

Innovative Recycling Container Project



A trial of innovative recycling containers designed to test whether consumer behaviour patterns and recycling rates can be influenced by the type of container used for recycling

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Front cover photography: Strobe Container in place at Bangor University

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Executive summary

Wrap commissioned this project with the purpose to examine whether behaviour towards recycling when using a container which had been specifically designed to incorporate innovative elements and functionality could be affected when compared against traditional recycling containers.

To assess the performance of the containers and what impact the introduction of a bespoke designed recycling unit has, a five month trial was established at two of Wales' largest universities, Bangor and Swansea. The trial implemented five new containers (hereon referred to as the Strobe Container), into locations across each of the campuses. Each Strobe container provided the opportunity to recycle plastic bottles and cans (food or drink) in individual receptacles as well as a provision for the collection of general waste.

Wybone Limited was appointed the preferred manufacturer to supply the container. With a history of over 40 years of manufacturing litter bins and recycling containers, Wybone's ability to create bespoke product solutions has seen them become one of the UK's market leading manufacturers of recycling containers.

The project was managed jointly between Wybone Limited and Plan Recycling Consulting. Plan Recycling have been the responsible organisation for monitoring the performance of the containers through a series of material assessment audits. Each university were assessed twice monthly, over the five month period.

The Container

The Strobe container was designed specifically for this project. Prior to its construction, Wybone Limited had not manufactured a container utilising the amount of interactive elements which the Strobe has. Comparing the Strobe against other containers currently available on the market, it provides a significant amount of interactivity for its user which makes it a unique product. Manufactured from steel, the Strobe is designed to be used both externally and internally. The features of the container which set it apart from existing containers on the market are:

- Solar panels located in the top of the container to provide power for the audio and visual elements;
- Illuminated signs which respond when an item of packaging is deposited for recycling;
- Audible feedback to the consumer when an item of packaging has been recycling;
- Multi-sensors fitted inside the container to detect when recycling has occurred;
- Transparent bodied front to show the contents of each receptacle to act as an advisory steer;
- Braille plates located on the fascia panels of the recycling receptacles

Figure 1 shows the Strobe Container in situ at Bangor University



Figure 1 Strobe Container

The Locations

The universities of Bangor and Swansea were invited to be the host locations for the trial. Of similar sizes and student population, the universities provided a level ground on which to assess the performance of the Strobe. Each university has its own existing recycling scheme in place prior to the placement of the Strobes. Whilst those schemes are inherently collecting the same materials for recycling, each university has its own method of collection.

At Bangor University, all items collected for recycling are done so using the source segregated method of collection. This means that for each item collected, there is an individual collection container.

Figure 2 shows an example of a typical recycling container at Bangor University.



Figure 2 Existing Recycling Container at Bangor University

Conversely at Swansea University, the collection method is co-mingled. The Strobe collects recyclables in a source segregated manner and this conflicts with the existing arrangements in place. Whilst the existing arrangements didn't conflict with the trial, the trial did test to see how behaviour change could be affected using a different type of container than to what is already in existence.

Figures 3, 4 and 5 show the different types of recycling containers at Swansea University.



Figure 3 External Mixed Recycling Container



Figure 4 Internal Recycling Container with Glass Provision



Figure 5 Internal Recycling Container

1.0 Introduction

The purpose of this project was to ascertain whether the implementation of an innovative designed recycling container would affect the behaviour patterns of the users in two major university locations in Wales and encourage a greater level of participation whilst at the same time enhancing the quality of recyclate collected.

In order to achieve an equal comparison of behaviour and participation, the universities of Bangor and Swansea were invited to be host locations. The remit of the project sought to create a balanced trial, by implementing the same number of containers in each location and as far as possible mirroring the positioning of each of those containers. By replicating the locations of the containers, the trial was monitored for a period of 5 months to assess:

- The volumes of material collected
- The quality of material collected (recyclate vs. contamination)
- Participation rates
- Consumer behaviour.

A survey of a number of students was undertaken to gather feedback on the impact the new containers have and whether they would improve recycling behaviours.

The containers were designed as a bespoke container specifically for the delivery of this project. As a remit for the project, the containers were required to demonstrate elements of innovation, which set them apart from any other containers, which are currently available on the market. The result of the design provided the Strobe container with:

- Audible Feedback to the recycler when a can or plastic bottle was deposited
- Illuminating signs to reinforce the message about recycling
- Solar powered panels to power the audio / visual panels
- LED Dot Matrix counter to provide a visual count of the amount of items collected for recycling
- Clear Bodied panels to provide ease of recognition as to what materials are to be collected
- Braille plates for the partially sighted

Implemented during the final week of May 2013, the containers were installed in readiness for the trial to commence. Management of the trial, undertaking the assessments and collecting the data and the production of the final report has been delivered on behalf of Wybone Limited by Andy Newton of Plan Recycling Consulting. Each university has been assessed on a twice monthly basis for the period June 2013 through to October 2013. The assessments have been carried out with each university being assessed on the consecutive days to ensure that there is consistency.

In addition to the assessments delivered, a student facing consumer survey was conducted to establish the views of those students who have used the Strobe containers to understand what impression the containers have had and whether the containers themselves could influence recycling behaviours and rates across any given environment.

2.0 The Container



Figure 6 Specification Sheet for the Strobe Container

The Strobe Container was designed specifically for this project.

Utilising the design team at Wybone Limited and with input from Plan Recycling Consulting, the Strobe was designed with the purpose to engage its users with a range of interactive elements which were designed to increase participation and influence behaviour towards recycling specific material streams.

Constructed principally from metal in order to allow the Strobe to be used both internally and externally, the container incorporates a significant number of features which make it an entirely unique container. Previous research into what influences behaviour when recycling has indicated that clarity rather than ambiguity leads to increased participation and a higher quality of recycle collected.

The Strobe's appearance makes it immediately obvious as to which material streams it is collecting. As a bespoke product, it can be configured to collect whichever material streams it is required to.

For this project, the focus was solely on the collection of cans and plastic bottles.

A prerequisite of this project was to implement a container which was very different from current containers on the market and for a container which would act as an engaging recycling collection point. The result of the design work created a container which embraced the simplicities of clarity yet provided its users with audio and visual feedback when it was used.



Figure 7 The Strobe Container

3.0 Trial Locations

Each of the universities has been supplied with five strobe containers. The locations for the strobes has been mirrored where possible, in order to draw a comparison of the volumes of material each container collects, whether contamination is more prevalent in certain locations and whether increases in footfall actually enhance recycling rates.

