

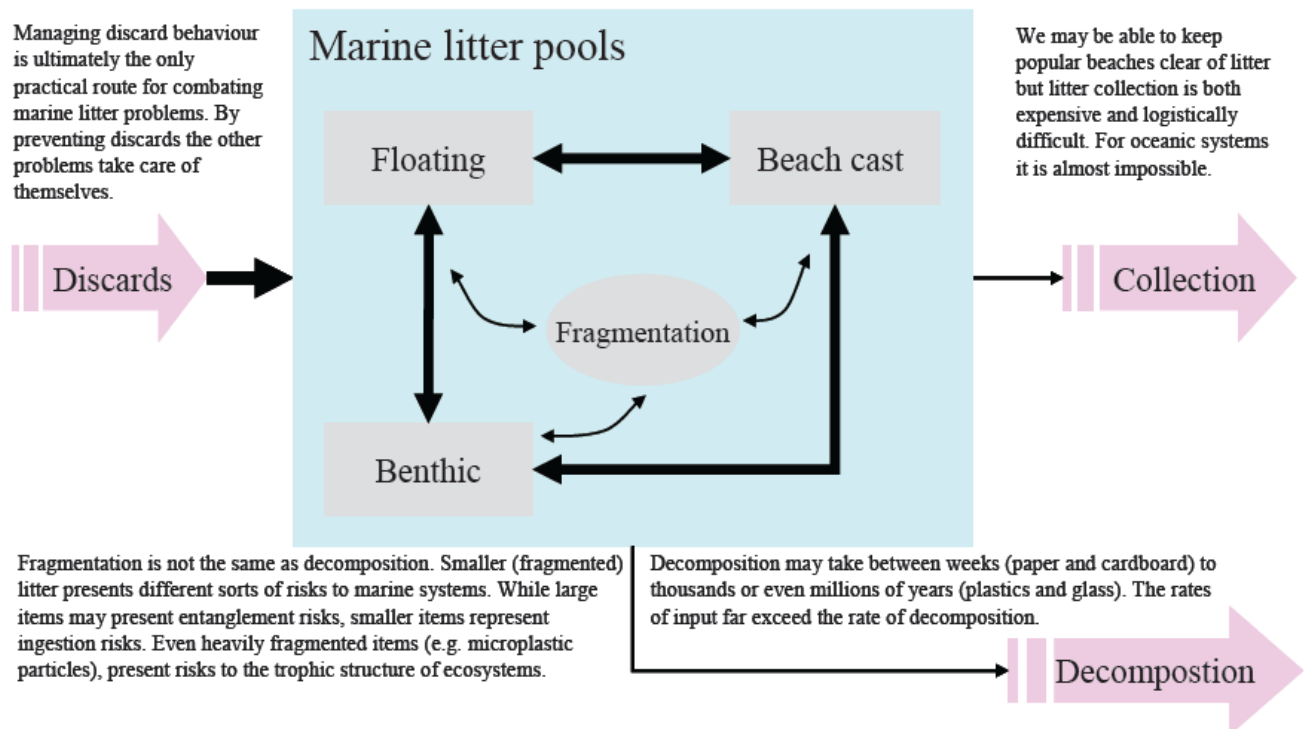
## Standard guidelines for monitoring beached marine debris at the Falkland Islands.

Marine debris surveys are widely used to monitor and compare quantities throughout regions of the world. However, there is a need to standardise guidelines for monitoring programmes so comparative studies, at both national and international scales, are possible. The frame work for the Falkland Islands approach is based on the United Nations Environmental Programme (UNEP) and Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) guidelines.

The Falkland approach has been developed to take into account the main sources of marine debris entering the system. The Falklands are sparsely populated with no major urban areas, the nearest mainland with large populated coastal cities is South America, located 600 km to the west. There are significant marine activities in the surrounding seas and the wider sea region. Due to these factors the vast majority of debris reaching the Falklands' shores are likely to be transported via the ocean.

### Definition of marine debris (UNEP)

Waste, discarded or lost material, resulting from human activities, that has made it into the marine environment, including material found on beaches or material that is floating or has sunk at sea. Some organic materials (food waste) are excluded and natural sourced materials such as vegetation (kelp, algae). Only processed organic materials such as cloth or processed timber are included.



