



# Marine litter

in the

## Southeast Pacific Region



PERMANENT COMMISSION FOR THE SOUTH PACIFIC





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# MARINE LITTER IN THE SOUTHEAST PACIFIC REGION: A REVIEW OF THE PROBLEM

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PERMANENT COMMISSION FOR THE SOUTH PACIFIC - CPPS  
EXECUTIVE SECRETARIAT OF THE PLAN OF ACTION FOR THE PROTECTION  
OF THE MARINE ENVIRONMENT AND COASTAL AREAS IN THE SOUTHEAST PACIFIC  
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PERMANENT COMMISSION FOR THE SOUTH PACIFIC – CPPS  
Executive Secretariat of the Plan of Action for the Protection  
of the Marine Environment and Coastal Areas of the Southeast Pacific  
Av. Carlos Julio Arosemena kilómetro 3,  
Complejo Comercial Albán Borja, Edificio Classic, piso 2.  
Tel: (593-4) 2221200, 2221202. Fax 2221201  
Email: [cpps\\_pse@cpps-int.org](mailto:cpps_pse@cpps-int.org). [www.cpps-int.org](http://www.cpps-int.org)  
Guayaquil, Ecuador

UNITED NATIONS ENVIRONMENT PROGRAMME – UNEP  
REGIONAL SEAS PROGRAMME  
UNEP Division of Environmental Policy Implementation  
P.O Box 30552  
Tel: 254 20 7624 033/544. Fax: 254 20 7624 618  
<http://www.unep.org/regionalseas/>  
Nairobi, Kenya

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## Executive Summary

Regional information is systematized regarding the production of solid waste from land-based and marine sources that can become marine litter in the Southeast Pacific Ocean. It is estimated that the coastal population (15.6 million people) produces around 123 thousand t year<sup>-1</sup> of persistent litter (plastics, glass, metal) that is not collected; of which between 12,304 and 36,909 t year<sup>-1</sup> may become marine litter. There is no estimation of the production from marine sources, though there is evidence that vessels discharge persistent litter at sea.

A model of the likely flow of litter is proposed, although there is no quantitative information to estimate the amounts generated from each source. The Protocol for the Protection of the Southeast Pacific from Land-based Sources of Pollution is the appropriated legal framework to address the problems of marine litter in the region; however, the main challenge is to implement this instrument.

The main causes of marine litter in the region include:

- (1) Discharge of persistent litter from land-sources, caused by insufficient collection and inadequate disposal of solid waste, direct dumping on waterways and public areas, increasing use of disposable containers (beverage bottles, food wrappings) and plastic bags, and climatic events (*e.g.*, El Niño, flooding) that transport waste to the ocean.
- (2) Insufficient clean-up of beaches, estuaries and waterways, caused by litter overflow during tourist seasons, direct dumping by coastal populations, rapid re-accumulation of beach litter with residues transported by winds and sea currents, and that clean-up and disposal costs have not been internalized.
- (3) Dumping in the ocean, caused by throwing litter at sea by certain groups (*e.g.*, artisanal fishing boats), illegal dumping, limited facilities to collect the litter at port, inadequate facilities to handle waste onboard, insufficient control of infractions, and disposal of abandoned/damaged fishing gear.

The Regional Programme focus on these key issues and proposes an eight year strategy within the framework of the Protocol for the Protection of the Southeast Pacific from Pollution from Land-based Sources. The general objective is to minimize the discharge of persistent solid residues from land-based and sea-based sources in the Southeast Pacific Ocean. The Programme has seven specific objectives:

1. Increase the coverage of garbage collection systems in coastal municipalities and to ensure the appropriated disposal of persistent materials to prevent their release into the environment.
2. Eradicate the discharge of persistent litter from vessels.
3. Minimize the disposal of fishing gear in coasts and at sea.
4. Establish the volumes of production, patterns of distribution and accumulation, and impacts of marine litter in the region.
5. Recognize the problem of marine litter as a priority issue in the agendas of the countries in the region.
6. Reduce the use of disposable containers and wrappings of persistent materials that can eventually become marine litter.
7. Establish a regional policy on marine litter.

For each objective there are a number of proposed actions at national and regional levels.



# 1. Introduction

Marine litter is a global problem affecting biodiversity, public health, recreational and productive activities in coastal and marine areas. Historically, the sea has been used as a litter deposit. Notwithstanding, discharge dimensions are impressive. The Academy of Science of the United States of North America has estimated that 6.4 million tons of garbage enter the ocean each year<sup>1</sup>. Several international initiatives have been developed to deal with the impacts of marine litter. For example, MARPOL 73/78 includes requirements for litter management; the Protocol for the Protection of the Southeast Pacific from Land-based Sources of Pollution, adopted by the Southeast Pacific countries in 1983<sup>2</sup>, includes the obligation of combating pollution from various sources including persistent residues. The United Nations Environment Programme (UNEP) has highlighted the deficiencies that persist in the implementation on international and bi-national agreements on this issue and limitations in managing persistent residues (UNEP, 2005).

The problem of marine litter was recognized by the UN General Assembly, which in its Resolution A/60/L.22 - Oceans and the Law of the Sea - of 29 November 2005 in articles 65-70 calls for national, regional and global actions to address the problem of marine litter. This GA resolution notes the lack of information and data on marine debris, encourages States to develop partnerships with industry and civil society, urges States to integrate the issue of marine debris within national environmental strategies, and encourages States to cooperate regionally and subregionally to develop and implement joint prevention and recovery programmes for marine debris. In response to the GA call, UNEP (GPA and the Regional Seas Programme), through its Global Marine Litter Initiative took an active lead in addressing the challenge, among others, by assisting 11 Regional Seas around the world in organizing and implementing regional activities on marine litter (Baltic Sea, Black Sea, Caspian Sea, East Asian Seas, Eastern Africa, Mediterranean Sea, Northwest Pacific, Red Sea and Gulf of Aden, South Asian Seas, South East Pacific, and Wider Caribbean).

The first part of this document presents the available information on marine litter in the Southeast Pacific Ocean. The area includes the coastal zones of five countries: Chile, Colombia, Ecuador, Panama and Peru. Detailed information at country level may be found in the national reports by Alfaro (2006) (Peru), Coello & Macías (2006) (Ecuador), Escobar (2006) (Colombia), González (2006) (Panamá) and Rovira (2006) (Chile). The second part of this report includes the Regional Programme for the Integrated Management of Marine Litter in the Southeast Pacific, which has been elaborated within the framework of the Protocol for the Protection of the Southeast Pacific from Land-based Sources of Pollution. The elements of the Programme were outlined in the Regional Workshop on Sustainable Management of Marine Litter in the Southeast Pacific carried out in Panama City, Panama, on 27-28 September 2006, from the analysis of national diagnostics above mentioned.

## 2. Regional Problems of Marine Litter

### 2.1 Definitions

The internationally definition for marine litter refers to “*all solid persistent material, manufactured or elaborated, which is disposed of or abandoned in the marine or coastal environment*”. Marine litter has been included as a major pollution source category in the Global Programme of Action for the Protection of the Marine Environment from Land Based Activities<sup>3</sup> (GPA).

The Protocol for the Protection of the Southeast Pacific from Land-based Sources of Pollution includes amongst substances taken into consideration “*synthetic persistent materials that can float, remain in suspension or sink, which may become obstacles to any legitimate use of the sea*”<sup>4</sup>. This definition is concordant with the definition included in the GPA.

Annex V<sup>5</sup> of MARPOL 73/78 defines litter as “all kinds of food, domestic and operational waste, excluding fresh fish, generated during the normal operation of the vessel and liable to be disposed of continuously or periodically”.

The countries of the region do not have in their national regulations specific definitions for marine litter. National regulations, in general, refer to waste and residues<sup>6</sup> which include persistent and perishable components (Table 1). Nevertheless, the definition included in the CPPS Protocol is binding for the High Contracting Parties, countries which have also adopted the GPA.

### 2.2 Main sources

Litter found in coastal areas of the Southeast Pacific originates from land and marine sources. Land sources would be the main contributors in generating marine litter (Table 2), although there is not enough information to estimate the contribution made by marine sources.

The celebration of the international coastal clean-up day, a global initiative of the organization Ocean Conservancy, has provided data on the magnitude of the marine litter in the region (Table 3). A rough estimate can be obtained multiplying the amount of litter<sup>7</sup> (kg km<sup>-1</sup>) by the coastline extension of the five countries. Thus, it is estimated that at the time of the coastal clean-up day in 2005 there were on the Southeast Pacific around 30,333 tons of litter. Although this figure was surely exaggerated<sup>8</sup>, it does provide an idea of the magnitude (*i.e.*, thousands of tons of persistent waste) of the problem. Alfaro (2006), reports an increase from 0.35 kg m<sup>-2</sup> on the beach in 2002 to 0.94 kg m<sup>-2</sup> in 2005. There is no similar data for the other countries; however, this could be an indicator that the amount of marine litter is increasing.

Table 1. National definitions related to marine litter.

Country <sup>a</sup>	Definition of marine litter in national normative
Panama	No specific definition for marine litter exists. The terms solid refuse and solid residue are used to refer domestic, industrial, sea and land port garbage.
Colombia	No specific definition for marine litter exists. The regulation for marine pollution <sup>9</sup> includes the concept of marine litter within the term CONTAMINANT "all substances which due to their nature and/or concentration are susceptible of causing degradation to the marine environment".
Ecuador	No specific definition for marine litter exists. The norm on environmental quality <sup>10</sup> includes the following definition for SOLID WASTE "all non-dangerous solids, perishable or not, with the exception of human or animal excretions. The same definition is used for refuse, ashes, elements swept from streets, industrial waste, from non-contaminating hospital services, marketplaces, popular fairs, beaches, debris, among others". The terms solid refuse and solid waste are used as synonyms
Peru	The General Law for Solid Residues <sup>11</sup> defines SOLID RESIDUES as "those substances, products, sub-products in solid or semi-solid state or condition which must be disposed of by their generators according to what has been established in the normative law or due to the risks to health and the environment".
Chile	No specific definition for marine litter exists. The Regulation for Water Pollution Control defines litter as "all kinds of left over food as well as residues resulting from domestic chores and the routine operations on naval craft under normal working conditions."

<sup>a</sup> In geographic order from north to south.

Table 2. Sources of litter collected on the international coastal clean-up day in the countries of the Southeast Pacific in 2005.

Activities that generate waste	Panama	Colombia	Ecuador	Peru	Chile
	Percentage of total articles collected on beaches				
Activities on the shore and recreational activities	78.3	91.7	35.1	79.5	85.7
Activities in oceans and other water bodies	18.0	4.9	7.2	8.6	3.2
Activities related to smoking	4.1	1.8	56.1	5.0	9.8
Biomedical and hygienic waste	1.7	0.3	0.6	4.1	0.3
Inadequate disposal of solid waste	2.9	1.2	1.0	2.8	1.0

Source: the Ocean Conservancy.

