/day. The range of general waste generation rates in LAC is relatively wide, with the minimum, 25th and 75th percentiles close to the Middle East and North African (MENA) Region, and the maximum more similar with Europe and North America (Table 1).

Table 1. Average and Range of National Waste Generation Rates (municipal waste) by Region

REGION (KG/PERSON/DAY)	2016 AVERAGE	MINIMUM	25TH PERCENTILE	75TH PERCENTILE	MAXIMUM
Sub-Saharan Africa	0.46	0.11	0.35	0.55	1.57
East Asia and Pacific	0.56	0.14	0.45	1.36	3.72
South Asia	0.52	0.17	0.32	0.54	1.44
Middle East and North Africa	0.81	0.44	0.66	1.40	1.83
Latin America and Caribbean	**0.99**	**0.41**	**0.76**	**1.39**	**4.46**
Europe and Central Asia	1.18	0.27	0.94	1.53	4.45
North America	2.21	1.94	2.09	3.39	4.54

Source: [14]

The high overall waste generation rates from a few territories/countries (that are high income and have relatively high tourism) increase the regional average and come from (in order from highest to lowest): U.S. Virgin Islands (4.46 kg/person/day), British Virgin Islands (3.75 kg/person/day), Cayman Islands (3.43 kg/person/day), Puerto Rico (3.28 kg/person/day), and Aruba (2.91 kg/person/day) (Table 2). In terms of the same overall per person waste generation rates, the LAC region being, on average, the most urbanized region (about 80% urban) still has a lower overall waste generation rate on average per capita than North America, which has only a slightly higher urbanization rate, but generates over double the quantity of waste per person per day (2.21 kg/person/day) [14]. This could mean the LAC region is not following the typical trend of increasing waste with increasing urbanization at this time, or that other factors, like a stratified urbanization, lower per capita income in urban areas, and/or waste generation rates skew the typical correlation observed. It is an interesting issue to explore further in the region.

In terms of waste composition, according to the most recent World Bank data compiled on the region, food and organic (green) waste makes up the largest percentage of the waste stream in LAC countries by mass (52.4% on average), followed by other materials (not identified) at 15% and then paper and cardboard (13.1%) [14]. Plastic is the fourth largest component by mass of the LAC municipal waste stream, encompassing 12.4% on average [14]. Country-level waste composition data in LAC region show that the percentage of plastic by mass in the waste stream ranges from 6.3% in the British Virgin Islands to 23.2% in St. Kitts and Nevis (Table 2). Based upon 2020 population values [13] and World Bank statistics [14], the overall total waste generated in LAC region based upon the model developed for this work (See Table A3 in Appendix) is 232.8 MMT. The total plastic waste generated is 28.8 MMT (Table 2, Figure 3).

Table 2. Countries in LAC, Waste Generation Rates and Percent Plastic

COUNTRY	ECONOMIC STATUS[A]	WASTE GENERATION RATE [KG/PERSON/DAY][A]	% PLASTIC IN WASTE STREAM	2020 PLASTIC WASTE GENERATED [MT][B]
Anguilla	HIC	2.10	12.4	1,719
Antigua and Barbuda	HIC	0.90	13.0	4,193
Argentina	UMI	1.14	14.6	2,764,776
Aruba	HIC	2.91	12.4	15,729
Bahamas	HIC	1.85	13.0	29,646
Barbados	HIC	1.72	17.1	31,622
Belize	UMI	0.76	19.0	21,061
Bolivia	LMI	0.57	10.2	246,843
Brazil	UMI	1.04	13.5	10,849,597
British Virgin Islands	HIC	3.75	6.3	3,223
Cayman Islands	HIC	3.43	11.0	8,531
Chile	HIC	1.15	9.4	717,586
Colombia	UMI	0.76	12.8	1,746,950
Costa Rica	UMI	0.86	11.0	176,028
Cuba	UMI	0.67	9.6	259,631
Curacao	HIC	0.55	12.4	3,767
Dominica	UMI	0.50	16.0	2,168
Dominican Republic	UMI	1.08	10.0	413,898
Ecuador	UMI	0.89	11.4	628,233
El Salvador	LMI	0.77	10.0	182,151
Falkland Islands	HIC	2.10	12.4	304
French Guiana	UMI	1.20	12.4	15,788
Grenada	UMI	0.83	16.4	5,619
Guadeloupe	UMI	1.20	12.4	20,469
Guatemala	UMI	0.47	17.3	508,807

Guyana	UMI	0.72	14.2	27,996
Haiti	LI	0.58	12.7	297,567
Honduras	LMI	0.65	14.4	315,735
Jamaica	UMI	1.00	12.2	125,066
Martinique	HIC	2.10	12.4	34,098
Mexico	UMI	1.16	10.9	5,937,255
Montserrat	UMI	1.20	12.4	292
Nicaragua	LMI	0.80	12.4	224,614
Panama	HIC	1.03	12.0	175,678
Paraguay	UMI	0.76	12.4	247,377
Peru	UMI	0.75	10.5	919,104
Puerto Rico	HIC	3.28	10.4	397,067
Saint Kitts and Nevis	HIC	1.67	23.2	7,611
Saint Lucia	UMI	1.21	22.0	16,176
Saint Martin	HIC	1.71	12.4	2,520
Saint Vincent and the Grenadines	UMI	0.79	8.4	2,456
Sint Maarten (Dutch part)	HIC	2.10	13.0	4,369
Suriname	UMI	0.41	11.0	10,034
Trinidad and Tobago	HIC	1.47	19.2	124,332
Turks and Caicos Islands	HIC	2.10	16.3	6,987
Uruguay	HIC	1.01	11.0	137,372
Venezuela, RB	UMI	0.88	12.4	1,140,880
Virgin Islands (U.S.)	HIC	4.46	13.0	22,482
TOTAL				**28,835,411**

a Data from World Bank What a Waste Report 2.0 [14]
b Values calculated in this study [2]

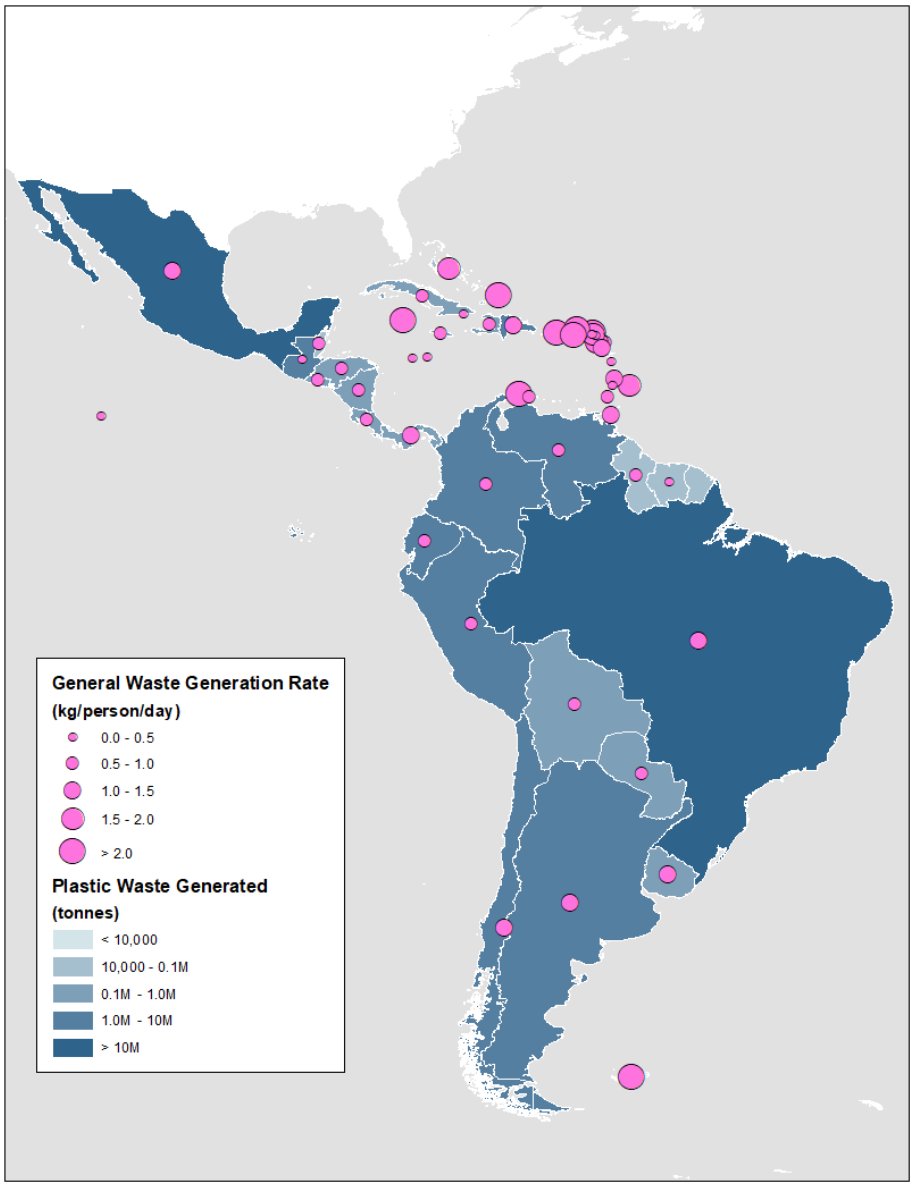

Figure 3. General Municipal Waste Generation rate (kg/person/day) and Plastic Waste Generated by Country in the LAC Region (metric tons)

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Plastic Waste Management

Collection

Collection of waste materials is a critical step in the waste management process. Home-based collection is the most convenient for citizens with drop-off collection centers as a second approach to manage waste properly. As such, waste collection coverage varies in the LAC region. Based upon data from the World Bank, 81% of waste generated in the LAC region is collected, and 84% of the population has waste collection coverage. According to Kaza et al. (2018), 85% of urban waste is collected while only 30% of rural waste is collected [14]. In general, coverage of 95% and greater is typical in many cities in middle and high income countries in the region. The lowest city collection rate is 12% in Port au Prince, Haiti [14]. Country-wide, collection coverage (where reported) by percentage of population ranges from 46.6% reported by Paraguay to 100% collection reported by St. Lucia (Table A1, in Appendix).

End-of-Life Management

Waste management encompasses a multitude of techniques and methodologies ranging from formal waste management infrastructure from sanitary landfills and materials recovery/recycling facilities to informal systems like waste picking and independent collecting. Several types of landfills and open dumping methods occur for management of waste. Sanitary landfills are landfills designed with liner systems, leachate and gas collection, along with placing waste in the landfill with compaction and daily cover, as well as restricting the site to workers only. Non-sanitary landfills may also be termed controlled dumpsites, which may not have liner systems, or leachate and gas collection, but might have more structured placement methods and restricted access to the site (although waste pickers may still be allowed). Waste may still blow out of a controlled dumpsite if daily cover is not used. Open dumping is placing waste in pits or on the ground without any structured methods, without any gas or leachate management, and with open access to anyone or any animals to pick through or be exposed to the waste. Waste may be blown, washed or carried away from an open dumpsite. Illegal dumping of waste may also occur along roadsides or in rural areas, but these are separate occurrences to disposal at landfills or open dumpsites. Open air burning of waste in residential areas or at dumpsites, also occurs as a form of waste management. Waste management data from the World Bank is reported for each country based on the following categories: Controlled Landfill, Sanitary Landfill, Recycling, Composting, Anaerobic Digestion, Incineration, Advanced Thermal Treatment, Waterways, Open Dumping, Other, Unaccounted For, and Unspecified [14]. LAC as a region manages waste by 26.8% open dumping, 69% landfilling (approximately 52.4% sanitary landfill, 14.6% controlled landfill and 1.5% landfill unspecified), 4.5% recycling and 1% or less of composting and incineration. Definitions of terms used in this section can be found in Table A2 in the Appendix.

Landfilling and Open Dumping

The total portion landfilled (69%) is the highest percent of waste managed in landfills in the world (compared to all other World Bank regional

averages). The next highest landfilled percentage is North America at 54% [14]. The open dumping percentage (26.8%) compares to open dumping in the Europe and Central Asia region (25.6%) [14]. The practice of open dumping in the LAC region ranges from 4% reported in Colombia to 84% reported in Trinidad and Tobago [14].

Recycling

The LAC Region has the lowest reported average recycle rate (for all waste) across all regions at 4.5%, but it is just below the reported 5.1% in the South Asia region [10]. Data associated with plastics-only recycling in LAC is unknown but is likely lower than other more valuable materials like metals and paper. In formal waste management systems, operations and plastics recyclers are typically private companies and governments, and may or may not require detailed reporting. The informal waste sector is not quantitatively considered in the recycling rates of the 2018 World Bank report. See the section below on the informal sector for more discussion.

Mismanaged Waste

For the estimate of mismanaged plastic waste and plastic waste available to enter the ocean, mismanaged plastic waste was considered to be the sum of plastic waste that is inadequately managed or littered. Inadequately managed waste is waste that is not managed in a controlled setting, cannot be accounted for and is usually part of other (often informal) methods (Table A2, in the Appendix). The World Bank values for Open Dumping, Unaccounted For, and Other were used to inform this percentage of inadequately managed waste for each country. In addition, where Landfill Unspecified, Unaccounted For and Other values existed, each country was investigated further in a literature search for more information about their waste management systems. The Unaccounted For category typically represented countries that had minimal reporting coupled with little evidence of proper management of waste. The Other category included open burning and burying. For countries that had a value reported for the Landfill Unspecified category, the associated waste management literature was reviewed and decisions on whether to include the value in the inadequate percentage were made on a case-by-case basis.

Informal Sector

The informal sector is extensive and active within the LAC region and plays a significant role in the quantities of plastics that are collected and recycled. Informal waste workers are typically external to formalized, government led or registered private enterprises, and work independently within an informal economic system, often collecting only waste that has value to sell. As such, informal workers are more likely to be exposed to unsafe health and environmental conditions and often have less access to safety equipment and procedures. Cities studied by the World Bank report numbers of waste pickers from 175 in Cusco, Peru, to 20,000 in São Paolo, Brazil. The average number of active waste pickers in many larger cities is approximately 4,000 people collecting and processing recyclable materials [14]. Latin American countries make up the largest position of countries with waste pick-

er cooperatives that are members of the Global Alliance of Waste Pickers; these countries are Argentina, Brazil, Bolivia, Chile, Costa Rica, Colombia, Ecuador, Dominican Republic, Paraguay, Peru, Puerto Rico, Venezuela, Uruguay and Nicaragua [23]. Informal workers already contribute to the management of solid waste and prevention of pollution from plastic and even climate attenuation through recycling. In recent work, informal recycling had the potential of attenuating the climate change index by 10% for the municipal solid waste system [24].

Inclusion of the informal sector in the development of infrastructure has many benefits; current workers are experts on the front lines of waste management and including them, with improved conditions, recognition and respect, preserves thousands of people's livelihoods [25]. Aparcana (2017) classified formalization of informal sectors into three categories: 1) informal waste workers organized in associations or cooperatives, 2) organized in community based organizations or micro- and small enterprises, and 3) contracted as individual workers by the formal waste sector [26]. The study also explored measures for removing barriers to formalization, classifying them into five other categories: policy/legal, institutional/organizational, technical, social, and economic/financial. Twenty case studies of formalization were examined and possible links between approaches to formalization and barriers, 'persistent' challenges, and key enabling factors improving the likelihood of successful formalization were all discussed [26].

Information sharing about the informal sector can be found through the Open Knowledge portal of the Regional Initiative for Inclusive Recycling [27]. For example, Brazil's Recycling Yearbook 2017-2018 is posted; this document was created by ANCAT (Associação Nacional dos Catadores e Catadoras de Materiais Recicláveis) and Pragma Soluções Sustentáveis, with the aim of giving visibility to the importance of recyclers in the recycling chain [28]. The document reports 26,000 tonnes of plastic recycled by the pickers in Brazil for one year, from 2017 to 2018, of which 28% of the mass and 40% of the value, was PET [28]. To further highlight the importance of recyclers, from the same Regional Initiative for Inclusive Recycling source [11], it's established that only 2% of cities in the LAC region have formal recycling programs and that up to 50% of all recycling in the LAC region is contributed by approximately two million informal recycling workers. Accordingly, eleven countries including Colombia, Brasil, Ecuador, Peru, Chile, and Argentina legally recognize recyclers labor in their MSWM with Recovery frameworks (GIRSU from its Spanish initials). Additionally, government support of the informal recycling sector through regulation, recognition, and educational initiatives has been present in Mexico, El Salvador, Colombia, Ecuador, Brazil, Peru, Chile, Argentina, Dominican Republic, and Panama.

Plastic Scrap Trade

The UN Comtrade Database [29] provides international trade data regarding imports and exports of plastics. Trade data were organized on the basis of the Harmonized Commodity Description and Coding Systems (HS), an international nomenclature structure for international trade commodities, which was implemented by the UN in 1988. Countries report trade data based on the HS code. Trade flows are reported in mass (kg) of exports and imports. The plastic "waste, parings, and scraps" of PE, PS, PVC, and other plastics (which scrap polymers that do not have an individual HS code like PP and PET). The available data for PE, PS, PVC, and other plastics from 1988 to 2018 were used to examine the regional trends of international trade of plastic scrap from the LAC. Trade patterns were analyzed over time by country and individual polymer.

LAC Region

According to Brooks et al. (2018) [30], the LAC region was the fourth highest plastic scrap exporting region out of eight with 5.9% of exports between 1988 and 2016. The region was the third lowest plastic scrap importing region out of eight at 0.8% of imports in the same time period (1988 – 2016). Cumulatively over the 28 years, the region has exported 12.6 MMT and imported 2 MMT. This data illustrates that the LAC region relies more on exporting plastic scrap than importing it. The Brooks et al (2018) data has been subsequently updated through 2018 and reported here for the LAC region (Figure 4).

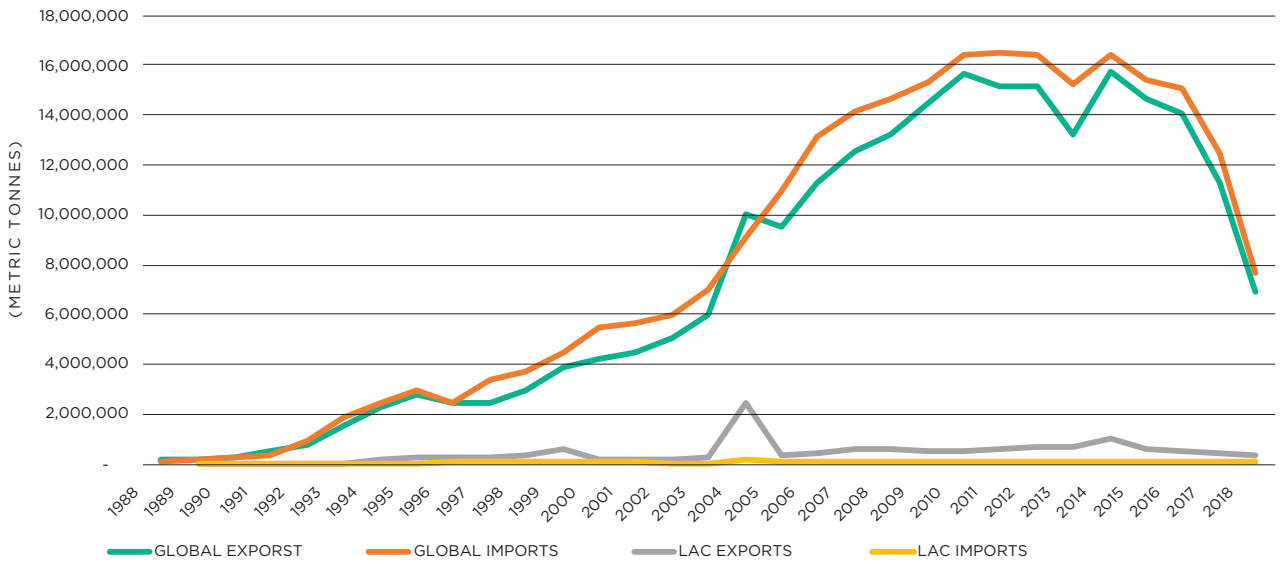

Figure 4. Annual Trade of Plastic Scrap: Global and LAC Region [27]

Plastic Scrap Trade by LAC Country

From a global perspective, Mexico is the only country in the region to be in the top exporters globally (fifth in Brooks et al., 2018 [30]) having cumulatively exported 10.5 MMT of plastic scrap, or 4.9% of global exports from 1988 to 2016. As of 2018, Mexico still leads the region cumulatively in both exports and imports, having traded 85% of the regions plastic scrap exports and 58% of the regions plastic scrap imports (Table 3 and 4). In 2018, the largest fraction of Mexico's exports (33%) went to the USA. Still 4% of them went to China (even with the new import restriction policy in place) with another 4% going to Malaysia. In addition, 2% went to both Latvia and the category of "other Asia, nes", where "nes" stands for "not elsewhere specified" and most commonly is Taiwan. Cumulative trade from 1988 – 2018 for all LAC countries with trade data available are provided in Table A3 in the Appendix.

