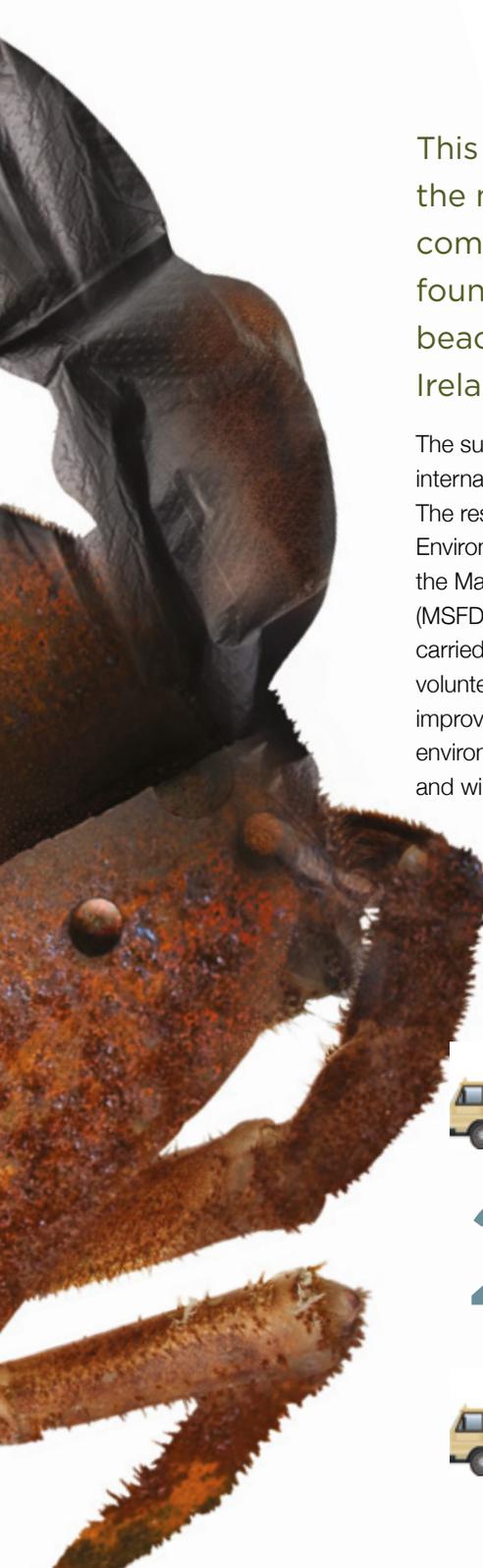


Litter on beaches in Northern Ireland 2013

KEEP
NORTHERN
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MARINE
SURVEY



This report summarises the main findings of a comprehensive survey of litter found on fourteen reference beaches around Northern Ireland during 2013.

The survey was carried out using the internationally recognised OSPAR methodology. The results form part of the Department of the Environment's response to the requirements of the Marine Strategy Framework Directive (MSFD) for marine litter. Four surveys were carried out during the year. After each survey volunteers clean the beach, improving the local environment for people and wildlife.



284

plastic bottles were found on average per kilometre – if this were replicated around the whole coast of Northern Ireland we would have enough to fill six shipping containers every year.



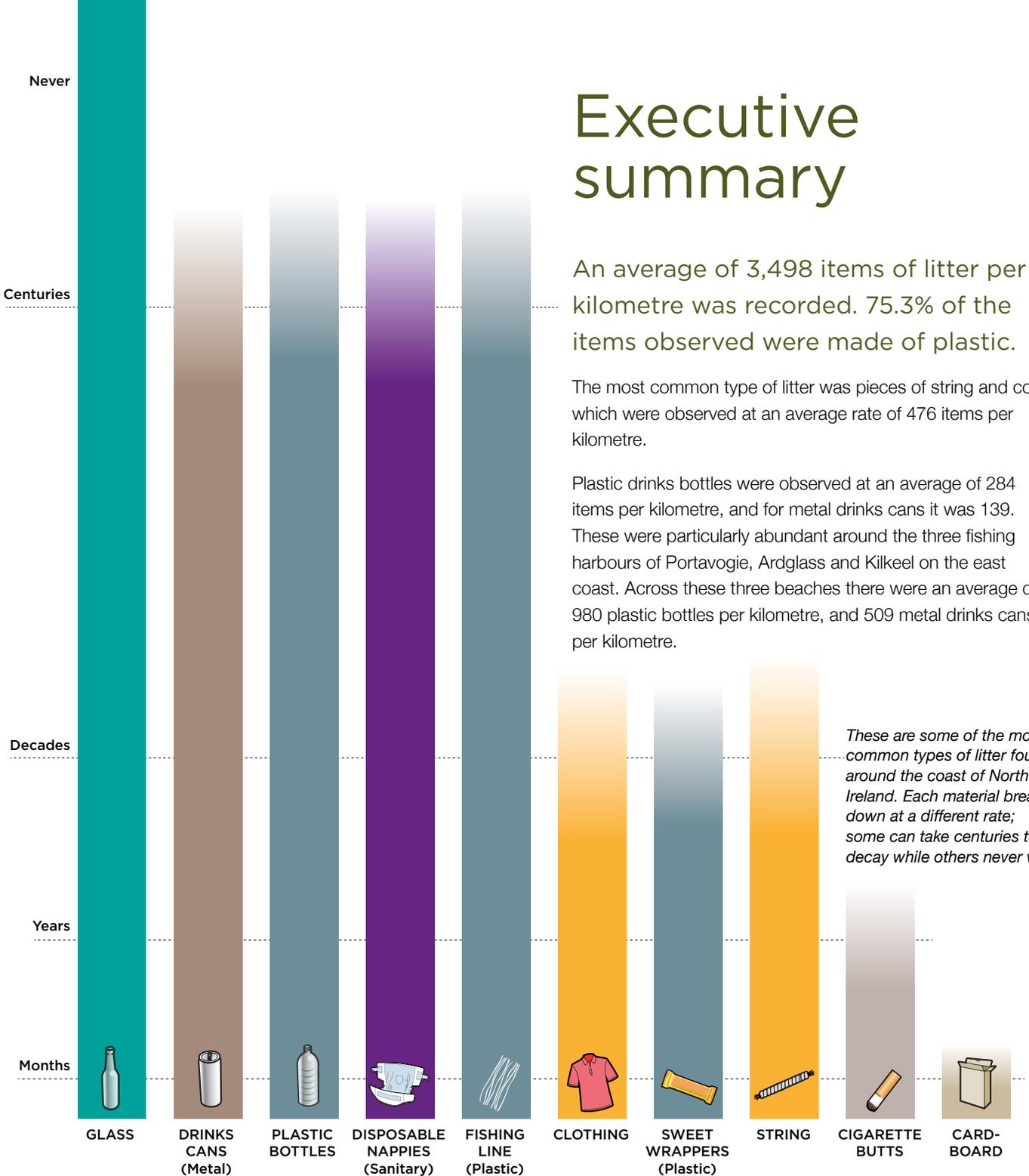
Executive summary

An average of 3,498 items of litter per kilometre was recorded. 75.3% of the items observed were made of plastic.