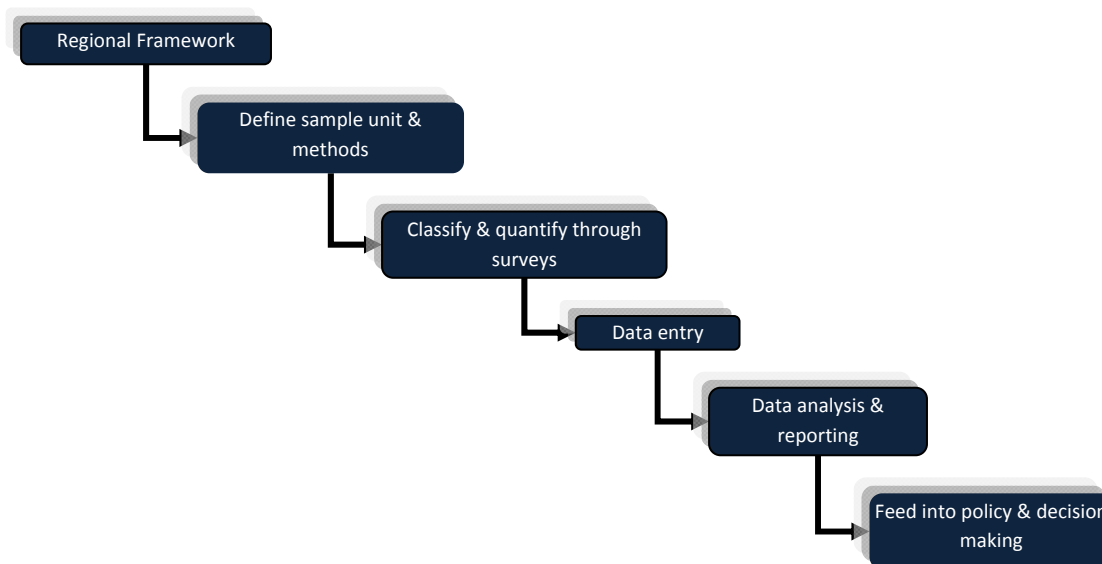
**Figure 1.** Lifecycle of marine debris (taken form UNEP 2009).

The movement of marine debris from one pool to another illustrates the options for consideration of marine debris management (Figure 1). These main points are:

1. If discard exceeds the removal process the amount of marine debris will increase over time (this is particularly relevant to the Falklands where removal is limited due to the remote nature of the coastlines and low population);
2. Given the resistant properties of many common debris items, in particular those manufactured in the last 30 years since plastic has become prevalent, degradation is going to be slow and therefore items will persist for a long time;
3. Management can only be effective by controlling the entry point and therefore reducing the amount of debris that enters the system in the first place. This is largely achieved through effective waste management such as good facilities for land based refuse, port and harbours facilities. Education and awareness is also vital in influencing behaviour and attitudes.

Without effective management the amount of marine debris is likely to increase over time. The management of marine debris is ultimately a global issue as items such as lightweight floating plastics have the ability to travel large distances, and the discard source may be many thousands of kilometres from the eventual stranding location.

Quantifying and understanding the rates moving through the lifecycle of marine debris, as well as the sources, is an essential process to build strategies and solutions in reducing the amount entering the system. Once the sources, rates and quantities, and type of debris have been identified, a management solution can be applied (Fig. 2).



**Figure 2.** Steps involved at a regional level for marine debris assessment (UNEP 2009).

## Classifying marine debris

The classification of marine debris involves a three tier approach:

1. Broadest category based on form and use (table 1; table 3).
2. Material composition of items (e.g. plastic, glass, metal) (table 2).
3. Detailed description of form (e.g. plastic bottle, toothbrush) (table 2).

Tier 1 groups	Description
CONTAINERS	Often sealed buoyant forms made from plastic, glass and metal.
PACKAGING	Typically plastic sheeting and wrappers, but also foam or rubber.
FISHING & BOATING	Gear associated with fishing operations.
CLOTHES & SHOES	Fabrics, rubbers and plastics – commercial or personal items.
HYGIENE	Associated with human sewage disposal methods and items used in personal hygiene.
OTHER	Broad range of miscellaneous or otherwise infrequent or unusual items.