<sup>\*</sup> Referential data due to the fact that it represents the Colombian Caribbean shore.

 Main source of waste

 Secondary source of waste

Table 3. Estimates of articles collected on beaches of the region during the international coastal clean-up day in September 2005.

Country	Coastal extension (km)	Length of cleaned beach (km)	Number of articles collected		Weight of articles collected(kg)	
			Total	Number km <sup>-1</sup>	Total	kg km <sup>-1</sup>
Panama	1,700	91.7	96,498	1,051.9	68,520.8	747.0
Colombia <sup>a</sup>	1,300	37.0	18,355	495.9	2,497.1	67.5
Ecuador	4,359 <sup>b</sup>	72.4	346,949	4,790.8	32,427.9	447.8
Peru	3,080	20.9	91,963	4,395.6	110,433.9	5,278.5
Chile	83,850 <sup>c</sup>	ND	158,834	ND	ND	ND

Sources:

Coastal extension: Alfaro (2006), Coello & Macías (2006), Escobar (2006), González (2006), and Rovira (2006).

Litter collected from the beach: the Ocean Conservancy

<sup>a</sup> Referential data as they refer to Colombian Caribbean.

<sup>b</sup> 2,959 km on the continental coast and 1,400 km on the Galapagos Archipelago coast.

<sup>c</sup> Including island coastlines.

## 2.2.1 Land sources

The region has limitations of coverage for the collection and disposal of litter, particularly in rural areas where garbage is commonly disposed by throwing waste into waterways<sup>12</sup> and unused plots of land. Mostly open dumps<sup>13</sup> are used or sites with a certain degree of management (also known as “*vertederos*”) from where a portion of the litter can go back into the environment (and eventually reach the sea) through runoff, wind, informal recyclers<sup>14</sup> and animals. The use of sanitary landfills<sup>15</sup> is limited.

There are some diagnoses on the situation of litter management in the countries of the region (e.g. ANAM, 2004; CONAM, 2004; CONAM & PAHO, 2002; PAHO, 2005; PAHO, 2001; PAHO, 2002). UNEP (1999) deals briefly on the subject of litter as a land source of pollution and Escobar (2000) presents litter production estimates on the coastal area of the region for the 1990’s. At the time, it is estimated that litter production was around 5.2 million tons per year (Table 4), of which nearly 1.7 million t year<sup>-1</sup> were not collected and consequently a fraction of these residues would have the potential of becoming marine litter.

Table 4. Litter production estimate in the coastal region at the beginning of the 1990’s.

Country*	Litter production on the coast (t year <sup>-1</sup> )	Uncollected litter (t year <sup>-1</sup> )
Panama	298,706	119,482 <sup>a</sup>
Colombia	116,800 <sup>b</sup>	40,880 <sup>b</sup>
Ecuador	2,673,752 <sup>c</sup>	828,863 <sup>d</sup>
Peru	1,695,425 <sup>e</sup>	729,032 <sup>f</sup>
Chile	438,000 <sup>g</sup>	ND
<b>Total</b>	<b>5,222,683</b>	<b>1,718,258<sup>h</sup></b>

Estimates from Escobar’s data (2000).

\* In geographical order from north to south.

<sup>a</sup> Panama City’s production 298,706 t year<sup>-1</sup> of which 60% are disposed off in sanitary landfills.

<sup>b</sup> Buenaventura’s production (250 t day<sup>-1</sup>) and Tumaco (70 t day<sup>-1</sup>). 72% of litter from Buenaventura was collected and 40% from Tumaco.

<sup>c</sup> Estimate for 20 coastal centers, including Guayaquil.

<sup>d</sup> 69% of litter was collected.

<sup>e</sup> Production of ca. 4,645 t day<sup>-1</sup> on the coast.

<sup>f</sup> It indicates that 2,648.4 t day<sup>-1</sup> (57%) are treated.

<sup>g</sup> Estimated production on the coast of 1,200 t day<sup>-1</sup>.

<sup>h</sup> Does not include estimates for Chile.

ND Unavailable information.

Currently, it is estimated that 15.6 million people constitute the population that influences directly on litter production in coastal zones<sup>16</sup> (Fig.1). This population generates ca. 4.54 million tons of litter per year (Fig. 1). Most are perishable organic residues (Table 5); however, a fraction of persistent elements (*i.e.*, plastics, glass and metal) reaches the sea and becomes marine litter. In order to estimate this fraction the following equation was applied:

$$BM = \left[ \sum_i^n (P_i * TP_i * 0,365 * NR_i * MP_i) \right] * T$$

Where,

- $BM$  Potential marine litter from land sources (metric tons year<sup>-1</sup>).
- $P_i$  Population in municipality  $i$  that faces the sea, estuary or gulf (number of inhabitants).
- $TP_i$  Rate of garbage production in municipality  $i$  (kilograms person<sup>-1</sup> day<sup>-1</sup>).
- $0,365$  Coefficient to transform the results into tons year<sup>-1</sup>.
- $NR_i$  Fraction of the population without garbage collection and disposal services in municipality  $i$ .
- $MP_i$  Fraction of persistent materials in the garbage of municipality  $i$  (*i.e.*, plastics, glass and metals).
- $T$  Fraction of persistent litter which could reach estuaries and the ocean. It is estimated to be between 0.1 and 0.3.

For the application of this calculation scheme the following is assumed:

1. Plastics (including in this category all synthetic materials that can be molded such as synthetic rubber, styrofoam<sup>17</sup> / rubber foam, PET), glass and metal constitute persistent residues which can become marine litter.
2. Marine litter is generated from the fraction of persistent materials which are not collected in coastal municipalities.
3. Part of the non-collected persistent garbage will remain trapped on land and does not become marine litter. It is assumed that between 10% and 30% of the persistent garbage could reach the sea.

This calculation scheme was analyzed and agreed on during the Regional Workshop on the Sustainable Management of Marine Litter in the Southeast Pacific, carried out in Panama City (Panama) in September 2006 (CPPS, 2006a).

The equation was applied using available information from multiple sources from the countries of the region, with the exception of Chile which already has an accurate data base regarding garbage collected and deposited in sanitary landfills and controlled dumps (Rovira, 2006). It has been estimated that the region generates between 12,304 and 36,909 tons of marine litter per year (Table 6 y Figure 2). Plastics are a minor fraction of the garbage in the five countries (Table 5), however, remains made of this material (bottles, bags and plastic lids) are the most common residues on the beaches (Table 7).

In the five countries the municipalities are responsible for operating garbage collection and disposal services, directly or through companies hired for that purpose. In all cases, garbage management also involves environmental and health authorities. Legislation related to garbage/litter management is diverse. In Panama, a preliminary a legislation project related to management and solid waste disposal is being formulated. In Colombia<sup>18</sup> and Ecuador<sup>19</sup>, garbage management has been incorporated into laws related to environmental management. Peru has a specific law on the subject (*i.e.*, General Law on Solid Waste). In Chile the legal framework is based on the Constitutional Organic law for Municipalities and Sanitary Code.

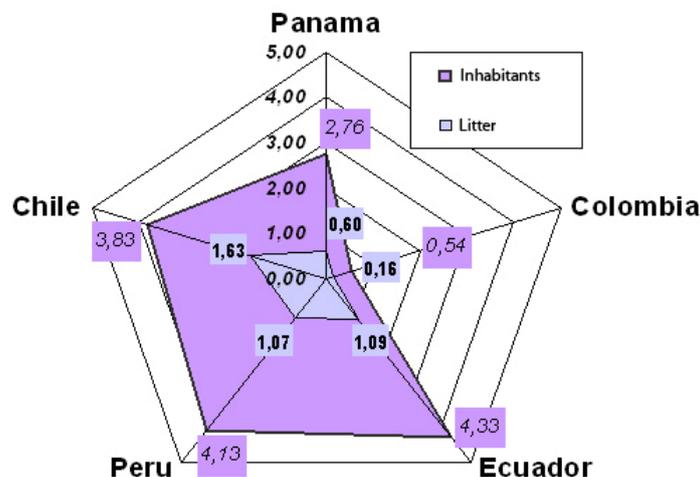


Figure 1. Population (in millions inhabitants) and total production of litter (millions t year<sup>-1</sup>) in the coastal area of the Southeast Pacific. Sources: Alfaro (2006), Coello & Macías (2006), Escobar (2006), González (2006) and Rovira (2006).

All the countries have recycling companies and public initiatives or non-governmental organizations (NGOs) related to garbage management. Panama even exports waste for recycling; ANAM (2004), reported that between 1996 and 2001 around 7.7 million kilograms of plastic waste were exported. In Colombia, it is estimated that recycling actions account for 12% of total residues generated in the country (Escobar, 2006); furthermore, there is a law that established the day of the recycler<sup>20</sup>. In Ecuador, there are several recycling companies (the main one on the coast is REIPA) but its main focus is on paper and cardboard (PAHO, 2002). In Peru, 14.7% of municipal solid residues are recycled (CONAM & PAHO, 2002). In Chile, around 20% of PET<sup>21</sup> plastic is recovered from Santiago<sup>22</sup>. However, initiatives centered in coastal areas are mainly of a small scale and do not greatly diminish the persistent material load that turn into marine litter. Alfaro (2006), highlighted that the increase in the price of PET bottles for recycling stimulated Peruvian recyclers to search for such waste which resulted in a reduction of this type of bottles on beaches. None of these bottles were found in the coastal clean-up day at Carpayo, Callao, in 2005.

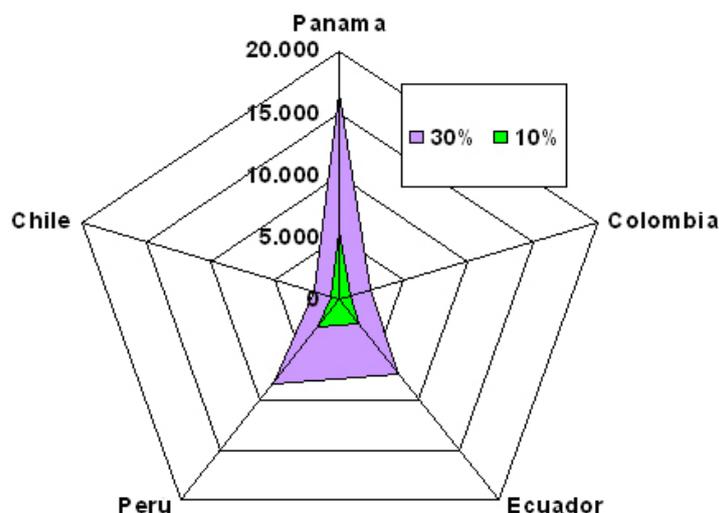


Figure 2. Marine litter production estimate from land sources (metric tons year<sup>-1</sup>) in the Southeast Pacific. Note: it is assumed that marine litter corresponds to 10% - 30% of persistent litter (*i.e.*, plastic, metal and glass) that goes uncollected by the garbage collection and disposal systems of coastal municipalities.

Table 5. Per capita generation and composition of solid residues in the countries of the region.