Table 3. Top 10 Plastic Scrap Exporters in LAC Region (cumulative 1988 – 2018) [30]

COUNTRY	CUMULATIVE EXPORTS (METRIC TONS)	% OF REGION	% OF WORLD
Mexico	11,212,367	83%	5.0%
Argentina	423,065	3.1%	0.2%
Ecuador	228,122	1.7%	0.1%
Dominican Republic	224,347	1.7%	0.1%
El Salvador	196,967	1.5%	0.1%
Brazil	167,870	1.2%	0.1%
Chile	164,966	1.2%	0.1%
Costa Rica	118,058	0.9%	0.1%
Guatemala	114,848	0.9%	0.1%
Nicaragua	104,682	0.8%	<0.1%

Table 4. Top 10 Plastic Scrap Importers in LAC Region (cumulative 1988 – 2018) [30]

COUNTRY	CUMULATIVE IMPORTS(TONNES)	% OF REGION	% OF WORLD
Mexico	1,312,267	58%	0.5%
Brazil	133,467	5.9%	0.1%
Colombia	122,278	5.4%	<0.1%
Chile	112,089	5.0%	<0.1%
Costa Rica	104,654	4.6%	<0.1%
El Salvador	100,297	4.4%	<0.1%
Bahamas	70,690	3.1%	<0.1%
Peru	55,101	2.4%	<0.1%
Ecuador	47,752	2.1%	<0.1%
Dominican Republic	46,027	2.0%	<0.1%

Plastic Scrap Trade by Polymer

Plastics that have more inherent value (e.g., PET bottles or high-density polyethylene (HDPE) used in detergent bottles and food packaging), have become a global commodity encompassing the largest fraction of what is traded globally [30]. LAC countries primarily export the "other plastics" category of the UN Comtrade database, which represents polymers of plastic that are not specified individually by the harmonized system [29]. This category includes PET bottles and polypropylene (PP), which is often used in food packaging and containers (Figure 5).

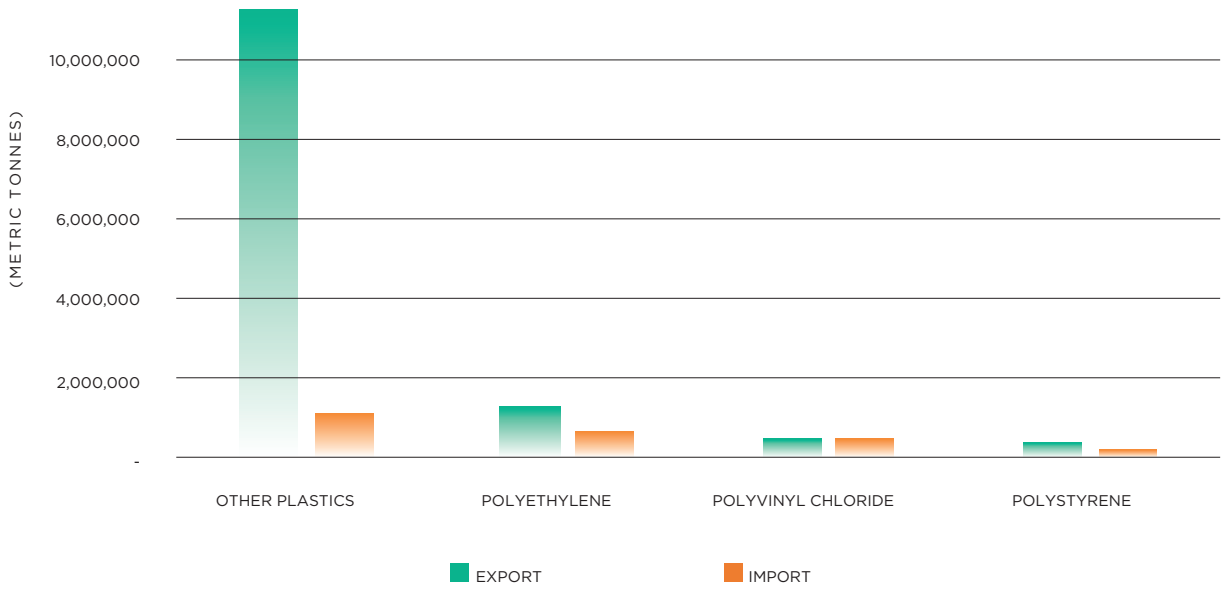

Figure 5. Cumulative Trade of Plastic Scrap by Polymer in LAC Region (1988-2018) [30]

Plastic Scrap Trade Impacted by China Restrictions

China was historically the world's largest importer of plastic scrap. However, on December 31st, 2017, China implemented a policy restricting the import of 24 different waste materials, including plastic scrap. This policy had cascading significant impacts on the global recycling industry, and put pressure on historical exporters (e.g., USA, Germany, Japan, etc.) to manage their waste domestically or elsewhere. It is estimated that the ban could potentially displace 111 MMT of plastic scrap that would have been imported into China by 2030 [30]. Since most LAC countries do not constitute a large part of the global exports of plastic scrap, the Chinese policy likely has not had as extreme of an impact regionally on exports as other regions that rely heavily on exporting waste, except for Mexico as the largest exporter (Mexico still exported a small percentage, 4% to China in 2018). With the new Chinese policy in place, it does not yet appear that more imports are coming to the LAC region, although this may change in the future. Overall imports to the region decreased by about 12% from 2017 to 2018. Globally exports worldwide are down about 38% in that same timeframe.

Plastic Waste Leakage

Municipal Solid Waste (MSW)

Based upon previously published values for 2010 [2], 46 countries/economies (48 countries/economies minus land-locked Bolivia and Paraguay) located in the LAC region contributed 7.2% (2.3 MMT of 32 MMT) of the global coastal mismanaged plastic waste available to enter the ocean. For this study, a similar, but updated, model to Jambeck et al., 2015 [2] was developed to estimate the quantity of land-based plastic waste potentially available to enter the ocean for the LAC region (see model details in Table A4, in the Appendix). The updates to the model included 2020 coastal populations [13] and new waste metrics from the Word Bank What a Waste 2.0 [14]. Coastal populations are defined as people living within 50km of the sea, similar to Jambeck et al., 2015 [2]. All the LAC countries included in this analysis have a coastline except for Bolivia and Paraguay. However, there is potential for mismanaged plastic from landlocked countries to enter the ocean via rivers. In Bolivia, for instance, the Rio Beni is a tributary of the Amazon River. In Paraguay, the Rio Parana is adjacent to Asuncion (population 1.5 million approx.) and is one of the most important basins in South America that flows to the ocean. The mismanaged plastic waste percentages in the region (as defined in the previous sections on waste management) range from 2% in the Cayman Islands, US Virgin Islands, Martinique, and Turks and Caicos, to 49% in Haiti, with an average of 19% mismanaged plastic waste (Table A3 in the Appendix). The total estimated plastic waste available to enter the ocean in LAC in 2020 is **3.7 MMT** (Figure 6). This 2020 quantity is about one and a half times more than was estimated in 2010 (2.3 MMT). Under business-as-usual projections, the regional quantity available to enter the oceans in 2030 becomes 4.1 MMT and in 2050 becomes 4.4 MMT. Tables A5-A7 provide estimates listed by country for 2020, 2030, and 2050.

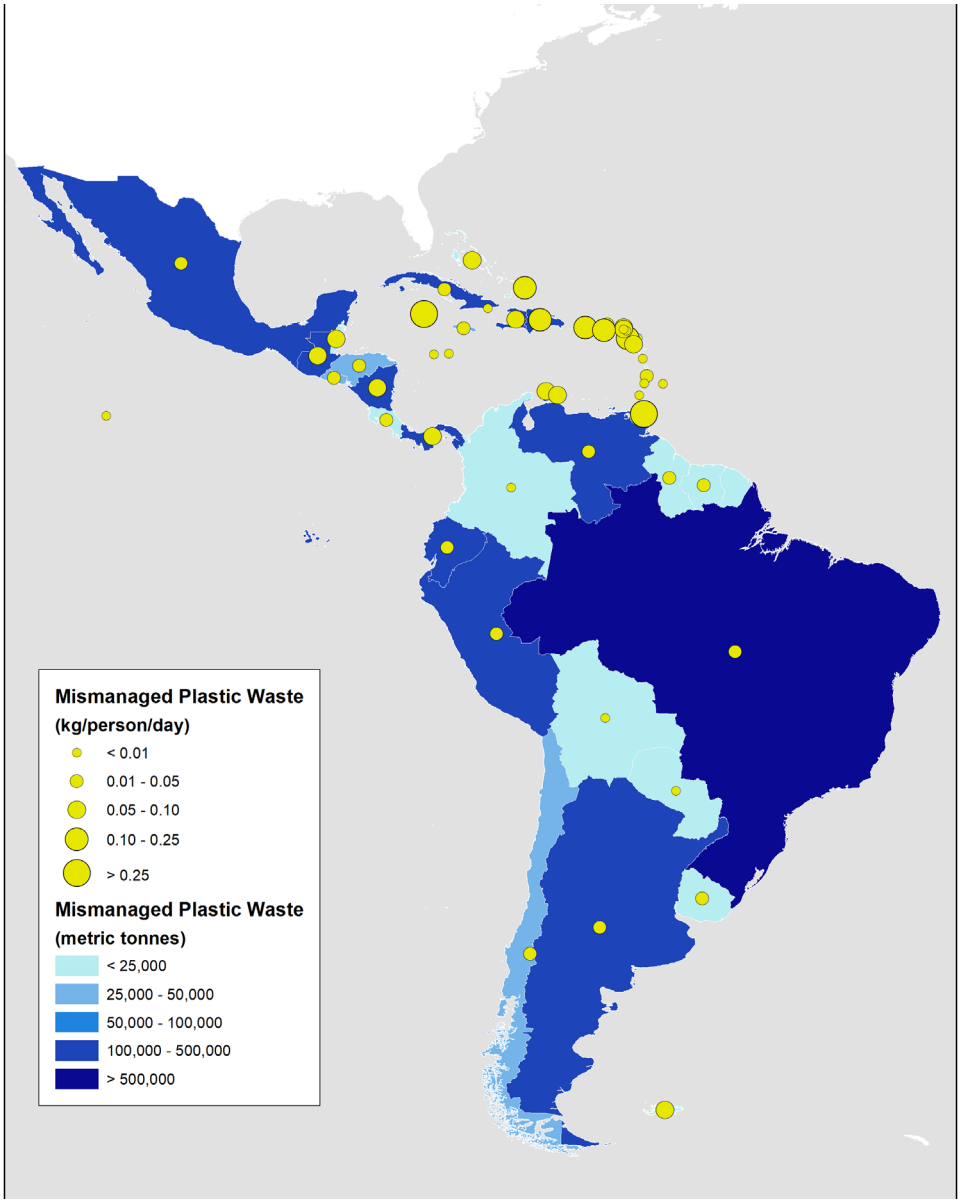

Figure 6. Estimated Mismanaged Plastic Waste in LAC

The growth in this new model is slower than previously predicted in Jambeck et al. (2015) [2] likely because of the updated waste generation rates from more recent data. The 2025 estimate made in Jambeck et al. (2015) was 4.3 MMT, a value not predicted to be reached by this new model until 2040. In general, the countries with more waste available to enter the ocean are upper middle-income countries, but with an average mismanaged waste percentage of 26%, the mismanaged waste is driven by coastal population density. Haiti is the only low income (LIC)

country in the region and has the third highest plastic quantity available to reach the ocean, driven by the lack of waste management options in the country. See Figure 7 for this trend and Tables A3 though A5 in the Appendix for detailed list of country data. Because of its proximity to the ocean, some percent of the coastal mismanaged plastic waste enters the ocean, but those values are still unknown and not well described in the literature yet, but 15%, 25% and 40% were applied to coastal mismanaged waste in Jambeck et al. (2015) [2].

In some cases, a total quantity (based upon the entire population, not just coastal population) of mismanaged plastic waste in a country or region is important to examine. Several LAC countries have mostly coastline (e.g., small islands, Chile), while others also have a large inland component (e.g, Brazil). Therefore, we also calculated the total quantity of mismanaged plastic waste per country-wide in the LAC Region (details for each country are provided in Tables A8 – A10 in the Appendix). The total quantity of mismanaged plastic waste based upon total country population in 2020 is 8.4 MMT. In 2030 and 2050 this increases to 9.2 MMT and 10.3 MMT, respectively. Figure 7 shows the trend of increase in a "business as usual" scenario, as well as a comparison of coastal versus total population mismanaged plastic waste for the LAC Region.

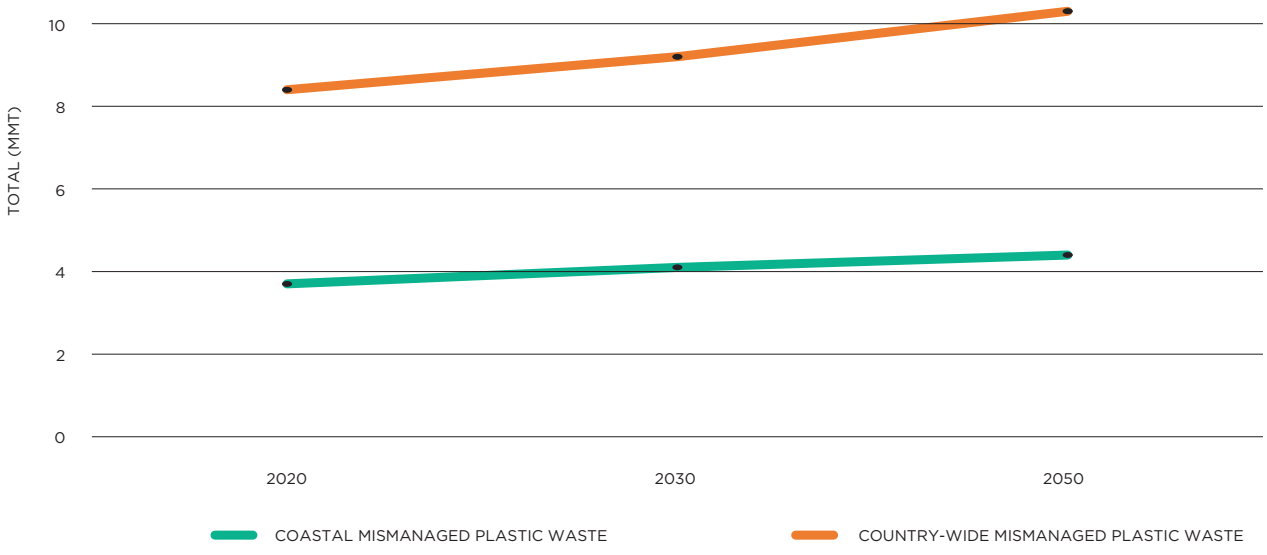

Figure 7. Coastal and Total Population Mismanaged plastic waste for the LAC Region 2020 – 2050

Other Sources

There are other sources of plastic into the ocean and these can include both macro (large) items and microplastic (less than 5mm in size) items. Maritime sources include lost, discarded and derelict fishing gear from both commercial and recreational fishing, aquaculture, and losses from shipping. Microplastic can enter the ocean via non-treated and treated wastewater discharges and from run-off from the land where plastic fragments into smaller pieces. These are additive sources of plastic into the aquatic systems and ocean in the LAC region and regional research on microplastics is discussed in subsequent sections. Maritime sources of plastic may warrant further investigation as this report focused primarily on municipal solid waste as a source of plastic input into the environment and waterways.

Litter Characterization

Data from the 2018 International Coastal Cleanup show that cigarette butts are the most commonly found item in the world. Cleanups held in the LAC Region for the annual event totaled to 4,490,000 items, weighing 917 MT. The top 10 items collected globally are all plastic items, and in LAC these items made up more than 50% of the entire items collected. In the LAC Region, the top three most reported items include plastic beverage bottles (13.3%), cigarette butts (7.72%), and plastic bottle caps (7.38%) (Figure 8) [31].

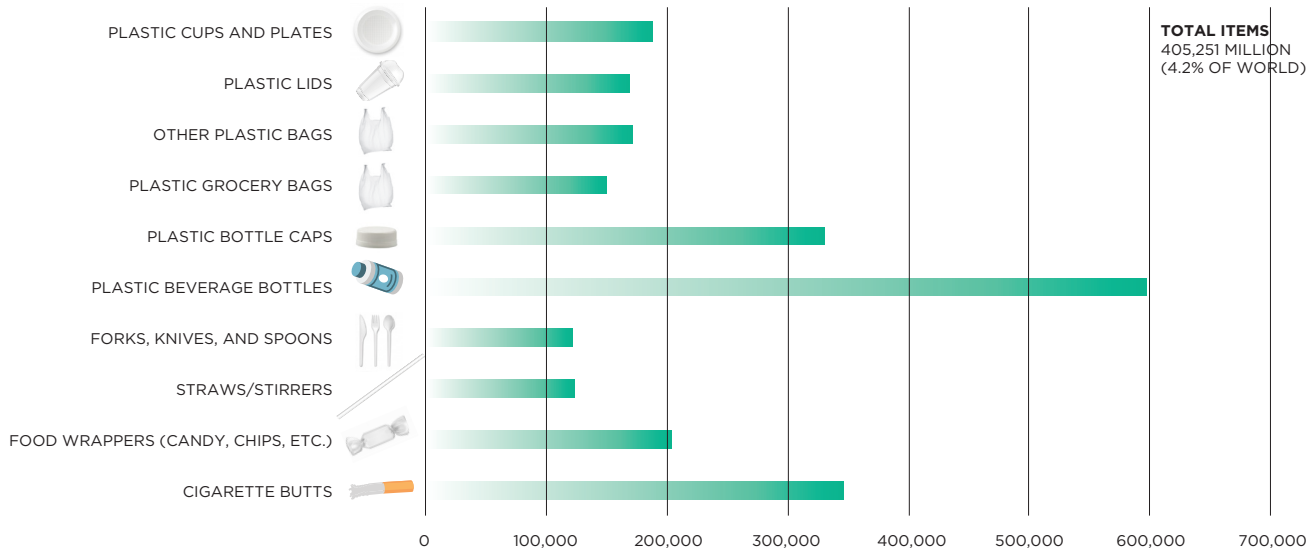

Figure 8. Top Litter Items in the LAC region from the Ocean Conservancy International Coastal Cleanup 2018 [31]

Litter data was also compiled from an open access database (debristracker.org) that allows people to opportunistically and systematically report litter found (Figure 9).

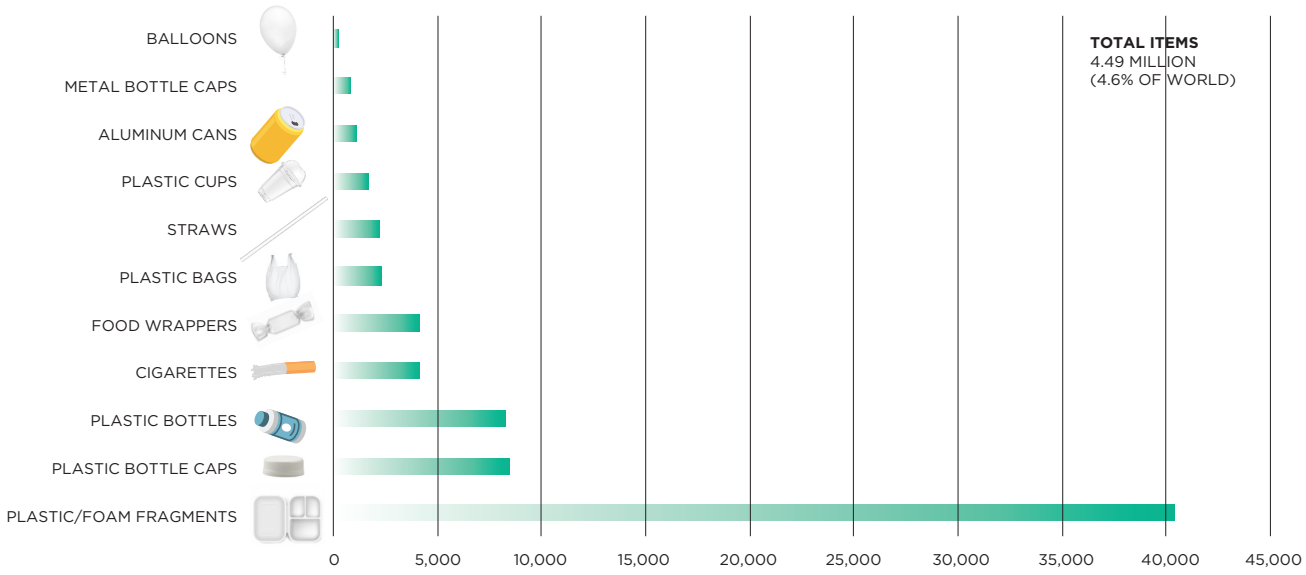

Figure 9. Top Litter Items Compiled from Marine Debris Tracker Database 2011 – Present

There were 105,251 items reported in the LAC Region, with similar results to the Ocean Conservancy data. Plastic bottles, caps and cigarettes were all at the top, however, there was one difference in that people also reported a high number of plastic fragments with Debris Tracker. A total of 17,530 entries were made with Debris Tracker in countries like Ecuador (Galapagos Islands), Virgin Islands, Dominican Republic, Peru, Bahamas, Antigua, Grand Cayman, etc. (Figure 10). Much of the plastic waste that is mismanaged or littered is multi-layer, low-value plastic waste due to mono-materials being more commonly recycled. Mono-material plastics that are easily recyclable are more likely to be collected for recycling as opposed to multi-layer packaging (e.g. chip packets) or thin, lightweight plastic bags, which can tangle in mechanical recycling machinery [18].