**Table 1.** Category level 1 tier.

	Tier level 2. Material	Tier level 3. Description	ID category
1	Plastic	Drinking bottle < 2 L	C01
2	Plastic	Other plastic bottle < 2 L	C02
3	Plastic	Bottle cap & lid	C03
4	Plastic	Container - tub - jar < 4 L	C04
5	Plastic	Container > 4 L	C05
6	Plastic	Container lid	C06
7	Plastic	Crate – basket	C05, FB12
8	Plastic	Net float – buoy – fender	FB10
9	Plastic	Fishing net – mesh	FB11
10	Plastic	Jig lure, jig reel, traps, pots	FB12
11	Plastic	Monofilament line	FB12
12	Plastic	Rope	FB13
13	Plastic	String	FB13
14	Plastic	Tori line	FB14
15	Plastic	Strapping band	P15
16	Plastic	Film – sheet	P16

17	Plastic	Adhesive tape	P17
18	Plastic	Roll – tube	P18
19	Plastic	Plastic bag	P21
20	Plastic	Sack	P21
21	Plastic	Bubble wrap	P22
22	Plastic	Tarpaulin	P22
23	Plastic	Food wrapper	P24
24	Plastic	Broken – miscellaneous <5 cm	O35
25	Plastic	Broken – miscellaneous >5 cm	O35
26	Plastic	Toy	O36
27	Plastic	Piping - plumbing - cable	038
28	Plastic	Cigarette lighter	O39
29	Plastic	Fibre glass	040
30	Plastic	Paint brush	041
31	Plastic	Toothbrush	S28
32	Plastic	Reinforced ground mesh (terram)	O43
33	Plastic	Cotton bud stick	S27
34	Plastic	Hard hat	CL32
35	Plastic	Toiletries – comb, razor	S28
36	Plastic	Drinking straw	P24
37	Plastic	Other	
38	Foamed plastic	Foam piece - sheet	P19
39	Foamed plastic	Cup and food box	P24
40	Foamed plastic	Foamed buoy, life raft, life jacket	FB14
41	Foamed plastic	Insulation & packaging	P19
42	Foamed plastic	Other	
43	Cloth	Clothing, hat, glove	CL30
44	Cloth	Bag	CL30
45	Cloth	Hessian, sail, canvas	CL34
46	Cloth	Carpet & furnishing	CL31
47	Cloth	Material, rag, cloth	CL30
48	Cloth	Other	
49	Glass & ceramic	Bottle & jar	O46
50	Glass & ceramic	Light bulb, strip	O42
51	Glass & ceramic	Fragment	O46
52	Glass	Other	
53	Metal	Aluminium drink can	C08
54	Metal	Can – paint, food can < 4 L	C04
55	Metal	Gas cylinder, tank, drum, bucket > 4 L	C05
56	Metal	Foil wrapper, cartoon, tetra pack	P24
57	Metal	Fishing related: metal buoy	FB10
58	Metal	Aerosol spray can	C07
59	Metal	Wire	O44
60	Metal	Other: piece, miscellaneous, appliance	
61	Paper/ Cardboard	Paper & cardboard	P20

62	Paper/ Cardboard	Food & drink container, cigarette packet	P24
63	Paper/ Cardboard	Other	
64	Rubber / Plastic	Boot	CL33
65	Rubber / Plastic	Flip flop & sandal	CL33
66	Rubber / Plastic	Glove	CL32
67	Rubber / Plastic	Tyre	O37
68	Rubber / Plastic	Piece - sheet	P23
69	Rubber / Plastic	Other	
70	Wood	Cork	O47
71	Wood	Palette, spool	O47
72	Wood	Other: broom handle	O47
73	Hygiene / plastic	Sanitary item, pad, nappy etc.	S26
74	Other	Specify	

**Table 2.** Tier 2 and 3 categories and detailed list of marine debris items stranded at the Falklands

Category Tier 1	Falkland ID Code	Debris type
Containers	C01	Plastic drink bottle <2L
	C02	Other plastic bottle < 2L
	C03	Bottle cap / top
	C04	Container / tubs < 4L
	C05	Container / buckets / drums / cylinders > 4L
	C06	Container lids
	C07	Aerosol Cans
	C08	Metal drink and food cans
	C09	Other
Fishing and boating	FB10	Float /fender/ buoy
	FB11	Fishing net / mesh
	FB12	Fishing related (jigs/jigging reel/ line/ crate / tray)
	FB13	Rope & string
	FB14	Other (tori line, life rafts, life vest)
Packaging	P15	Strapping bands
	P16	Plastic film - sheets
	P17	Adhesive tape
	P18	Plastic roll (tubing for rolls of film)
	P19	Foam (insulation & packaging)
	P20	Paper & cardboard
	P21	Plastic bags & sacks
	P22	Bubble wrap/tarpaulin/woven sack
	P23	Rubber sheet
	P24	Food boxes, food wrappers, drink cartoons & cups
	P25	Other