Country	Per capita generation of solid residues <sup>+</sup> (kg inhab <sup>-1</sup> day <sup>-1</sup> )		Composition of municipal solid residues (%)						
	Domestic <sup>e</sup>	Municipal <sup>f</sup>	Cardboard & paper	Metal	Glass	Textiles	Plastics	Perishable organic	Others & inert
Panama <sup>a</sup>	0.60	0.81	25	4	6	ND	17	46	2
Colombia <sup>b</sup>	0.69	0.69	8.91	1.05	3.25	1.33	5.7	77.45	4.1
Ecuador	0.69	N/D	9.60	0.70	3.70	0.00	4.50	71.40	0.00
Peru <sup>c</sup>	0.53	0.71	7.50	2.30	3.40	1.50	4.30	54.50	25.90
Chile <sup>d</sup>	0.69	0.93	ND	ND	ND	ND	ND	55	ND

Source: PAHO unless otherwise stated (2005).

<sup>+</sup> In north to south geographical order.

<sup>+</sup> Country average.

<sup>a</sup> Residue composition data from ANAM (2004).

<sup>b</sup> Residue composition data are average figures which correspond to the Colombian Caribbean (Escobar, 2006).

<sup>c</sup> CONAM (2004) presents the following litter composition paper 6.49; cardboard 0.97; plastics 4.3; glass 3.39; ferruginous metals 2.2; non-ferruginous metals 0.16; textiles and rags 1.56; leathers and rubbers 0.3; woods 0.93; others 25.2; and organics 54.5.

<sup>d</sup> Litter composition in coastal municipalities includes 55% organic residues, 17% paper and cardboard, 8% textiles and others, 10% plastics, glass and metals (Rovira, 2006).

<sup>e</sup> PAHO (2005) defines them as solid residues generated by population's households.

<sup>f</sup> PAHO (2005) defines them as solid or semisolid residues originating from urban activities in general. These can be residential or domestic, commercial, institutional, from small industry or from sweeping and cleaning of streets,

markets, public areas and others.

The coastline is of great value to the five countries, especially for tourist and recreational use. Consequently several initiatives have been established to clean the beach front. In Colombia, cleaning campaigns have been developed for the tourist beaches of Tumaco and Buenaventura. Escobar (2006), highlights the experience of the Project: "Tumatai: Tumaco we want you clean". Since its beginning in the first 1990's, the Coastal Resources Management Programme (PMCR) has supported the planning of tourist seasons in the main beaches in Ecuador, including schemes to keep them clean. Additionally, a process of certification with an ecolabel Blue Flag is underway in five beaches in the Guayas province, which includes regular cleaning of the beaches. Likewise, a system for cleaning several stretches of the Estero Salado (estuarine zone) which surround Guayaquil is underway (Coello & Macías, 2006). In Peru, several municipalities have established processes for periodically cleaning beaches (*e.g.*, Callao since 1999) (Alfaro, 2006). In southern Chile, in the regions Aysén and Los Lagos, salmon farms have carried out cleaning campaigns on the beaches during the last ten years. The tourist beaches of the country (considered as such for the number of visitors) are cleaned periodically by the respective municipalities (in many of them every day during the summer). Nevertheless, a high proportion has insufficient cleaning due to financial limitations of municipalities (Rovira, 2006).

Alfaro (2006), pointed out that the costs involved in beach cleaning are high and may become unaffordable to coastal municipalities, since they are in addition to the regular costs of cleaning public places and of garbage collection and disposal that municipalities already face. Coello & Macías (2006), make the same observation about the regular cleaning of tourist beaches and the Estero Salado. In general, the costs associated to cleaning the coastline have not been internalized.

Table 6. Estimate of litter from land sources that has the potential of becoming marine litter (persistent materials).

Country	Coastal population	Garbage per capita production (kg person <sup>-1</sup> day <sup>-1</sup> )	Garbage collection coverage	Persistent fraction of garbage <sup>+</sup> (%)	Uncollected persistent garbage* (t year <sup>-1</sup> )	Marine litter potential (t year <sup>-1</sup> )
Panama	2,767,896 <sup>a</sup>	0.59 <sup>b</sup>	Urban 75% Rural 40-50%	27 <sup>c</sup>	55,650 <sup>d</sup>	5,565 – 16,695
Colombia	543,000 <sup>e</sup>	0.8 <sup>f</sup>	Buenaventura 72% and Tumaco 40% <sup>g</sup>	10.35 <sup>h</sup>	8,061 <sup>i</sup>	806 – 2,418
Ecuador	4,336,812 <sup>j</sup>	0.69	58.5% <sup>k</sup>	8.9 <sup>l</sup>	24,823 <sup>l</sup>	2,482 – 7,447
Peru	4,133,853 <sup>m</sup>	0.711	75 <sup>n</sup>	10.35 <sup>o</sup>	27,759	2,776 – 8,328
Chile <sup>p</sup>	3,839,195 <sup>q</sup>	1.16	96% – 98%	10	6,747.8 <sup>r</sup>	675 – 2,021 <sup>r</sup>

<sup>+</sup> Glass, plastic and metal.

\* Corresponds to the uncollected fraction of persistent materials (*i.e.*, glass, plastics and metal).

<sup>a</sup> Population projection for July 1<sup>st</sup> 2006 in the provinces of Chiriquí, Veraguas, Herrera, Los Santos, Cocolé, Panama, and Darién. Source: Departamento de Análisis de Situación y Tendencias de la Salud, Sección de Registros Médicos y Estadísticas de Salud. Ministerio de Salud. 62.2% of the population is urban and 37.8% is rural (ANAM, 2004).

<sup>b</sup> De la Cruz (2004), ANAM (2004).

<sup>c</sup> ANAM (2004), see Table 5.

<sup>d</sup> González (2006).

<sup>e</sup> Population in 2001 of the four departments with maritime fronts to the Pacific Ocean. The Colombian Pacific coast has 16 coastal municipalities.

<sup>f</sup> Escobar (2006).

<sup>g</sup> Escobar (2006). The remaining settlements on the Colombian coastline do not have garbage collection service.

<sup>h</sup> Glass 3.25%, plastic 5.70%, metals 1.05%, and rubber 0.35%. Average figures that correspond to the Colombian Pacific (Escobar, 2006); see also Table 5.

<sup>i</sup> Corresponds to 10.35% of uncollected garbage estimate, carried out by Escobar (2006). The author estimated to be 46,170.54 t year<sup>-1</sup> from direct sources and 31,719.14 t year<sup>-1</sup> from indirect sources (total 77,889.68 t year<sup>-1</sup>) and also presents an estimated amount which is higher than the present calculation (*i.e.*, 9,891.9 t year<sup>-1</sup>).

<sup>j</sup> Population in 2001 (Population and Housing Census) of the 36 municipalities with coastlines.

<sup>k</sup> Average value. The range in municipalities is 10.5% - 93.5% (see Table 4 in Coello & Macías, 2006)

<sup>l</sup> Coello & Macías (2006).

<sup>m</sup> 2005 Census. Population of the 120 district municipalities and 32 provincial municipalities with a coastal front.

<sup>n</sup> CONAM (2004).

<sup>o</sup> CONAM (2004) presents the following composition of persistent materials in garbage: plastics 4.3; glass 3.39; ferruginous metals 2.2; non-ferruginous metals 0.16; and leather and rubber 0.3. Total = 10.35%.

<sup>p</sup> Chile has a database with direct information on the quantity of garbage deposited in sanitary landfills and managed dumps (Rovira, 2006). In 2005 1,619,490 t were deposited.

<sup>q</sup> 102 municipalities with access to the sea.

<sup>r</sup> Rovira (2006).

## 2.2.2 Marine sources

In the five countries waste from marine sources have been reported (Table 7). However, there is very little quantitative information regarding the origin and volume of these residues. It is assumed that the main sources are the discarding or loss of fishing gear (*e.g.*, nets, floaters, pieces of rope) and waste thrown overboard from ships.

Table 7. The ten most commonly found items collected during the international coastal clean-up day of in 2005 in the countries of the region. Source: the Ocean Conservancy.

Panama		Colombia <sup>23</sup>		Ecuador		Peru		Chile	
Percentage of the total of articles collected from the beaches									
Beverage plastic bottles	11.8	Beverage plastic bottles	20.6	Cigarettes / filters	55.5	Beverage plastic bottles	41.4	Bottle caps and other containers	38.7
Bags	10.6	Beverage glass bottles	16.6	Bottle caps and other containers	8.4	Bags	10.3	Beverage plastic bottles	30.9
Clothes	10.2	Bottle caps and other containers	12.8	Bottle caps and other containers	6.4	Bottle caps and other containers	7.1	Cigarettes / filters	8.4
Cups, plates and utensils	8.6	Bags	12.2	Bags	4.8	Cups, plates and utensils	4.1	Food wrappings	4.4
Beverage glass bottles	7.4	Plastic joints	8.4	Food wrappings	3.9	Clothes	3.0	Bags	4.1
Beverage cans	6.5	Clothes	4.7	Rope	2.9	Toys	2.6	Plastic joints	2.8
Bottle caps and other containers	6.4	Cups, plates and utensils	4.2	Cups, plates and utensils	2.9	Cigarettes / filters	2.5	Beverage glass bottles	1.4
Food wrappings	6.2	Food wrappings	3.7	Beverage glass bottles	2.3	Plastic straws and swizzlers for drinks	2.5	Chlorine bottles, other cleaning articles	1.1
Plastic joints	4.1	Beverage cans	3.1	Plastic joints	1.7	Diapers	2.3	Cigarette packs and wrappings	0.9
Oil bottles	2.9	Plastic straws and swizzlers for drinks	2.7	Plastic straws and swizzlers for drinks	1.6	Beverage cans	2.2	Building materials	0.9
Total	74.7	Total	89.0	Total	89.2	Total	78.0	Total	93.6

Escobar (2006), estimated that each year 5,376 units of nylon net enter the Colombian Pacific as floating litter, the majority of which is probably confined near the shore (2-3 miles). Fishing remains accounted for a small percentage of the total articles found on the coastal clean-up day 2005 (Table 8). Fishing boats also discharge persistent litter like bottles, cans, food wrappings and motor oil containers<sup>24</sup>. Escobar (2006), estimated that the Colombian fishing fleet generates *ca.* 273 tons year<sup>-1</sup> of marine litter. There is no similar estimate for the other countries of the region.

Table 8. Percentage of fishing remains found on beaches on international coastal clean-up day in 2005 in the countries of the region.

Country	Fishing lines	Fishing nets	Rope	Floaters
Panama	0.18	1.25	1.26	1.39
Colombia <sup>a</sup>	0.12	0.01	0.20	0.01
Ecuador	0.34	0.40	2.87	0.83
Peru	0.28	0.52	0.89	0.44
Chile	0.05	0.06	0.42	0.12

<sup>a</sup> Referential data as it corresponds to the Colombian Caribbean.