The most common type of litter was pieces of string and cord, which were observed at an average rate of 476 items per kilometre.

Plastic drinks bottles were observed at an average of 284 items per kilometre, and for metal drinks cans it was 139. These were particularly abundant around the three fishing harbours of Portavogie, Ardglass and Kilkeel on the east coast. Across these three beaches there were an average of 980 plastic bottles per kilometre, and 509 metal drinks cans per kilometre.

These are some of the most common types of litter found around the coast of Northern Ireland. Each material breaks down at a different rate; some can take centuries to decay while others never will.



Cotton bud sticks were observed at an average of 127/km around the whole coast, but were significantly more common on the north coast, being observed more than twice as often here than on the east coast (91/km). If Harbour Beaches are discounted they are more than four times as common (48/km).

Unsurprisingly, items which are commonly observed on our streets as part of terrestrial litter monitoring, including plastic and metal drinks containers and confectionary wrapping, are present in large numbers in marine litter washing up on beaches.

The results make clear that the beaches next to the fishing harbours were more affected by litter than the rest of the coastline of Northern Ireland. Around four times as much litter for a given length of beach was observed on these

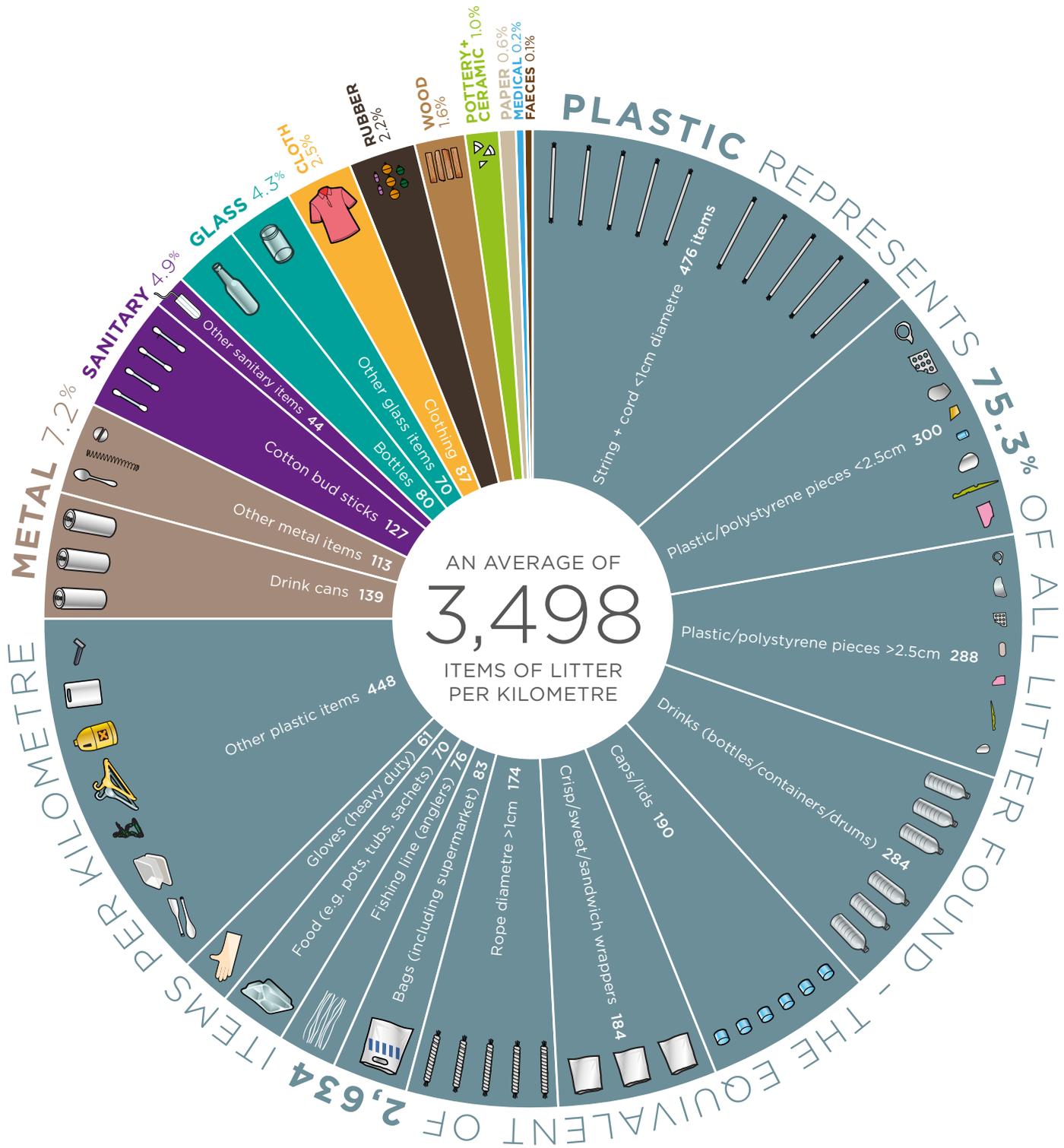
beaches than elsewhere. Drinks bottles in particular were around nine times as common on harbour beaches as on other east coast beaches (980/km against 120/km).

The north coast of Northern Ireland was less affected by marine litter than the east coast. Along the north coast an average of 2,405 items/km were observed, while along the east coast the figure was 3,935 items/km. However, if fishery harbours are excluded the east coast falls to 2,001 items/km.

Comparing the survey data from the 3 surveys preceding the plastic bag levy (September 2012 – April 2013) with the same six-month period after the levy was introduced (September 2013 – April 2014) indicates that 24% fewer plastic bags were observed following the levy, despite a 35% rise in the overall number of items observed.



Information about litter is collected by trained surveyors (left) four times per year, with the data averaged to give the figures quoted. Large pieces of tangled nets and rope (above) are sometimes encountered. They may be meters in length and net tractors to drag them from the beach. The pink rectangle is an A4 clipboard to show scale.



Foreword



The Minister for the Environment shows his support for efforts to collect marine litter, which include education, infrastructure improvements and beach cleans, and even divers collecting rubbish directly from the seafloor.



The launch of the 'Fishing for Litter' scheme, which encourages fishing vessels to store litter caught in their nets for appropriate disposal and promotes responsible practices.