At **Bangor University**, the location of the Strobe's was as follows:



Maes Glas Sports Centre



Main Arts Lecture Theatre 1st Floor (M.A.L.T)



Main Arts Lecture Theatre



Wheldon Building (Outside)



Wheldon Building

Where natural lighting is limited, the Strobe containers are fitted with a supplementary power source which, when connected to the mains electrical supply continues to provide the container with its innovative feedback elements of audio and visual to ensure that they are consistent with those containers which are operating fully using the solar panel power sources.

At **Swansea University**, the locations of the Strobe containers are:



Welsh National Pool (Outside)



Library



Lecture Theatre



Fusion Cafe



Wallace Building

In all instances, where an existing recycling container or general waste bin was in location prior to the installation of the Strobe, these have been removed to provide the Strobe with a greater visibility and presence to allow for a greater level of interaction from consumers, students and staff alike.

Both universities implement a recycling collection scheme although whilst these schemes exist there are substantial differences between both universities in their methods of collection.

At Bangor University, each material collected for recycling, is done so in a specific designated container, adopting a "source segregated" scheme. This means that for every recyclable material stream which the university collects, they implement an individual container to collect that material stream.

At Swansea University, the scheme in place collects all recyclables, with the exception of glass, as Dry Mixed Recycling (DMR). The scheme provides its users with the opportunity to recycle plastics, cans, paper, and card. The implementation of a DMR scheme provides its users with the opportunity to dispose of all recyclables (excluding glass) into a solitary container.

As such, the introduction of the strobe containers to collect cans and plastic bottles in a segregated manner is very different to the existing scheme which is in place across the entire campus, including the student residencies and as such the quantities of non targeted recyclables being collected were anticipated to be higher than at Bangor University.

Each of the Strobe containers offers the opportunity to recycle as well as dispose of general waste.

The containers have been designed in line with Welsh Government policy on preferred collection methods, i.e. materials to be collected separately at source. Plastic bottles in one compartment and cans (food and drink) in the other.

All other material streams which the Strobe collects are treated as general waste. Were this container to be introduced into the market place for general sale, its modular design allows it to be customised to collect whichever recycle streams were appropriate.

During the assessment period of this trial, all known recyclables which were collected erroneously were sorted and subsequently sent off along with the plastic bottles and cans for onward recycling.

4.0 Contamination

All material, regardless of its form, which was found present within the Strobes and not found to be either plastic bottles or cans was treated as a contaminant and discounted from the data collected.

The primary contamination materials found within the strobes were:

- Coffee Cups
- Plastic Vending Drinks Cups
- Food Packaging
- Other plastic packaging
- Confectionary wrappers
- Food Waste and
- Paper

For the purposes of this project, any materials collected which were neither a plastic bottle nor a can (food or drink can) were deemed to be contaminants as these were non target materials for the trial.

Figures 8 - 12 show typical examples of contamination found during the assessment process.

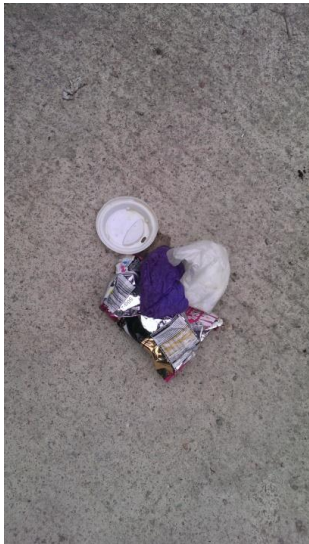


Figure 8 Food Packaging Contamination

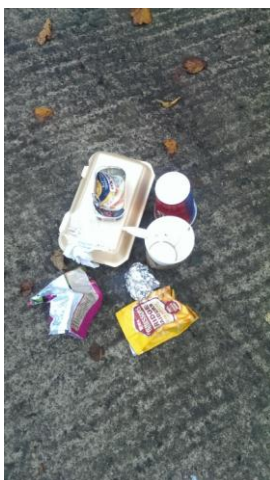


Figure 9 Food Packaging / Coffee Cups



Figure 10 Mixed Contamination



Figure 11 Plastic Packaging Contamination



Figure 12 Polystyrene Food Cartons / Plastic Vending Cups Contamination

At Swansea University, the mixed recycling collection scheme permits the collection of other plastics in addition to plastic bottles. Where PET/PS vending cups were found to be collected, these were sorted after the assessments were completed and placed into the recycling.

At Bangor, where such items as shown in the **Figures 8 - 12** were found, these were disposed of as general waste as per the collection methods of the university.

5.0 Assessments

A suite of full material assessments were carried out on a bi-monthly basis between the months of June and October 2013.

Each assessment sampled a whole day's worth of material from each of the Strobes to build up a picture of what the potential recycling volumes could be, should the containers be used in a similar manner on a daily basis. For extrapolation purposes, the data which was collated through the assessments per month has been aggregated together and then multiplied by 10 to represent the number of available days of which the Strobes could be emptied.

In addition to the volumes of recyclables collected through the containers, the general waste fractions were also assessed to identify whether this proportion of the container was being used in the correct manner.

As general waste bins were removed prior to the installation of the Strobes, it was hoped that the visibility of the Strobe would not only increase volumes of general waste, but to also increase awareness as to the opportunity to recycle cans and plastic bottles at the same location.

The results in terms of what volume each Strobe collected fluctuated depending upon its location and also the time of the year (students leaving campus in June and not returning until September). However, both Universities are constantly busy throughout the year with visitors, exhibitions and events which ensured that the Strobes were still accessible to be used.

For each assessment, the material was weighed in its total form to provide a gross weight of the volume of material collected. The material was then emptied out and photographed in its entire form.

Figure 13 shows the timetable of material assessments undertaken throughout this project.

	June	July	August	September	October
Bangor 1st Assessment	14-Jun	09-Jul	05-Aug	02-Sep	07-Oct
Bangor 2nd Assessment	28-Jun	22-Jul	19-Aug	23-Sep	14-Oct
Swansea 1st Assessment	13-Jun	10-Jul	06-Aug	03-Sep	08-Oct
Swansea 2nd Assessment	27-Jun	24-Jul	21-Aug	25-Sep	15-Oct

Figure 13 Timetable of Material Assessments

Figures 14-17 show examples of the material collected throughout the assessment process.



Figure 14 Unsorted Bottle Material



Figure 15 Sorted Bottle Material



Figure 16 Unsorted Bottle Material



Figure 17 Sorted Bottle Material

6.0 Data

The data collected from each of the assessments was split into 3 sets:

- Gross volume of material collected from each Strobe receptacle
- Net weight of plastic bottles or cans
- Net weight of contamination

Where material wasn't present for any of the containers, an assumption was made based upon the previous assessment undertaken. This assumed data only applied in instances at Swansea University. All of the assessments undertaken at Bangor were based upon actual material collected.