The Southeast Pacific has important ports and intense maritime traffic. Nevertheless there is no estimate of the garbage thrown into the ocean from merchant ships. Despite national<sup>25</sup> and international normative currently in force such as Annex V of MARPOL<sup>26</sup>, illegal discharge of garbage and plastics at sea continues. In Chile, Thiel *et al.* (2003) reported that the main concentrations of floating marine litter were found (86.9% plastics) in coastal areas near the main ports. The principal component of this garbage was plastic bags (47.6% of residues registered). Due to the fact that the bags sink relatively fast, it is believed that the main origin of this litter is the discharge from Merchant ships. It must be pointed out that the concentrations of floating litter found in Chile (1 to 36 items km<sup>-2</sup>) are not different from others found in the rest of the world. Rovira (2006), indicates that an important source of litter could be the tourist cruises that operate in Chile.

### 2.3 Dynamics of litter

As was previously indicated, marine litter comes from land and marine sources. The dynamics of marine litter is complex. Available information has been structured to visualize flows of production and relocation of litter, but no quantitative information was available to characterize these processes.

Regarding land sources, key elements include the efficiency of collection services and the quality of waste and residue discharge (Fig. 3). Part of the garbage generated by the population is collected and taken to sanitary landfills and dumps. Sanitary landfills are garbage deposits from which there exists a remote possibility that garbage can escape and become marine litter. On the other hand, garbage that is taken to dumps has higher possibilities of turning into marine litter depending on the quality of the dump's operation. In some dumps garbage is buried and/or burnt through which residues are eliminated from the system. Nevertheless, a part of the garbage can reach river courses or coastal zones directly through runoff, wind, natural events (*e.g.*, El Niño, floods), animals or people. Actions of recyclers remove persistent elements (*e.g.*, plastics) from the system.

The uncollected portion of garbage can be (1) burnt or buried (thus removing residues from the system); (2) collected by recyclers; (3) thrown out into waterways (a very common practice in rural and marginal urban communities); or (4) thrown out in land in creeks, wastelands, public roads or clandestine dumps. Persistent residues (*i.e.*, plastics, metal and glass) that remain on land can eventually, due to the action of some factor (*e.g.*, wind and rain), be transported into waterways or directly to the coastal zone.

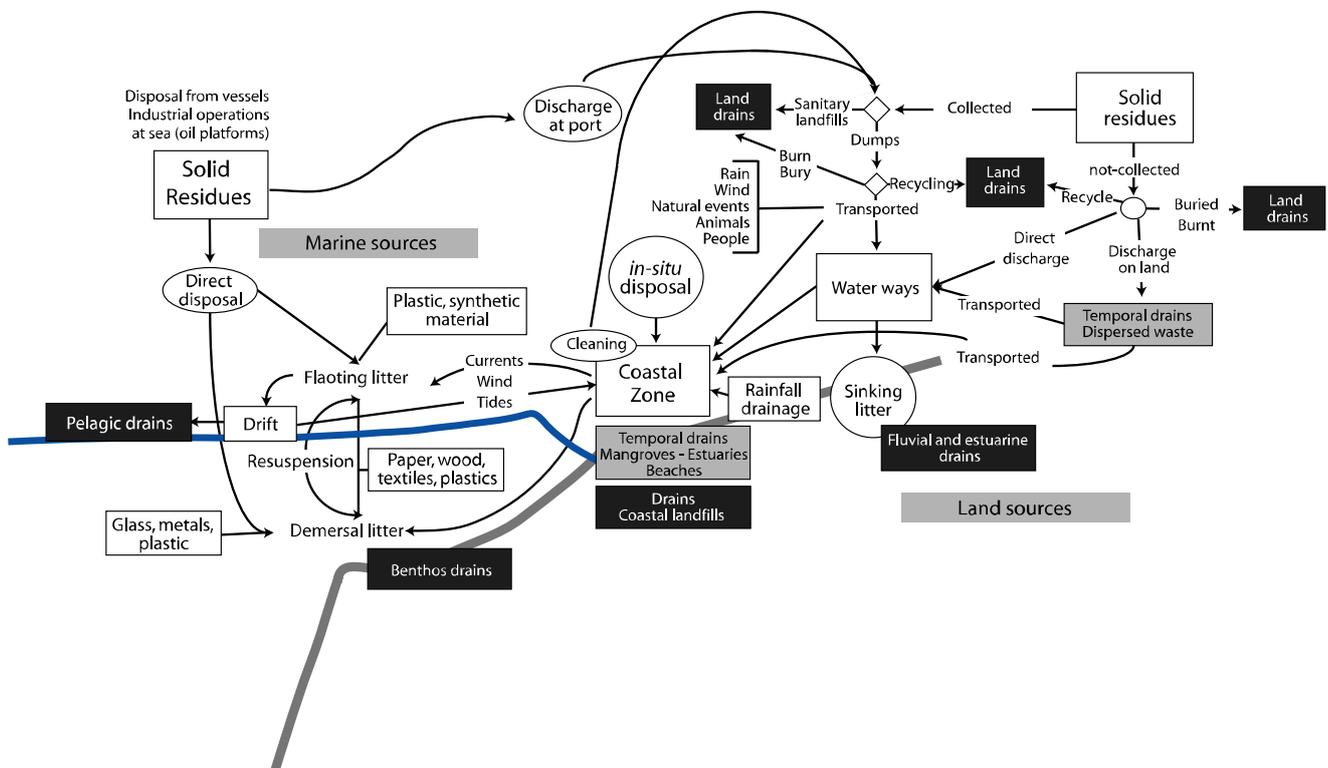


Figure 3. Main flows in the dynamics of marine litter.

Not all the garbage transported by water courses reaches the ocean. Some garbage sinks and deposits on river bottoms<sup>27</sup>; however, the action of certain events (*e.g.*, intense precipitation and swells) can eventually remove and re-suspend garbage from the bottom whence it can also reach the ocean. Another part of garbage will reach estuaries where becomes trapped in temporal deposits. Escobar (2006), reports that some of the waste accumulate in mangrove roots, stilt neighborhoods and other structures (*e.g.*, docks). Coello & Macías (2006), also observed this and additionally reported that through wind and tidal action, floating litter accumulates in the narrowest channels of estuaries.

The coastal area is where the problem of persistent residues is more conspicuous. Besides the residues from land, there is direct disposal of garbage in estuaries, beaches and neighboring plots (part of this garbage reaches the coast through runoff), as well as residues from the sea. The more obvious portion in estuaries and mangroves (acting as temporary deposits) is floating litter, but a fraction that has not been accounted for could be deposited at the bottom (and eventually be re-suspended due to different factors). Part of the garbage generated on the coast can be trapped in landfills. Escobar (2006), reported that in Tumaco and Buenaventura much of the garbage is used in landfills to gain land from the sea. This practice also occurs on the coast of Ecuador. In Guayaquil, until recently, it was very common the use of garbage to fill estuaries. At this time, debris<sup>28</sup> is mainly used in marginal neighborhoods to convert areas invaded by stilt constructions into land that can be legalized. The process for cleaning beaches and estuaries remove the residues but the final impact depends on the place where they are deposited. Residues going to dumps located on the coastal zone have a very high probability of becoming, once again, marine litter. There are recyclers that remove persistent material from the coastline, but from the available information of the region, it is assumed that their impact is very small.

Litter from land sources reaching the ocean may, due to winds and currents, float and keep itself drifting (floating or pelagic litter) or eventually sink to become demersal litter (Fig. 3). Part of the floating garbage coming from land sources can return to the coast and deposit itself on the beach. Another part can wind up in the open ocean; it is reported that floating litter can cross the Pacific. Thiel *et al.* (2003), found that floating litter forms patches mainly in coastal waters, but they also found patches in oceanic waters. In the North Pacific a great accumulation of floating litter has been identified in the calm waters that form the general pattern of oceanic circulation – a pelagic deposit (Moore 2003). It is estimated that this accumulation of floating litter represents around three million tons of residues. Nothing similar has been reported in the South Pacific where the pattern of oceanic circulation is similar; it is not improbable that something akin exists. Little is known of the garbage when reach the bottom. For the region, the Ocean Conservancy only reports data of submarine cleaning in Ecuador in 2005; in this case, litter on the bottom was mainly constituted by residues of activities in the ocean and water bodies (Fig. 4).

Litter from marine sources has the same behavior as was previously mentioned: keeping afloat or sinking. Winds and currents can take floating litter towards the coast or drifting out to the open ocean. Ships' residues are discharged in facilities available at port<sup>29</sup> for that purposes. Nevertheless, if these residues are disposed of in dumps near the coastline, there is a probability that they will turn into marine litter again.

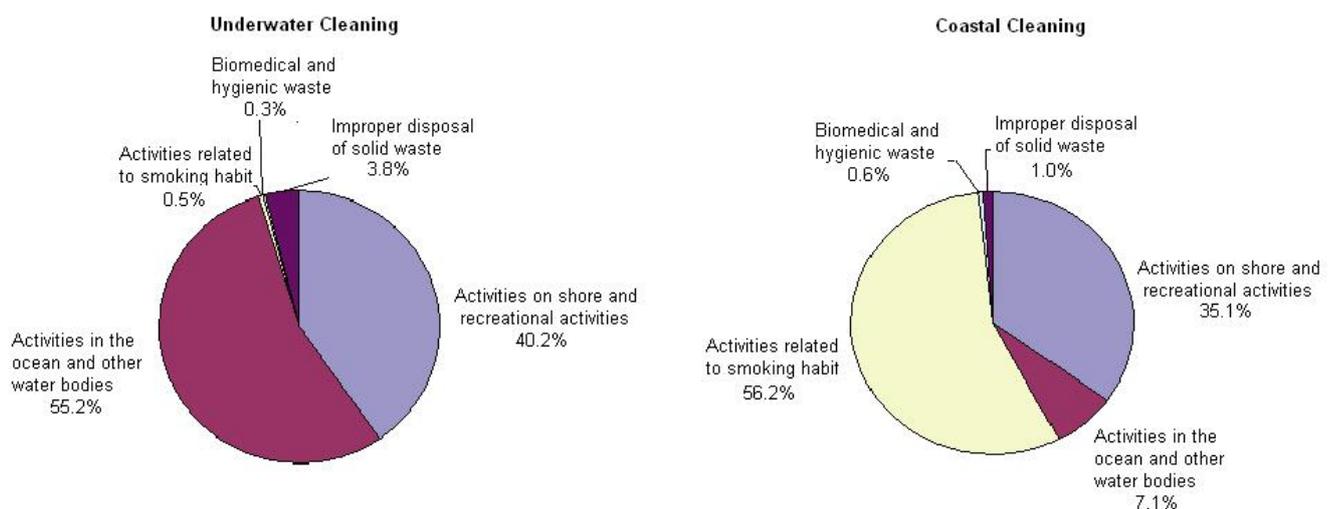


Figure 4. Comparison of litter composition found during the beach cleaning day and underwater cleaning in 2005 in Ecuador.