The second marine litter survey report arrives at a time when there is much to be positive about. The Marine Litter Strategy is in place and being implemented and the civic pride programme, Live Here Love Here, has become a reality.

At the same time the Northern Ireland Fishery Harbour Authority introduced the Fishing For Litter project in Ardglass, which has landed five tonnes of litter to date. This does not mean the tide has turned! People are still dropping litter and the battle for the hearts and minds of those who carry out such environmental incivilities has yet to be won. The difference is that we now have a plan with new ideas. Add to this the growing mood of intolerance around littering and we have a recipe for success.

This report from Keep Northern Ireland Beautiful helps us focus on our seas, where much of what we drop and discard ends up; directly, washed down rivers and via the sewage system. The data being gathered will help us focus local resources to tackle the problem and, as part of the response to the Marine Strategy Framework Directive, allow trends around the European coastline to be followed. There is growing concern around marine litter within the European Union. The possibility of the EU extending producer responsibilities to cover the cost of removing litter may reduce litter entering the marine environment but the vision must surely be centred on preventative action, not cure. Three quarters of litter found on beaches is plastic; much of this could be recycled. Litter around fishing harbours remains a concern too.

It is too early to draw conclusions and we will need several years' worth of data before we can begin to see trends. Yet litter levels are high; far higher than anything we see on our streets. Thankfully, more people are now challenging anti-social behaviour, like littering, when they see it. Over 5% of the population of Northern Ireland volunteered to help roll back the tide of litter in The 2014 BIG Spring Clean. That's 105 thousand people who care passionately about littering.

The work is funded by the Department of the Environment's Marine Division. Surveys and particularly the clean-ups rely heavily on volunteer groups and local authorities. Thank you to everyone who helped for your continued support and effort, in all weathers throughout the year. Your work is helping to keep Northern Ireland beautiful, which in turn is helping us all have a better quality of life as well as reducing our impact on the natural environment, attracting more visitors and, gradually, making it socially unacceptable to drop litter.

You can download the full report from our website at www.KeepNorthernIrelandBeautiful.org/marinelittersurveys



Dr. Ian Humphreys
Chief Executive
Keep Northern Ireland Beautiful

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“95% of fulmars sampled in the North Sea had plastic in their stomach – they had ingested an average of 35 pieces¹.”



Marine litter and the Marine Survey

Marine litter

There is broad international recognition of the marine litter problem. Indeed, marine litter on land has been highlighted by the United Nations Environment Programme as a priority for the period 2012-2016, putting it in the same category as the dumping of raw sewage into the sea or destruction of coral reefs. The European Union has made litter one of the eleven descriptors to be measured in the Marine Strategy Framework Directive in a bid to ensure that human activities do not adversely impact marine life.

Measuring litter at sea is very difficult, as the distribution of litter is influenced so heavily by winds, tides and currents and the shape of the coast and seabed². The UNEP estimates that 6.4 million tonnes of litter enters the ocean each year³. Because of the large variations observed, many studies have tried to estimate the amount of litter in relatively smaller geographical areas, such as the North Sea⁴.

Between 2001 and 2007 the OSPAR Pilot Study – the first comprehensive study of marine litter in the North East Atlantic – found an average of 5,420 items of marine litter of varying size per kilometre of reference beaches from Norway to Spain. In what they termed the ‘Celtic Seas’ around the island of Ireland, the west coast of Scotland, the coast of Wales and the north coast of Cornwall the figures exceeded 6,000 items per kilometre. The first systematic survey of marine litter in Northern Ireland, between September 2012 and April 2013, found an average of 4,033 pieces of litter on 14 reference beaches. Considerable variation in type and volume of litter was reported in this initial study, with beaches nearest to fishing harbours particularly badly littered.



Litter washed up on Ballyhornan beach

Analysis of the OSPAR pilot data indicates that the highest rate of deposition of litter in the North East Atlantic occurs during the autumn and winter. By contrast, the North Sea experiences its maximum deposition during the spring⁵.

Where does it come from?

Around 80% of marine litter starts out on land⁶, and the rest from activities at sea. Litter dropped on beaches can go directly into the sea, but litter far inland can be transported to the sea by rivers and sewers. Once in the sea, the fate of an individual piece of litter is dictated in large part by its buoyancy. Materials such as wood and many plastics that do not sink onto the seafloor can be driven great distances by wind and tides. Litter washed into local seas from rivers

and streams, or picked up by rising tides on beaches may therefore be carried great distances, or wind and tides may deposit litter on a beach only a short distance from where it entered the sea.

As it lacks significant buoyancy, Sewage Related Debris is usually deposited not far from the source, and is more likely to 'strand' than larger items of litter such as plastic bottles⁷.

How do we measure it?

Keep Northern Ireland Beautiful began monitoring marine litter on behalf of the Department of the Environment in September 2012. Fourteen reference beaches were chosen based on their location, profile and ease of access for cleaning. Popular visitor beaches were not considered as these would be cleaned by local authorities impacting the quality of the data. On each reference beach a 100m section was measured and every piece of litter within that zone was counted, using the internationally-recognised OSPAR method. There are four surveys carried out per year, one approximately every three months. The surveys follow a calendar year, so the first survey takes place in January. Once the litter has been counted volunteer groups collect it for responsible disposal by the land owner.