The material assessed in each instance represented a typical day's worth of collected material within each Strobe container. In order to produce an extrapolated data set for each month, the following equation was applied:

$2 \times \text{assessment data} \times 10 \text{ days} = 20 \text{ days of material.}$

20 days of material represents the number of available days per month for the containers to be emptied.

For the period between June and October 2013, the total volume of material collected between both Universities was 3.59 tonnes. This total represents the entire volume of material collected within the Strobe containers, including contamination.

The graph at **Figure 18** shows the split between plastic bottles and cans collected within the respective receptacles and also the quantity of contamination found present.

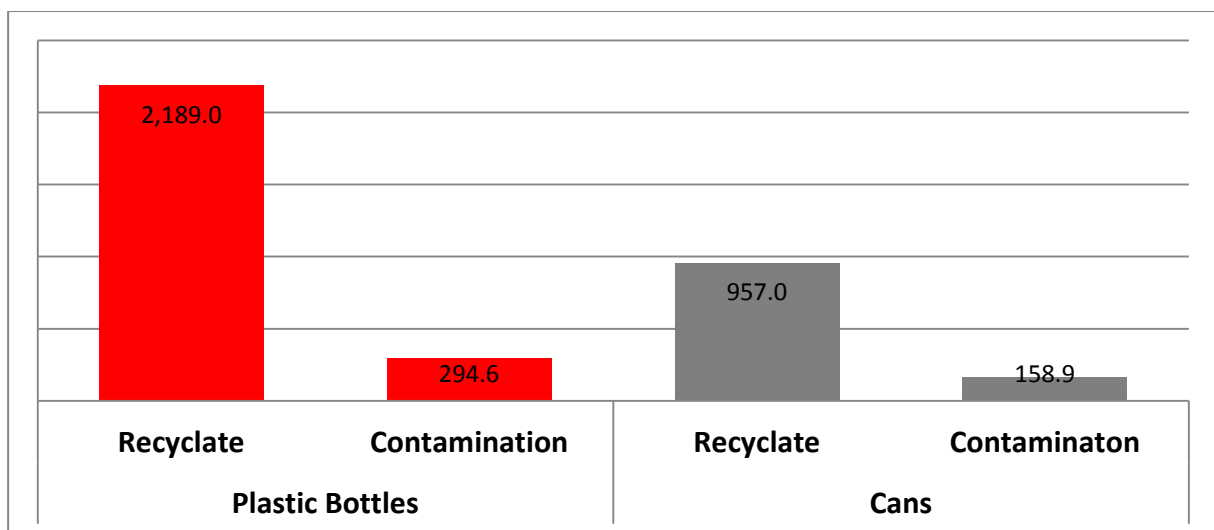


Figure 18 volumes of recyclables and contamination (kgs)

When comparing the volumes collected as a percentage, the chart at **Figure 19** demonstrates how successful the Strobe containers were at collecting the correct materials for recycling.

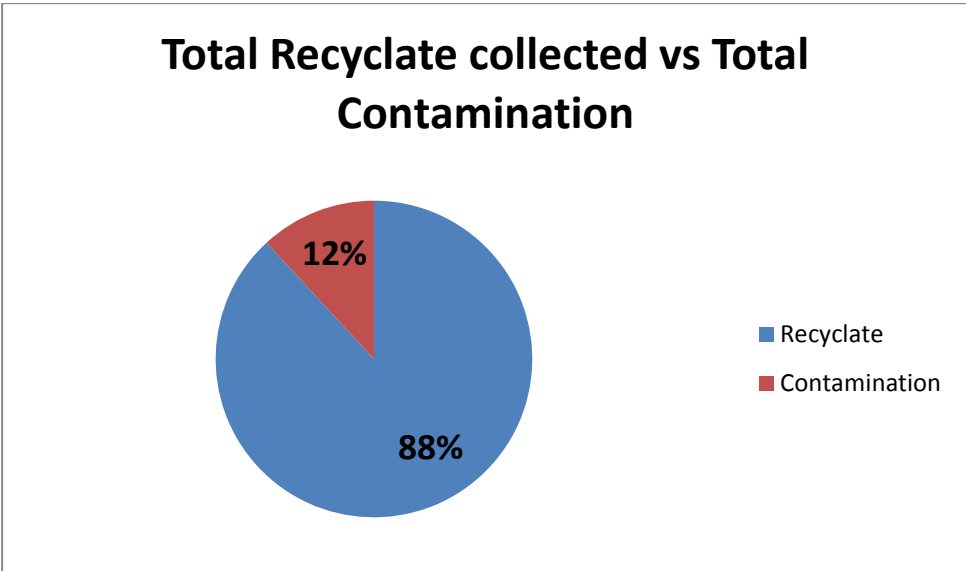


Figure 19 Comparison of recyclate and contamination collected in total

The performance of each university was influenced by the existing recycling schemes which are already in existence. Whilst the Strobe container has the ability to influence behaviour change through its innovativeness, the inherent behaviour of the staff and students of each university respectively, ultimately had the greatest effect on how the Strobes were used.

Bangor University

Bangor University implements a source segregated collection recycling scheme across the campus. This scheme applies to all container deployed both internally and externally. The introduction of the Strobe containers mirrors this existing scheme and consequently the participation rates and volumes of material collected throughout the assessment period were reflected by these behaviour patterns.

The total volume of material collected during the assessment period at Bangor University was **1,724kgs**. **Figure 20** shows the breakdown of material collected across each of the five Strobe containers.

	Plastic Bottles		Cans	
	Gross Weight	Net Weight	Gross Weight	Net Weight
Wheldon LT	136	125.3	67	60.5
Maes Glas	360	350.2	140	106.2
Main Arts Lecture Theatre (MALT)	220	183	93	56.5
1st Floor MALT	341	313.2	73	68.5
Wheldon Outside	210	189.8	84	83.4
Total Volumes	1,267	1,161.5	457	375.1

Figure 20 Total Material Collected at Bangor University

Of the **1,724kgs** of material, a total of **1,536kgs** was clean, high quality recyclable material. Taking into consideration that the Strobe containers were simply installed within the campus with no supporting communications collateral advising as to why they were there and what they were collecting represents a substantial success.

Figures 21 and 22 demonstrate as a percentage how successful the Strobe containers were at engaging with the consumers who used them.