Figure 10. Locations of Litter reported by users of Marine Debris Tracker

Microplastics in LAC[2]

2 **A literature search for microplastics was conducted for the LAC Region, including 62 studies from the 48 countries. The number of studies conducted has been growing since 2009 (Figure 11). From the studies reviewed at this time, the vast majority of microplastic research is occurring in Brazil, which has over 50 microplastic studies, followed by Chile and Mexico (Figure 12). Most studies are focused on presence of microplastics in sediment, followed by fish, and plankton, but studies have found microplastics in animals ranging from mussels and squids to turtles, seals, birds and even insects. Few freshwater studies have been done in the region outside of Brazil. Additionally, most studies originated with upper-middle income countries. No studies published were associated with low income or lower middle-income countries, indicating an important knowledge gap as these nations may have less resources for managing, monitoring, and reducing plastic litter. The list of the studies reviewed is in Table A9 in the Appendix.**

The presence of microplastics has been documented in a wide range of locations in LAC that may pose a risk to ecosystems, animals, and humans. Microplastics have been found in both marine and freshwater environments, drinking water and wastewater, as well as food and air. Although tracking the source and transport of microplastics is difficult, there is documented evidence of microplastic sources into water from a range of different activities, infrastructure, and land uses. Microplastic sources include wastewater discharge, sewer overflows, industrial effluent, fragmentation and degradation of plastics in the aquatic environment, atmospheric deposition, drinking water production and distribution, and land-based runoff including road paint and tire wear, textile washing, and agricultural runoff. The risk of microplastics to human health is largely a function of hazard and exposure [30]. Hazards associated with microplastics derive from the physical hazards, chemical hazards, and microorganisms that can be absorbed by microplastics. There has not yet been confirmed evidence that ingestion of microplastics is a current exposure risk through drinking water at this time [32]. However, there could be high risk to aquatic ecosystems within a century if microplastic generation and emissions continue with business-as-usual practices [33].

Most microplastic research in the region has been conducted in Brazil (see Footnote 2). Out of the 30 locations that microplastic literature was found outside of Brazil in this review, over half was conducted in Chile, Argentina, Colombia, and Mexico. Most microplastic research in the region has been conducted in the natural environment, with most findings reporting presence of microplastics in beach sediment (See Figure A1, A2 and Table A11 in the Appendix). Only three studies evaluated microplastic presence in freshwater ecosystems including thethe Elqui, Maipo, and BioBio River systems in Chile the Magdelena River in Colombia, and the Atoyac River basin in Mexico [34-36]. Most animal-based microplastic research in the region has focused on fish, with microplastics having been found in 100% of fish guts in two separate studies in Argentina [37, 38], and one similar study in Chile found that coastal fish species saw a higher abundance of microfibers than other offshore, oceanic species. Other species studied for microplastic presence include zooplankton, amphipods, squid, turtles, and whales with microplastics or microfibers having been documented in all of them.

Policy Innovations and Interventions

Data on policies in the LAC region were compiled from the UN Single Use Plastics: A Roadmap for Sustainability [39] (Figure 13). Eleven LAC countries reported national policies in place or imminent [39]. Nine of these national level policies target plastic bag through bans and/or levies. In Antigua and Barbuda, in addition to a national plastic bag ban, there is also a ban on expanded polystyrene (often called "styrofoam," although this is a brand name, hereafter called "EPS foam") food containers, utensils, and coolers. The national ban on plastic bags in Belize is accompanied by a ban on EPS foam and plastic food utensils as well. Guyana and St. Vincent and the Grenadines have bans targeting EPS foam products as well. Uruguay and Colombia both have national levies in place targeting plastic bags. Information showing documented impacts from national bans are largely unavailable, however, the policy in Colombia has resulted in a 27% reduction in plastic bag use [40]. Costa Rica has passed comprehensive national policies focusing on banning a range of disposable plastic products with the goal of fully eliminating them by 2021 [39].

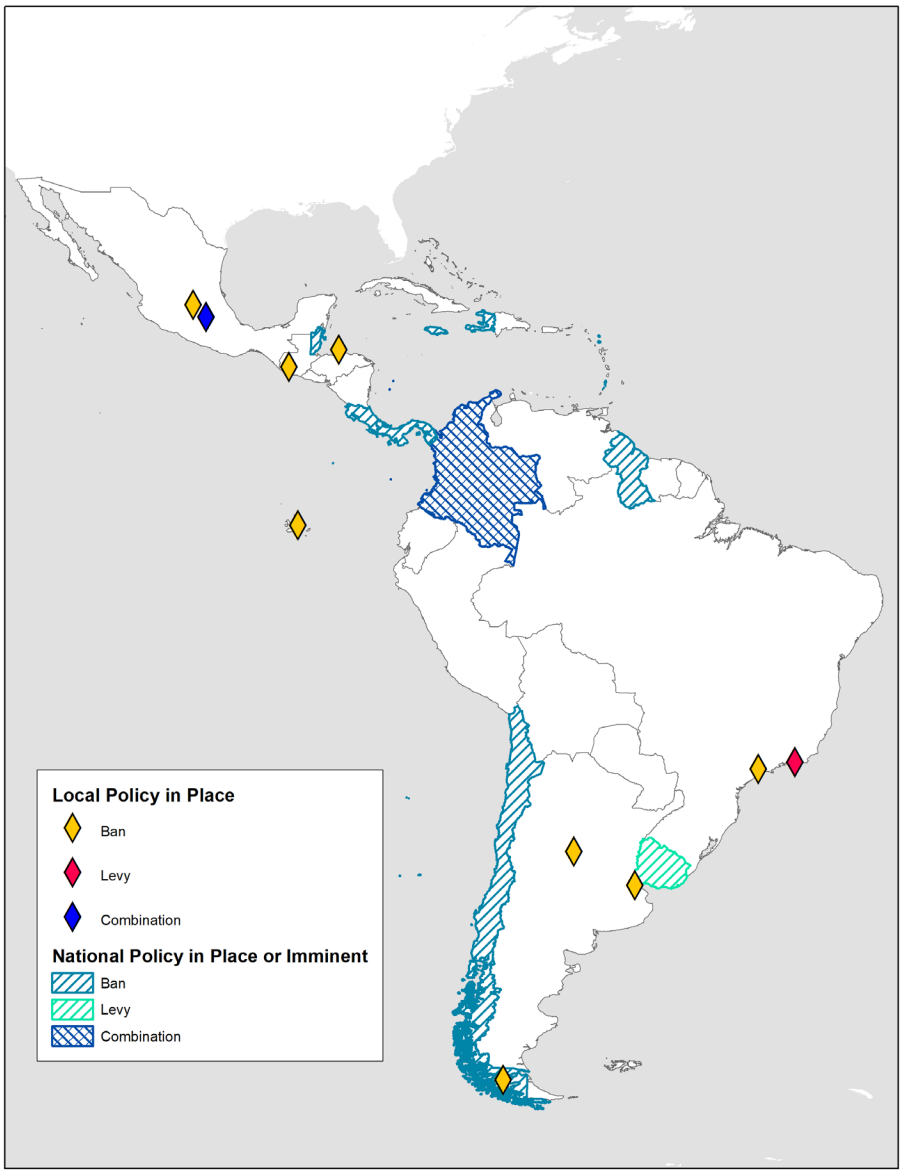

Figure 13. Policies Related to Single-Use Plastic in LAC (compiled from [35]).

In addition to national policies, sub-national policies implemented at the local level are in place in ten different locations throughout the region (Figure 13). Most local policies are plastic bag bans. San Pedro La Laguna, Guatemala bans both plastic bags and EPS foam. Two of the largest cities in the region have widespread sub-national policies. Mexico City, Mexico has a combined ban and levy policy that requires retailers to charge a fee for plastic bags, and the policy further requires bags to be biodegradable. Similarly, Rio de Janeiro, Brazil has a levy in place that

requires markets to both provide alternatives to plastic bags and take back bags for proper disposal, while also incentivizing the public to bring their own bags through shopping discounts and deposit schemes [41]. Similar to national policies, little published research information is available regarding the impact of these policies, although some success has been reported. The Rio de Janeiro policy has reportedly resulted in a 24% annual reduction in plastic bags [42]. In Honduras, the plastic bag policy in the Bay Islands communities have seen complete elimination of plastic bags in Guanaja and an 80% and 50% reduction in use in Utila and Roatan, respectively [43].

In addition to direct bans or levies on specific single use plastic items such as bags, utensils, and takeout containers, other promising forms of governance include extended producer responsibility (EPR) and deposit schemes. EPR is a concept in which manufacturers and producers are held legally responsible for the way in which their products are managed as waste. Globally, 17% of EPR policies target packaging, including paper and plastic [44]. Regionally, EPR schemes have been established in Chile, Mexico, Brazil, Argentina, and Colombia, with most of the EPR programs focusing on electronic waste [45], but efforts are being taken in the region to begin implementing policies related to plastics and packaging. Under the 2005 Comprehensive Policy on Waste Management in Chile, a draft EPR framework was submitted in 2013 which aims to hold producers of priority products, including packaging, legally accountable for management systems for those products once they become waste. Under this law, PET bottles have a 12% collection rate achieved by the program in its early stage [45]. Similarly, in 2018, the Colombian Ministry of Environment issued a resolution for the management of packaging, including plastic through an EPR program, with a goal of requiring producers to include a minimum of 10% recycled content in their products by the first year of the program, and then will increase by 2% annually until it reaches 30% by 2030 [46].

In addition to policies targeted at producers of plastic products, economic tools like deposit schemes that allow consumers to return plastic items in return for a small financial incentive have been documented to be particularly successful for reducing mismanaged plastic waste (Schuyler et al., 2018). In Guayaquil, Ecuador, a deposit scheme is in place through the city's bus transit system in which riders can return plastic bottles for two cents each [47]. In Costa Rica, a deposit scheme called, ecoins® similarly exchanges discounts on products, services, and sustainable experiences for glass and plastic bottles and aluminum cans [48].

Countries of Focus

The countries of focus Brazil, Chile, Colombia, Ecuador, Mexico, and Peru are all Latin American countries with both inland and coastline access to the ocean. In terms of global solid waste indicators, the World Bank provides relevant data on the patently connected coastal systems. Since, there is also a more subtle, but as well irrefutable, network of connections between municipal solid waste management and coastal/global solid waste it is important to look at local initiatives and solid waste indicators from a national perspective as well. Information on solid waste management policies and practices in these countries is currently limited to what is available from official channels and government websites, which are the main source of data for this report aside from the World Bank report previously discussed. The information was, however, enough to paint a picture of increasing involvement in environmentally sustainable solid waste practices in the region through both global and local initiatives. For instance, all countries of focus are part of the UN global initiative Clean Seas aiming to fight marine pollution [49], but they also have developed their own national programs to decrease, and eventually eliminate, mismanaged waste from inland and coastal areas.

Brazil

Brazil is a country with 33,379 km of coastline and a 2020 population of 211,715,973 [50, 51]. While the coast has a high population density, the country stretches far inland. Brazil is the largest country in South America and in the Southern Hemisphere. The world's largest tropical wetland, Pantanal, extends through the west central part of the country and the world's largest waterfalls system, Iguazu Falls, is shared with Argentina [50]. The majority of the Amazon River Basin is contained in Brazil and Guanabara Bay of Rio de Janeiro is a water body of significance that has historically been polluted by waste.

Summary from this Research

Based upon the most recent World Bank data and methods outlined in previous sections of this report, Brazil data is summarized in Table 5.

Table 5. Summary of Waste Generation, Plastic and Leakage for Brazil

DESCRIPTION (UNITS)	QUANTITY (UNITS)
Waste Generation per person (kg/d)	1.04 kg/d
Percent Plastic (%)	13.5%
Total Plastic Waste (MT/yr)	10,849,597 MT/y
2020 Coastal Mismanaged Waste (MT/yr)	828,870 MT/y
2020 Coastal Mismanaged Waste per person (kg/d)	0.035 kg/d
2030 Projected Coastal Mismanaged Waste (MT/yr)	1,089,091 MT/y
2050 Projected Coastal Mismanaged Waste (MT/yr)	1,123,946 MT/y

Additional Solid Waste Generation and Management Data

Additional data beyond the World Bank report was compiled to find other relevant waste generation and management data for Brazil (Table 6). The Government of Brazil, through the website of the Ministry of Environment, presents data from 2017 with indicators on municipal solid waste and a map with the location of data-providing cities [52]. They also provide a marine debris panel with MSW and Marine Debris indicators as a part of their Fight Marine Debris program [53].

Table 6. Summary of Data on Waste Management in Brazil

	DESCRIPTION (UNITS)	QUANTITY (UNITS)
Generation and Collection MSW 2018	Per person waste generation (kg/d)	0.96 (kg/d)
	% Collection	92.1%
	% Collection with recovery option	38.1%
Most Recent MSW Composition Estimates	% Plastic	13.5%
	% organic (food and green waste)	51.4%
	% paper, paperboard, cardboard	13.1%
	% Metal	2.9%
	% Glass	2.4%
	% Other	16.7%
MSW Final Disposal Sites (Recovery Non-Included)	% Open Dump	13.0%
	% Sub-regulated Landfill	11.4%
	% Landfill	75.6%
MSW Final Disposal for Diverted Materials	% Recycling (includes informal recycling)	1.7%
	%Composting	0.2%

Note: Indicators might differ from the World Bank Report data per year sampled. Source [52, 54]

Action on Marine Litter

The Fight Marine Debris Plan (PNCLM from its name in Portuguese) aims to engage the community in a six part plan that includes solid waste management, as well as research and education to reduce and stop the flow of solid waste to the marine environment (Posters 1 and 2) [53].

Policies

Brazil passed a National Solid Waste Policy in 2010. The policy contained the requirement for all 5,570 municipalities to write a solid waste plans by 2012; all dumpsites closed by 2014; organic waste reduced by 53 percent; recycling increased to 45 percent; raising waste-to-energy production by 2031; and social inclusion of 75 percent of waste pickers by 2031 [56]. As of 2015 an estimated 40 percent of municipalities had submitted SWM plans, and about 3,000 open dumps and sub-regulated landfills were still active. In 2015, Brazil's Minister of Environment signed a sectorial agreement (reverse logistics/ extended producer responsibility agreement) on packaging waste for 1) oil packaging, 2) lamps, and 3) general packaging. General packaging is paper and paperboard, plastic, aluminum, steel, glass and cartons. Under the agreement, producers are responsible for the collection of their end-of-life packaging. The agreement includes a goal to reduce packaging waste being sent to landfills by 22% by 2017, although recycling goals for individual packaging materials are not specified in the agreement [56, 57].

Plastic bans exist in the cities of Rio de Janeiro and state of Sao Paulo. Both the city and the state have banned plastic bags and plastic straws, with more potential single-use plastic bans. Rio de Janeiro passed the law in June 2018, implementing it in July 2019. Sao Paulo approved the law in January 2020, to be implemented in January 2021 [58]. Although extended producer responsibility policies have been on the books since 2010, the state of Sao Paulo passed a bill in 2018 that require all companies operating in the state to comply with the policy (it is no longer voluntary).

Specific Projects

The Brazilian government has recently launched the Zero Waste Program, in which they want to support communities in the reduction and proper Disposal of solid waste following a diagnostic, goal-setting, development, and implementation framework [59].

Private Sector Involvement

Additional projects such as Waste Expo Brasil serve as a bridge for the private and public solid waste sectors by bringing contributions from entrepreneurs, manufacturers, suppliers, etc., while gathering associations, syndicates, and such, under the umbrella of the ministries of environment and regional development [60].

Other Additional Activities

As mentioned in the previous section on microplastics, Brazil has the highest quantity of published papers on microplastic in the LAC Region.

Chile

Chile is a country with 78,563 km of coastline and a 2020 population of 18,186,770 [50, 51]. Chile is the longest north-south trending coun-

try in the world, extending across 39 degrees of latitude and near sea lanes between the Atlantic and Pacific Oceans [50]. The country does not stretch far inland and the extensive coastline is from the islands in the south as well. Additionally, the major rivers in its Andean Mountains flow from east to west, emptying into the Pacific Ocean.

Summary from this Research

Based upon the most recent World Bank data and methods outlined in previous sections of this report, Chile data is summarized in Table 7.

Table 7. Summary of Waste Generation, Plastic and Leakage for Chile

DESCRIPTION (UNITS)	QUANTITY (UNITS)
Waste Generation per person (kg/d)	1.15 kg/d
Percent Plastic (%)	9.4%
Total Plastic Waste (MT/yr)	717,586 MT/y
2020 Coastal Mismanaged Waste (MT/yr)	27,552 MT/y
2020 Coastal Mismanaged Waste per person (kg/d)	0.017 kg/d
2030 Projected Coastal Mismanaged Waste (MT/yr)	37,410 MT/y
2050 Projected Coastal Mismanaged Waste (MT/yr)	39,469 MT/y

Additional Solid Waste Generation and Management Data

Additional data beyond the World Bank report was compiled to find the most recent waste generation and management data for Chile (Table 8). The Ministry of Environment keeps track of open dumps in maps [61]. The MSW Composition Estimates and Collection with recovery option indicators were not easily found from updated official sources, for which the former represent 2010 and the latter was not given. The current sources seem to indicate that the recovery option is currently a task of the informal sector until the EPR laws regulated it further [61].

Table 8. Summary of Data on Waste Management in Chile

	DESCRIPTION (UNITS)	QUANTITY (UNITS)
Generation and Collection MSW 2017	Per person waste generation (kg/d)	1.22kg/d
	% Collection	96%
	% Collection with recovery option	Not given
Most Recent MSW Composition Estimates	% Plastic	9.4%
	% organic (food and green waste)	53.3%
	% paper, paperboard, cardboard	12.4%
	% Metal	2.3%
	% Glass	6.6%
	% Other	16%
MSW Final Disposal Sites (Recovery Non-Included)	% Open Dump	2.4%
	% Landfill	78.2%
	% Sub-regulated Landfill	19.5%
MSW Final Disposal for Diverted Materials	% Recycling (includes informal recycling)	1.7%
	% Other recovery	1.8%

Note: Indicators might differ from the World Bank Report data per year sampled. Source: [62, 63]

Action on Marine Litter

Besides the partnership between the Ocean Conservancy and the Chilean Government to combat oceanic plastic pollution [64], the latter party through the General Direction of Marine Territories and Merchant Marine (DIRECTEMAR from its Spanish initials) has initiatives such as cleaning of the beaches once a year drawing considerable crowds of volunteers and support [65]. After each campaign, they sample the type of debris and describe it for the public in poster form (Poster 2017).

Policies

Since 2018, the Chilean government has developed initiatives against the use and distribution of plastic bags and straws. Then, it effectively banned the former since the beginning of 2019 for big distributors, with a more lenient timeline of two years for small businesses [66]. The 2016 Framework Law for Waste Management, Extended Producer Responsibility and Promotion of Recycling passed extended producer responsibility in Chile with the addition of the inclusion of the informal waste sector [67]. Without inclusion of

this sector, changes or improvements to waste management infrastructure may put thousands of people out of work [68].

Specific Projects

The Chilean government considers Chile Basura Cero (Chile Zero Waste) part of its official circular economy program creating regulations and promotion that allow for recycling, proper waste management, and citizen involvement to achieve this goal [69].