Table 1: The annual survey schedule

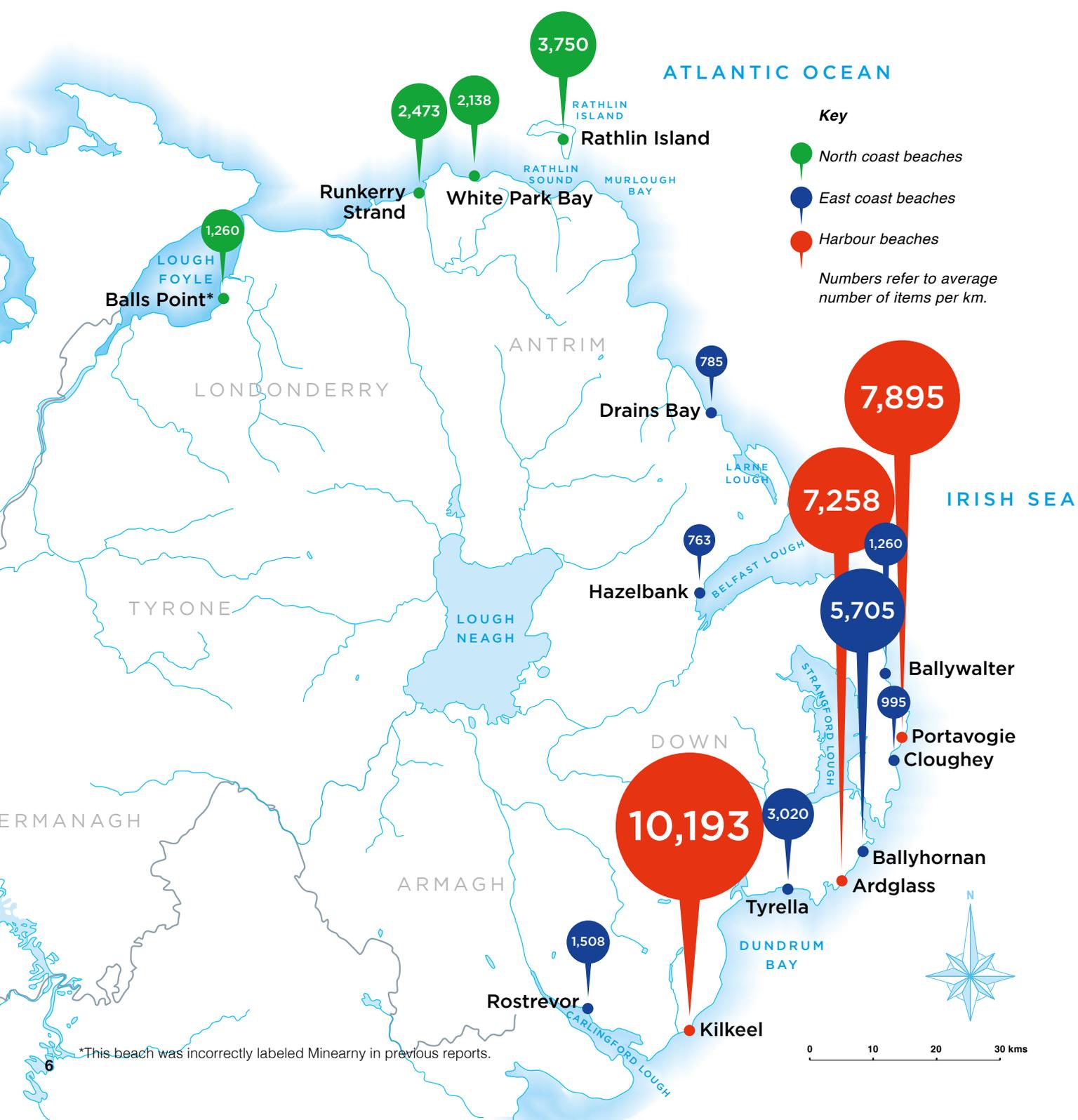
Survey number	Season	Survey completed
1	Winter	January
2	Spring	April
3	Summer	July
4	Autumn	October

What is OSPAR?

OSPAR is the mechanism by which fifteen Governments of the western coasts and catchments of Europe, together with the European Community, cooperate to protect the marine environment of the North-East Atlantic. It started in 1972 with the Oslo Convention against dumping. It was broadened to cover land-based sources and the offshore industry by the Paris Convention of 1974. These two conventions were unified, up-dated and extended by the 1992 OSPAR Convention. OSlo and PARis: OSPAR.

What does this report cover?

This report covers two periods: The bulk of the report refers to the calendar year 2013, as this is the agreed reporting period for marine litter under the MSFD. In this section we identify points of note on individual beaches, or within our defined survey areas: The report also includes a summary of the work undertaken to date, which covers the period from September 2012 to April 2014. This section characterises each survey period and gives an impression of the change from one window to the next. This section will expand to identify any apparent trends as more data is added with the continuation of this survey.



Marine Survey beaches

Table 2: Volunteer groups by beach 2013

Beaches surveyed and who cleaned them	Volunteer numbers	Total volunteer hours	Bags of litter collected
Balls Point <i>Translink</i>	53	104	58
Runkerry Strand <i>CITO Geocachers; Include Youth</i>	46	87	42
White Park Bay <i>Friends of White Park Bay</i>	102	224	95
Rathlin Island <i>Rathlin Island Community and Development Association; Volunteer Now</i>	86	153	75
Drains Bay <i>BASE Ballymena; Larne YMCA; Roddensvale Special School</i>	68	92	35
Hazelbank <i>McDonalds Abbey Centre; CITO Geocachers; Translink</i>	42	93	51
Ballywalter <i>Ballywalter Action Group; Include Youth; CITO Geocachers</i>	47	86	50
Portavogie <i>Portavogie Action Group</i>	51	93	130
Cloughey <i>Cloughey and District Community Association</i>	34	65	39
Ballyhornan <i>Ballyhornan Residents Association; NI Environment Agency; St Patrick's Grammar School</i>	71	157	115
Ardglass <i>Ardglass Festival Association; McDonalds Downpatrick</i>	54	88	62
Tyrella <i>McDonalds Downpatrick; St Joseph's Primary School; Translink</i>	91	186	126
Kilkeel North <i>Mourne Heritage Trust; CITO Geocachers; Citi Belfast; Power NI</i>	111	335	280
Rostrevor <i>Kilbroney Residents Association</i>	37	80	60
Total	893	1,842	1,218

The work of the volunteer groups listed has been invaluable. Their efforts have not only allowed the survey to continue, but have improved the local environment on each of the reference beaches. They have our gratitude.



A group of children from St Joseph's Primary, Downpatrick helping to collect litter from Tyrella beach during the annual BIG Spring Clean event, when they filled a large trailer with litter in a single morning.

Results and conclusions for 2013

Amounts and types of litter observed

An average of 3,498 items of litter were present on each kilometre of beach in Northern Ireland. The variation from beach to beach was significant, with the least at Hazelbank with 760 items per kilometre, and the most at Kilkeel North with 10,190 items per kilometre.

Over 20,000 items of litter were recorded by the survey team across 14 beaches and four survey rounds. In three of the four windows string & cord less than 1cm in diameter was the most common litter type; in survey 1 (winter) it was the second-most common (see **Table 3**). The survey with the greatest rate of litter deposition was spring. While the Spring of 2013 was one of the coldest on record for the UK and significantly wetter than usual in the south-east of Northern Ireland, there were no significant storms or other weather factors⁹ which would be likely to cause the deposit of greater amounts of litter on beaches. March and April were in fact slightly drier than average, with less rain to wash litter into rivers or storm drains. As noted in the introduction, the Celtic Seas generally experience their annual maximum deposition in winter. A review of the wider data from around the UK, Ireland and the North Sea would indicate if this was a localised effect. Additional context on seasonal variability is provided in the Comparison of Surveys section.

Averaged over the year, pieces of string and cord were over 50% more common than any other litter type, with an average of 476 individual items/km on all beaches. String and cord is also the only type of litter in the top ten most common types which is generally held to not come from land-based activities, having been identified as a product mainly of the fishing industry. In order to target this specific type of litter the NI Fishery Harbour Authority has organised a cooperative net

menders scheme in Ardglass. Nets are repaired within the harbour and offcuts are collected for responsible disposal, while crew are made aware of the importance of everyone playing their part to reduce marine litter.