Residues found on beaches represent only a small fraction of the problem of marine litter. There are undetermined quantities of floating litter in temporary deposits (*e.g.*, mangroves, estuary inlets “*cogollos*”) in the ocean. As well as a large quantity of persistent residues with the potential of turning into marine litter in dumps and rainfall drains. The magnitude of litter deposited at the bottom of rivers, estuaries and oceans is unknown. Cleaning of coastal

zones and reception of ship's garbage at ports could be "solutions" of no transcendence if its final disposal is inadequate.

## 2.4 Impacts of marine litter

It is known that marine litter generates diverse impacts:

1. Public health problems;
2. Degradation of coastal environments;
3. Mortality of fauna (*e.g.* ghost fishing, animals that become entangled in or swallow pieces of plastic);
4. Reduction of aesthetic and recreational value of the coastal border;
5. Clogging of sanitary sewages and rainfall drainages; and
6. Damage to ships/vessels (*e.g.* entangled or damaged propellers, clogging of cooling systems).

It has also been reported that fragments of floating plastic become agents of dispersion of invasive species (Pearce, 2002), have entered into the sea's trophic chain (McKee, 2004) and accumulate hydrophobic toxic substances becoming sponges of DDT, PCB and hydrocarbons (Moore, 2003).

There are no estimates of the magnitude and monetary costs related to these impacts in the Southeast Pacific. An additional element is the cost of cleaning the coastline which should be undertaken by municipalities, picking up residues that are not totally generated by their resident populations or by tourists and visitors. Alfaro (2006), presented the case of the municipality of Ventanillas in Peru that would have to invest around US \$400 thousand year<sup>-1</sup> in order to clean its coastline, while its annual budget for public cleaning is US \$200 thousand. Alfaro (*op cit.*) also estimated that it would require *ca.* US \$2.5 million to cover labor costs for cleaning the Peruvian coast (in addition to the requirements of machinery and materials). Marine litter puts pressure on the capacity for waste cleaning and management of coastal municipalities – Alfaro (2006) cites the experience of Playa de Carpayo of only 500 m in length where the litter brought in by the sea is of such magnitude that it nullifies cleaning efforts. It must be pointed out that many coastal municipalities have severe technical and financial limitations to tackle this problem.

## 2.5 Monitoring systems

Most information available on marine litter comes from the activities carried out during the celebration of the international coastal cleanup day, an Ocean Conservancy initiative. In Panama, Ecuador and Peru these efforts have been developed throughout many years and are now institutionalized. In Panama, the National Association for the Conservation of Nature (ANCON) maintains since 1991 this Programme on the beaches of the Pacific and in two provinces with beaches on the Caribbean coast. In Ecuador, the Coastal Resources Management Programme (PMCR) has coordinated since 1994 the celebration of international coastal cleanup day in the continent. In Galapagos, this event is organized by *Albatros* Foundation. In Peru, this activity has taken place since 1999 coordinated by the non governmental organization VIDA and the Peruvian Navy through the General Direction of Port Authorities and Coast Guards (DICAPI). In Colombia, the international coastal cleanup day is mainly carried out in the Caribbean<sup>30</sup> and is coordinated by the Corporation of Sustainable Development CORALINA, with support of governmental institutions and sponsorship from the private sector.

This activity is relatively new in Chile. The Pontific Catholic University of Chile, that manages a marine coastal protected area in the Central Zone called Las Cruces, organized "the international coastal cleanup day" on 1<sup>st</sup> October 2005, on the beaches of the central coast between Tunquen and Rocas de Santo Domingo in the Valparaíso Region (Rovira, 2006). Ocean Conservancy has information on some specific actions carried out in the past, but data have not been systematized.

There is also specific information generated by several initiatives in the countries. For example, the Project: "Tumatai: Tumaco we want you clean" of Colombia, and the Programme for beach management of the Council of Guayas Province (which began in 2005 and reports weekly on the weight of litter collected in five beaches of the Programme) and the plan for the recovery of the Estero Salado in Guayaquil City, in Ecuador.

Nevertheless, municipal statistics on garbage collection and disposal are not always reliable, especially in areas where open dumps are used. For the current work it was not possible to obtain statistics on litter from ships left in port facilities, but it is possible that this information exists in large ports as those of Panama.

## 3. SITUATION ANALYSIS

Marine litter in the region is generated through three main causes: (1) discharge from land sources, (2) insufficient cleaning of the coastline and (3) discharge of garbage at sea (Fig. 5).

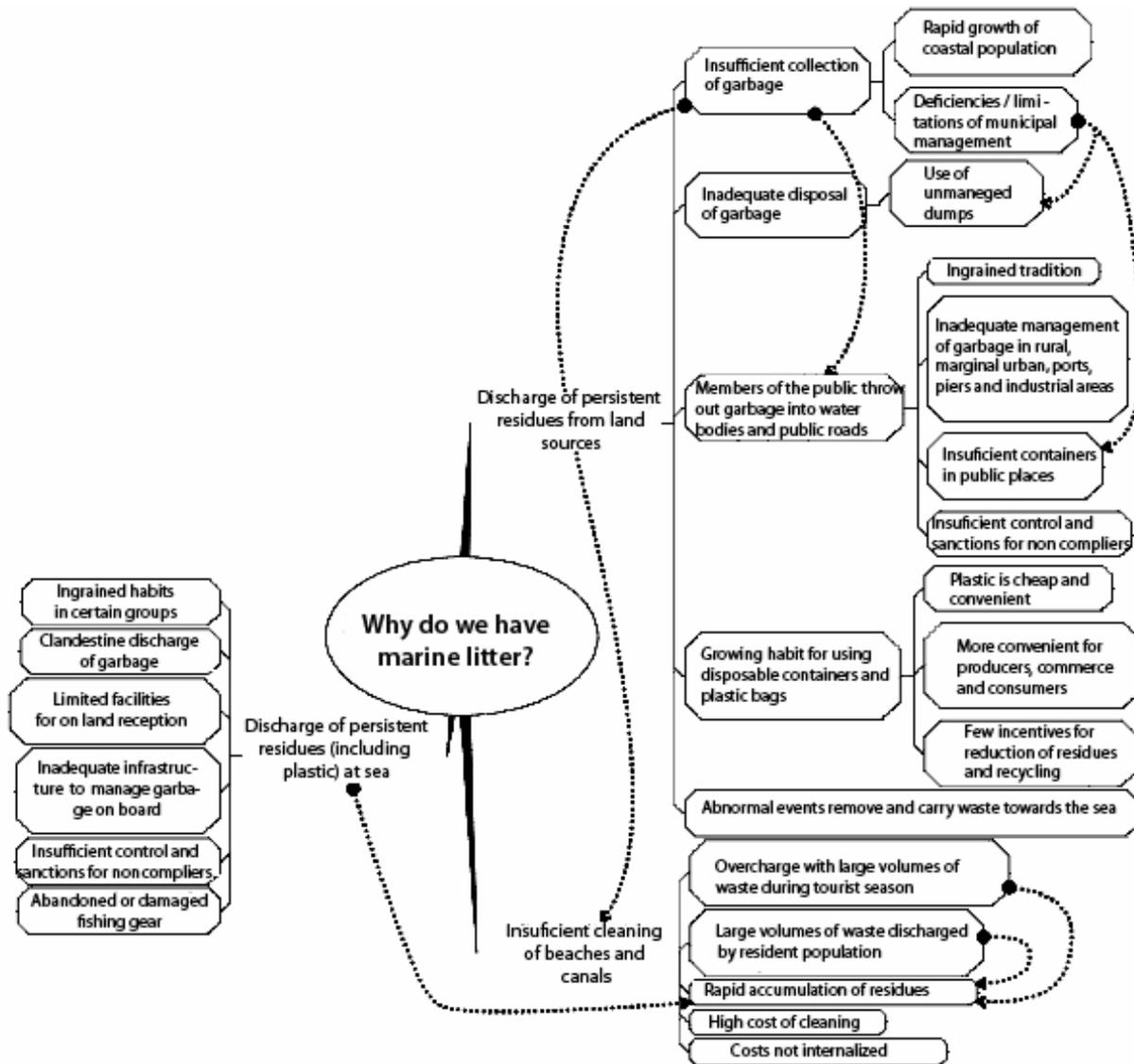


Figure 5. Causes of the presence of marine litter in the Southeast Pacific.

As it has been previously observed, the root causes of waste from land sources in the Southeast Pacific are the low coverage of the collection service and the inadequate disposal of garbage. Both are directly related to the capacities of coastal municipalities to handle solid residues generated within their jurisdiction. A key aspect of the problem is that segments of the population discard litter directly into the environment; apparently this practice is deeply rooted in some rural areas and marginal urban groups, fishermen, among others. Rural communities that do not have garbage collection services do not always manage their waste in a suitable manner. Another important element is the increasing practice to use of discarded containers and packaging made of persistent materials (e.g., plastics, aluminum, glass, styrofoam and tetra pack), as well as plastic bags. Plastic is cheap, but apparently the public does not perceive the impacts generated by discarding it into the environment. Finally, an additional important factor is the dispersal of persistent residues (either through runoff or open dumps) during abnormal climatic events.

The second major cause is the insufficient cleaning of the coastline, which is generated by:

- (1) Waste overload generated by tourists during holiday seasons, which may surpasses the installed capacity for garbage collection and disposal;
- (2) Continuous waste discharge by the local population, which in some areas (e.g. Buenaventura, Tumaco, Guayaquil) can be of considerable magnitude due to insufficient coverage in garbage collection and deficient disposal systems;

- (3) The rapid re-accumulation of garbage on the coastline, since some areas (e.g. Callao, Ballenita) continually receive important volumes of litter from the sea;
- (4) The high costs of maintaining continuous cleaning systems, which can surpass the municipalities' financial capacity;
- (5) The costs of cleaning, garbage collection and disposal are not internalized as the costs are paid by a population that not always is the main generator of residues.

The third major cause is the discharge of litter in the ocean. For some people operating small vessels (e.g., artisanal fishermen and coastal cabotage), it is common practice to discard their waste overboard. Such vessels do not always allow the handling of waste onboard. Apparently there is no clear understanding of the consequences of discarding persistent residues into the sea. However, the clandestine discharge by larger vessels with obligation of handling their waste, is also taking place. Apparently the control aboard is insufficient or is occurring because the lack of ship's garbage reception in port facilities. Finally, it must be taken into consideration that during fishing operations, pieces of gear (e.g. floaters, fishing lines, nets) are lost or discarded. The responsibility for the impact of these wastes has been widely discussed in different forums (e.g. APEC, 2004). However, no initiatives for recycling and reuse of fishing gear were identified for the region, or the labeling of gear to identify its origin and apply accountability schemes (e.g. FAO, 2004).