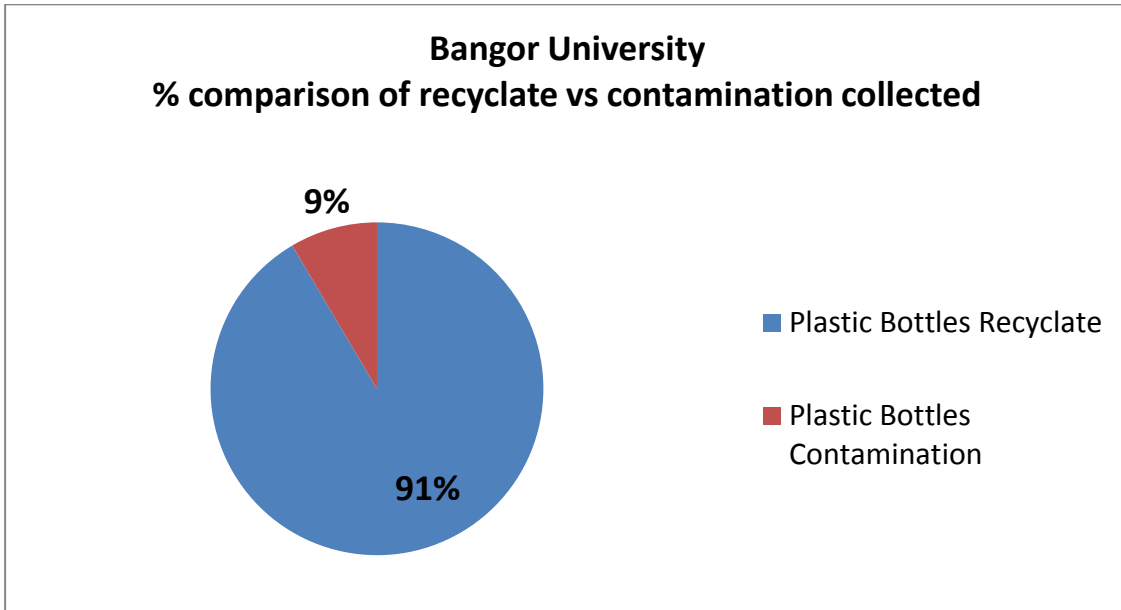


Figure 21 A total % comparison of recyclate vs. contamination found in the Plastic Bottle receptacles

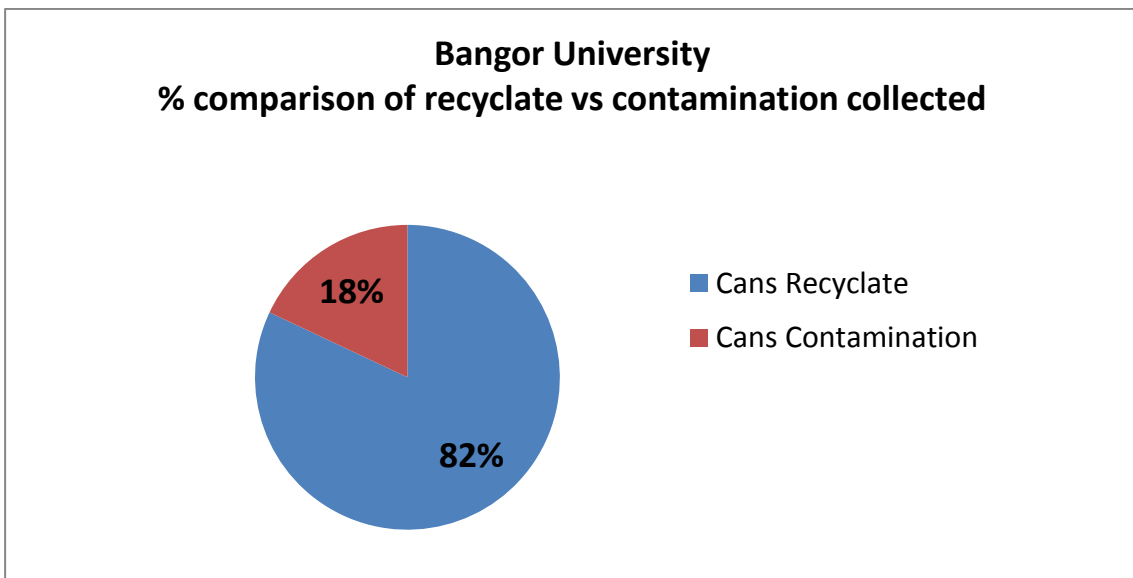


Figure 22 A total % comparison of recyclate vs. contamination found in the Can receptacles

Investigating further through the data reveals that despite the location of the Strobe containers being a mix of internal and external, their usage was very consistent regardless of where they were located.

With the exception of the container which was based outside the main entrance to the **Maes Glas Sports Hall**, all the other containers were subjected to very similar volumes of material. The Strobe located outside the entrance to **Maes Glas** was the container which collected the greatest volumes of both cans and plastic bottles.

Figures 23 and **24** demonstrate the breakdown of material collected across all 5 Strobe containers throughout the trial period.

Net Weight of Plastic Bottles Collected (kgs)

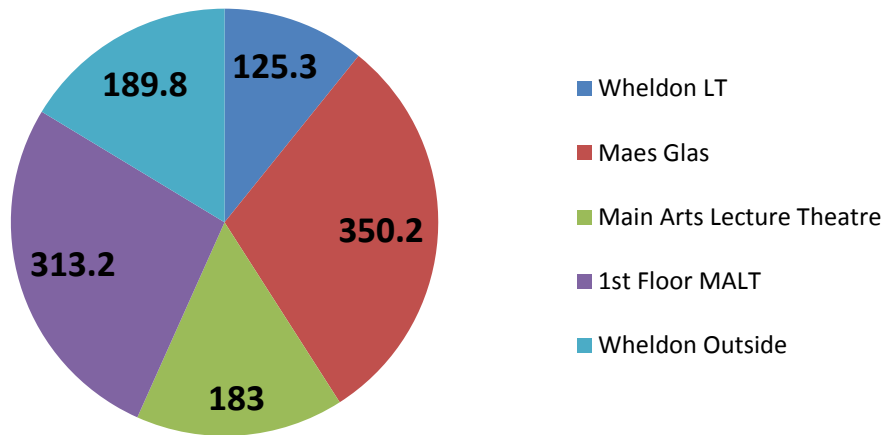


Figure 23 Net Weight of Plastic Bottles collected by Container Location

Net Weight of Cans Collected (kgs)