Taken together, pieces of plastic bigger and smaller than 2.5cm (approximately 1 inch) were observed 588 items/km on average, while the two size classes were almost equally common (300:288). Plastic does not dissolve but simply breaks up into smaller and smaller pieces. It is not clear if the smaller pieces were released that size or are a result of the breakdown of larger pieces. The impacts of these pieces on marine organisms and the ecosystems as a whole are a topic for significant research⁹. The effect of plastics in this size class is particularly concerning due to the potential for ingestion by marine organisms¹⁰ and the proportionately high surface area to which toxic chemicals may adhere¹¹.

Four of the top ten types of litter arise from a convenience lifestyle. Plastic bottles (284/km), their tops (190/km), confectionary wrappers (184/km) and drinks cans (139/km) have all been discarded rather than disposed of appropriately. The 2013 NI Litter Survey¹² indicates that confectionary litter was present on 59% of streets in Northern Ireland, while drinks litter was present on 47%. These are the two most common types of litter after cigarette-related items. We can draw a clear line of inference between the relative abundance of litter discarded on streets and that found washing up on beaches. Interestingly, cigarette-related litter was rarely found on the reference beaches – the average rate was less than ten cigarette butts per kilometre. This could be due the decision not to include beaches which are popular with tourists. Even on the designated bathing beaches at Tyrella and Ballywalter, sections chosen for survey were well removed (300m+) from the recreational area.

Table 3: Comparison of the survey windows

Spring had the highest number of observations, especially of string and cord and plastic pieces <2.5cm. Plastic pieces >2.5cm were most abundant in the winter survey. Fishing line was unusually common in the summer survey.

*Other glass items were recorded more often, but problems reliably removing these led to their exclusion from the analysis. It was not possible to guarantee that we were not recounting items that had been included in the last survey.

Rank	2013 average	N/km	Survey 1 (winter)	N/km	Survey 2 (Spring)	N/km	Survey 3 (Summer)	N/km	Survey 4 (Autumn)	N/km
1	String & cord diameter <1cm	476	Plastic /Polystyrene pieces > 2.5 cm	412	String & cord <1cm	675	String & cord <1cm	434	String & cord <1cm	435
2	Plastic /Polystyrene pieces < 2.5 cm	300	String & cord <1cm	362	Plastic/Polystyrene pieces < 2.5 cm	485	Plastic drinks container	303	Plastic /Polystyrene pieces > 2.5 cm	206
3	Plastic /Polystyrene pieces > 2.5 cm	288	Plastic /Polystyrene pieces < 2.5 cm	337	Plastic drinks container	390	Plastic /Polystyrene pieces < 2.5 cm	242	Rope diameter >1cm	189
4	Drinks (bottles/containers/drums)	284	Plastic drinks container	279	Plastic /Polystyrene pieces > 2.5 cm	351	Plastic /Polystyrene pieces > 2.5 cm	211	Plastic caps / lids	184
5	Caps / lids	190	Plastic caps / lids	193	Confectionary wrapper	238	Plastic caps / lids	170	Plastic /Polystyrene pieces < 2.5 cm	178
6	Crisp / sweet / lolly / sandwich wrappers	184	Confectionary wrapper	188	Rope diameter >1cm	229	Fishing line (anglers)	151	Confectionary wrapper	172
7	Rope diameter >1cm	174	Cotton bud sticks	157	Plastic caps / lids	214	Confectionary wrapper	139	Plastic drinks container	165
8	Drink cans	139	Drink cans	152	Drink cans	179	Rope diameter >1cm	134	Drink cans	114
9	Cotton bud sticks	127	Rope diameter >1cm	146	Cotton bud sticks	145	Drink cans	121	Cotton bud sticks	95
10	Bags (including supermarket)	83	Glass bottles*	125	Plastic bags	136	Cotton bud sticks	111	Fishing line (anglers)	81

Table 4: Most common large items observed during the survey

Rank	Litter type	/km
1	Gloves (industrial/professional gloves)	61
2	Other large plastic/Polystyrene	6
3	Rope (diameter more than 1cm)	6
4	String and Cord (diameter less than 1cm)	5
5	Strapping bands	4



Examples of beaches affected by marine litter. Among the thousands of smaller pieces of litter in these photos are larger plastic items including oil drums, buckets, paint tins, lobster pots, a toilet seat, a golf bag, a wheely bin, most of a TV and a welding mask.

The only type of SRD to make the top ten was cotton bud sticks, with 127 items per kilometre. These can usually be distinguished from the very similar lollipop sticks by the small notch cut in the end to help anchor the fibre strands. NI Water has for several years run an educational campaign to persuade people not to flush sanitary items. Portavogie was the individual beach worst affected by cotton buds, with almost twice as many observed here as on any other beach (see **Table 3**). However, almost half of the total number was observed in the Winter survey (survey 1), which also had the highest rate of observation for towels and tampons for the year, so it may be that this was due to an abnormal event near to the sample site. In general, cotton buds were observed more than twice as often on north coast beaches as on east coast beaches (201/km against 97/km)

Other than cotton buds, SRD items such as condoms and sanitary towels are found infrequently, with less than 30 items/km recorded. Similarly, encountering dog faeces (these do not fall within the MSFD definition of marine litter) was uncommon, with less than 10 found per kilometre. Faeces which had been bagged and left were as common as those which were unbagged. The only beach without a bin to dispose of such waste was Balls Point, which is particularly remote.

Despite the levy put on them in April 2013, plastic bags are the tenth most common type of litter, with an average of 83 per kilometre. See the Comparison of Surveys section for additional information.

Balloon litter, a type of plastic, has received increasing attention in recent years, and an average of 20 items/km were observed in this survey. This makes it the 33rd most common type of litter; more common than plastic cups, cigarette lighters or sanitary towels.

Large items survey

Large items such as oil drums and pallets are surveyed over one kilometre because they are much less common than smaller items, so a bigger search area is needed to provide meaningful data. These surveys counted items that were more than 50cm (20inches) along one axis. All of the most common items were plastic, with long industrial gloves the most common at 13 items per kilometre. Large bits of plastic from various sources were the next most common, at 11 items per kilometre. An average of 70 large items/km was observed, including wheelie bins, oil drums and fish boxes (see **Table 4**). The largest items observed were tangled pieces of nets and rope measuring up to 4m across.

Comparison of different survey areas

The fourteen reference beaches were split into three separate sample areas; all beaches on the north coast; all beaches on the east coast; and the three east coast beaches next to fishing harbours. Beaches adjacent to the three fishing harbours on the east coast on Northern Ireland had four times the number of litter items as other reference beaches on the east coast, and more than three times the number as on beaches on the north coast (see **Table 5**).