Hygiene	S26	Sanitary pads / applicators
	S27	Cotton buds
	S28	Toothbrushes, combs, razors
	S29	Other
Clothing & shoes	CL30	Soft clothing, material, hats, gloves, bags
	CL31	Soft furnishing
	CL32	Hard hats & gloves (industrial, rubber)
	CL33	Boots, shoes, sandals
	CL34	Other
Other	O35	Broken pieces & fragments
	O36	Toy
	O37	Tyre
	O38	Plumbing / cable / hose
	O39	Cigarette lighter
	O40	Fibre glass
	O41	Paint brush
	O42	Light bulb /strip
	O43	Reinforcement ground mesh (terram)
	O44	Wire
	O45	Engine parts
	O46	Glass
	O47	Processed timber (excluding drift wood)
O48	OTHER	

**Table 3.** Codes to classify general marine debris group into Tier 1 (modified from UNEP classification system)

## Conducting Surveys

The following should be taken into account before selecting a beach to survey:

1. Beaches should be of a shallow slope and wider than (5 m) to allow debris to collect.
2. Rock platforms and areas or cliffs that are exposed and deluged by waves are not suitable as debris is likely to be removed.
3. Beaches should be open to oceanic influences and prevailing weather conditions as much as possible.
4. Beaches should not be occupied by breeding seals and sea birds and should be free of ice and snow.
5. Beaches should be at least 100 m in length, and no less than 50 m.

## Recording information for beach surveys

<b>Location:</b>			
<b>Date:</b>		<b>Distance:</b>	
<b>Distance (m)</b>		<b>Aspect (direction facing sea):</b>	
<b>GPS co-ordinates</b>	Start Latitude	Start Longitude	
	End Latitude	End Longitude	
<b>Names:</b>			
<b>Project:</b>			
<b>Tide:</b>	Low	Medium	High
<b>Stranded kelp on beach:</b> None, Low, Med, High			
<b>Beach substrate:</b> Sand, Boulder, Rock and Sand, Pebble, Shingle, Other			
<b>Flotsam, tree trunks:</b> None, Low, Med, High		<b>Whalebones:</b>	

**Table 4.** Data collection form and heading categories for individual beach surveys.

**Location:** Beach name if known or nearest known point and name of island or farm.

**Date:** Day on which survey conducted.

**Distance:** Approximate distance of survey (metres).

**Aspect (direction facing sea):** Record the direction the beach is facing the sea (e.g. North-west).

**GPS co-ordinates** – Decimal degrees if possible in coordinate system WGS 1984.

**Names:** Names of all the surveyors.

**Project:** Indicate if surveys are conducted in conjunction with other projects.

**Tide:** Indicate the tide level at time of survey.

**Beach substrate:** Indicate the predominant substrate of beach.

**Flotsam:** Indicate presence of stranded natural wood, trunks on beach.

**Kelp:** Indicate presence and levels of stranded or rotting kelp on beach.

**Whalebones:** Indicate presence and numbers of whale bones from likely stranding events and where possible record relative sizes and age (e.g. recent, very old).

## Sampling

### 1. Snap shot of beach debris items (where no collection is made).

Record and tally all beach debris from the low tide line to the vegetation line along the survey length. Debris often collects in stranded kelp and can get wind blown into vegetation at the back of the beach. Items such as natural unprocessed wood and organic materials should not be included.

On items where writing is visible (e.g. on food wrappers, drink bottles, aerosol cans etc.) record the origin of manufacture where possible or record the language (table 5).

Record the relative sizes of objects where possible (see table 6).

### 2. Long-term monitoring of beach accumulation rates

A number of beaches (minimum of three) should be selected as study sites. These should be known to collect moderate amounts of debris frequently. Long-term monitoring should not be conducted on sand beaches as items tend to get buried and re-earthed.

Monitoring to assess rates should be conducted either:

Daily (for a consecutive 12 days)

Monthly where access is limited

Yearly at remote sites

Ideally weight needs to be taken in conjunction with a count of items. If items cannot be removed from the beach then each item should be marked with permanent spray or paint to be discounted at the repeat survey.