Private Sector Involvement

In Chile, multiple non-profits created an alliance whose purpose was to work towards a circular economy and sustainable waste management to achieve the goal of zero waste. Their approaches vary from environmental programs and education to empowerment of small actors such as informal recyclers [70].

Another way the private sector in Chile is involved with Solid Waste Management is through supporting foundations like the Fundacion Basura (Trash Foundation), which seeks to promote sustainable waste management. Some of the private businesses involved include Universities, Banks, Recycling, and Food & Drinks companies [70].

Other Additional Activities

Chile hosted Our Ocean in 2015, highlighting the country's dedication to protecting the ocean from many stressors, including plastic waste. A large citizen science program studying litter on Chilean Beaches was founded in 2007 by Professor Martin Thiel at Universidad Católica del Norte (UCN) in Coquimbo, Chile. The program called Científicos de la Basura allows students to participate in collecting data on marine litter and raising awareness and education about the issue of plastic pollution.

In 2019, Chile launched the Chilean Plastics Pact, the third national initiative joining the Ellen MacArthur Foundation's Plastics Pact network. The Latin American Plastics Pact: El Pacto Chileno de los Plásticos is lead by the Ministry of Environment and the non-profit corporation Fundación Chile. It brings together local businesses, governments, and NGOs to work towards a circular economy for plastics [71].

Colombia

Colombia is a country with 5,874 km of coastline and a 2020 population of 49,084,841 [50, 51]. It is the only country in South America that borders both the North Pacific Ocean and Caribbean Sea. It is also a portion of the Amazon River Basin.

Summary from this Research

Based upon the most recent World Bank data and methods outlined in previous sections of this report, Colombia data is summarized in Table 9.

Table 9. Summary of Waste Generation, Plastic and Leakage for Colombia

DESCRIPTION (UNITS)	QUANTITY (UNITS)
Waste Generation per person (kg/d)	0.76 kg/d
Percent Plastic (%)	12.8%
Total Plastic Waste (MT/yr)	1,746,950 MT/y
2020 Coastal Mismanaged Waste (MT/yr)	18,800 MT/y
2020 Coastal Mismanaged Waste per person (kg/d)	0.006 kg/d
2030 Projected Coastal Mismanaged Waste (MT/yr)	18,730 MT/y
2050 Projected Coastal Mismanaged Waste (MT/yr)	19,294 MT/y

Additional Solid Waste Generation and Management Data

Additional data beyond the World Bank report was compiled to find the most recent waste generation and management data for Colombia (Table 10). As a part of their solid waste report, the Colombian government has a map of regional solid waste generation [72]. MSW Composition was determined by the 2015 National Framework for MSWM based on a multi-city sample [73].

Table 10. Summary of Data on Waste Management in Colombia

	DESCRIPTION (UNITS)	QUANTITY (UNITS)
Generation and Collection MSW 2018	Per person waste generation (kg/d)	0.64 kg/d
	% Collection	89.5%
	% Collection with recovery option	Not given
Most Recent MSW Composition Estimates	% Plastic	10.8%
	% organic (food and green waste)	61.5
	% paper, paperboard, cardboard	6.6%
	% Metal	1.0%
	% Glass	2.4%
	% Other	7.7%
MSW Final Disposal Sites	% Open Dump	2.0%
	% Landfill	96.0%
	% Sub-regulated Landfill	1.9%
	% Treatment Plants (Recycling)	0.1%
MSW Final Disposal for Diverted Materials	% Recycling (includes informal recycling)	17%
	% Other recovery	17%

Note: Indicators might differ from the World Bank Report data per year sampled. Source: [62, 63]

Action on Marine Litter

As of March 13, 2017 according to the publication [74], the Colombian government was committed to develop a National Program for Marine Debris Management (Programa Nacional de Manejo de Residuos Sólidos en el Mar – PNMRESMAR). There is, however, no evidence of the program being implemented as of yet.

Policies

Colombia made informal recycling an official part of the solid waste management system in 2016, through the 596 Decree of 2016, in which MSWM supports and encourages material recovery [75].

In 2018, the Colombian Ministry of Environment issued Resolution 1407/2018 on EPR for the management of packaging waste and packaging of paper, cardboard, plastic, glass, and metal. This

resolution is an extensive EPR scheme to manage general packaging. Producers are required to create waste management programs (individually or collectively) for the National Environmental Licensing Authority (ANLA) by the end of 2020. The waste management program plans must include the following: 1) Information of producers and operators/administrators participating in the plan, 2) Types and volume of packaging placed on the market, 3) Targets to be met, 4) Operational strategies, collection and treatment mechanisms, locations of collection, etc., 5) Public awareness initiatives, 6) Methods for monitoring and analyzing data, and 7) Financial mechanisms/operational budget [76].

Producers must implement programs through legal entities or partnerships and municipalities are required to support waste collection as well as help with public awareness. Implementation will begin in 2021, and initial progress reports will be required by ANLA in April 2022. By 2021, at least 10% of packaging produced must be recovered and by 2030, it increases to 30%. ANLA will conduct annual evaluations of the programs and give points based upon operators meeting requirements. Operators must maintain a minimum score in order to remain authorized [77].

The Colombian Government, through its 1973/2019 Law, has banned the production, commercialization, distribution and entry of single-use plastic products to its three main Caribbean islands and nearby insular chain in an effort to keep plastics from entering the oceans at these points [78]. Colombia has also established taxes and penalties in an effort to reduce consumption of plastic bags and single-use plastic products with a success rate of 53% reduction of plastic bags distributed [79] and a 71% conscious reduction from people's perspective [80]. According to the National Department of Planning the inland cities of Bogota and Cali had reductions of more than 79% consumption of plastic bags whereas the coastal city of Barranquilla had a 65.3% [80]. Moreover, the government created a panel for the Sustainable Management of Plastics that has the purpose of replacing the totality of single-use plastic bags with biodegradable or reusable bags by the end of 2020 [79].

Specific Projects

In 2013, the Capital of Colombia implemented the Plan Zero Waste in collaboration with the recyclers' cooperatives to, among other goals, teach consumers to separate at the source and to create an environmentally conscious culture that would allow for materials recovery before final Disposal [81]. In June of 2017, the Medellin Declaration on Marine Litter in Life Cycle Assessment (LCA) and Management was signed, facilitated by the Forum for Sustainability through Life Cycle Innovation (FSLCI) in close cooperation with La Red Iberoamericana de Ciclo de Vida (RICV). The Declaration calls for "an improved handling of plastic resources and is meant to encourage researchers and relevant stakeholders to develop new methodologies to address marine litter better within Life Cycle Assessments." It outlines a need for 10 actions including more science-based data collection, capacity building, technical assistant, standardized definitions, and impact assessment models incorporating LCA [82].

Private Sector Involvement

The Private Sector in Colombia interacts with MSW from its collection by private companies [73] to the collection of information about recycling and recovery of materials [72].

Other Additional Activities

Colombia is a member of the United Nations Framework Convention on Climate Change (UNFCCC) International Environmental Treaty (committing to stabilize greenhouse gas emissions), is working towards the UN Sustainable Development Goals (responsible consumption and production), and is actively participating in the Latin America and the Caribbean Initiative for Sustainable Development (ILAC from its Spanish Initials) [72].

Ecuador

Ecuador is a country with 4,597 km of coastline and a 2020 population of 16,904,867 [50, 51]. The country shares its major rivers with neighboring countries Peru (to the south) and Colombia (to the north). The country has four geographic areas: the Sierras (mountains), the Costa (coastal area), Amazonia (the Amazon River area) and Insular (Galapagos Islands). The snowmelt and rain in the mountains flow to the Amazon River Basin, or to the west, to the Pacific Ocean.

Summary from this Research

Based upon the most recent World Bank data and methods outlined in previous sections of this report, Ecuador data is summarized in Table 11.

Table 11. Summary of Waste Generation, Plastic and Leakage for Ecuador

DESCRIPTION (UNITS)	QUANTITY (UNITS)
Waste Generation per person (kg/d)	0.89 kg/d
Percent Plastic (%)	11.4%
Total Plastic Waste (MT/yr)	628,233 MT/y
2020 Coastal Mismanaged Waste (MT/yr)	79,063 MT/y
2020 Coastal Mismanaged Waste per person (kg/d)	0.037 kg/d
2030 Projected Coastal Mismanaged Waste (MT/yr)	105,097 MT/y
2050 Projected Coastal Mismanaged Waste (MT/yr)	123,440 MT/y

Additional Solid Waste Generation and Management Data

Additional data beyond the World Bank report was compiled to find the most recent waste generation and management data for Ecuador (Table 12). Additional solid waste generation and management information including regional data on waste generation, source separation and collection are provided in [83]. The per person waste generation rate and percent plastic are slightly less than the data reported by the World Bank [14].

Table 12. Summary of Data on Waste Management in Ecuador

	DESCRIPTION (UNITS)	QUANTITY (UNITS)
Generation and Collection MSW 2018	Per person waste generation (kg/d)	0.86 kd/d
	% Collection	73.2%
	% Collection with recovery option	36.5%
Most Recent MSW Composition Estimates	% Plastic	10.7%
	% organic (food and green waste)	57.3%
	% paper, paperboard, cardboard	10.1%
	% Metal	3.3%
	% Glass	3.1%
	% Other	15.5%
MSW Final Disposal Sites	% Open Dump	25.6%
	% Landfill	45.7%
	% Sub-regulated Landfill	28.8%
	%Composting	0.6%
MSW Final Disposal for Diverted Materials	% Recycling (includes informal recycling)	0.6%
	% Other recovery	17%

Note: Indicators might differ from the World Bank Report data per year sampled. Source: [83, 84]

Action on Marine Litter

From an international standpoint, the Ecuadorian government joined efforts with the ONU's Mares Limpios program, which promotes smart networking and official agreements between governments and independent parties in an effort to reduce plastic pollution in the oceans [85]. Also, from a local perspective, after thorough investigation, the Ecuadorian government through the National Institute of Fishing (INP from its Spanish initials) implemented the permanent campaign "Plásticos en el mar... NO MÁS!" (Plastics in the Sea... NO MORE!) [86]. Joined by multiple research institutes and universities, the campaign now led by both the INP and the Trash Scientists-Ecuador Chapter started their environmental education from the inside out educating fishermen and associated parties [86]. In addition, Ecuador has joined the UN Clean Seas Campaign.

Policies

Ecuador has implemented a two cent "green" tax on PET bottles that are not able to be returned

or recycled. This policy has resulted in an increase in PET value and a nearly 80% recycling rate for PET bottles in the country now [87]. This is one of the highest PET recycling rates in the region now. The government also has the ability to shut down businesses that do not meet required targets for collection and recycling of their products [88].

In 2014, plastic bags were banned from the Galapagos Archipelago. Additionally in the islands, Ecuadorian authorities continue their 2004 effort to rid the insular region from marine debris washed ashore from international sources [85]. The Ecuadorian Capital, Quito, decided to ban all single-use plastic products that were not in direct contact with raw food and were deemed as necessary by their department of health [85]. They would also educate on and support plastic reduction in the fabrication, commercialization, and distribution processes in order to encourage recycling, sustainability, and a circular economy for the city [89].

Specific Projects

As part of their Waste Management National Program (PNGIDS from its Spanish initials), the Ministry of Environment of Quito had the goal by 2017 of promote sustainability and a circular economy through the appropriate management of solid residuals from separation at the source to energy harnessing in a W2E program [90]. The Galapagos Islands, a UNESCO World Heritage Site since 1978, declared 2018 the "year of the fight against plastic pollution – bringing together the efforts of governments, scientists and citizens." Solid waste issues were addressed along with beach cleanups for waste that washes ashore and single-use plastics were reduced (beyond the plastic bag ban already in place since 2014), with the goal of the ban expanding to all single-use items [91].

Private Sector Involvement

MSWM happens in Ecuador through the government directly, through public contractors, or through companies of mixed economy in which the private sector can participate [84].

Other Additional Activities

Numerous Ecuadorian municipalities collect and treat organic waste in compost and vermiculture facilities [84].

Mexico

Mexico is a country with 23,761 km of coastline and a 2020 population of 128,649,565 [50, 51]. The Rio Bravo River borders the USA and Mexico and is a significant waterway to each of the countries before flowing to the Gulf of Mexico. According to the International Boundary and Water Commission of the United States (IBWC), the business and population growth along the river path, mostly of assembly plants and their respective workers, makes solid waste management of great interest in the area [92].

Summary from this Research

Mexico is the second highest generator of plastic waste (second to Brazil) in the region at 5.9 MMT/yr. It is the only country to rank globally for exports of plastic scrap (fifth in Brooks et al., 2018 [30]). Based upon the most recent World Bank data and methods outlined in previous sections of this report, Mexico data is summarized in Table 13.

Table 13. Summary of Waste Generation, Plastic and Leakage for Mexico

DESCRIPTION (UNITS)	QUANTITY (UNITS)
Waste Generation per person (kg/d)	1.16 kg/d
Percent Plastic (%)	10.9%
Total Plastic Waste (MT/yr)	5,937,255 MT/y
2020 Coastal Mismanaged Waste (MT/yr)	224,799 MT/y
2020 Coastal Mismanaged Waste per person (kg/d)	0.029 kg/d
2030 Projected Coastal Mismanaged Waste (MT/yr)	298,620 MT/y
2050 Projected Coastal Mismanaged Waste (MT/yr)	332,500 MT/y

Additional Solid Waste Generation and Management Data

Additional data beyond the World Bank report was compiled to find the most recent waste generation and management data for Mexico (Table 14). The most recent maps and visual data on municipal waste management in Mexico seem to be from the year 2013-2014, as part of the Secretariat of Environment and Natural Resources (SEMARNAT from the Spanish initials). The maps show waste collection and Disposal per region in the whole country and are located in a separate application from SEMARNAT [93] .

Table 14. Summary of Data on Waste Management in Mexico

	DESCRIPTION (UNITS)	QUANTITY (UNITS)
Generation and Collection MSW 2017 [78]	Per person waste generation (kg/d)	0.94 kg/d
	% Collection	83.8%
	% Collection with recovery option	Not Given
Most Recent MSW Composition Estimates [78]	% Plastic	13.3%
	% organic (food and green waste)	46%
	% paper, paperboard, cardboard	11.2%
	% Metal	2.4%
	% Glass	4.7%
	% Other	22.0%
MSW Final Disposal Sites (Recovery Non-Included) [78]	% Open Dump	4.3%
	% Landfill	41.2%
	% Sub-regulated Landfill	Not Given
MSW Final Disposal for Diverted Materials [78]	%Composting	Not given
	% Recycling (includes informal recycling)	9.6%

Note: Indicators might differ from the World Bank Report data per year sampled. Source: [94]

Action on Marine Litter

One of the Mexican Government Initiatives concerning Marine Debris is the Sustainable Development Objective 14 (ODS14 from its Spanish Initials), in which one goal is the reduction of any type of marine debris and pollution by 2025. They also address the need for plastic usage reduction in order to achieve the objective [95]. The Environmental branch of the UN in Mexico has also launched the #MaresLimpios (#CleanSeas) program urging their community to get involved in their fight against marine debris and against the use of single-use plastic products as one of the worst offenders according to their findings [96].

Policies

Although a national ban on single-use plastics is not evident in the country, many states have reduced, forbidden, and even penalized the use of plastic bags, straws, and EPS foam. Mexico City has been leading the plastic bags bans since 2010, with a prohibition of non-degradable plastic bags, to the recently implemented plastic bags ban that penalizes the distribution, commercialization, and use of plastic bags in any business transaction, excluding food services that require higher sanitation standards [97]. Other states with similar but sometimes more flexible plastic bag bans are Chiapas, Esta-

do de México, Querétaro, Sonora, Baja California Sur, Coahuila, Guerrero, Hidalgo, Morelos and San Luis Potosí [98].

Bans on other plastics such as single-use straws and EPS containers are more common in the country with 22 municipalities categorically prohibiting one or both, sometimes along plastic bags, and other municipalities leaving the decision to the consumer [94].

Specific Projects

The Mexican government is committed to reintroducing solid residuals back into the production chain in an effort to reduce its carbon footprint and encourage a circular economy as part of its Zero Waste program [99]. Although some of its programs include management of organic waste through composting, anaerobic digestion and similar technologies [96], they also have considered energy harnessing from other types of solid residuals [97].

Private Sector Involvement

Mexico also allows for governments to contract out their MSWM to private companies that amount to approximately 10% of the total MSWM responsible parties [94]. The Mexican government also expects to create interest in the private sector to invest in post-consumer recyclable materials to complete the MSWM and Recovery Framework [100].

Other Additional Activities

The Sustainable cities network is a strategy for SWM, public spaces recovery, and ecotechnologies in construction and the National profile of Chemical Substances shows the framework for substances and residues management [101].

Peru

Peru is a country with 3,362 km of coastline and a 2020 population of 31,914,989 [50, 51]. Peru shares with the country of Bolivia, the world's highest navigable lake, Lago Titicaca. Additionally, a slope of its Nevado Mismi, a 5,316 m peak, is the ultimate source of the Amazon River [50].

Summary from this Research

Based upon the most recent World Bank data and methods outlined in previous sections of this report, Peru data is summarized in Table 15.

Table 15. Summary of Waste Generation, Plastic and Leakage for Peru

DESCRIPTION (UNITS)	QUANTITY (UNITS)
Waste Generation per person (kg/d)	0.75 kg/d
Percent Plastic (%)	10.5%
Total Plastic Waste (MT/yr)	919,104 MT/y
2020 Coastal Mismanaged Waste (MT/yr)	250,364 MT/y
2020 Coastal Mismanaged Waste per person (kg/d)	0.046 kg/d
2030 Projected Coastal Mismanaged Waste (MT/yr)	316,566 MT/y
2050 Projected Coastal Mismanaged Waste (MT/yr)	357,962 MT/y

Additional Solid Waste Generation and Management Data

Additional data beyond the World Bank report was compiled to find the most recent waste generation and management data for Peru (Table 16). As a part of their solid waste report, the Peruvian government has two maps of solid waste generation both at the provincial and district levels [102].

Table 16. Summary of Data on Waste Management in Peru

	DESCRIPTION (UNITS)	QUANTITY (UNITS)
Generation and Collection MSW 2012	Per person waste generation (kg/d)	0.58 kg/d
	% Collection	85.7%
	% Collection with recovery option	21%
Most Recent MSW Composition Estimates	% Plastic	10%
	% organic (food and green waste)	51%
	% paper, paperboard, cardboard	8.7%
	% Metal	2.8%
	% Glass	3.2%
	% Other	24.3%
MSW Final Disposal Sites (Recovery Non-Included)	% Open Dump	62%
	% Landfill	38%
	% Sub-regulated Landfill	Not given
MSW Final Disposal for Diverted Materials	%Composting	Not given
	% Recycling (includes informal recycling)	2.2%

Note: Indicators might differ from the World Bank Report data per year sampled. Source: [1031

Action on Marine Litter

Since 2018, the Peruvian Government through the Multi-sector Commission for Environmental Management and the Marine-Coastal Habitat (COMUNA per its Spanish initials) created the Technical Working Group Specialized in Marine Debris (GTTE-Residuos y Desechos Marinos). The main goal of the GTTE-Marine Debris is to promote communication among participating actors to reduce marine debris in Peru [104]. Their current main focus is on identification of avenues for marine debris reduction and possible roadblocks and efficiency.

Policies

Peru has a law that "public sectors must use plastics with a minimum 80% recycled content" based on the Supreme Decree 011-202-MINAM;

Ministerial Resolution 021-2011-MINAM [105]. The government of Peru, at the end of 2019, effectively banned the manufacture and distribution of single use plastic straws and thin/small plastic bags as well as the use of plastic wraps on printed press [106]. In the same vein, the government had added a plastic bag fee that created a reduction of 30% consumption of plastic bags [106], and it is set to increase per year at a 100% increase the first year, 50% the second year, 25% the year after, etc. [107]. It is also said that the single-use plastic ban does not seek to damage, but instead promote an innovative plastics industry that uses organic bases for their products [107].

Specific Projects

Besides their nine-year effort to create separation at the source and selective collection [108], the government of Peru has a couple of solid waste initiatives aiming to educate people to reduce solid waste at the source. As the Plastic Bans are targeted towards production and commercialization of single-use plastic products in Peru, the #MenosPlasticoMasVida campaign's main goal is to educate consumers to take action and become responsible citizens curtailing consumption of single-use plastic products [109]. On the other hand, the Peru Limpio umbrella covers a variety of regional and local solid waste initiatives, from marine debris collection days to intensive environmental education concerning the proper way to manage solid waste [110]. Pepsico Latin America started their Recycling with Purpose circular economy model in Peru and plans to eventually extend the program in Argentina, Brazil, Chile, Colombia, Costa Rica, Mexico, Panama, Guatemala, and Jamaica [111].