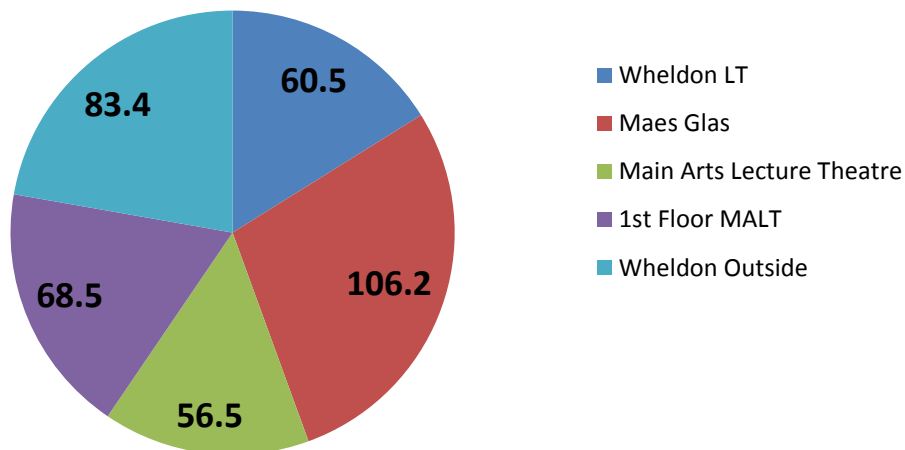


Figure 24 Net Weight of Cans collected by Container Location

Understanding that the trial period covered the months when the students had all vacated the University for the summer holiday period, the volumes of materials which were collected were extremely high.

The **Maes Glas** sports hall is used as a multi-purpose sports venue during the summer periods and this explains why the volumes of materials collected with that particular Strobe container were higher than the others located around the campus.

Figures 25 and 26 demonstrate the volumes of materials collected across each of the containers on a monthly basis.

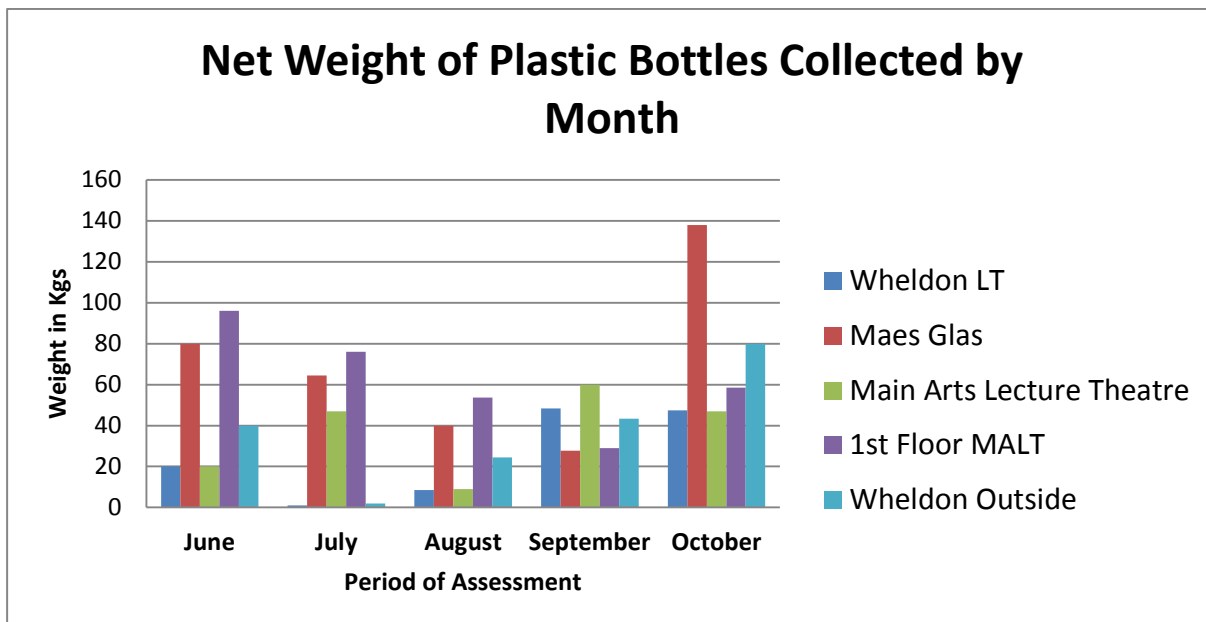


Figure 25 Net weight of Plastic Bottles collected by container per month at Bangor University

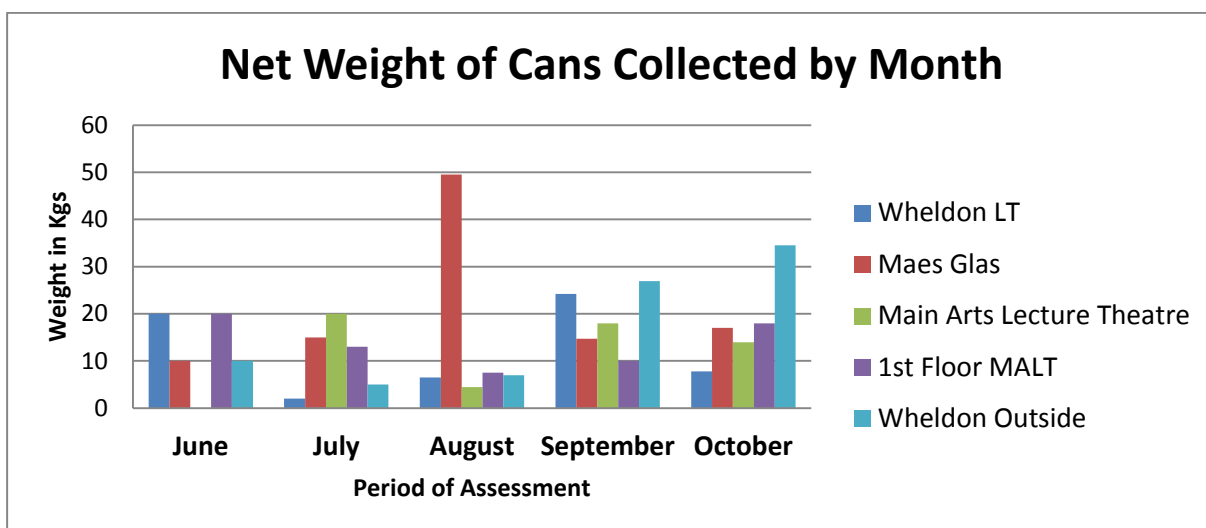


Figure 26 Net weight of Cans collected by container per month at Bangor University

The months of September and October saw the largest overall volumes of material collected across the trial period.

The return of the student population would have been responsible for this growth in material collected. However as the graphs in **Figures 25** and **26** demonstrate, there were substantial volumes collected during the previous three months when the students were absent from the campus.