### 3.1 Incidence of the regional Protocol on land sources (CPPS)<sup>31</sup>

The Protocol for the Protection of the Southeast Pacific from Land-based Sources includes among pollutant items in Annex I "*persistent synthetic materials which can float, remain in suspension or sink, which could be an obstacle to any legitimate use of the sea*". This is what would be understood as marine litter from the Protocol's perspective. The High Contracting Parties have gone ahead with the Protocol's implementation (e.g., all of the countries have national policies and regulations that contribute to the reduction of pollution from land-based sources) and the Permanent Commission for the South Pacific (CPPS) has fostered the implementation of this instrument specially through the Plan of Action for the Protection of the Marine Environment and Coastal Areas of the Southeast Pacific.

The Protocol is the appropriated general framework which establishes the conditions to tackle the problem of marine litter; nevertheless the challenge is how to make operational this instrument.

There are five elements which can substantially support the solution of marine litter problems in the Southeast Pacific:

In Article III – General Obligations.

1. "*The High Contracting Parties will issue laws and regulations for the prevention, reduction and control of pollution in the marine environment from land sources, including rivers, estuaries, pipelines and drainage structures, taking into consideration regulations and standards as well as internationally agreed practices and procedures.*"

This paragraph constitutes the framework for establishing specific national regulations on marine litter, particularly the reduction in the use and recycling of persistent materials.

2. "*The High Contracting Parties will endeavor to harmonize their policies on the matter, in the regional scale.*"

This paragraph establishes the basis for sustaining a regional policy on marine litter from land sources, which could include a reduction in the use and recycling of the more conspicuous persistent materials such as plastic.

3. In Article IV – Obligations Regarding Annex I.

*"The High Contracting Parties will make an effort to prevent, reduce, control and eliminate in their respective zones under the scope of application of the current Protocol, pollution from land-based sources caused by the substances listed in Annex I of this Protocol. For this purpose, countries will elaborate and put into practice, jointly or individually, suitable Programmes and measures.*

*Those Programmes and measures should take into consideration, for their progressive application, the capacity for adaptation and conversion of the existing facilities, the Parties' economic capacity and their need for development."*

These paragraphs permit the possibility of applying national measures to deal with the discharges of persistent residues. The second paragraph provides the necessary flexibility for the introduction of progressive changes in the systems of production and use of these materials.

#### 4. In Article VII – Cooperation Between Parties.

*“The High Contracting Parties which require assistance in their struggle against pollution from land-based sources, could request, either directly or through the General Secretariat, the cooperation of the other Parties, especially those that could be affected by pollution*

*Cooperation could include assistance provided by experts and the necessary equipment and supplies to combat pollution.*

*The required High Contracting Parties will consider, in the speediest manner possible, the request submitted and will respond at their discretion, in accordance to their possibilities, and will inform the requesting Party immediately on the way, dimension and conditions of the cooperation that they may be in the capacity of supplying.”*

These paragraphs permit the possibility of collaboration among countries of the region in order to deal with the problem of marine litter from land sources.

#### 5. In Article VIII – Surveillance Programmes.

*“The High Contracting Parties, directly or in collaboration with the Executive Secretariat or other competent international organization, will gradually establish individual or collective Programmes of two or more Parties regarding the surveillance of pollution from land sources, with the aim of:*

- a) Evaluating the nature and extent of pollution;*
- b) Adopting the adequate measures to avoid or reduce the effects of pollution;*
- c) Evaluating the effects of the measures undertaken under this Protocol for the reduction of pollution in the marine environment;*
- d) Informing the other High Contracting Parties and the Executive Secretariat on the actions to be adopted and regarding any activity that is being developed or that is intended for development with the aim of combating pollution.”*

This section in the protocol establishes the basis for implementing in the region a reporting system regarding advances on the implementation of the Protocol and, in this specific case, on the reduction of discharges of persistent residues. Article IX complements these guidelines establishing precisions to that respect (e.g., pollutant statistics [persistent residues] discharged into each country).

To summarize, in spite of the fact that the Protocol has existed for over twenty years, it still constitutes an adequate framework to combat pollution from land-based sources. Once the dimension of the problem of marine litter and its impacts is better understood, countries of the region can implement specific actions to face such form of pollution under the Protocol framework. However, it must be taken into account that the main emphasis given by the countries has been pollution through wastewater (CPPS, 2006b).

## **4. REGIONAL PROGRAMME FOR INTEGRATED MANAGEMENT OF MARINE LITTER**

### **4.1. General objective.**

To minimize the discharge of solid persistent residues from land and marine sources into the Southeast Pacific Ocean.

**4.1.1. Specific objective 1.** To increase the coverage of garbage collection systems in coastal municipalities and to ensure the appropriated disposal of persistent materials to prevent their release into the environment.

#### Recommended actions at national level

1. Give priority to investment in garbage collection and disposal systems in coastal municipalities and in those located on river basins draining into the Pacific Ocean.
2. Take the necessary measures in garbage management plans to avoid the escape of persistent residues that may become marine litter.
3. Establish systems to record and sharing information on the quantities and composition of garbage collected and disposed of.
4. Establish management indicators on garbage collection and disposal systems, especially in coastal municipalities.

5. Strengthen mechanisms for the control of illegal discard of garbage and sanction on offenders.

#### Regional actions

1. Facilitate the understanding of the problem of marine litter and how a more efficient collection of solid residues can contribute to the solution of litter generation. To this effect, educative materials for municipalities and authorities will be prepared and diffused. It will be requested to the Focal Points of the Plan of Action for the Protection of the Marine Environment and Coastal Areas of the Southeast Pacific their assistance for their distribution and to organize events (*e.g.*, seminars, conferences, press releases, interviews in the media) and actions which can stimulate the analysis of the problem in each country.
2. Promote the exchange of experiences regarding the integrated management of garbage in the coastal zone of the region. To this effect, workshops can be organized in each country to identify and systematize successful local experiences which can eventually be consolidated into a regional workshop. Examples and methods of efficient management of solid residues (mainly persistent residues) will be identified, so that they can be duplicated in the region. Feasible objectives will be identified to broaden the coverage of adequate garbage collection and disposal systems in the coastal municipalities of the region.
3. Prepare a practical guide for the integrated management of solid residues in the coastal areas of the region. To this effect, a working group should be formed with national specialists who will outline applicable guidelines based on previous successful experiences. The final version of this guide will be analyzed and approved in a workshop of experts from the region.
4. Promote knowledge among coastal municipalities about the Protocol for the Protection of the Southeast Pacific from Land-based Sources of Pollution, requesting the commitment of local authorities in the management of persistent residues which can become marine litter. To this effect, dissemination material will be prepared (*e.g.*, brochures, posters, PowerPoint presentations) to be distributed by each country through the Focal Point of the Plan of Action for the Protection of the Marine Environment and Coastal Areas of the Southeast Pacific. Focal Points will be asked to organize meetings with all the coastal municipalities of the country.
5. Promote that the High Contracting Parties of the Protocol agree on goals for (a) coverage of garbage collection systems in coastal municipalities, and (b) disposal in sanitary landfills and managed dumps in coastal municipalities. For this purpose, Parties will be consulted on possible feasible objectives (to be determined). A meeting will be convened to analyze the proposed objectives and their subsequent approval.

#### **4.1.2. Specific objective 2.** To eradicate the discharge of persistent litter from vessels.

##### Recommended actions at national level

1. Adopt or implement, whichever be the case, Annex V of MARPOL 73/78.
2. Adopt regulations to prohibit the disposal of persistent litter from ships.
3. Establish control and auditing mechanisms to avoid discharge of persistent litter from ships.
4. Promote the adoption of codes of conduct by relevant stakeholders (*e.g.*, fishing, tourism, freight) in order to avoid the discharge of persistent litter at sea.

##### Regional actions

1. Promote understanding of the problem and impacts of marine litter (particularly plastic) discarded from ships by various sectors which operate in coastal and oceanic waters (*e.g.*, fishing, freight and passenger transport, marine tourism, aquaculture). To this effect, informative material will be prepared (as appropriate for each sector) for its distribution through the Focal Points of the Plan of Action for the Protection of the Marine Environment and Coastal Areas of the Southeast Pacific who will organize periodic events (*e.g.*, seminars, conferences, press releases, interviews in the media) and other activities that will promote the analysis of the problem among stakeholders.
2. Stimulate the exchange of experiences regarding regulations and control of litter discharge from ships. To this effect, a regional workshop will be organized with the participation of national authorities and delegates of the International Maritime Organization (IMO) and other relevant institutions. Key elements for the analysis will be the implementation of Annex V of MARPOL and the control of litter discharge from small vessels. Successful experiences in the region and an ensemble of recommendations for the countries will be identified.
3. Produce guidelines for the handling of solid residues aboard small vessels. For this purpose, a regional working group will be created with national specialists to identify successful practices within the region and abroad; technical support from IMO or other relevant institutions will be looked for. The final draft of the guide will be analyzed and adjusted in a regional workshop of experts, and later validated by stakeholders from each country. Finally, the guide will be published and distributed through the Focal Points in all countries of the region. This guide will also be available in electronic format from CPPS and

Focal Points web sites. Additionally, educative material will be prepared and diffused (*e.g.*, posters) promoting the use of the guide and highlighting its key issues.

#### **4.1.3. Specific objective 3.** To minimize the disposal of fishing gear in the coasts at sea.

##### Recommended actions at national level

1. Implement programmes to promote the adequate disposal of damaged or obsolete fishing gear (*e.g.*, recycling, exchange).
2. Analyze the feasibility of incorporating regulations penalizing the abandonment of fishing gear at sea.
3. Analyze the feasibility of implementing identification mechanisms for fishing gear in order to establish responsibility of owners due to the impacts of abandoned gear on third parties and biodiversity.

##### Regional actions

1. Support actions to understand the problem and impacts caused by abandoned or discarded fishing gear in the region, in the framework of the Protocol for the Protection of the Southeast Pacific from Land-based Sources of Pollution. For this purpose, a regional working group with experts in fisheries and economy will be formed to compile, systematize and assess the available information in each country, in order to quantify the impacts and associated costs caused by abandoned gear. Recommendations will also be outlined (*e.g.*, incentives, penalization) to reduce losses of fishing gear and the impacts caused by ghost fishing. Results will be analyzed in a regional workshop of experts, published and delivered to national authorities for their consideration. Finally, a regional high level meeting of fishing authorities will be convened to analyze the results and recommendations made by the working group, and to establish possible national and regional actions.
2. Promote the understanding of impacts and costs caused by abandoned fishing gear. To this effect, results from the activity formerly described will be used as inputs (*i.e.*, the extent of the problem and the impacts generated by abandoned or discarded fishing gear in the coasts and seas of the region) to prepare informative materials (as appropriate according to fishing sectors of each country) to be distributed through the Focal Points of the Plan of Action for the Protection of the Marine Environment and Coastal Areas of the Southeast Pacific. Focal Points will organize periodically events and actions to analyze the issue with the fishing sectors of each country.

#### **4.1.4. Specific objective 4.** To establish the volumes of production, patterns of distribution and accumulation, and impacts of marine litter in the region.