Private Sector Involvement

Peru has worked its SWM legal framework to include participation of the private sector through regulation, responsibility, and support towards the MSWM and Recovery goals [103]

Other Additional Activities

Peru considers of great importance to include within the MSWM and Recovery Framework educational campaigns and events that have proven to spark interest from the general public [103].

Conclusions

Countries in the LAC region range from large populous nations to small island states, with rich biodiversity and unique ecosystems that have the potential to be harmed by plastic pollution. There are waterways, rivers, and coastal areas (especially impacted by plastic pollution) that are important to economies and livelihoods. Tourism is a key economic driver in some areas, further burdening some nations beyond their domestic waste generation that is increasing as economic growth occurs. One of the primary influencing factors for plastic leakage found in 2015 was lagging infrastructure while rapid economic growth as waste generation rates increased [2]. The region is experiencing this as plastic waste ends up in the environment, waterways and ocean with the potential to impact ecosystems and human health.

As a region, the LAC manufactures 4% of the plastic produced around the world, although bioplastics production makes up 9% of the global quantity produced. Consumption of plastic in the LAC is 8% of global total with Mexico higher than the regional average (32 kg/person/year)

at 48 kg/person/year [22]. In comparison to other World Bank regions, the LAC has the third highest per person waste generation rate at 0.99 kg/person/day, only less than North America, and Europe and Central Asia [14]. This generation rate is also higher than the global average of 0.74 kg/person/day. Although for reportedly being 80% urbanized, this rate is lower than other similarly urbanized regions, likely influenced by the wide range of economic status and stratified urbanization observed in the region. The average percent plastic in the waste stream is 12.4% (ranging from 6.3% in the British Virgin Islands to 23.2% in St. Kitts and Nevis) [14]. This results in an annual total quantity of plastic waste produced in the LAC of 28.8 MMT.

According to the most recent compiled World Bank data, LAC landfills an average of 69% of its waste, which is the highest landfill rate in the world. Some of these landfills are sanitary (52%), but some are only controlled (14.6%) and some are unspecified. Add landfilling to the percentage that is also open dumped (26.8%) and that means about 96% of the waste generated in LAC is disposed of on land. The recycle rate is very low, around 4% (an even smaller portion is exported, with Mexico leading any exports that do occur). While these are the formally reported numbers, there also is an informal sector in LAC where recovery and recycling can take place, but reports of quantities in this sector still appear relatively small. Because of the portion of waste that is open dumped and landfilled (unspecified) or managed by other (described in this report as mismanaged), there is a total of 8.4 MMT of plastic waste mismanaged in the region. As for what portion of that might reach the ocean, the coastal mismanaged waste (generated within 50 km of the coastline) is 3.7 MMT. Global totals (using different methods) have reported that 19 – 23 MMT may be reaching aquatic systems in 2016 [112] (3.7 MMT makes up 19% while 8.4 MMT makes up 44% of the lowest input of 19 MMT), both of which show a significant contribution from the LAC region to the total input of plastic into the environment, aquatic systems and the ocean. Some of the most common items found in litter in the region are water bottles, bottle caps, food wrappers and cigarettes, as well as plastic fragments. Water bottles are often recycled in other countries where they have value, but that does not appear to be the majority of the situation in LAC.

In terms of solutions to plastic leakage, many LAC countries are working on policies like extended producer responsibility regulations, restrictions on single-use plastic, and increasing recycling. EPR seems to be a critical component to bring in the resources needed to change the management system from over 95% land-based disposal and to increase the recycling rates (even if they are underreported). While preventing waste in the first place is the preferred method to reduce ocean-bound plastic and mismanaged waste, if LAC is to move towards a circular economy, recycling has to increase, and that means product materials and design may need to be reexamined. The drivers of the systems that are in place, both economic and social, should be evaluated so that points within the system can be pinpointed for the greatest change. The LAC region has an opportunity to be a leader in addressing plastic pollution and making real progress towards circular materials management, and through this evolution, providing lessons learned for the rest of the world.

References

References

1. Geyer, R., J.R. Jambeck, and K.L. Law, *Production, use, and fate of all plastics ever made*. Science Advances, 2017. 3(7): p. e1700782.
2. Jambeck, J.R., et al., *Plastic waste inputs from land into the ocean*. Science, 2015. 347.
3. Worm, B., et al., *Plastic as a Persistent Marine Pollutant*. Annual Review of Environment and Resources, 2017. 42(1): p. 1-26.
4. Forrest, A., et al., *Eliminating Plastic Pollution: How a Voluntary Contribution From Industry Will Drive the Circular Plastics Economy*. Frontiers in Marine Science, 2019. 6(627).
5. Wilcox, C., E. Van Sebille, and B.D. Hardesty, *Threat of plastic pollution to seabirds is global, pervasive, and increasing*. Proc Natl Acad Sci U S A, 2015. 112(38): p. 11899-904.
6. Bucci, K., M. Tulio, and C.M. Rochman, What is known and unknown about the effects of plastic pollution: A meta-analysis and systematic review. Ecological Applications, 2019.
7. Rochman, C.M., et al., *Anthropogenic debris in seafood: Plastic debris and fibers from textiles in fish and bivalves sold for human consumption*. Scientific Reports, 2015. 5: p. 14340.
8. Zambrano-Monserrate, M.A., M.A. Ruano, and L. Sanchez-Alcalde, *Indirect effects of COVID-19 on the environment*. Science of the Total Environment, 2020: p. p. 138813.
9. Prata, J.C., et al., *COVID-19 Pandemic Repercussions on the Use and Management of Plastics*. Environmental Science & Technology, 2020.
10. Trentmann, N., *Waste Management Wants Consumers to Pay More as It Moves More Trash*, in Wall Street Jounral. 2020.
11. Inter-American Development Bank, *Iniciativa Regional Para el Reciclaje Inclusivo*. 2020.
12. Juan, M.B., *The Coasts of Latin America at the End of the Century*. Journal of Coastal Research, 2001. 17(4): p. 885-899.
13. Center for International Earth Science Information Network (CIESIN) Columbia University, *Gridded Population of the World, Version 4 (GPWv4): Population Density, Revision 11*. 2018, NASA Socioeconomic Data and Applications Center (SEDAC): Palisades, NY.
14. Kaza, S., et al., *What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050., in Urban Development Series*. 2018, World Bank: Washington, DC.
15. PlasticsEurope, *Plastics the Facts - 2019*. 2019.
16. EuropeanBioplastics, *Bioplastics: Facts and Figures*. 2019.
17. US DOE (US Department of Energy). *Global Ethanol Production*. 2018 [cited 2020 May 16]; Available from: https://afdc.energy.gov/data/10331.
18. Moss, E., Eidson, A., and Jambeck J., S*ea of Opportunity: Supply Chain Investment Opportunities to Address Marine Plastic Pollution*. 2017, Encourage Capital on behalf of Vulcan, Inc.: New York, New York.
19. Wang, S., et al., Biodegradation of Poly(3-hydroxybutyrate-co-3-hydroxyhexanoate) Plastic under Anaerobic Sludge and Aerobic Seawater Conditions: Gas Evolution and Microbial Diversity. Environmental Science & Technology, 2018. 52(10): p. 5700-5709.
20. UNEP (United Nations Environment Programme), *Biodegradable Plastics and Marine Litter: Misconceptions, concerns and impacts on marine environments*, T.G.P.o.A.f.t.P. of and the Marine Environment from Land-based Activities (GPA), Editors. 2015, UNEP (United Nations Environment Programme), Nairobi.
21. United Nations Environment Programme (2018). Mapping of global plastics value chain and plastics losses to the environment (with a particular focus on marine environment). Ryberg, M., Laurent, A., Hauschild, M. United Nations Environment Programme. Nairobi, Kenya.
22. Manufactura (manufactura.mx) and ANIPAC, Per capita consumption of plastic in Mexico and Latin America in 2017 (in kilograms), obtained from Statista https://www.statista.com/statistics/971251/plastic-consumption-per-capita-mexico-latin-america/, October 4, 2020.

References

23. Global Alliance of Waste Pickers. *Where are we?* 2020 [cited 2020 April 28]; Available from: https://globalrec.org/where-are-we/#2/0.9/0.2.

24. Botello-Álvarez, J.E., et al., *Informal collection, recycling and export of valuable waste as transcendent factor in the municipal solid waste management: A Latin-American reality*. Journal of Cleaner Production, 2018. 182: p. 485-495.

25. Dias, S.M., *Waste pickers and cities. Environment and Urbanization*, 2016. 28(2): p. 375-390.

26. Aparcana, S., *Approaches to formalization of the informal waste sector into municipal solid waste management systems in low- and middle-income countries: Review of barriers and success factors*. Waste Management, 2017. 61: p. 593-607.

27. Regional Initiative for Inclusive Recycling. *Open Knowledge portal*. [cited 2020 May 16]; Available from: https://reciclajeinclusivo.org/centro-de-conocimiento/.

28. ANCAT (Associação Nacional dos Catadores e Catadoras de Materiais Recicláveis), *ANUÁRIO DA RECICLAGEM 2017-2018*. 2019.

29. United Nations Department of Economic and Social Affairs Statistics Division, UN Commodity Trade Statistics Database, https://comtrade.un.org/data/.

30. Brooks, A.L., S. Wang, and J.R. Jambeck, *The Chinese import ban and its impact on global plastic waste trade*. Science Advances, 2018. 4(6).

31. Ocean Conservancy. *Top 10 Items Found*. 2018 July 30, 2019]; Available from: https://oceanconservancy.org/trash-free-seas/international-coastal-cleanup/annual-data-release/.

32. World Health Organization (WHO), *Microplastics in drinking-water*. 2019: Geneva.

33. SAPEA, Science Advice for Policy by European Academies, *A Scientific Perspective on Microplastics in Nature and Society*. 2019: Berlin: SAPEA.

34. Rech, S., et al., *Sampling of riverine litter with citizen scientists - findings and recommendations*. Environmental Monitoring & Assessment, 2015. 187(6): p. 1-18.

35. Shruti, V.C., et al., *Microplastics in freshwater sediments of Atoyac River basin*, Puebla City, Mexico. Science of The Total Environment, 2019. 654: p. 154-163.

36. Martínez Silva P, Nanny MA. Impact of Microplastic Fibers from the Degradation of Nonwoven Synthetic Textiles to the Magdalena River Water Column and River Sediments by the City of Neiva, Huila (Colombia). Water. 2020;12(4).

37. Pazos, R.S., et al., *Microplastics in gut contents of coastal freshwater fish from Rio de la Plata estuary*. Marine Pollution Bulletin, 2017(1).

38. Arias, A.H., et al., *Evidence of Microplastic Ingestion by Fish from the Bahía Blanca Estuary in Argentina, South America*. Bulletin of Environmental Contamination and Toxicology, 2019. 102(6): p. 750-756.

39. UNEP, *Single-Use Plastics: A Roadmap for Sustainability*. 2018.

40. United Nations Environment Program (UNEP). *Farewell plastics carrier bag!* . 2017; Available from: https://oceanconference.un.org/commitments/?id=16526.

41. Beveridge & Diamond P.C. *Rio de Janeiro Imposes Retailer Responsibility for Plastic Shopping Bags*. Latin American Region Environmental Quarterly (October) 2009; Available from: http://www.bdlaw.com/news-697.html.

42. Siqueira, L., *Plastic bag bans in Brazil spark debate*, in ICIS News. 2011.

43. The Summit Foundation. *Eliminating Plastic Pollution on the Mesoamerican Reef*. 2017; Available from: http://www.summitfdn.org/mesoamerican-reef/eliminating-plastic-pollution-on-the-mesoamericanreef/.

44. OECD, *Extended Producer Responsibility*. 2016.

45. OECD, *What have we learned about Extended Producer Responsibility in the past decade? Case Study: Chile*. 2014, Organization for Economic Cooperative Development.

References

46. Ministerio de Ambiente y Desarrollo Sostenible, *Por la cual se reglamenta la gestion ambiental de los residuos de envases y empaques de papel, carton, plastico, vidrio, metal y se toman ostras determinaciones*. 2018.

47. Alcaldia de Guayaquil. *En la Terminal Río Daule se inaugura máquina de reciclaje y trituración de botellas, el jueves 27 de junio. (In the Rio Daule terminal, the plastic bottles recycling machine is unveiled, on Thursday June 27)*. 2019 [cited 2020 June 21]; Available from: https://guayaquil.gob.ec/Paginas/noticias/2019/junio/noticia5012.aspx.

48. *ecoins. ¿Cómo funciona?* 17 May 2020]; Available from: https://costarica.ecoins.eco/QuienesSomos/Index.

49. CleanSeas. (n.d.) Latin American and Caribbean countries champion marine conservation. Retrieved on September 25, 2020 from https://www.cleanseas.org/impact/latin-american-and-caribbean-countries-champion-marine-conservation

50. Central Intelligence Agency, *The World Factbook.* 2020: Washington, DC.

51. Burke, L., et al., *Coastal Ecosystems, in Pilot Analysis of Global Ecosystems* (PAGE). 2001, World Resources Institute: Washington, DC.

52. Ministerio do Meio Ambiente Brasil. *Painel Residuos Solidos Urbanos: Indicadores Municipais (Municipal Solid Waste Panel: Municipal Indicators)*.2017 [cited 2020 February 27]; Available from: https://app.powerbi.com/view?r=eyJrIjoiNGVkYTRiZTktMGUwZS00OWFiLTgwNWYtNGQ3Y2JlZmJhYzFiIiwidCI6IjJiMjY2ZmE5LTNmOTMtNGJiMS05ODMwLTYzNDY3NTJmMDNlNCIsImMiOjF9.

53. Ministerio do Meio Ambiente Brasil. *Combate ao Lixo no Mar (Fight Marine Debris)*. [cited 2020 Frebruary 27]; Available from: https://www.mma.gov.br/agenda-ambiental-urbana/lixo-no-mar.html.

54. Alfaia, R.G.D.S.M., Costa, A.M., & Campos, J.C. (2017). Municipal solid waste in Brazil: A review. Waste Management & Research, 35(12), 1195-1209.

55. Sistema Nacional de Informações sobre Saneamento Brasil. *Diagnóstico do Manejo de Resíduos Sólidos Urbanos (Diagnostic of Solid Waste Management.* 2018 [cited 2020 February 27]; Available from: http://www.snis.gov.br/downloads/diagnosticos/rs/2018/Diagnostico_RS2018.pdf.

56. World Bank, Brazil: *Integrated Solid Waste Management and Carbon Finance Project*, in *What Works*. 2018, World Bank: Washington, DC.

57. NVC Netherlands Packaging Centre. *Packaging EPR agreement signed in Brazil*. 2015 [cited 2020 May 18]; Available from: https://www.en.nvc.nl/news/item/epr-verpakkingsovereenkomst-getekend-in-brazilie/.

58. Cidade de Sao Paulo Brasil. *Prefeito sanciona Lei que proíbe o fornecimento de produtos descartáveis de plástico (Governor Sanctions Law that Prohibits the Supply of Single-Use Plastic Products)*. 2020 [cited 2020 February 27]; Available from: http://www.capital.sp.gov.br/noticia/prefeito-sanciona-lei-que-proibe-o-fornecimento-de-produtos-descartaveis-de-plastico.

59. Ministerio do Meio Ambiente Brasil. *MMA lança Programa Nacional Lixão Zero (Ministry for the Environment launches the National Zero Waste Program)*. 2019 [cited 2020 February 27]; Available from: https://www.mma.gov.br/informma/item/15466-mma-lan%C3%A7a-programa-nacional-lix%C3%A3o-zero.html.

60. WasteExpo. (n.d.) Waste Expo Brasil/Home. Retrieved on September 25, 2020 from http://www.wasteexpo.com.br/eng-home.html

61. Alianza Basura Cero Chile. *Alianza Basura Cero Chile: Ejes estratégicos (Zero Waste Alliance Chile: Strategic Axis)*. [cited 2020 March 5]; Available from: https://alianzabasuracero.cl/quienes-somos/.

62. Subsedere (Subsecretaría de Desarrollo Regional y Administrativo). *Diagnóstico De La Situación Por Comuna Y Por Región En Materia De Residuos Sólidos Domiciliarios Y Asimilables (Diagnostic on Residential Solid Waste and Similar per Commune and Region*). 2018 [cited 2020 March 5]; Available from: http://www.subdere.gov.cl/sites/default/files/4.1_diagnostico_introduccion_agosto_2018.pdf.

63. CONAMA, Comisión Nacional del Medio Ambiente, Chile. 2010.Primer Reporte Del Manejo De Residuos Sólidos En Chile (First Report of Solid Waste Management in Chile). Retrieved on September 25, 2020 from http://www.hidronor.cl/pdf/1_Primer_Reporte_del_Manejo_de_Residuos_S%C3%B3lidos_en_Chile_Conama_2010.pdf

64. Ocean Conservancy. *Ocean Conservancy and Government of Chile Announce Partnership to Combat Ocean Plastic Pollution through APEC*. 2019 [cited 2020 MArch 6]; Available from: https://oceanconservancy.org/news/ocean-conservancy-government-chile-announce-partnership-combat-ocean-plastic-pollution-apec/.

65. DIRECTEMAR (Dirección General del Territorio Marítimo y de Marina Mercante de la Armada de Chile). *Limpieza de playas (Cleaning of Beaches)*. [cited 2020 March 6]; Available from: https://www.directemar.cl/directemar/intereses-maritimos/limpieza-de-playas.

66. Ministerio del Medio Ambiente Chile. *Gobierno de Chile promulga Ley de bolsas plásticas (Chilean Government promotes Plastic Bags Law)*. 2018 [cited 2020 March 5]; Available from: https://mma.gob.cl/gobierno-de-chile-promulga-ley-de-bolsas-plasticas/.

67. Ministerio de Medio Ambiente, Chile. (n.d.2) *Ley de fomento al Reciclaje (Law for Encouraging Recycling)*. Retrieved on September 25, 2020 from https://mma.gob.cl/economia-circular/ley-de-fomento-al-reciclaje/

68. Ministerio de Medio Ambiente, Chile. (n.d.3) *Política de Inclusión de Recicladores de Base 2016-2020 (Policy to Include Base Recyclers 2016-2020)*. Retrieved on September 25, 2020 from https://mma.gob.cl/wp-content/uploads/2016/12/Politica-de-inclusion-de-recicladores-de-base.pdf

69. Ministerio de Medio Ambiente, Chile. (n.d.1) *Chile Cero Basura. (Zero Waste Chile)*. Retrieved on September 25, 2020 from https://mma.gob.cl/economia-circular/chile-cero-basura

70. Fundacion Basura. *Fundacion Basura: Somos (Trash Foundation: We Are)*. [cited 2020 March 5]; Available from: https://www.fundacionbasura.org/somos/.

71. New Plastics Economy. *Chile joins Plastics Pact network*. 2019 [cited 2020 July 13]; Available from: https://www.newplasticseconomy.org/news/chile-joins-plastics-pact-network.

72. Superinterdencia de Servicios Públicos Domiciliarios, Colombia. (2019). *Disposición final de residuos sólidos informe nacional 2018 (Final Disposal of Solid Waste National Report 2018)*. Retrieved on September 25, 2020 from https://www.superservicios.gov.co/sites/default/archivos/Publicaciones/Publicaciones/2020/Ene/informe_nacional_disposicion_final_2019_1.pdf

73. CONPES, Consejo Nacional de Politica Economica y Social, Colombia. 2016. *Política Nacional Para La Gestión Integral De Residuos Sólidos (National Framework for SWM and Recovery).* Retrieved on September 25, 2020 from https://colaboracion.dnp.gov.co/CDT/Conpes/Econ%C3%B3micos/3874.pdf

74. CCO (Comision Colombiana del Oceano). *I Comité Técnico Nacional para la prevención de la contaminación marina 2017 (I National Technical Committee for Marine Pollution Prevention)*. 2017 [cited 2020 March 6]; Available from: http://www.cco.gov.co/cco/prensa/cco/prensa/noticias/135-gestion-del-territorio-marino-costero/341-i-comite-tecnico-nacional-para-la-prevencion-de-la-contaminacion-marina-2017.html.

75. Ministerio de Vivienda (Minvivienda), Colombia. (n.d.). *Gestión de Residuos Solidos: Aprovechamiento (Solid Waste Management: Material Recovery)*. Retrieved on September 25, 2020 from http://www.minvivienda.gov.co/viceministerios/viceministerio-de-agua/gestioninstitucional/gesti%C3%B3n-de-residuos-solidos/aprovechamiento

76. Ministerio de Ambiente, Colombia. (2018). Ministerio de Ambiente y Desarrollo Sostenible: Resolucion 1407 (Ministry of Environment and Sustainable Development: Resolution 1407). Retrieved on September 25, 2020 from https://www.minambiente.gov.co/images/normativa/app/resoluciones/5d-RES%201407%20DE%202018.pdf

References

77. Enviro-Pac. *Industry Updates Legislation Colombian resolution establishes packaging EPR*. 2018; Available from: https://www.enviro-pac.com/single-post/2018/09/25/Colombian-Resolution-Establishes-Packaging-EPR.