Perhaps surprisingly, the most common item on harbour beaches was plastic drinks containers. Close inspection of the data (see **Table 6**) indicates that this was driven largely by Kilkeel North, where an average of 1,938/km was observed. Portavogie and Ardglass had an average of 580/km and 423/km respectively, and were the second and third most affected. Glass bottles were also significantly more prevalent on harbour beaches than in other areas, with an average of 293/km against an average of 103/km on east-coast non-harbour beaches and 22/km on the north coast. This finding is complicated by the distribution of the bottles, with over 75% found on Ardglass beach. A compounding factor was the difficulty removing broken bottles and small pieces of glass

Table 5: Comparison of different survey areas

*Beaches adjacent to fishing harbours had an average of 8448 litter items per kilometre, 980 of which were plastic drinks containers. *Glass pieces have been removed from this analysis as they proved impossible to consistently remove after the first count and were subsequently reclassified. Ardglass was responsible for over 75% of the total number of glass bottles.*

Rank	East coast (all beaches)	N/km	East coast no harbours	N/km	Harbour beaches	N/km	North coast beaches	N/km
1	String & cord diameter <1cm	465	String & cord diameter <1cm	264	Plastic drinks bottles	980	String & cord diameter <1cm	684
2	Plastic drinks bottles	378	Plastic /Polystyrene	152	String & cord diameter <1cm	696	Plastic /Polystyrene pieces < 2.5 cm	366
3	Plastic /Polystyrene pieces > 2.5 cm	312	Pieces < 2.5 cm	150	Plastic /Polystyrene pieces > 2.5 cm	634	Plastic /Polystyrene pieces > 2.5 cm	268
4	Plastic /Polystyrene pieces < 2.5 cm	276	Plastic /Polystyrene pieces > 2.5 cm	134	Plastic /Polystyrene pieces < 2.5 cm	556	Plastic caps / lids	263
5	Rope diameter >1cm	204	Confectionary	132	Drink cans	509	Cotton bud sticks	219
6	Confectionary	204	Plastic caps / lids	115	Rope diameter >1cm	353	Confectionary	186
7	Drink cans	185	Plastic drinks bottles	104	Confectionary	298	Rope diameter >1cm	164
8	Plastic caps / lids	175	Rope diameter >1cm	57	Glass bottles*	293	Shotgun cartridges	61
9	Glass bottles*	103	Plastic bags	49	Plastic caps / lids	228	Plastic drinks bottles	59
10	Plastic bags AND Cotton bud sticks	98	Cotton bud sticks	45	Caps / lids	228	Fishing line (anglers)	51
Average number of all items		3,935		2,001		8,448		2,405

“A 2009 study found plastic in the stomachs of nearly 10% of the fish they examined¹³.”

Marine Ecology Progress Series



(which are not shown in Table 6 for this reason). They proved so difficult to reliably remove that after consulting with other operators who carry out OSPAR surveys, we clarified that only whole or large pieces of bottles should be counted and very small glass pieces should be overlooked. It is interesting to note that the vast majority of glass bottles contain alcoholic drinks, as almost all soft drinks are sold in plastic bottles. The highest average numbers were found on the three Harbour beaches and on the three beaches nearest to rivers.

We can see the pattern of harbour beaches being different from the rest of the east coast and the north coast in other notably common types of litter. Confectionary litter could be expected to be more common on the north coast than in other areas due to the relative concentration of 'destination' beaches – Blue Flag or Seaside Resort Award – on the north coast, as tourists using beaches is a recognised route for litter to enter the marine environment. This was not the case however, with confectionary litter more than twice as common on fishery harbour beaches (298/km) as it was on the rest of the east coast (134/km), and almost twice as common as on the north coast (186/km)

String and cord were more frequently observed on fishery harbour beaches than on other coasts. A close look at the data for each beach, however, shows that it was more abundant on Ballyhornan than it was on Ardglass, 5km down the coast. String and cord was in fact most abundant on the beach at Rathlin Island. It is not clear why this would be the case. As mentioned in the introduction, there are many interacting factors which affect where marine litter will be deposited. On Rathlin, a possible cause for the high deposition of sting and cord and pieces of plastic is the location of the beach itself. It is a gently sloping sand beach next to the harbour, on the inside of the 'L'-shaped island. Relatively strong tidal currents run around the island, and form vortices on either side of the island depending on the point in the tidal cycle. These powerfully mix the water column and with it any litter that is suspended. The harbour and beach are protected from the force of this by the shape of the island,

which results in weaker currents in the on the inside of the 'L'-shape. As the currents flow into the bay and lose power, they are no longer able to carry the litter and deposit in this area.

Tidal charts indicate that the nominal flow on the east coast is southward, which would suggest that litter would be carried toward Ballyhornan from Belfast, Portavogie and Strangford Lough. However, if that were the case the beaches at Ballywalter and Cloughey would be expected to also be heavily littered. Both are however comparatively free of litter, which suggests that Belfast and Portavogie are not the source of the litter on Ballyhornan. Ballyhornan itself is protected from the current to the north by Killard Point, and by Guns Island to the south-east, putting the beach in a position not unlike the beach on Rathlin. The portion of the beach surveyed is also relatively steeply sloped, which all may contribute to the deposition of litter here. Further investigation of the currents and tides around this point may prove enlightening.

It is interesting to note that Rostrevor has a very low average for string and cord. It's location inside Carlingford Lough likely ensures that the major inputs are riverine rather than marine, preventing significant volumes of string and cord, which is generated at sea, from washing onto the beach. The same low levels are present on Hazelbank and Balls Point, although they are much less noticeable due to the lower average load on that part of the coast.

Plastic and Polystyrene less than 2.5cm was observed in roughly equal abundance on both north coast and east coast beaches. However, the east coast beaches were mostly pebble beaches, especially on the sections in which the survey is set. Ballyhornan and Tyrella are the only truly sandy beaches in this zone. Kilkeel North is a pebble beach while Ardglass and Rostrevor are gravelly, with some fine sand. It is possible that plastic of this size is lost in the interstices of the pebble/gravel matrix on these three beaches. Indeed, we see that they have comparatively low levels of smaller plastic waste observed. The amount of plastic and polystyrene <2.5cm waste on Ballyhornan beach is surprising.

Table 6: Average number per kilometre of selected litter types at each beach in 2013

Averages are shown for each sample area. Kilkeel North, Portavogie and Ardglass are in the top three in most categories. Rathlin has the highest numbers of string and cord.