##### Recommended actions at national level

1. Analyze the relevant recommendation (article 65) included in Resolution A/RES/60/30 of the United Nations General Assembly of 29 November 2005.
2. Establish mechanisms to collect relevant information on the production of marine litter (*e.g.*, production of litter per capita in coastal municipalities, records of discharges in dumps and sanitary landfills, production per capita of litter in ships).
3. Incorporate the issue of marine litter in national research agendas, encouraging universities and research institutes to take interest in key issues such as patterns of marine litter transport, identification of sites of accumulation and sinking and decay rates of different materials.
4. Promote research to quantify the negative impacts generated by marine litter and estimates of its associated costs.

##### Regional actions

1. Promote the standardization of concepts and definitions related to marine litter in the region (*e.g.*, floating litter, demersal litter) as well as a common methodology for the collection of relevant information (*e.g.*, quantification of floating litter, determination of density of litter on beaches, assessment of volumes of submerged litter) and assessment of the costs generated by negative impacts. For this purpose, an interdisciplinary working group will be organized to systematize the available information at national, regional and international level (*e.g.*, definitions, indicators, quantitative methods, economic valuation methods), and develops guidelines for the collection, processing and analysis of data on marine litter. The guideline draft will be sent to experts from other regions in order to obtain their input: compatibility with methods used in other regions will be looked for with the aim of allowing the comparison of results. Finally, the definitive draft will be analyzed and fine-tuned in a regional workshop of experts. Guidelines will be widely distributed among universities, research institutions, coastal municipalities and the relevant national authorities (*e.g.*, fishing, tourism, science and technology) through the national focal points. The digital version of the guideline will be available from different websites in the region.

2. Promote regional cooperation on research of several aspects related to marine litter, following the guidelines of the Protocol for the Protection of the Southeast Pacific from Land-based Sources of Pollution. For this purpose, meetings in each country will be organized to outline a proposal of research agenda. A regional meeting of scientists and authorities will be convened in order to analyze and prioritize the items of such agenda. Funds from national sources will be requested as well as from international cooperation in order to initiate its implementation. The agenda will be widely disseminated in the region. Mechanisms to support coordination efforts, exchange of information among researchers of the region and following up will be established in order to assess the implementation process.
3. Identify funding opportunities to support research projects to generate information for decision making.

**4.1.5. Specific objective 5.** To recognize the problem of marine litter as a priority issue in the agendas of the countries in the region.

Recommended actions at national level

1. Analyze relevant recommendations from Resolution A/RES/60/30 of the United Nations General Assembly.
2. Develop activities for:
  - a. Increasing awareness of the population on marine litter problems and their associated costs.
  - b. Municipalities and the institutions responsible for the management of solid residues in coastal areas recognize the link existing between their activities and the problem of marine litter.
  - c. Relevant authorities (*e.g.*, fishing, tourism, public health, environment, merchant marine) conscientious of the problem and impacts generated by marine litter.
3. If relevant, consider involving official support and recognition in celebrating the international coastal clean-up day as a mechanism for raising public awareness and to generate systematic data.
4. Present the problem to ministerial cabinets of the countries to promote the inclusion of the marine litter issue in national agendas.

Regional actions

1. Include the issue of marine litter in Ministerial and/or Presidential declarations. This will include the analysis of recommendations indicated in Resolution A/RES/60/30 of the United Nations General Assembly.
2. Include the issue of marine litter, directly or indirectly, in the agendas of multiple meetings organized by CPPS, maintaining the issue present and generating interest of authorities and technicians.
3. Produce educative materials for awareness focused on: (i) the general public, (ii) journalists, and (iii) country authorities. The materials will be updated as new information is generated. National Focal Points will be asked to look for sponsors to print enough material to reach as much people as possible. The focal points will also be in charge of distributing this material strategically.
4. Prepare booklets on the problem of marine litter for students of elementary and secondary levels. National Focal Points of the Plan of Action for the Southeast Pacific will identify potential funding sources in order to print the booklets and will coordinate with education institutions in each country to promote its inclusion in the curricula. The booklets will be available in websites of various institutions in the region so that they may be reproduced as needed.
5. Establish a site on marine litter in CPPS's website. This will make easier the access to multiple technical materials, contributing to their dissemination and promoting the collaboration of experts and authorities from the region.
6. Submit for consideration of the High Contracting Parties the institutionalization of the regional coastal clean-up day.

**4.1.6. Specific objective 6.** To reduce the use of disposable containers and wrappings of persistent materials that can eventually become marine litter.

Recommended actions at national level

1. Support coastal municipalities to adopt regulations in order to:
  - a. Discourage the use of containers and wrappings made of persistent materials with a high probability of turning into marine litter (*e.g.*, plastic bags, disposable drink bottles, fast food wrappings, and packaging tapes).
  - b. Stimulate the minimization of commercial and industrial residues (*e.g.*, packaging material) and their recycling.
2. Establish incentives for the reduction, recovery, and recycling of persistent materials (plastics, glass, metals) that are part of the garbage, and to promote that recycling enterprises broaden their scope and coverage in coastal municipalities.

3. Promote among the general public a culture of recycling and responsible consumption.
4. Stimulate cleaner production and negotiate agreements with companies to assume responsibilities for withdrawing containers, wrappings and packaging made of persistent materials.

Regional actions

1. Promote the exchange of regional and international experiences in reducing disposable containers and wrappings, and encouraging the recovery and recycling of persistent materials from the region. For this purpose meetings will be organized at national and regional levels.
2. Impulse a regional political declaration (at ministerial or presidential level) related to the minimization of persistent residues, clean production, recycling, and responsible consumption as feasible alternatives to reduce the problem of marine litter.
3. Prepare a work booklet for pupils in the basic education encouraging responsible consumption and reducing the use of disposable plastic containers and wrappings. National Focal Points will look for sponsorship to print the booklet and will coordinate with education authorities of each country to promote its incorporation in the curricula. Booklets will be available in web sites of different institutions in the region so that they can be reproduced as needed.

**4.1.7. Specific objective 7.** To establish a regional policy on marine litter.

Recommended actions at national level

1. Evaluate the compliance of national regulations related to the problem of marine litter, obligations with respect to the Protocol for the Protection of the Southeast Pacific from Land-based Sources of Pollution and with section IX of Resolution A/RES/60/30 of the United Nations General Assembly.
2. Take the appropriated actions to strengthen the compliance of relevant national norms and obligations regarding the Protocol for the Protection of the Southeast Pacific from Land-based Sources of Pollution.
3. Discuss and outline proposals for a regional policy on marine litter.

Regional actions

1. Distribute the recommendations on marine litter of Resolution A/RES/60/30 from the United Nations General Assembly and the results of the Global Programme of Action Meeting (Beijing 2006). Additionally, National Focal Points will be requested to organize meetings with stakeholders involved in the subject.
2. Convene a workshop to analyze the degree of compliance of the Protocol for the Protection of the Southeast Pacific from Land-based Sources of Pollution and the efficacy of the measures adopted. This meeting would prioritize national reports on obligations respect to the Annex I and particularly to marine litter; additionally, recommendations will be analyzed regarding the Resolution A/RES/60/30 of the United Nations General Assembly.
3. Establish a regional working group to outline a regional policy on marine litter. The proposal will be submitted for consideration to the High Contracting Parties for its analysis and approval.
4. Organize ordinary biannual sessions as established within the Protocol for the Protection of the Southeast Pacific from Land-based Sources of Pollution, ensuring the analysis of the problem of marine litter as part of pollutants listed in Annex I.

**4.2. Chronogram**

	Years							
	1	2	3	4	5	6	7	8
<b>Specific objective 1. To increase the coverage of garbage collection systems in coastal municipalities and to ensure the appropriated disposal of persistent materials to prevent their release into the environment.</b>								

**Recommended actions at national level**

1	Investment in adequate garbage collection and disposal systems	x	x	x	x	x	x	x	x
2	Take measures in garbage management plans	x	x						
3	Establish systems for recording and sharing information on garbage and composition	x	x						

		Years								
		1	2	3	4	5	6	7	8	
4	Establish management indicators	x	x							
5	Strengthen control and sanction on offenders	x	x							
<b>Regional actions</b>										
1	Facilitate understanding of the problem									
	• Prepare educative materials for municipalities and authorities	x								
	• Distribute materials	x	x							
	• Events to stimulate analysis of the problem in each country		x	x	x					
2	Promote exchange of experiences									
	• National workshops to identify and systematize successful experiences	x	x							
	• Regional workshop on exchange and consolidation		x							
	• Publishing proceedings and dissemination		x							
3	Prepare a practical guide for the integrated management of solid residues in coastal areas of the region.									
	• Creation of a regional working group	x								
	• Formulate guidelines and prepare the guide	x								
	• Validation in a regional workshop of experts		x							
	• Publication and dissemination		x							
4	Promote knowledge of the Protocol									
	• Prepare dissemination materials	x								
	• Dissemination in countries	x								
	• Informative meetings with coastal municipalities in each country	x	x							
5	Goals for garbage coverage and disposal in coastal municipalities									
	• Consultation with the High Parties		x							
	• Regional meeting for analysis and approval		x							
	• Meetings on evaluation and follow up				x				x	

<b>Specific objective 2. To eradicate the discharge of persistent litter from vessels.</b>
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**Recommended actions at national level**

1	Adopt or implement Annex V of MARPOL 73/78	x	x	x	x				
2	Adopt regulations to prohibit the discharge of persistent waste from ships	x	x	x					
3	Establish control and auditing measures	x	x	x					
4	Promote codes of conduct in key sectors		x	x	x	x			

**Regional actions**

1	Promote understanding of the problem								
	• Prepare educative materials for the key sectors involved in the problem	x							
	• Distribute materials	x	x						
	• Events to stimulate analysis of the problem with relevant sectors		x	x	x				
2	Promote exchange of experiences on regulation and control of litter discharge from ships								
	• Regional workshop for analysis		x						
	• Publishing and disseminate proceedings		x	x					

		Years							
		1	2	3	4	5	6	7	8
3	Prepare a practical guide for solid residue management aboard minor vessels								
	• Creation of a regional working group	x							
	• Identification of successful practices and outline of the guide	x							
	• Regional workshop of experts to validate the guide	x							
	• Validation with key actors in each country	x	x						
	• Publishing and dissemination of the guide		x						
	• Prepare diffusion materials to stimulate the use of the guide		x						
	• Distribution of materials		x	x					

**Specific objective 3. To minimize the disposal of fishing gear in coasts and at sea.**

**Recommended actions at national level**

1	Implement incentive Programmes for adequate disposal	x	x	x	x	x	x		
2	Analyze the feasibility of penalizing the abandonment of fishing gear	x	x						
3	Analyze the feasibility of implementing identification systems and owners responsibility	x	x						

**Regional actions**

1	Sponsor actions for measuring the problem and its impacts								
	• Form a regional working group		x						
	• Compile, systematize and analyze information		x						
	• Economic valuation of impacts		x	x					
	• Analysis of results at a regional workshop of experts			x					
	• Publishing and dissemination of results			x	x				
	• Regional meeting of fishing authorities to outline national actions and cooperation					x			
2	Promote understanding of impacts and costs								
	• Prepare educative materials for fishing sectors				x				
	• Distribution in each country				x				
	• Events for the analysis within each sector				x	x			