78. Gobierno de Colombia Presidencia de la Republica. *Abecé de la Ley 1973 de 2019 que prohíbe el ingreso, el uso y la comercialización de plásticos en el archipiélago de San Andrés, Providencia y Santa Catalina. (ABC of the 2019-1973 Law that prohibits entry, use, and commercialization of plastic in the archipelago of San Andrés, Providencia y Santa Catalina)*. 2019 [cited 2020 March 7]; Available from: https://id.presidencia.gov.co/Paginas/prensa/2019/190719-Abece-Ley-1973-2019-prohibe-ingreso-uso-comercializacion-plasticos-San-Andres-Providencia-Santa-Catalina.aspx.

79. Ministerio de Ambiente Colombia. *Se redujo en más de un 50 % el uso de bolsas plásticas en los principales establecimientos comerciales del país (Reduction of More than 50% Usage of Plastic Bags in Commercial Establishments in the Country)*. 2018 [cited 2020 March 7]; Available from: http://www.minambiente.gov.co/index.php/noticias/4358-se-redujo-en-mas-de-un-50-el-uso-de-bolsas-plasticas-en-los-principales-establecimientos-comerciales-del-pais.

80. Gobierno de Colombia Departamento Nacional de Planeacion. *El 71% de hogares colombianos redujo el consumo de bolsas plásticas. (71% of Colombian Households Reduced their Plastic Bags Consumption)*. 2018 [cited 2020 March 7]; Available from: https://www.dnp.gov.co/Paginas/El-71-de-hogares-colombianos-redujo-el-consumo-de-bolsas-pl%C3%A1sticas.aspx.

81. Bogota Mi Ciudad Habitat. *Basura Cero Responsabilidad de todos (Zero Waste Everyone's Responsibility)*. 2013 [cited 2020 March 7]; Available from: https://bogota.gov.co/mi-ciudad/habitat/basura-cero-responsabilidad-de-todos.

82. Sonnemann, G. and S. Valdivia, *Medellin Declaration on Marine Litter in Life Cycle Assessment and Management*. International Journal of Life Cycle Assessment, 2017. 22(10): p. 1637-1639.

83. Gobierno de Ecuador - Ecuador en Cifras. *Gestion de Residuos Solidos (Solid Waste Management)*. 2017 [cited 2020 March 8]; Available from: https://www.ecuadorencifras.gob.ec/documentos/web-inec/Encuestas_Ambientales/Municipios_2017/Residuos_solidos_2017/PRESENTACION_RESIDUOS_2017.pdf.

84. INEC, Instituto Nacional de Estadistica y Censos, Ecuador. (2017). GAD Municipales-2017: Gestión de Residuos Solidos/Tabulados. (Solid Waste Management). Retrieved on September 25, 2020 https://www.ecuadorencifras.gob.ec/gad-municipales-2017/

85. Ministerio del Ambiente Ecuador. *Ecuador y ONU Medio Ambiente lanzan un llamado para terminar con la contaminación por plásticos (Ecuador and ONU Environment Launch Call to End Plastics Pollution)*. 2018 [cited 2020 March 8]; Available from: https://www.ambiente.gob.ec/ecuador-onu-medio-ambiente-lanzan-llamado-terminar-la-contaminacion-plasticos/.

86. INP (Instituto Nacional de Pesca) Ecuador. *"Plásticos en el mar... NO MÁS!" (Plastics in the Sea... NO MORE!)*. 2018 [cited 2020 March 8]; Available from: http://www.institutopesca.gob.ec/plasticos-en-el-mar-no-mas/.

87. Barragan, P.Z. *Recycling: The Price is Right*. 2014 19 May 2020]; Available from: https://blogs.iadb.org/ciudades-sostenibles/en/recycling-the-price-is-right/.

88. International, T.B.Y., *The Business Year: Ecuador 2020*. 2020.

89. Secretaria de Ambiente Quito Ecuador. *Consejo Metropolitano de Quito Resolucion C009-2019: Ordenanza Metropolitana Para La Disminución De Plásticos De Un Solo Uso En El Distrito Metropolitano De Quito (Metropolitan Council of Quito Consejo Metropolitano de Quito Resolution C009-2019: Metropolitan Ordinance for the Reduction of Single-use Plastics in the Metropolitan District of Quito)*. 2019 [cited 2020 March 9]; Available from: http://www.quitoambiente.gob.ec/ambiente/images/Secretaria_Ambiente/Documentos/buenas_practicas/manuales/RC-2019-009-DMQ-INSTITUCION_PUBLICA_LIBRE_UTILIZACION_PRODUCTOS_PLASTICOS.pdf.

References

90. SUIA (Sistema Unico de Informacion Ambiental) Ministerio del Medio Ambiente Ecuador. *PNGIDS: ¿Quiénes somos? (PNGIDS: Who are we?)*. [cited 2020 March 9]; Available from: http://suia.ambiente.gob.ec/quienes-somos-pngids.

91. UNEP (United Nations Environment Program). *In the Galápagos, fighting the rising tide of plastic pollution*. 2018 [cited 2020 April 15]; Available from: https://www.unenvironment.org/news-and-stories/story/galapagos-fighting-rising-tide-plastic-pollution.

92. IBWC, International Boundary and Water Commission, United States and Mexico. (n.d.). United States Section: About the Rio Grande. Retrieved on September 25, 2020 from https://www.ibwc.gov/CRP/riogrande.htm

93. SEMARNAT (Secretaria de Medio Ambiente y Recursos Naturales). E*l Medio Ambiente en Mexico 2013-2014: Residuos sólidos urbanos. (Environment in Mexico 2013-2014: Municipal Solid Waste)*. 2014 [cited 2020 March 3]; Available from: https://apps1.semarnat.gob.mx:8443/dgeia/informe_resumen14/07_residuos/7_1_2.html.

94. SEMARNAT (Secretaria de Medio Ambiente y Recursos Naturales). *Prevención y gestión integral de los residuos: Programa orientado a los estados y municipios (Waste Management and Prevention: State and Municipal Directed Program)*. 2017c [cited 2020 March 4]; Available from: https://www.gob.mx/semarnat/acciones-y-programas/prevencion-y-gestion-integral-de-los-residuos.

95. Gobierno de Mexico. *#MaresLimpios, una tarea de todos (#CleanOceans, a task for everyone)*. 2018 [cited 2020 March 2]; Available from: https://www.gob.mx/semarnat/articulos/mareslimpios-una-tarea-de-todos.

96. Gobierno de Mexico. *Agenda 2030: Objetivo de Desarrollo Sostenible 14: Vida Submarina (Sustainable Development Objective 14: Marine Life*. 2017 [cited 2020 March 2]; Available from: https://www.gob.mx/agenda2030/articulos/14-vida-submarina.

97. SEDEMA (Secretaria de Medio Ambiente). *Llama Sedema a respetar prohibición y no aceptar bolsas de plástico desechables (Sedema asks to respect the ban and reject single-use plastic bags)*. . 2020 [cited 2020 March 3]; Available from: https://sedema.cdmx.gob.mx/comunicacion/nota/llama-sedema-respetar-prohibicion-y-no-aceptar-bolsas-de-plastico-desechables.

98. Gobierno de Mexico. *Prohibición Del Uso De Bolsas De Plástico: Derecho Comparado A Nivel Internacional Y Estatal (Plastic Bags Usage Ban: Comparative Law at the State and International Level)*. 2019 [cited 2020 March 3]; Available from: http://www.diputados.gob.mx/sedia/sia/spi/SAPI-ISS-20-19.pdf.

99. Gobierno de Mexico. *Visión Nacional Hacia Una Gestión Sustentable: Cero residuos (National Goals towards Sustainable Management: Zero Waste)*. 2019 [cited 2020 March 4]; Available from: https://www.gob.mx/cms/uploads/attachment/file/435917/Vision_Nacional_Cero_Residuos_6_FEB_2019.pdf.

100. SEMARNAT (Secretaria de Medio Ambiente y Recursos Naturales). *Fomento al aprovechamiento de la fracción orgánica de los RSU (Promotion of Harnessing of the Organic Percentage of MSW)*. 2017b [cited 2020 March 4]; Available from: https://www.gob.mx/semarnat/acciones-y-programas/fomento-al-aprovechamiento-de-la-fraccion-organica-de-los-rsu.

101. SEMARNAT (Secretaria de Medio Ambiente y Recursos Naturales). *Aprovechamiento energético de residuos urbanos (EnRes) (Energy Harnessing of Urban Residuals (EnRes)*). 2017a [cited 2020 March 4]; Available from: https://www.gob.mx/semarnat/acciones-y-programas/aprovechamiento-energetico-de-residuos-urbanos-enres.

102. INEI (Instituto Nacional de Estadistica e Informatica) Peru. *Un Analisis de la Eficiencia de la Gestion Municipal de Residuos Solidos en el Peru y sus Determinantes (Analysis of Municipal Solid Waste Management in Peru)*. 2018 [cited 2020 March 6]; Available from: https://www.inei.gob.pe/media/MenuRecursivo/investigaciones/residuos-solidos.pdf.

References

103. Ministerio de Medio Ambiente Peru. I*nforme Anual De Residuos Sólidos Municipales Y No Municipales En El Perú Gestión (Annual Report of Municipal and No-Municipal Solid Waste Management Peru)*. 2012 [cited 2020 March 6]; Available from: http://redrrss.minam.gob.pe/material/20140423145035.pdf.

104. Ministerio de Medio Ambiente Peru. *Grupo Técnico De Trabajo Especializado "Residuos Y Desechos Marinos" (Technical Working Group Specialized in "Marine Debris"*). 2018 [cited 2020 March 6]; Available from: http://www.minam.gob.pe/comuma/wp-content/uploads/sites/106/2019/04/PPT-GTTE-Residuos-y-desechos-marinos-17.07.18.pdf.

105. UNEP, *Legal Limits on Single-Use Plastics and Microplastics: A Global Review of National Laws and Regulations*. 2018.

106. Gobierno de Peru Ministerio del Ambiente. *Impuesto al consumo de las bolsas de plástico será de S/ 0.20 durante el 2020 (Plastic Bag Usage Fee will be of S/0.20 During 2020*). 2019a [cited 2020 March 6]; Available from: http://www.gob.pe/institucion/minam/noticias/76338-impuesto-al-consumo-de-las-bolsas-de-plastico-sera-de-s-0-20-durante-el-2020.

107. Gobierno de Peru Ministerio del Ambiente. *MINAM: Desde este viernes se prohíbe la fabricación de cañitas de plástico (MINAM: Fabrication of Plastic Straws will be banned from this Friday on*). 2019b [cited 2020 March 6]; Available from: http://www.gob.pe/institucion/minam/noticias/71200-minam-desde-este-viernes-se-prohibe-la-fabricacion-de-canitas-de-plastico.

108. Ministerio de Medio Ambiente Peru. *Programa nacional de segregación en la fuente y recolección selectiva de residuos sólidos (National Program of Source Separation and Selective Collection of Solid Waste*). [cited 2020 March 6]; Available from: http://www.minam.gob.pe/gestion-de-residuos-solidos/programa-nacional-de-segregacion-en-la-fuente-y-recoleccion-selectiva-de-residuos-solidos/.

109. Ministerio de Medio Ambiente Peru. *Campaña #MenosPlásticoMásVida (#LessPlasticMoreLife Campaign*). [cited 2020 March 6]; Available from: http://www.minam.gob.pe/menos-plastico-mas-vida/campana-menosplasticomasvida/.

110. Gobierno de Peru Ministerio del Ambiente. *Minedu se suma a la estrategia Perú Limpio (Minedu joins the Clean Peru Strategy*). . 2019c [cited 2020 March 6]; Available from: http://www.minam.gob.pe/wp-content/uploads/2018/06/Instructivo-para-el-uso-de-la-marca-Peru-Limpio.pdf.

111. PepsiCo, *PepsiCo Latin America Doubles Down on Its Commitment to Inclusive Recycling by Launching "Recycling with Purpose", a Program That Will Promote a Circular Economy*. 2019: Miami, Florida.

112. Borrelle, S. B., J. Ringma, K. L. Law, C. C. Monnahan, L. Lebreton, A. McGivern, E. Murphy, J. Jambeck, G. H. Leonard, M. A. Hilleary, M. Eriksen, H. P. Possingham, H. De Frond, L. R. Gerber, B. Polidoro, A. Tahir, M. Bernard, N. Mallos, M. Barnes and C. M. Rochman. 2020. Predicted growth in plastic waste exceeds efforts to mitigate plastic pollution. Science 369(6510): 1515.

113. Blettler, M.C.M., et al., *Plastic pollution in freshwater ecosystems: macro-, meso-, and microplastic debris in a floodplain lake*. Environmental Monitoring And Assessment, 2017. 189(11): p. 581-581.

114. Pazos, R.S., D.E. Bauer, and N. Gómez, *Microplastics integrating the coastal planktonic community in the inner zone of the Río de la Plata estuary (South America)*. Environmental Pollution, 2018. 243: p. 134-142.

115. Goss, H., J. Jaskiel, and R. Rotjan, *Thalassia testudinum as a potential vector for incorporating microplastics into benthic marine food webs*. Marine Pollution Bulletin, 2018. 135: p. 1085-1089.

116. Colabuono, F.I., et al., *Plastic ingestion by Procellariiformes in Southern Brazil*. Marine Pollution Bulletin, 2009. 58(1): p. 93-96.

117. Ivar do Sul, J.A., Â. Spengler, and M.F. Costa, *Here, there and everywhere. Small plastic fragments and pellets on beaches of Fernando de Noronha (Equatorial Western Atlantic)*. Marine Pollution Bulletin, 2009. 58(8): p. 1236-1238.

118. Costa, M.F., et al., *On the importance of size of plastic fragments and pellets on the strandline: a snapshot of a Brazilian beach*. Environmental Monitoring and Assessment, 2010. 168(1): p. 299-304.

119. Tourinho, P.S., J.A. Ivar do Sul, and G. Fillmann, *Is marine debris ingestion still a problem for the coastal marine biota of southern Brazil?* Marine Pollution Bulletin, 2010. 60(3): p. 396-401.

120. Guebert-Bartholo, F.M., et al., *Using gut contents to assess foraging patterns of juvenile green turtles Chelonia mydas in the Paranaguá Estuary, Brazil*. Endangered Species Research, 2011. 13(2): p. 131-143.

121. Dantas, D.V., M. Barletta, and M.F. da Costa, *The seasonal and spatial patterns of ingestion of polyfilament nylon fragments by estuarine drums (Sciaenidae)*. Environmental Science and Pollution Research, 2012. 19(2): p. 600-606.

122. Majer, A.P., M.C. Vedolin, and A. Turra, *Plastic pellets as oviposition site and means of dispersal for the ocean-skater insect Halobates*. Mar Pollut Bull, 2012. 64.

123. Ramos, J.A.A., M. Barletta, and M.F. Costa, I*ngestion of nylon threads by Gerreidae while using a tropical estuary as foraging grounds*. Aquatic Biology, 2012. 17(1): p. 29-34.

124. Ivar do Sul, J.A., et al., *Pelagic microplastics around an archipelago of the Equatorial Atlantic*. Marine Pollution Bulletin, 2013. 75(1): p. 305-309.

125. Ivar do Sul, J.A., M.F. Costa, and G. Fillmann, *Microplastics in the pelagic environment around oceanic islands of the Western Tropical Atlantic Ocean*. Water, Air, & Soil Pollution, 2014. 225(7): p. 2004.

126. Lima, A.R.A., M.F. Costa, and M. Barletta, *Distribution patterns of microplastics within the plankton of a tropical estuary*. Environmental Research, 2014. 132: p. 146-155.

127. Turra, A., et al., *Three-dimensional distribution of plastic pellets in sandy beaches: shifting paradigms*. Sci Rep, 2014. 4.

128. Brennecke, D., et al., *Ingested microplastics (>100Qm) are translocated to organs of the tropical fiddler crab Uca rapax*. Marine Pollution Bulletin, 2015. 96(1): p. 491-495.

129. Fernandino, G., et al., *How many pellets are too many? The pellet pollution index as a tool to assess beach pollution by plastic resin pellets in Salvador, Bahia, Brazil*. Journal of Integrated Coastal Zone Management, 2015. 15(3): p. 325-332.

130. Lima, A.R.A., M. Barletta, and M.F. Costa, *Seasonal distribution and interactions between plankton and microplastics in a tropical estuary.* Estuarine, Coastal and Shelf Science, 2015. 165: p. 213-225.

131. Nobre, C.R., et al., *Assessment of microplastic toxicity to embryonic development of the sea urchin Lytechinus variegatus (Echinodermata: Echinoidea)*. Marine Pollution Bulletin, 2015. 92(1): p. 99-104.

132. Santos, R.G., et al., *Debris ingestion by juvenile marine turtles: An underestimated problem*. Marine Pollution Bulletin, 2015. 93(1): p. 37-43.

133. de Carvalho, D.G. and J.A. Baptista Neto, *Microplastic pollution of the beaches of Guanabara Bay, Southeast Brazil*. Ocean & Coastal Management, 2016. 128: p. 10-17.

134. Castro, R.O., et al., *Evaluation of microplastics in Jurujuba Cove, Niterói, RJ, Brazil, an area of mussels farming*. Marine Pollution Bulletin, 2016. 110(1): p. 555-558.

135. Gandara e Silva, P.P., et al., *Leachate from microplastics impairs larval development in brown mussels.* Water Research, 2016. 106: p. 364-370.

136. Gusmão, F., et al., *In situ ingestion of microfibres by meiofauna from sandy beaches.* Environmental Pollution, 2016. 216: p. 584-590.

137. Miranda, D.d.A. and G.F. de Carvalho-Souza, *Are we eating plastic-ingesting fish?* Marine Pollution Bulletin, 2016. 103(1): p. 109-114.

138. Moreira, F.T., et al., *Revealing accumulation zones of plastic pellets in sandy beaches.* Environmental Pollution, 2016. 218: p. 313-321.

139. Moreira, F.T., et al., *Small-scale temporal and spatial variability in the abundance of plastic pellets on sandy beaches: Methodological considerations for estimating the input of microplastics*. Marine Pollution Bulletin, 2016. 102(1): p. 114-121.

140. Santana, M.F.M., et al., *Microplastic contamination in natural mussel beds from a Brazilian urbanized coastal region: Rapid evaluation through bioassessment.* Marine Pollution Bulletin, 2016. 106(1): p. 183-189.

141. Fisner, M., et al., *Quantifying microplastic pollution on sandy beaches: the conundrum of large sample variability and spatial heterogeneity*. Environmental Science and Pollution Research, 2017. 24(15): p. 13732-13740.

142. Silva-Cavalcanti, J.S., et al., *Microplastics ingestion by a common tropical freshwater fishing resource*. Environmental Pollution, 2017. 221: p. 218-226.

143. Vendel, A.L., et al., *Widespread microplastic ingestion by fish assemblages in tropical estuaries subjected to anthropogenic pressures*. Marine Pollution Bulletin, 2017. 117(1): p. 448-455.

144. Dantas, N.C.F.M., et al., *Plastic intake does not depend on fish eating habits: Identification of microplastics in the stomach contents of fish on an urban beach in Brazil*. Marine Pollution Bulletin, 2020. 153: p. 110959.

145. Browne, M.A., et al., *Accumulation of Microplastic on Shorelines Woldwide: Sources and Sinks*. Environmental Science & Technology, 2011. 45(21): p. 9175-9179.

146. Chagnon, C., et al., *Plastic ingestion and trophic transfer between Easter Island flying fish (Cheilopogon rapanouiensis) and yellowfin tuna (Thunnus albacares) from Rapa Nui (Easter Island)*. Environmental Pollution, 2018. 243: p. 127-133.

147. Corradini, F., et al., *Evidence of microplastic accumulation in agricultural soils from sewage sludge disposal*. The Science of the Total Environment, 2019.

148. Hidalgo-Ruz, V. and M. Thiel, *Distribution and abundance of small plastic debris on beaches in the SE Pacific (Chile): a study supported by a citizen science project.* Mar Environ Res, 2013. 87-88: p. 12-8.

149. Pozo, K., et al., *Presence and characterization of microplastics in fish of commercial importance from the Biobío region in central Chile*. Marine Pollution Bulletin, 2019. 140: p. 315-319.