Swansea University

Swansea University implements a co-mingled mixed dry recyclables recycling scheme across the campus. This scheme applies to all containers deployed both internally and externally. The introduction of the Strobe containers conflicts with this existing scheme and consequently the participation rates and volumes of material collected throughout the assessment period were reflected by these behaviour patterns.

The total volume of material collected during the assessment period at Swansea University was **1,422kgs**. **Figure 27** shows the breakdown of material collected across each of the five Strobe containers.

	Plastic Bottles		Cans	
	Gross Weight	Net Weight	Gross Weight	Net Weight
Fusion Cafe	166	60.5	61	55.5
Welsh National Pool	239	202.9	144	138.8
Wallace Building	275	240.05	173	128.65
Library	91	80	41	41
Lecture Theatre	151	149.5	81	61
Total Data	922	732.95	500	424.95

Figure 27 Breakdown of Material Collected at Swansea University

Of the **1,422kgs** of material, a total of **1,156kgs** was clean, high quality recyclable material. Like the implementation at Bangor, there were no communications materials deployed around Swansea University advising as to the whereabouts of the Strobe containers or how they should be used.

As Swansea implements a different recycling scheme and one which is done so using a variety of different containers, the introduction of the Strobe containers would be very different from anything else currently implemented across the campus.

The staff and students at Swansea University are used to simply using one container to collect all recyclable materials which affects their behaviour patterns. Source segregating is only used for the collection of glass. With that in mind, it was interesting to see that despite the existing scheme in place, the Strobe containers continued to produce encouraging levels of materials collected on a monthly basis.

Figures 28 and 29 demonstrate as a percentage how successful the Strobe containers were at engaging with the consumers who used them.

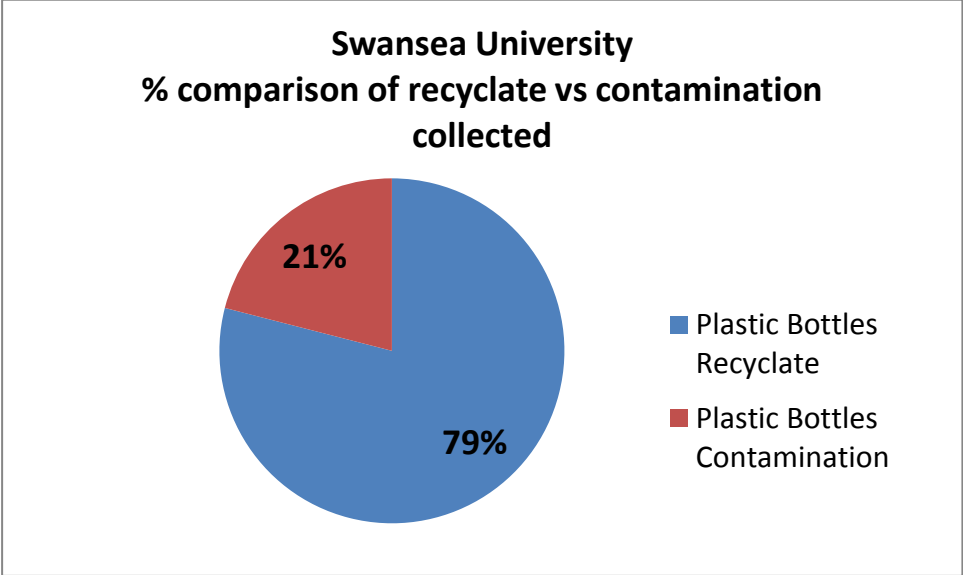


Figure 28 A total % comparison of recycle vs. contamination found in the Plastic Bottle receptacles

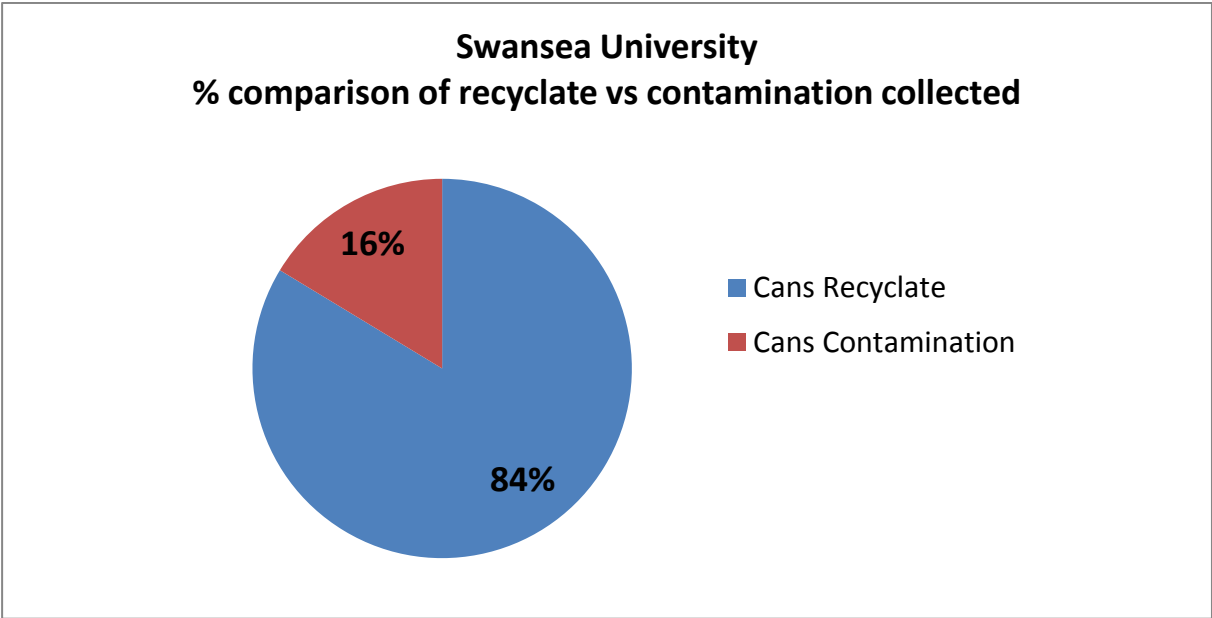


Figure 29 A total % comparison of recycle vs. contamination found in the Can receptacles

Unlike at Bangor University, the Strobe containers located externally at Swansea University were the ones which collected the greatest volumes of material. Of the five containers implemented only two were sited externally, **Wallace Building** and **Welsh National Pool** respectively.

The **Welsh National Pool**, despite being located within the grounds of Swansea University is a facility which is available to be used by the general public as well as staff and students of the University. This certainly would have been a contributory factor as to the amount of material it collected both clean recyclables and contaminants.

Figures 30 and 31 demonstrate the breakdown of material collected across all 5 Strobe containers throughout the trial period.