**Specific objective 4. To establish the volumes of production, patterns of distribution and accumulation, and impacts of marine litter in the region.**

**Recommended actions at national level**

1	Analyze recommendations relevant to Resolution A/RES/60/30	x							
2	Establish systems for the collection of information on garbage production	x	x						
3	Incorporate the issue of marine litter in the national research agendas	x	x	x					
4	Promote research on impacts and costs		x	x	x	x	x		

**Regional actions**

1	Promote unification of concepts, definitions and methodology								
	• Organize an interdisciplinary working group	x							
	• Information, systematization and analysis	x	x						
	• Prepare a proposal for a methodology guide		x						
	• Revision of the proposal by international specialists		x						

		Years							
		1	2	3	4	5	6	7	8
	• Regional workshop of experts to validate the guide		x						
	• Publishing and dissemination the guide			x					
2	Promote cooperation and research								
	• National meetings to outline the basic research agenda		x						
	• Outline basic research agenda		x						
	• Regional meeting of scientists and authorities to analyze and adopt the agenda			x					
	• Publishing and dissemination the research agenda			x					
	• Obtain national funding for research as well as international cooperation to implement the agenda			x	x	x			
	• Establish a support mechanism for coordination, information exchange and follow up to the implementation of the agenda			x					
	• Implementation of the priority research agenda				x	x	x	x	x
3	Obtaining financial support to support research projects to generate priority information		x	x	x	x			

**Specific objective 5. To recognize the problem of marine litter as a priority issue in the agendas of the countries in the region.**

**Recommended actions at national level**

1	Analyze the recommendations of the United Nations General Assembly	x							
2	Development activities for key actors at local level	x	x	x					
3	Official support and recognition for celebrating the international coastal clean-up day	x	x						
4	Marine litter issue in ministerial cabinets and promote its incorporation into the national agenda		x						

**Regional actions**

1	Include the problem in regional declarations	x	x	x	x	x	x	x	x
2	Include the issue in working agendas of CPPS	x	x	x	x	x	x	x	x
3	Elaborate and disseminate awareness materials for specific audiences	x	x	x	x	x	x	x	x
4	Prepare educational booklets for basic and secondary education								
	• Prepare booklets and validate them with focal groups in each country	x							
	• Look for sponsors, print and disseminate	x	x	x					
	• Make the booklets available on websites	x	x	x	x	x	x	x	x
5	Establish and maintain a site on marine litter in CPPS' website	x	x	x	x	x	x	x	x
6	Consider the establishment of a regional coastal clean-up day		x						

**Specific objective 6. To reduce the use of disposable containers and wrappings of persistent materials that can eventually become marine litter.**

**Recommended actions at national level**

1	Support the adoption of regulations at local level	x	x	x	x	x			
2	Establish incentives to reduce, recover and recycle litter made of persistent materials	x	x	x	x	x			
3	Promote a culture of recycling and responsible consumption	x	x	x	x	x	x	x	x
4	Promote cleaner production	x	x	x	x	x	x	x	x

		Years							
		1	2	3	4	5	6	7	8
<b>Regional actions</b>									
1	Promote the exchange of experiences								
	• National meetings	x	x	x					
	• Regional meeting			x					
2	Promote a regional declaration on minimization of residues, cleaner production, recycling and responsible consumption		x	x					
3	Booklet for basic education students in the region								
	• Prepare a booklet and validate it with focal groups in each country		x						
	• Look for sponsors, print and disseminate		x	x	x				
	• Make booklet available in CPPS' website		x	x	x	x	x	x	x

<b>Objective 7. To establish a regional policy on marine litter</b>
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**Recommended actions at national level**

1	Evaluate compliance of relevant national regulations, obligations regarding the Protocol and advances regarding Resolution A/RES/60/30 of the United Nations	x	x	x					
2	Strengthen compliance of regulations and obligations regarding the Protocol	x	x	x	x	x			
3	Debate and outline proposals for a regional policy on marine litter		x	x					

**Regional actions**

1	Disseminate recommendations on marine litter of Resolution A/RES/60/30 of the United Nations and the results of the GPA meeting (Beijing 2006)	x							
2	Convene a workshop to analyze the degree of compliance of the Protocol	x	x						
3	Establish a regional working group to outline a regional policy			x					
	• Outline a regional policy proposal			x					
	• Submit for consideration of the High Contracting Parties			x					
4	Organize ordinary biannual sessions of the Protocol		x		x		x		x

### 4.3. Funding options

Implementation of the Regional Programme for the Integrated Management of Marine Litter in the Southeast Pacific would require funds from different sources. Funds should be made available gradually. It is proposed that funding should be visualized in two periods of four years each.

Actions at national level would rely mainly on local funding. Investments to broaden the coverage of garbage collection and its disposal in sanitary landfills and managed dumps will probably come from development banks in each country or in the region (*e.g.*, Interamerican Development Bank, Corporación Andina de Fomento). Likewise, the required investments to make Annex V of MARPOL 73/78 operational (*e.g.*, garbage reception facilities in ports) could come from port operators and from already established funding mechanisms in the countries. Funds for research will require support from national research funds, even though it will be necessary to complement these activities in cooperation with research centers and universities abroad interested in the issue, as well as from international cooperation agencies. Actions for public awareness and communication will require multiple sources of support, including sponsorships (*e.g.*, port authorities, government institutions, NGOs, companies linked to the issue).

Actions at regional level will require support from various sources:

1. Government contributions. Part of the actions will be funded with contributions made by the governments within the framework of their regional organizations.

2. International cooperation. It is required to ensure support schemes within the framework of the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities and the Regional Seas Programme of the United Nations Environment Programme (UNEP). It will also be necessary to establish cooperation agreements with other countries and international organizations (*e.g.*, Ocean Conservancy) which may be interested in investing in the solution to the problem.
3. Global Environment Fund. Several elements of the regional Programme can be financed with support from GEF, mainly through medium sized projects.
4. Sponsorships. It would be convenient to establish financial schemes from companies with regional presence linked to the issue (*e.g.*, food and drinks companies). Funds could be focused on information and diffusion actions, applied research and promotion of recycling.

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# NOTES

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- <sup>1</sup> United Nations Environment Programme, GPA Coordination Office, Marine Litter – trash that kills, [www.gpa.unep.org](http://www.gpa.unep.org); <http://marine-letter.gpa.unep.org/facts/what-where.htm>
- <sup>2</sup> The Protocol has been ratified by the five countries of the region, Chile, Colombia, Ecuador, Panama and Peru.
- <sup>3</sup> Adopted on 3 November 1995 by the Intergovernmental Conference gathered in Washington D.C. between 23 October and 3 November 1995.
- <sup>4</sup> Annex 1 of the Protocol.
- <sup>5</sup> Came into force on 31 December 1988.
- <sup>6</sup> PAHO defines LITTER as a synonym of solid municipal residues/waste and of solid residues/waste (PAHO, 2003). SOLID MUNICIPAL RESIDUES are solid or semi-solid residues coming from urban activities in general. These can be of household or domestic, commercial, institutional, small industry, or from cleaning and sweeping of streets, markets, public areas and others in origin.
- <sup>7</sup> The quantity of litter, in weight, is not available for Chile in 2005. That is why the figure of 128.4 kg per kilometer of beach was used as it was the global average for 2005 as estimated by Ocean Conservancy from the results of 74 countries.
- <sup>8</sup> Quantities found in certain beaches (mainly close to populated areas) are being extrapolated for the entire coastal extension.
- <sup>9</sup> Decree 1875 of 1979.
- <sup>10</sup> Environmental quality norm for the management and final disposal of not-hazardous solid waste, Annex 6, Book VI, Unified Text of Secondary Legislation of the Ministry of the Environment, Executive Decree 3399 published in the Official Registry 725 of 16 December 2002.
- <sup>11</sup> Law 27314.
- <sup>12</sup> For example, the company Ocean Pollution Control S.A. which operates in the Panama Canal recently requested the community not to discard garbage into the water bodies as it collects daily around three tons of waste which include dead animal remains, wood, domestic electric appliances, organic garbage and plastics (<http://oceanpollution.net/NOTICIAS/Muelle-18.htm>).
- <sup>13</sup> Dump. Open places where residues are discarded in indiscriminate manner and without receiving any sanitary treatment. Synonym of “vertedero” “vaciadero” or “basurero” (PAHO, 2003).
- <sup>14</sup> People who make a living from the extraction of recyclable materials from garbage (e.g. plastics, paper, glass). Throughout the region they are known under several names “pepenadores”, “minadores”, “chamberos”.
- <sup>15</sup> Sanitary landfill. Engineering technique for the adequate confinement of municipal solid residues. It entails the spreading and compacting of residues their overlaying with soil or some other inert material, at least daily, and the control of gasses and leaching and the proliferation of vectors in order to avoid environmental pollution and to protect the health of the population (PAHO, 2003).
- <sup>16</sup> Refers to the population of municipalities with front to the sea, estuaries or gulfs. The population of the higher parts of the basins whose waste eventually reach the ocean was not included.
- <sup>17</sup> Expanded Polystyrene.
- <sup>18</sup> Law 99 of 1993.
- <sup>19</sup> Law for the Prevention and Control of Environmental Pollution (Code 20 published in the Official Registry Supplement 418 of 10 September 2004).
- <sup>20</sup> Law 511 of 1999.
- <sup>21</sup> Higher value plastic with bottles and caps are manufactured. Polyethylene Terephthalate (PET) is used for beverage bottles films for food wrapping and containers for pharmaceutical use.
- <sup>22</sup> Which is not by the sea, but has 40% of the country’s population.
- <sup>23</sup> Referential data as it corresponds to the Colombian Caribbean.
- <sup>24</sup> Artisanal fishermen use these containers (as well as other plastic bottles) as floaters or buoys for their fishing practices.
- <sup>25</sup> For example, Code of Maritime Police in Ecuador or Regulation for Litter Management in floating equipment of the Panama Canal Port Authority, 2600ESS-330.
- <sup>26</sup> Entered into force on 31 December 1988 and prohibits the discarding of plastics, restricts discharges of other litter onto coastal areas and forces governments to guarantee the availability of garbage reception facilities in their ports.
- <sup>27</sup> It is probable that only litter with high floatability (floating litter such as plastic bottles with air, foamy plastics) can make a complete crossing of the ocean.
- <sup>28</sup> Debris. Waste obtained as a result of construction work and the demolition of buildings and other structures (PAHO, 2003)
- <sup>29</sup> A requirement of Annex V of MARPOL.
- <sup>30</sup> Ocean Conservancy records primarily data for the San Andrés Island.
- <sup>31</sup> The texts of the articles from the Protocol referred in this section have been translated for the purposes of this document and therefore they do not represent the official translation by CPPS.