150. Pozo, K., et al., *Persistent organic pollutants sorbed in plastic resin pellet — "Nurdles" from coastal areas of Central Chile*. Marine Pollution Bulletin, 2020. 151: p. 110786.

151. Johnson, D.E., et al., *Preventing plastics pervading an oceanic oasis: Building the case for the Costa Rica Thermal Dome to become a World Heritage site in ABNJ*. Marine Policy, 2018. 96: p. 235-242.

152. Naranjo-Elizondo, B. and J. Cortés, *Observations of Litter Deposited in the Deep Waters of Isla del Coco National Park*, Eastern Tropical Pacific. 2018. 5(91).

153. Rosas-Luis, R., *Description of plastic remains found in the stomach contents of the jumbo squid Dosidicus gigas landed in Ecuador during 2014*. Marine Pollution Bulletin, 2016. 113(1): p. 302-305.

154. Green, D.S., et al., *A comparison of sampling methods for seawater microplastics and a first report of the microplastic litter in coastal waters of Ascension and Falkland Islands*. Marine Pollution Bulletin, 2018. 137: p. 695-701.

155. Rose, D. and M. Webber, *Characterization of microplastics in the surface waters of Kingston Harbour*. Science of The Total Environment, 2019. 664: p. 753-760.

156. Fossi, M., et al., *Are whale sharks exposed to persistent organic pollutants and plastic pollution in the Gulf of California (Mexico)? First ecotoxicological investigation using skin biopsies.* Comparative Biochemistry and Physiology Part C: Toxicology & Pharmacology, 2017. 199.

157. Piñon-Colin, T.d.J., et al., *Microplastics on sandy beaches of the Baja California Peninsula*, Mexico. Marine Pollution Bulletin, 2018. 131: p. 63-71.

158. Borges Ramirez, M.M., R. Dzul Caamal, and J. Rendón von Osten, *Occurrence and seasonal distribution of microplastics and phthalates in sediments from the urban channel of the Ria and coast of Campeche, Mexico*. Science of The Total Environment, 2019. 672: p. 97-105.

159. Retama, I., et al., *Microplastics in tourist beaches of Huatulco Bay, Pacific coast of southern Mexico.* Marine Pollution Bulletin, 2016. 113: p. 530.

160. Bosker, T., L. Guaita, and P. Behrens, *Microplastic pollution on Caribbean beaches in the Lesser Antilles.* Marine Pollution Bulletin, 2018. 133: p. 442-447.

161. Davidson, T.M., *Boring crustaceans damage polystyrene floats under docks polluting marine waters with microplastic.* Mar Pollut Bull, 2012. 64.

162. De-la-Torre, G.E., et al., *Abundance and distribution of microplastics on sandy beaches of Lima, Peru*. Marine Pollution Bulletin, 2020. 151: p. 110877.

163. Jamieson, A.J., et al., *Microplastics and synthetic particles ingested by deep-sea amphipods in six of the deepest marine ecosystems on Earth*. 2019. 6(2): p. 180667.

164. Lozoya, J.P., et al., *Plastics and microplastics on recreational beaches in Punta del Este (Uruguay): Unseen critical residents?* Environmental Pollution, 2016. 218: p. 931-941.

165. Vélez-Rubio, G.M., et al., *Differential impact of marine debris ingestion during ontogenetic dietary shift of green turtles in Uruguayan waters.* Marine Pollution Bulletin, 2018. 127: p. 603-611.

Appendix

Table A1. Solid waste collection coverage by country in LAC Region

COUNTRY	RURAL % OF HOUSE-HOLDS	RURAL % OF POPULATION	TOTAL % OF HOUSE-HOLDS	TOTAL % OF POPULATION	TOTAL % OF WASTE	URBAN % OF HOUSE-HOLDS	URBAN % OF POPULATION
Aruba	NR	NR	NR	NR	NR	NR	NR
Argentina	NR	NR	NR	89.91	NR	NR	94.82
Antigua and Barbuda	NR	NR	NR	98.61	NR	NR	NR
Bahamas	NR	NR	NR	NR	NR	NR	NR
Belize	NR	NR	NR	85.2	NR	NR	NR
Bolivia	NR	5.9	NR	57.6	NR	NR	85.4
Brazil	NR	NR	NR	91.3	90.81	NR	NR
Barbados	NR	NR	NR	90	NR	NR	NR
Chile	NR	NR	NR	NR	95	NR	NR
Colombia	24.1	NR	NR	80.6	NR	97.4	NR
Costa Rica	NR	NR	NR	90.4	NR	NR	NR
Cuba	NR	0.04	NR	76.9	NR	NR	100
Curacao	NR	NR	NR	NR	NR	NR	NR
Cayman Islands	NR	NR	NR	NR	NR	NR	NR
Dominica	NR	NR	NR	94	NR	NR	NR
Dominican Republic	NR	NR	74.9	NR	NR	NR	NR
Ecuador	63.4	NR	88.4	NR	NR	99.3	NR
Grenada	NR	NR	98.3	NR	NR	NR	NR
Guatemala	NR	NR	NR	77.7	NR	NR	NR
Guyana	NR	NR	NR	89	NR	NR	NR
Honduras	NR	NR	NR	64.6	NR	NR	NR
Haiti	0.4	NR	12.4	NR	NR	NR	23.8
Jamaica	28	NR	63.99	76	NR	67	NR
St. Kitts and Nevis	NR	NR	NR	95	NR	NR	NR
St. Lucia	NR	NR	96.8	100	NR	NR	NR

COUNTRY	RURAL % OF HOUSE-HOLDS	RURAL % OF POPULATION	TOTAL % OF HOUSE-HOLDS	TOTAL % OF POPULATION	TOTAL % OF WASTE	URBAN % OF HOUSE-HOLDS	URBAN % OF POPULATION
St. Martin	NR	NR	NR	NR	NR	NR	NR
Mexico	NR	NR	NR	NR	93.4	NR	NR
Nicaragua	NR	NR	NR	92.3	NR	NR	NR
Panama	NR	NR	NR	84.9	NR	NR	NR
Peru	38.2	NR	NR	82.93	NR	95.3	NR
Puerto Rico	NR	NR	NR	NR	NR	NR	NR
Paraguay	NR	NR	47.2	46.6	NR	NR	NR
El Salvador	NR	NR	NR	78.8	NR	NR	NR
Suriname	NR	15	NR	79.5	48.7	NR	70
Sint Maarten	NR	NR	NR	NR	NR	NR	NR
Turks and Caicos	NR	NR	NR	NR	NR	NR	NR
Trinidad and Tobago	NR	NR	NR	94.31	NR	NR	NR
Uruguay	NR	NR	NR	98	NR	NR	100
St. Vincent and the Grenadines	95.4	NR	96.2	NR	NR	97.2	NR
Venezuela	NR	NR	NR	100	NR	NR	NR
British Virgin Islands	NR	NR	NR	97.2	NR	NR	NR
Virgin Islands (U.S.)	NR	NR	NR	NR	NR	NR	NR

Notes: NR = Not Reported; Source: [14]

Table A2. Definitions of solid waste terms used in this report

TERM	DEFINITION
Waste Generation Rate	The mass of waste generated per person per day, reported by country
Percent Plastic in the Waste Stream	The percentage of plastic comprising the municipal waste stream, reported by country
Plastic Waste Generation	The mass of plastic waste generated based on the population, waste generation rate, and the percent plastic in the waste stream
Coastal Plastic Waste Generation	Plastic waste generation by the populations that are located within 50 km of the coastline
Total Plastic Waste Generation	Plastic waste generation by the populations within an entire nation, territory, or economic state
Inadequately Managed Waste	Waste that is not managed in a controlled setting, cannot be accounted for and is usually part of other (often informal) methods such as open dumping, burning, or burying
Littered Waste	Waste that is not collected or managed and is deposited in the open or natural environment
Mismanaged Waste	The combined quantities of inadequate and littered fractions of waste
Coastal Mismanaged Plastic Waste	Mismanaged plastic waste that is generated by the populations that are located within 50 km of the coastline
Total Mismanaged Plastic Waste	Mismanaged plastic waste that is generated by the populations within an entire nation, territory, or economic state

Table A3. Cumulative (1988 – 2018) plastic scrap trade data by country in LAC region (UN Comtrade)

COUNTRY	EXPORT (MT)	IMPORT (MT)
Mexico	11,212,367	1,312,267
Argentina	423,065	4,365
Ecuador	228,122	47,752
Dominican Republic	224,347	46,027
El Salvador	196,967	100,297
Brazil	167,870	133,467
Chile	164,966	112,089
Costa Rica	118,058	104,654
Guatemala	114,848	30,069
Nicaragua	104,682	20,436
Paraguay	78,751	15,184
Venezuela	69,332	9,959
Colombia	61,046	122,278
Uruguay	58,434	14,933
Honduras	55,357	25,059
Bolivia	50,243	8,811
Panama	49,659	11,364
Trinidad and Tobago	18,051	1,898
Barbados	17,100	150
Jamaica	13,729	793
Peru	13,048	55,101
Belize	7,634	5,641
Suriname	3,482	30
Guyana	2,587	111
Saint Lucia	846	73
Bahamas	825	70,690

COUNTRY	EXPORT (MT)	IMPORT (MT)
Saint Vincent and the Grenadines	686	17
Cuba	561	284
Antigua and Barbuda	441	1
Saint Kitts and Nevis	45	7
Dominica	23	142
Netherlands Antilles	7	3
Grenada	6	7
Aruba	0	3
TOTAL	**13,457,186**	**2,253,960**

Table A4. Model approach for plastic waste generation and Country-wide and Coastal Mismanaged Plastic Waste

MODELED WASTE INDICATORS	CALCULATION COMPONENTS	DATA SOURCES
Plastic Waste Generation (tonnes/year)	population (country[a] or coastal[b]) x per capita waste generation rate[c] x % plastic in waste streamc	[a] CIA World Factbook [b] Calculated in ArcMap 10.8 with SEDAC GPWv4 [c] Kaza et al., 2018
Country-wide Mismanaged Plastic Waste (tonnes/year)	Plastic Waste Generation Country[a] x (% inadequately managed waste[d] + % littered wastee)	[d] Based on reported country-level values from Kaza et al., 2018 for treatment methods including unspecified landfills, open dumping, other (e.g., burning, burying), disposal in waterways, and unaccounted for [e] Based on Jambeck et al., 2015
Coastal Mismanaged Plastic Waste (tonnes/year)	Plastic Waste Generation Coastal[b] x (% inadequately managed waste[d] + % littered waste[e])	[d] Based on reported country-level values from Kaza et al., 2018 for treatment methods including unspecified landfills, open dumping, other (e.g., burning, burying), disposal in waterways, and unaccounted for [e] Based on Jambeck et al., 2015

Table A5. Mismanaged plastic waste in coastal populations by country in the LAC region in 2020t

COUNTRY	COASTAL POPULATION	% MISMANAGED WASTE[5]	2020 MISMANAGED COASTAL PLASTIC (MT)	2020 MISMANAGED COASTAL PLASTIC (KG/ PERSON/DAY)
Anguilla	18,090	34.1	587	0.089
Antigua and Barbuda	71,494	3.2	99	0.004
Argentina	13,036,775	24.6	194,963	0.041
Aruba	94,077	21.6	2,676	0.078
Bahamas	218,748	34.1	6,552	0.082
Barbados	225,643	3	727	0.009
Belize	246,052	68	8,819	0.098
Bolivia	-	57.5	-	-
Brazil	64,160,126	25.2	828,870	0.035
British Virgin Islands	37,381	11.9	382	0.028
Cayman Islands	41,167	81	4,592	0.306
Chile	4,419,541	15.8	27,552	0.017
Colombia	8,803,731	6	18,800	0.006
Costa Rica	2,011,964	11.1	7,711	0.011
Cuba	8,538,046	61.8	123,936	0.04
Curacao	151,345	100	3,767	0.068
Dominica	55,390	8	129	0.006
Dominican Republic	8,856,077	93.7	327,113	0.101
Ecuador	5,929,406	35.9	79,063	0.037
El Salvador	4,742,632	23.8	31,723	0.018
Falkland Islands	3,198	34.1	104	0.089
French Guiana	198,831	34.1	3,685	0.051
Grenada	77,192	3.5	134	0.005
Guadeloupe	321,557	34.1	5,959	0.051

COUNTRY	COASTAL POPULATION	% MISMANAGED WASTE[5]	2020 MISMANAGED COASTAL PLASTIC (MT)	2020 MISMANAGED COASTAL PLASTIC (KG/ PERSON/DAY)
Guatemala	2,483,090	77	56,714	0.063
Guyana	523,949	32.7	6,391	0.033
Haiti	10,908,742	92.1	270,004	0.068
Honduras	3,058,984	30.8	32,211	0.029
Jamaica	2,208,667	38	37,374	0.046
Martinique	326,897	34.1	10,601	0.089
Mexico	21,178,202	23	224,799	0.029
Montserrat	5,373	34.1	100	0.051
Nicaragua	2,534,076	82.4	75,605	0.082
Panama	3,386,032	44.3	67,672	0.055
Paraguay	-	25.4	-	-
Peru	14,888,953	58.4	250,364	0.046
Puerto Rico	2,919,365	35.3	128,129	0.12
Saint Kitts and Nevis	32,071	34.1	1,547	0.132
Saint Lucia	140,428	5.1	696	0.014
Saint Martin	32,556	34.1	860	0.072
Saint Vincent and the Grenadines	71,585	5.6	97	0.004
Sint Maarten	43,847	34.1	1,491	0.093
Suriname	457,130	100	7,676	0.046
Trinidad and Tobago	1,061,900	89.2	97,427	0.251
Turks and Caicos Islands	462	34.1	20	0.117
Uruguay	1,830,675	21.8	16,184	0.024
Venezuela	14,887,445	34.1	202,314	0.037
Virgin Islands (U.S.)	34,124	34.1	2,464	0.198
TOTAL			**3,693,456**	

Table A6. Mismanaged plastic waste in coastal populations by country in the LAC region in 2030

COUNTRY	COASTAL POPULATION	% MISMANAGED WASTE[5]	2030 MISMANAGED COASTAL PLASTIC (MT)	2030 MISMANAGED COASTAL PLASTIC (KG/ PERSON/DAY)
Anguilla	NR	34.1	-	-
Antigua and Barbuda	115,000	3.2	159	0.004
Argentina	20,035,921	24.6	299,635	0.041
Aruba	109,000	21.6	3,101	0.078
Bahamas	440,000	34.1	13,179	0.082
Barbados	290,000	3	934	0.009
Belize	356,662	68	12,783	0.098
Bolivia	NR	57.5	-	-
Brazil	84,302,968	25.2	1,089,091	0.035
British Virgin Islands	35,000	11.9	358	0.028
Cayman Islands	71,000	81	7,920	0.306
Chile	6,000,776	15.8	37,410	0.017
Colombia	8,771,207	6	18,730	0.006
Costa Rica	2,701,716	11.1	10,355	0.011
Cuba	11,282,403	61.8	163,772	0.04
Curacao	172,000	100	4,282	0.068
Dominica	78,000	8	182	0.006
Dominican Republic	11,094,646	93.7	409,798	0.101
Ecuador	7,881,869	35.9	105,097	0.037
El Salvador	5,760,324	23.8	38,531	0.018
Falkland Islands	NR	34.1	-	-
French Guiana	NR	34.1	-	-
Grenada	112,000	3.5	195	0.005
Guadeloupe	NR	34.1	-	-

COUNTRY	COASTAL POPULATION	% MISMANAGED WASTE[5]	2030 MISMANAGED COASTAL PLASTIC (MT)	2030 MISMANAGED COASTAL PLASTIC (KG/ PERSON/DAY)
Guatemala	3,492,782	77	79,775	0.063
Guyana	724,184	32.7	8,833	0.033
Haiti	12,065,699	92.1	298,640	0.068
Honduras	4,359,222	30.8	45,902	0.029
Jamaica	2,933,000	38	49,630	0.046
Martinique	NR	34.1	-	-
Mexico	28,132,866	23	298,620	0.029
Montserrat	NR	34.1	-	-
Nicaragua	3,134,454	82.4	93,518	0.082
Panama	4,863,116	44.3	97,192	0.055
Paraguay	NR	25.4	-	-
Peru	18,825,933	58.4	316,566	0.046
Puerto Rico	3,593,000	35.3	157,694	0.12
Saint Kitts and Nevis	61,000	34.1	2,943	0.132
Saint Lucia	186,000	5.1	922	0.014
Saint Martin	NR	34.1	-	-
Saint Vincent and the Grenadines	112,000	5.6	152	0.004
Sint Maarten	NR	34.1	-	-
Suriname	575,560	100	9,664	0.046
Trinidad and Tobago	1,374,000	89.2	126,062	0.251
Turks and Caicos Islands	NR	34.1	-	-
Uruguay	2,767,933	21.8	24,469	0.024
Venezuela	20,418,449	34.1	277,478	0.037
Virgin Islands (U.S.)	102,000	34.1	7,365	0.198
TOTAL			**4,110,936**	

Table A7. Mismanaged plastic waste in coastal populations by country in the LAC region in 2050

COUNTRY	COASTAL POPULATION	% MISMANAGED WASTE[5]	2050 MISMANAGED COASTAL PLASTIC (MT)	2050 MISMANAGED COASTAL PLASTIC (KG/ PERSON/DAY)
Anguilla	NR	-	-	-
Antigua and Barbuda	125,000	3.2	173	0.004
Argentina	22,435,048	24.6	335,514	0.041
Aruba	107,000	21.6	3,044	0.078
Bahamas	475,000	34.1	14,227	0.082
Barbados	280,000	3	902	0.009
Belize	446,393	68	15,999	0.098
Bolivia	NR	-	-	-
Brazil	87,000,998	25.2	1,123,946	0.035
British Virgin Islands	38,000	11.9	388	0.028
Cayman Islands	81,000	81	9,035	0.306
Chile	6,331,114	15.8	39,469	0.017
Colombia	9,035,165	6	19,294	0.006
Costa Rica	2,879,769	11.1	11,037	0.011
Cuba	10,621,907	61.8	154,184	0.04
Curacao	181,000	100	4,506	0.068
Dominica	77,000	8	180	0.006
Dominican Republic	12,164,860	93.7	449,328	0.101
Ecuador	9,257,518	35.9	123,440	0.037
El Salvador	5,939,432	23.8	39,729	0.018
Falkland Islands	NR	-	-	-
French Guiana	NR	-	-	-
Grenada	110,000	3.5	191	0.005
Guadeloupe	NR	-	-	-

COUNTRY	COASTAL POPULATION	% MISMANAGED WASTE[5]	2050 MISMANAGED COASTAL PLASTIC (MT)	2050 MISMANAGED COASTAL PLASTIC (KG/ PERSON/DAY)
Guatemala	4,442,454	77	101,466	0.063
Guyana	721,550	32.7	8,801	0.033
Haiti	13,505,618	92.1	334,280	0.068
Honduras	5,181,244	30.8	54,558	0.029
Jamaica	2,704,000	38	45,755	0.046
Martinique	NR	-	-	-
Mexico	31,324,652	23	332,500	0.029
Montserrat	NR	-	-	-
Nicaragua	3,503,684	82.4	104,534	0.082
Panama	5,802,084	44.3	115,958	0.055
Paraguay	NR	-	-	-
Peru	21,287,672	58.4	357,962	0.046
Puerto Rico	3,282,000	35.3	144,045	0.12
Saint Kitts and Nevis	63,000	34.1	3,040	0.132
Saint Lucia	182,000	5.1	902	0.014
Saint Martin	NR	-	-	-
Saint Vincent and the Grenadines	109,000	5.6	148	0.004
Sint Maarten	NR	-	-	-
Suriname	604,478	100	10,150	0.046
Trinidad and Tobago	1,295,000	89.2	118,814	0.251
Turks and Caicos Islands	NR	-	-	-
Uruguay	2,820,304	21.8	24,932	0.024
Venezuela	23,104,794	34.1	313,985	0.037
Virgin Islands (U.S.)	89,000	34.1	6,426	0.198
TOTAL			**4,422,839**	

Table A8. Mismanaged plastic waste in total populations by country in the LAC region in 2020