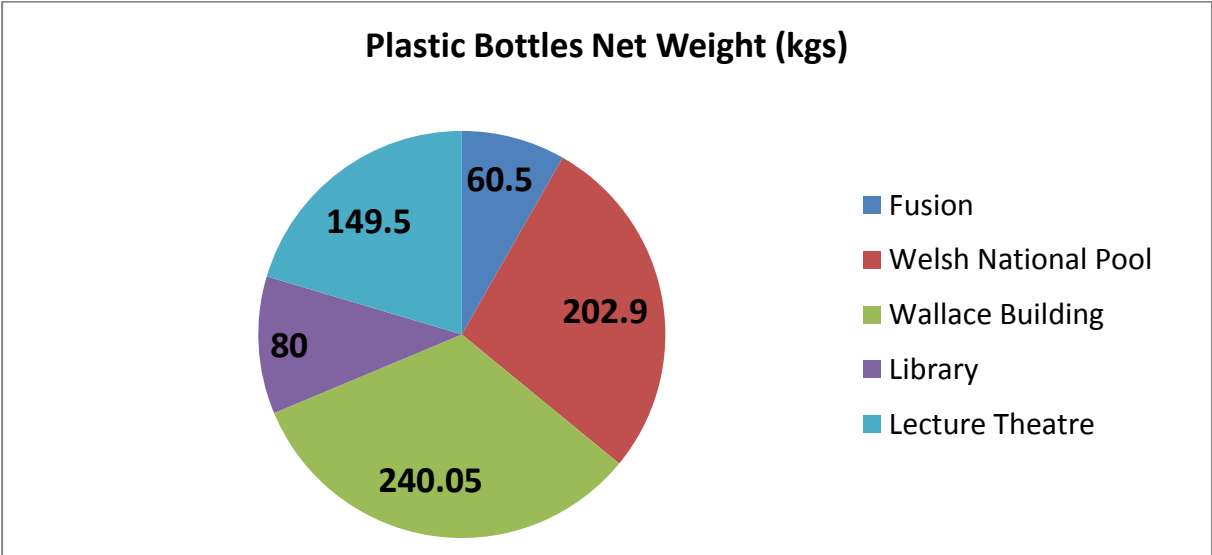


Figure 30 Net weight of Plastic Bottles collected by container location

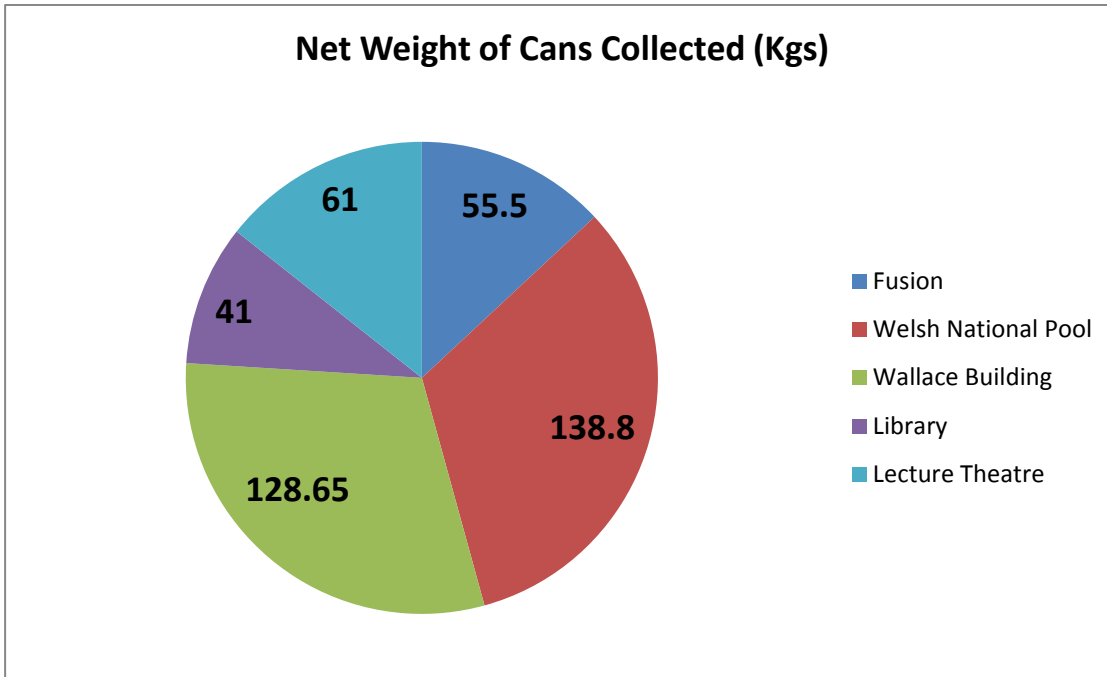


Figure 31 Net weight of Cans collected by container location

As an aggregated amount of material, **Fusion Cafe** collected the least amount of material within its Strobe. The likelihood for this is that throughout the course of its implementation, the Strobe located within **Fusion Cafe** was located directly alongside a water cooler, dispensing free water to anyone who frequented the cafe.

Another explanation for the performance of the container can be attributed to the fact that many of the consumers who purchased a drink within a plastic bottle invariably didn't finish the drink whilst they were within the cafe and subsequently took the plastic bottle away with them when they left the cafe.

Figures 32 and 33 demonstrate the volumes of materials collected across each of the containers on a monthly basis.