Area	Beach	Drinks bottles	Confectionary	String & cord <1cm	Plastic pieces < 2.5 cm	Plastic pieces > 2.5 cm	Drink cans	Glass bottles	Cotton bud sticks
North coast	Balls Point	113	80	13	98	80	40	78	23
	Runkerry	45	73	105	473	340	35	0	290
	White Park Bay	20	100	418	468	178	8	5	248
	Rathlin	23	285	1,485	400	313	25	5	245
East coast	Drains Bay	38	88	38	83	73	13	10	23
	Hazelbank	40	30	8	20	40	23	85	0
	Ballywalter	10	110	260	98	140	23	3	35
	<i>Portavogie</i>	580	428	495	540	620	570	78	515
	Cloughy	45	90	253	60	80	15	3	40
	Ballyhornan	330	410	1,250	520	515	65	10	180
	<i>Ardglass</i>	423	285	1,048	305	310	323	740	40
	Tyrella	150	288	730	123	240	65	5	93
	<i>Kilkeel North</i>	1,938	183	545	823	973	635	63	10
	Rostrevor	228	130	25	188	125	115	38	40
Average		284	184	476	300	288	139	80	127
North coast average		50	134	505	359	228	27	22	201
East coast average		378	204	465	276	312	185	103	98
<i>Fishing harbour average</i>		980	298	696	556	634	509	293	188
East coast non-harbour average		108	179	506	186	191	43	20	82

Key: **First** **Second** Third highest load of each type of litter. *Fishing harbour beaches in italics.*



A surveyor recording litter on the strandline. Volunteers will remove this litter in the weeks following the survey.

It's proximity to the Harbour at Ardglass could be expected to be a factor, but Ardglass beach has a relatively low load of this waste, so this is less likely, and as mentioned above the predominant tidal current is south away from Ardglass. Another possibility is the outflow from Strangford Lough either directly contributing to the load or creating a local deposition zone by affecting the local currents. Again, additional work would be necessary to determine the cause.

Taken all together, this serves to highlight a need for additional work to be undertaken to determine the sphere of influence of litter from the three fishing harbours.

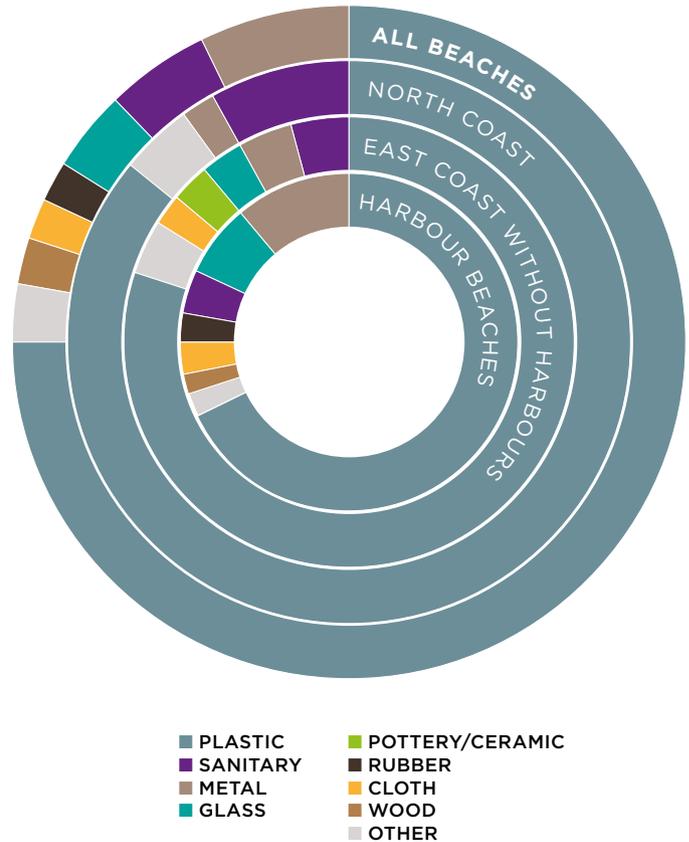
Materials making up marine litter

Plastic was the overwhelming constituent of marine litter around Northern Ireland (see **Table 7**). Plastic-based litter made up 75% of all litter observed in 2013, and 83% of litter items observed on the north coast. In addition, 94% of the north coast Sewage Related Debris was made up of cotton buds, which are also made of plastic. The distinction which puts plastic cotton buds under the SRD class is part of the OSPAR method which has been used for this survey. Adding these to the plastics figure indicates that plastic actually accounts for 92.5% of individual litter items observed on north coast beaches. The exact proportions of cotton buds to other types of SRD varies, but performing this calculation for the other survey zones gives 86% of east coast without harbours, 69% of harbour beaches and 78% of all reference beaches.

Metal was the second largest constituent of marine litter, with an average of 7% of items. The majority of these items were found on harbour beaches, where they made up 11% of the observed items, around three times as much as on surrounding beaches. The majority of metal items on all beaches was drinks cans, with the rest pieces of sheet or worked metal likely to be from repairs to vessels or pieces lost in accidents, but also included discarded bicycles and identifiable car parts. Wire from fences and other sources, and electrical flex were also relatively common metal items observed.

Comparison of the survey areas

Percentage of each material in litter observed. Plastic is the dominant material, but the proportion plastic observed on harbour beaches is much lower than the other east coast beaches or the north coast. The north coast has the highest percentage of sanitary waste; the harbour beaches the highest percentage of metal litter.



Glass and sanitary items are the only other materials with more than a few items per hundred observed – four and five in one hundred respectively. As mentioned above the majority of glass bottles are concentrated on Ardglass beach, where an average of 780 items/km was observed. This is almost nine times as many as the next most affected beaches, Hazelbank (85/km) and Portavogie (78/km).

Table 7: Percentages of each material type present in the litter in each survey area

The north coast has the highest percentage of plastic litter. While harbour beaches had the lowest percentage of plastic litter, the number of items meant that it was more abundant on these beaches than in the other groups.

Material	All beaches (%)	N/km	East coast without harbours	N/km	Harbour beaches	N/km	North coast	N/km
Plastic	75	2,634	84	1,678	68	5,718	83	1,996
Rubber	2	76	2	33	3	262	1	13
Cloth	2	87	2	41	3	295	0	10
Wood	2	57	1	21	2	172	1	34
Paper	1	23	1	14	1	58	0	11
Metal	7	252	4	74	11	941	2	46
Glass	4	150	2	38	7	572	1	31
Pottery/ceramic	1	34	0	2	1	98	2	43
Sanitary	5	171	4	88	4	312	9	209
Medical	0	8	0	4	0	19	0	6
Faeces	0	6	0	8	0	3	0	7



These images show damage caused by the Christmas storms of 2013 around the coast of Northern Ireland. The storms eroded several metres of sand dunes behind Portavogie beach and undercut this section of boardwalk, causing it to collapse.