COUNTRY	TOTAL POPULATION	% MISMANAGED WASTE[5]	2020 MISMANAGED PLASTIC (MT)	2020 MISMANAGED PLASTIC (KG/PERSON/DAY)
Anguilla	18,090	34.1	587	0.089
Antigua and Barbuda	98,179	3.2	136	0.004
Argentina	45,479,118	24.6	680,135	0.041
Aruba	119,428	21.6	3,398	0.078
Bahamas	337,721	34.1	10,115	0.082
Barbados	294,560	3	949	0.009
Belize	399,598	68	14,322	0.098
Bolivia	11,639,909	57.5	141,984	-
Brazil	211,715,973	25.2	2,735,110	0.035
British Virgin Islands	37,381	11.9	382	0.028
Cayman Islands	61,944	81	6,910	0.306
Chile	18,186,770	15.8	113,379	0.017
Colombia	49,084,841	6	104,817	0.006
Costa Rica	5,097,988	11.1	19,539	0.011
Cuba	11,059,062	61.8	160,530	0.04
Curacao	151,345	100	3,767	0.068
Dominica	74,243	8	173	0.006
Dominican Republic	10,499,707	93.7	387,823	0.101
Ecuador	16,904,867	35.9	225,410	0.037
El Salvador	6,481,102	23.8	43,352	0.018
Falkland Islands	3,198	34.1	104	0.089
French Guiana	290,691	34.1	5,387	0.051
Grenada	113,094	3.5	197	0.005
Guadeloupe	376,879	34.1	6,984	0.051
Guatemala	17,153,288	77	391,782	0.063

COUNTRY	TOTAL POPULATION	% MISMANAGED WASTE[5]	2020 MISMANAGED PLASTIC (MT)	2020 MISMANAGED PLASTIC (KG/PERSON/DAY)
Guyana	750,204	32.7	9,150	0.033
Haiti	11,067,777	92.1	273,940	0.068
Honduras	9,235,340	30.8	97,246	0.029
Jamaica	2,808,570	38	47,525	0.046
Martinique	358,749	34.1	11,634	0.089
Mexico	128,649,565	23	1,365,569	0.029
Montserrat	5,373	34.1	100	0.051
Nicaragua	6,203,441	82.4	185,082	0.082
Panama	3,894,082	44.3	77,825	0.055
Paraguay	7,191,685	25.4	62,834	-
Peru	31,914,989	58.4	536,665	0.046
Puerto Rico	3,189,068	35.3	139,966	0.12
Saint Kitts and Nevis	53,821	34.1	2,597	0.132
Saint Lucia	166,487	5.1	825	0.014
Saint Martin	32,556	34.1	860	0.072
Saint Vincent and the Grenadines	101,390	5.6	138	0.004
Sint Maarten	43,847	34.1	1,491	0.093
Suriname	609,569	100	10,235	0.046
Trinidad and Tobago	1,208,789	89.2	110,904	0.251
Turks and Caicos Islands	55,926	34.1	2,384	0.117
Uruguay	3,387,605	21.8	29,947	0.024
Venezuela	28,644,603	34.1	389,268	0.037
Virgin Islands (U.S.)	106,235	34.1	7,671	0.198
TOTAL			**8,421,125**	

Table A9. Mismanaged plastic waste in total populations by country in the LAC region in 2030

COUNTRY	TOTAL POPULATION	% MISMANAGED WASTE[5]	2020 MISMANAGED PLASTIC (MT)	2020 MISMANAGED PLASTIC (KG/PERSON/DAY)
Anguilla	NR	-	-	-
Antigua and Barbuda	115,000	3.2	159	0.004
Argentina	49,323,000	24.6	737,620	0.041
Aruba	109,000	21.6	3,101	0.078
Bahamas	440,000	34.1	13,179	0.082
Barbados	290,000	3	934	0.009
Belize	473,000	68	16,952	0.098
Bolivia	13,158,000	-		-
Brazil	225,472,000	25.2	2,912,820	0.035
British Virgin Islands	35,000	11.9	358	0.028
Cayman Islands	71,000	81	7,920	0.306
Chile	19,637,000	15.8	122,420	0.017
Colombia	53,134,000	6	113,464	0.006
Costa Rica	5,417,000	11.1	20,762	0.011
Cuba	11,496,000	61.8	166,873	0.04
Curacao	172,000	100	4,282	0.068
Dominica	78,000	8	182	0.006
Dominican Republic	12,098,000	93.7	446,858	0.101
Ecuador	19,555,000	35.9	260,747	0.037
El Salvador	6,786,000	23.8	45,391	0.018
Falkland Islands	NR	-	0	-
French Guiana	NR	-	0	-
Grenada	112,000	3.5	195	0.005
Guadeloupe	NR	-	0	-
Guatemala	21,203,000	77	484,277	0.063

COUNTRY	TOTAL POLULATION	% MISMANAGED WASTE[5]	2020 MISMANAGED PLASTIC (MT)	2020 MISMANAGED PLASTIC (KG/PERSON/DAY)
Guyana	825,000	32.7	10,063	0.033
Haiti	12,544,000	92.1	310,479	0.068
Honduras	11,147,000	30.8	117,376	0.029
Jamaica	2,933,000	38	49,630	0.046
Martinique	NR	-	0	-
Mexico	147,540,000	23	1,566,084	0.029
Montserrat	NR	-	0	-
Nicaragua	7,046,000	82.4	210,220	0.082
Panama	4,884,000	44.3	97,609	0.055
Paraguay	7,845,000	-		-
Peru	36,807,000	58.4	618,926	0.046
Puerto Rico	3,593,000	35.3	157,694	0.12
Saint Kitts and Nevis	61,000	34.1	2,943	0.132
Saint Lucia	186,000	5.1	922	0.014
Saint Martin	NR	-	-	-
Saint Vincent and the Grenadines	112,000	5.6	152	0.004
Sint Maarten	NR	-	0	-
Suriname	617,000	100	10,360	0.046
Trinidad and Tobago	1,374,000	89.2	126,062	0.251
Turks and Caicos Islands	NR	-	0	-
Uruguay	3,594,000	21.8	31,772	0.024
Venezuela	36,750,000	34.1	499,417	0.037
Virgin Islands (U.S.)	102,000	34.1	7,365	0.198
TOTAL			**9,175,567**	

Table A10. Mismanaged plastic waste in total populations by country in the LAC region in 2050

COUNTRY	TOTAL POPULATION	% MISMANAGED WASTE[5]	2050 MISMANAGED PLASTIC (MT)	2050 MISMANAGED PLASTIC (KG/PERSON/DAY)
Anguilla	NR	-	-	-
Antigua and Barbuda	125,000	3.2	173	0.004
Argentina	55,229,000	24.6	825,943	0.041
Aruba	107,000	21.6	3,044	0.078
Bahamas	475,000	34.1	14,227	0.082
Barbados	280,000	3	902	0.009
Belize	592,000	68	21,217	0.098
Bolivia	15,903,000	-	193,986	-
Brazil	232,688,000	25.2	3,006,042	0.035
British Virgin Islands	38,000	11.9	388	0.028
Cayman Islands	81,000	81	9,035	0.306
Chile	20,718,000	15.8	129,159	0.017
Colombia	54,733,000	6	116,878	0.006
Costa Rica	5,774,000	11.1	22,130	0.011
Cuba	10,823,000	61.8	157,103	0.04
Curacao	181,000	100	4,506	0.068
Dominica	77,000	8	180	0.006
Dominican Republic	13,265,000	93.7	489,963	0.101
Ecuador	22,968,000	35.9	306,256	0.037
El Salvador	6,997,000	23.8	46,803	0.018
Falkland Islands	NR	-	-	-
French Guiana	NR	-	-	-
Grenada	110,000	3.5	191	0.005
Guadeloupe	NR	-	-	-
Guatemala	26,968,000	77	615,950	0.063

COUNTRY	TOTAL POPULATION	% MISMANAGED WASTE[5]	2050 MISMANAGED PLASTIC (MT)	2050 MISMANAGED PLASTIC (KG/PERSON/DAY)
Guyana	822,000	32.7	10,026	0.033
Haiti	14,041,000	92.1	347,531	0.068
Honduras	13,249,000	30.8	139,510	0.029
Jamaica	2,704,000	38	45,755	0.046
Martinique	NR	-	-	-
Mexico	164,279,000	23	1,743,762	0.029
Montserrat	NR	-	-	-
Nicaragua	7,876,000	82.4	234,984	0.082
Panama	5,827,000	44.3	116,456	0.055
Paraguay	8,897,000	-	77,733	-
Peru	41,620,000	58.4	699,859	0.046
Puerto Rico	3,282,000	35.3	144,045	0.12
Saint Kitts and Nevis	63,000	34.1	3,040	0.132
Saint Lucia	182,000	5.1	902	0.014
Saint Martin	NR	-	-	-
Saint Vincent and the Grenadines	109,000	5.6	148	0.004
Sint Maarten	NR	-	-	-
Suriname	648,000	100	10,880	0.046
Trinidad and Tobago	1,295,000	89.2	118,814	0.251
Turks and Caicos Islands	NR	-	-	-
Uruguay	3,662,000	21.8	32,373	0.024
Venezuela	41,585,000	34.1	565,123	0.037
Virgin Islands (U.S.)	89,000	34.1	6,426	0.198
TOTAL			**10,261,443**	

Figure A1. Number of Peer-Reviewed Papers on Microplastic in the LAC Region

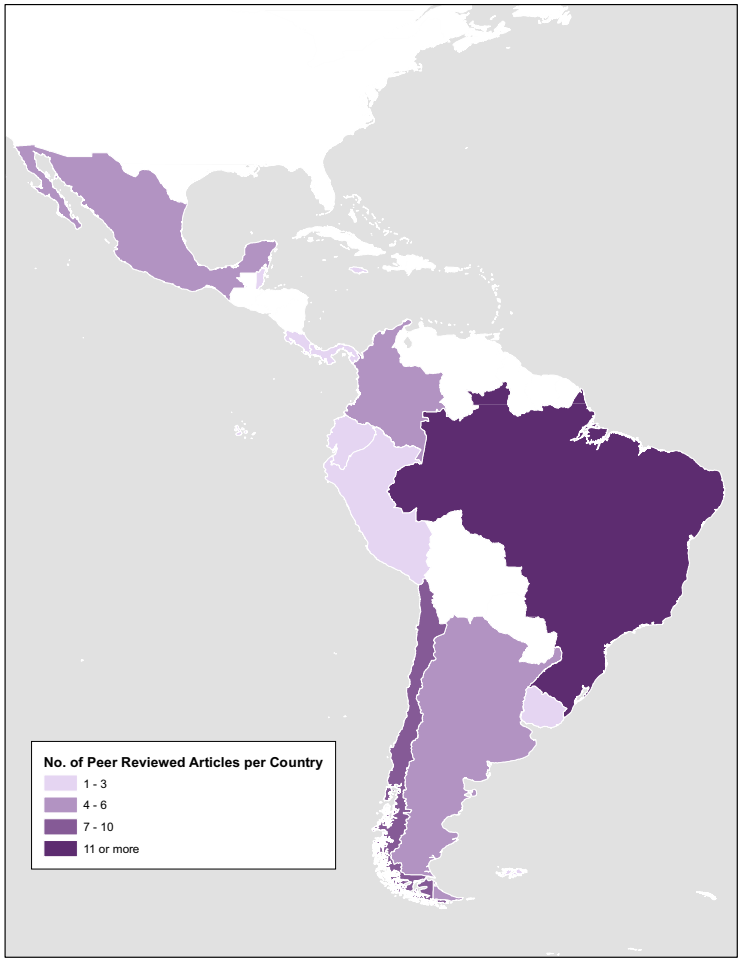

Figure A2. Location of Peer-Reviewed Papers on Microplastic in the LAC Region

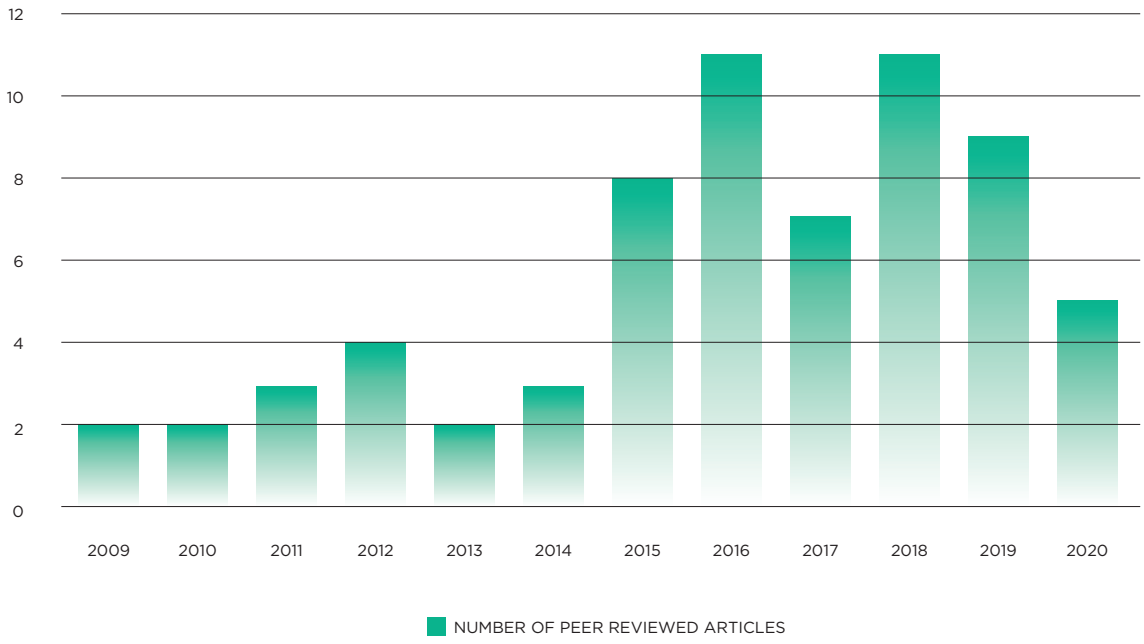

Table A11. Studies conducted on microplastics available in the LAC region

COUNTRY	LOCATION	AUTHOR	TYPE	SUBJECT
Anguilla	Anguilla Island	Bosker et al., 2018 [160]	Natural Environment	Sediment
Argentina	Bahia Blanca Estuary	Arias et al., 2019 [38]	Animal	Fish
Argentina	Laguna Setubal, Santa Fe City	Blettler et al., 2017 [114]	Natural Environment	Sediment
Argentina	Río de la Plata Estuary	Pazos et al., 2017 [37]	Animal	Fish
Argentina	Río de la Plata Estuary	Pazos et al., 2018 [115]	Natural Environment	Seawater
Belize	Turneffe Atoll	Goss et al., 2018 [116]	Natural Environment	Seagrass
Brazil	Rio Grande do Sul	Colabuono et al., 2009 [117]	Animal	Bird
Brazil	Fernando de Noronha, Pernambuco	Ivar do Sul et al., 2009 [118]	Natural Environment	Sediment
Brazil	Boa Viagem Beach, Pernambuco	Costa et al., 2010 [119]	Natural Environment	Sediment
Brazil	Peixe Lagoon, Rio Grande do Sul	Tourinho et al., 2010 [120]	Animal	Green Turtle and Sea Bird
Brazil	Paranaguá Estuary, Paraná	Guebert-Bartholo et al., 2011 [121]	Animal	Green turtle
Brazil	Goiana Estuary, Pernambuco	Possato et al., 2011 [122]	Animal	Fish
Brazil	Goiana Estuary, Pernambuco	Dantas et al., 2012 [123]	Animal	Fish
Brazil	Bahia	Majer et al., 2012 [124]	Animal	Insect
Brazil	Goiana Estuary, Pernambuco	Ramos et al., 2012 [125]	Animal	Fish
Brazil	Saint Peter and Saint Paul Archipelago, Pernambuco	Ivar do Sul et al., 2013 [126]	Animal	Plankton
Brazil	Fernando de Noronha, Pernambuco, Abrolhos, Bahia, and Trindade, Espírito Santo	Ivar do Sul et al., 2014 [127]	Animal	Plankton
Brazil	Goiana Estuary, Permambuco	Lima et al., 2014 [128]	Animal	Plankton
Brazil	Santos Estuary, São Paulo	Turra et al., 2014 [129]	Natural Environment	Sediment
Brazil	Niterói, Rio de Janeiro	Brennecke et al., 2015 [130]	Animal	Crab
Brazil	Salvador, Bahia	Fernandino et al., 2015 [131]	Natural Environment	Sediment
Brazil	Goiana Estuary, Permambuco	Lima et al, 2015b [132]	Animal	Plankton
Brazil	Boqueirão Beach, São Paulo	Nobre et al., 2015 [133]	Animal	Sea-urchin

COUNTRY	LOCATION	AUTHOR	TYPE	SUBJECT
Brazil	Goiana Estuary, Pernambuco	Santos et al., 2015 [134]	Animal	Green Turtle
Brazil	Guanabara Bay, Rio de Janeiro	de Carvalho and Baptista Neto, 2016 [135]	Natural Environment	Sediment
Brazil	Jurujuba Cove, Rio de Janeiro	Castro et al., 2016 [136]	Animal	Plankton
Brazil	Caraguatatuba, São Paulo	Gandara e Silva et al., 2016 [137]	Animal	Mussel
Brazil	Estaleiro and Estaleirinho Balneário Camboriú and Lemebeaches.	Gusmão et al., 2016 [138]	Animal	Benthic meiofauna
Brazil	Salvador, Bahia	Miranda and Carvalho-Souza, 2016 [139]	Animal	Fish
Brazil	Paranaguá estuary, Paraná	Moreira et al., 2016a [140]	Natural Environment	Sediment
Brazil	13 beaches of the coast of São Paulo, São Paulo	Moreira et al., 2016b [141]	Natural Environment	Sediment
Brazil	Santos estuary, São Paulo	Santana et al., 2016 [142]	Animal	Mussel
Brazil	Santos Estuary, São Paulo	Fisner et al., 2017 [143]	Natural Environment	Sediment
Brazil	Pajeú River, Pernambuco	Silva-Cavalcanti et al., 2017 [144]	Animal	Fish
Brazil	Paraíba	Vendel et al., 2017 [145]	Animal	Fish
Brazil	Meireles beach, Fortalaza Coastal zone	Dantas et al., 2020 [146]	Animal	Fish
Chile	Vina Del Mar and Punta Arenas	Browne et al., 2011 [147]	Natural Environment	Sediment
Chile	Easter Island	Chagnon et al., 2018 [148]	Animal	Fish
Chile	Mellipilla County	Corradini et al., 2019 [149]	Natural Environment	Sediment
Chile	39 beaches in Chile and Easter Island	Hidalgo-Ruz et al., 2013 [150]	Natural Environment	Sediment
Chile	Biobío River	Pozo et al., 2019 [151]	Animal	Fish
Chile	Elqui, Maipo, Maule, and BioBio Rivers	Rech et al., 2015 [34]	Natural Environment	Freshwater
Chile	7 Central Chile coastal areas	Pozo et al., 2020 [152]	Natural	Sediment
Costa Rica	Nicoya Peninsula Coast	Johnson et al., 2018 [153]	Animal	Zooplankton
Costa Rica	Isla del Coco National Park	Naranjo-Elizondo,2018 [154]	Natural Environment	Sediment

COUNTRY	LOCATION	AUTHOR	TYPE	SUBJECT
Ecuador	Manta, Manabí, and Santa Rosa de Salinas, Santa Elena	Rosas-Luis and Rigoberto, 2016 [155]	Animal	Squid
Falkland Islands	East Falklands	Green et al., 2018 [156]	Natural Environment	Coastal Water
Jamaica	Kingston Harbour	Rose and Webber, 2019 [157]	Natural Environment	Surface Water
Mexico	La Paz Bay	Fossi et al., 2017 [158]	Animal	Whales and Zooplankton
Mexico	Baja California Peninsula	Piñon-Colin et al., 2018 [159]	Natural Environment	Sediment
Mexico	Campeche, Gulf of Mexico	Borges Ramirez et al., 2019 [160]	Natural Environment	Sediment
Mexico	The Conejos, Tangolunda, Santa Cruz, and San Agustin Beaches	Retama et al., 2016 [161]	Natural Environment	Sediment
Mexico	Atoyac River Basin	Shruti et al., 2019 [35]	Natural Environment	Sediment
Netherlands Antilles	St. Eustatius	Bosker et al., 2018 [160]	Natural Envrionment	Sediment
Panama	Galeta Point	Davidson, 2012 [162]	Animal	Boring Crustaceans
Peru	Yuyos, Sombrillas, Agua Dulce, and Pescadores Beaches, Lima	De-La-Torre et al., 2020 [163]	Natural Environment	Sediment
Peru	Peru-Chile Trench	Jamieson et al., 2019 [1464	Animal	Deep-Sea Amphipods
Sint Maarten (Dutch part)	Entire Island	Bosker et al., 2018 [160]	Natural Environment	Sediment
Uruguay	Punta del Este Beaches	Lozoya et al., 2016 [165]	Natural Environment	Sediment
Uruguay	Coastal Uruguay	Vélez-Rubio et al., 2018 [166]	Animal	Turtles