### 3. Invasive species

A selection of items should be inspected for attachment of marine organisms. Samples of organisms should be collected and placed in labelled plastic bags and brought back to Stanley for identification. An indication of the survey effort should be noted by indicating how many items were inspected and how many items had a presence of attached marine organisms.

Language category	Examples of countries
Asian	Korea, Taiwan etc.
English	Falklands, UK, USA etc.
South American	Argentina, Chile, Brazil etc.
Spain	Europe
Spanish language	Either S. American or Spanish (Europe)
Other	Indicate

**Table 5.** Example of language categories for stranded marine debris.



Items	Size categories where appropriate		
Bottle	Small (300ml)	Large (>2L)	
Container	Small (<4L)	Large (>4L)	
Broken & miscellaneous plastic	<5 cm	>5 cm	
Net	Small (< 1 m x 1m)	Large (>1m x 1m)	
Rope	Bits of (< 10cm length)	Small (< 1m)	Large (>1 m)
String	Bits of (<10 cm)	Small (< 1m)	Large (>1m)
Packing straps, plastic film	Bits of (small degraded pieces)	Bundles / rolls (where many pieces have tangled to form 1 large item)	
Items (pieces of metal)	Small < 0.5 m	Large > 0.5 m	

**Table 6.** Example of recording system for categorising relative sizes of stranded marine debris.

Photo Guide of common debris items stranding at the Falkland Islands

			
Plastic drink bottle	Drink cans	Plastic other bottle	Bottle tops & caps
			
Plastic container > 2 L	Metal container > 2 L	Metal drum	Aerosol can
			
Floats	Inflated fenders	Jig lures and fishing line	Jiggling reel
			
Net	Mesh	Rope	String

			
Crate	Strapping bands	Strapping band bundle	Plastic film - sheets
			
Plastic film - bundle	Plastic roll and film	Adhesive tape	Foam sheet
			
Insulation (polystyrene)	Plastic bag	Plastic sack	Woven plastic sheet
			
Food wrappers	Cotton bud sticks	Comb	Flip flop – sandal
			
Shoe	Carpet / upholstery	Glove	Plastic fragments
			
Plastic miscellaneous	Cigarette lighter	Toy	Tyre
			
Piping	Paint brush	Metal piece	Terram

**FALKLANDS CONSERVATION BEACH DEBRIS SURVEY**

<b>Location</b>				
<b>Date:</b>		<b>Time:</b>	<b>Distance:</b>	
<b>GPS coordinates</b>		Start: End:		
<b>Names:</b>		<b>Project:</b>		
<b>Tide:</b> low Medium High		<b>Stranded Kelp:</b> None Low Med High		
<b>Beach:</b> Sand Boulder Rock Shingle Pebble Other:				
<b>Flotsam/trunks:</b> None Low Med High		<b>Whale bones</b> None Few Many Size: Age:		
Component	Item	Number	Language	Weight , Size, Comments
Plastics	Strapping band			
	Net			
	String			
	Rope			
	Plastic crate			
	Plastic net buoy/float			
	Plastic roll			
	Adhesive tape			
	Jig reel / Jig lure			
	Plastic bottle top/cap			
	Drink bottle small <300ml			
	Drink bottle > 300ml			
	Plastic bottle other large >2 L			
	Plastic bottle other small <2 L			
	Plastic container >4L			
	Plastic container <4L			
	Container lid			
	Plastic bag			
	Plastic sheeting			
	Plastic sack			
	Food wrapper			
	Plastic piping (plumbing)			
	Plastic broken item <5cm			
Plastic broken item >5cm				
Toothbrush				
Cigarette lighter				
Hardhat				
Polystyrene/ insulation				
Foam sheeting				
Rubber	Tyre			
	Rubber piece, sheet			
	Glove			
	Rubber boot			
Paper	Cigarette packet			
	Cardboard			
	Paper			
	Drink carton			
Glass	Bottle / jar			
	Fragment			
Metals	Metal net buoy			
	Food tin			
	Drink can			
	Aerosol spray can			
	Cans other			
	Iron/steel piece			
	Oil drum /barrel			
Wood	Processed timber			
	Cork			
Clothing	Clothing, hat, glove			
	Rag, material			
	Flip flop /sandal			
	Shoe			
Others (specify)				