This life saving equipment post survived the storms. The post used to stand tight against the sand dune. Now about a metre of sand has been deposited around it's base.



The bare brown earth visible in the cliff behind Ballyhornan shows the extent of erosion caused by the storms.

Comparison of Surveys from September 2012 to April 2014

The graph below shows the variability in the results from each survey. The bars indicate the proportion of different materials observed in each survey, and the overall height of the bar the number of items. Two elements stand out: significantly more litter was observed in Q1 of 2014; and that there is no overall pattern emerging from the data.

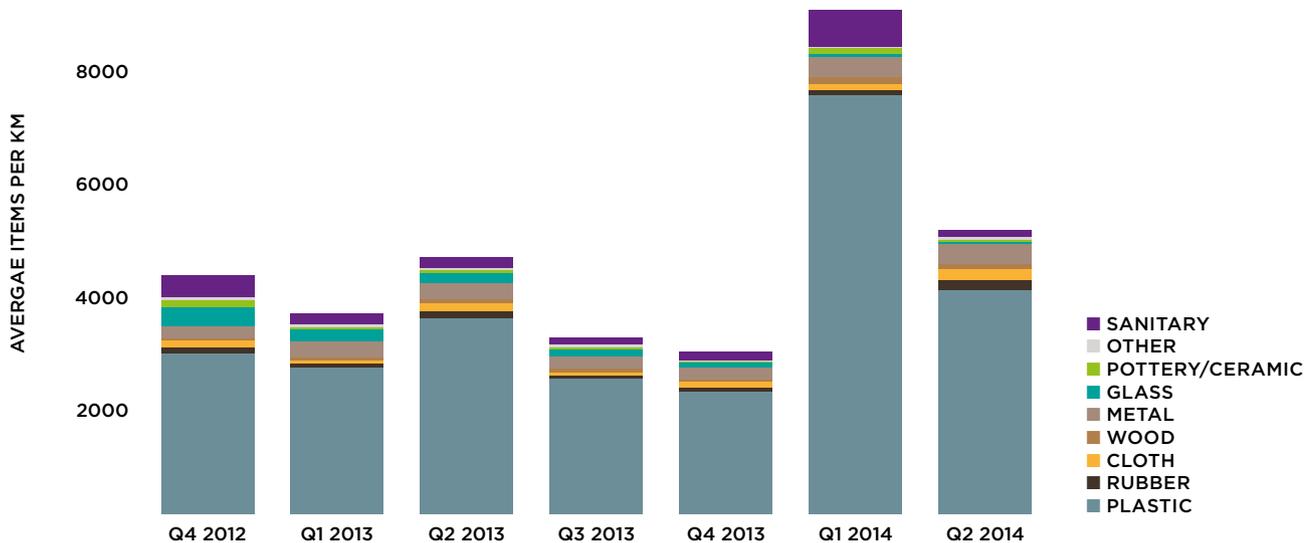
The storms of winter 2013, especially between Christmas and New Year had significant effects on the beaches, washing some beaches out, scouring meters of sand dune or cliff face away, and dumping sand on others. The data collected in Survey 1 2014 show a significant change in type and quantity of marine litter observed, matching the scale of change to the physical landscape. Large scale churning of the water column offshore has possibly brought more litter close to the coast where larger than normal waves have thrown it further

up the beach than subsequent tides have been able to reach, ensuring that it is not re-suspended and washed away. It is also possible that erosion of sand dunes on some beaches has liberated litter items that were locked away in the dunes during recent periods of deposition.

As we see in the graph, there is no pattern immediate in the seven samples. Looking at each season individually is similarly unenlightening: between the two Q4 (autumn) surveys the number of items observed dropped by 48%, as opposed to a 60% increase between the two Q1 (winter) surveys. The second Q2 (spring) survey recorded just 9% more litter. The average number of items observed over these seven surveys was 4,605 items per kilometre, but it is clear that more data is required before a reliable mean value for litter can be settled on.

Comparison of surveys from September 2012 to April 2014

A comparison of the composition and volume of litter observed in each survey from September 2012 to April 2014. The storms at the end of December 2013 caused the deposition of significantly higher amounts of litter than in any other survey. Each type of litter varies around an average value except glass, which reduces with each survey.

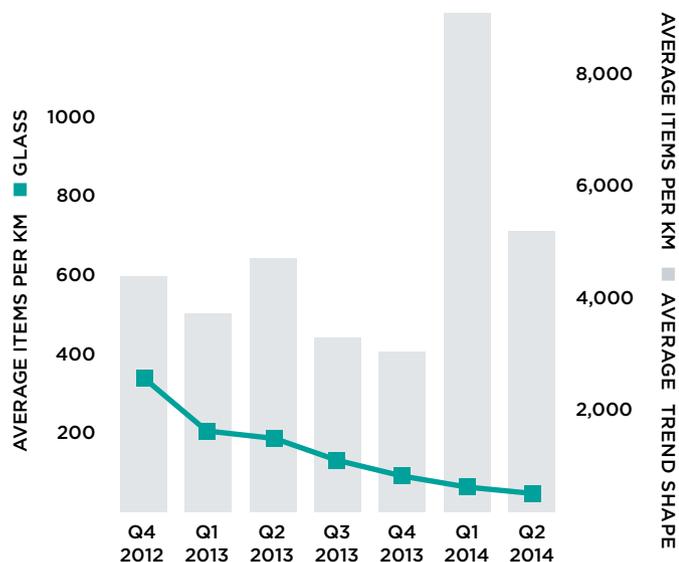


One component of the litter that has shown an apparent trend is glass. As we see in the graph below, the amount of glass observed has dropped in each survey, from almost 350/km in Q4 2012 to less than 50 in Q2 2014. As was noted above, the large majority of glass has been observed on Ardglass beach. On other beaches the observation frequency is falling as volunteers remove historic glass faster than it is deposited.

A comparison of two survey periods between September 2012 and January 2013, and the equivalent surveys from September 2013 and January 2014 are interesting. In terms of basic number of items, Rathlin, Ardglass and Kilkeel were relatively unchanged. Runkerry, Drains Bay and Hazelbank all experienced significant falls in the number of items, down over 70%. Ballywalter, Tyrella and Rostrevor were up by between 30% and 70%. The biggest change however was

Glass: September 2012 to April 2014

Glass is the only major type of litter that has reduced during the seven surveys carried out.



on Ballyhorman beach, where the number of litter items observed increased by 488%. Almost five times as much litter was observed during and following the storms of late 2013. During this period Ballyhorman had around twice as much litter per square metre as any other reference beach. There was also significant erosion of the cliff which backs the beach, estimated at 3-5m based on photos and GPS of the survey site.

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