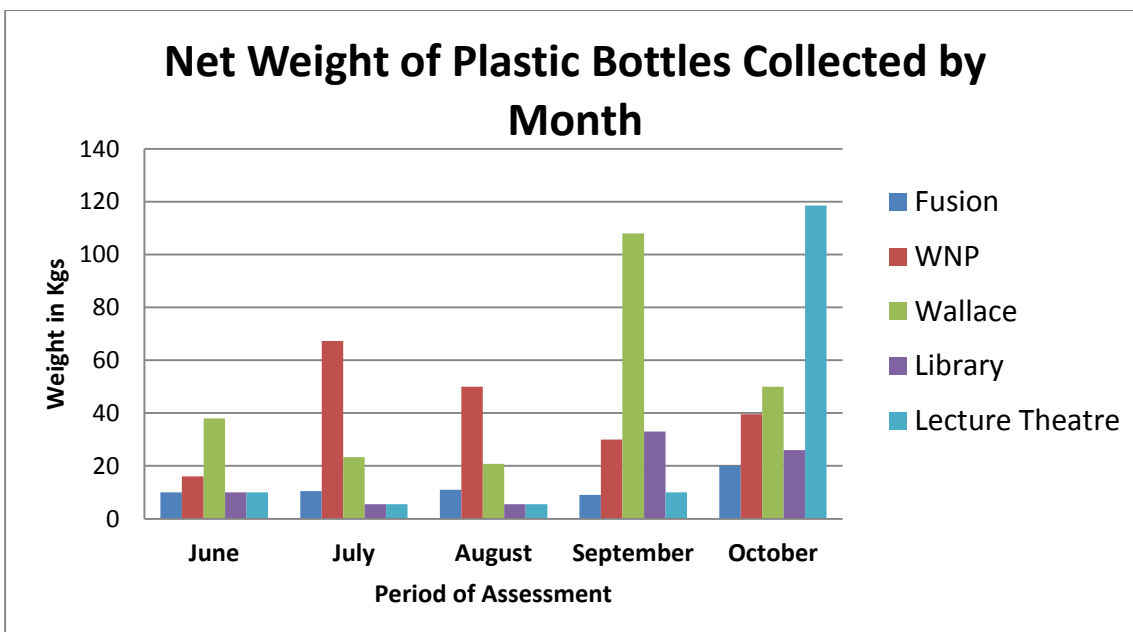


Figure 32 Net weight of Plastic Bottles collected by container per month at Swansea University

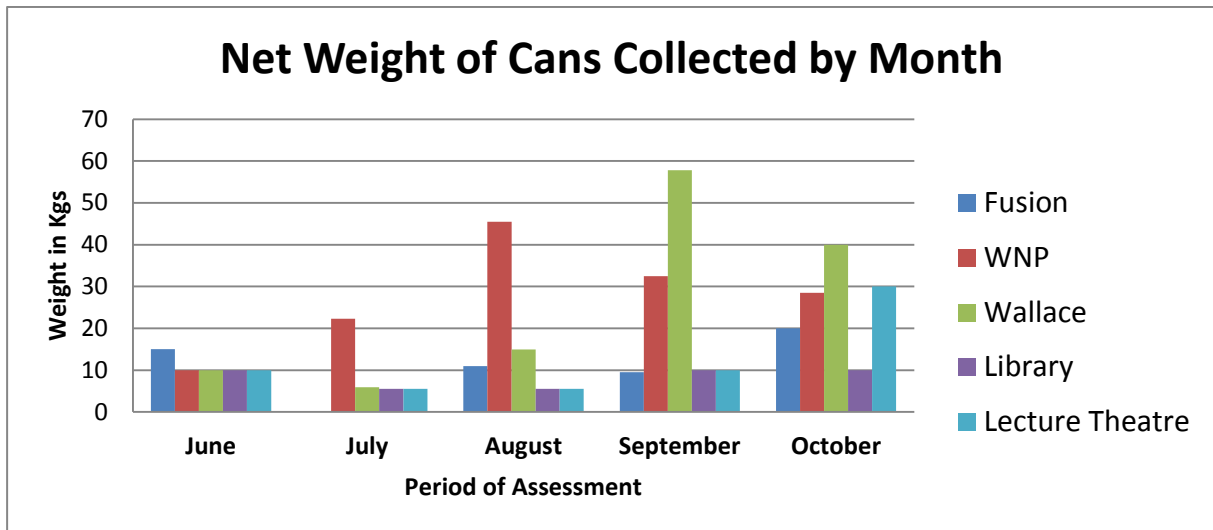


Figure 33 Net weight of Cans collected by container per month at Swansea University

The months of September and October saw the largest overall volumes of material collected across the trial period. The return of the student population would have been responsible for this growth in material collected. However as the graphs in **Figures 32** and **33** demonstrate, the largest volumes of plastic bottles and cans on any individual month occurred from the Strobe located at the Welsh National Pool during the months of July and August respectively.

7.0 Consumer Survey

In addition to the implementation of the Strobe containers into each university and the extensive assessments which were delivered, a consumer survey to understand first-hand what impact the containers have had upon the Universities was undertaken.

The survey sought to gain feedback from students to establish whether the introduction of a container which was significantly different to those already in situ across the campus would influence their behaviour when disposing of packaging (principally plastic bottles and cans) and whether the innovativeness of the containers affected their perceptions towards recycling or not.

The survey comprised of a series of short questions. **Figure 34** shows the survey questionnaire.

Innovative Container Recycling Project Survey	
Age:	
Gender:	
1.	How many times have you used the Strobe Recycling Container?
2.	What materials did you recycle?
3.	Does the appearance of the container attract your attention and encourage you to recycle or not? (Yes / No)
4.	Would you recycle more if all of the containers of campus were the same as the Strobe or not? (Yes / No)
5.	Do you think the interactive abilities of the container have an influence on whether you would use it to recycle or not? (Yes / No)
6.	Now you are aware of the container, are you likely to increase your recycling rate by using it more or not (Yes / No)
7.	Does being able to see inside the container at what materials are being collected make a difference to you or not? (Yes / No)

Figure 34 Consumer Survey Questionnaire

A total of 20 individuals were surveyed to gain their feedback on the Strobe container and ascertain whether its inclusion within the campuses would influence any behaviour changes and encourage an increase in recycling rates.

Figure 35 shows the results of the survey.

Innovative Container Recycling Project Survey - Results				
Age:	18-21	22-25	25+	
	9	9	2	
Gender:	Male	Female		
	11	9		
How many times have you used the Strobe Recycling Container?	Never	Once	Two - Five	More Than Five
	3	6	7	4
What materials did you recycle?	Cans	Plastic Bottles		
	6	14		
Does the appearance of the container attract your attention and encourage you to recycle or not?	Yes	No	Not Sure	
	15	3	2	
Would you recycle more if all of the containers of campus were the same as the Strobe or not?	Yes	No	Not Sure	
	18	1	1	
Do you think the interactive abilities of the container have an influence on whether you would use it to recycle or not?	Yes	No	Not Sure	
	12	5	3	
Now you are aware of the container, are you likely to increase your recycling rate by using it more or not?	Yes	No	Not Sure	
	16	4	0	
Does being able to see inside the container at what materials are being collected make a difference to you or not?	Yes	No	Not Sure	
	19	1	0	

Figure 35 Survey Results Table

The demographic of those who were invited to participate in the survey was an evenly split mix of male and females. Whilst the Strobe containers are located in areas of each campus which are principally frequented by students, staff was also invited to take part in the survey.

Of those individuals surveyed, almost half of the individuals had only used the container either once or never. Having now been made aware of the container, what it looks like and what its purpose in terms of collecting material is concerned, it was encouraging to see that over two thirds of the surveyed audience felt that the container would influence them to use it more often and therefore increasing the amount of recyclables collected.

Understanding that the objective of the trial was to ascertain whether the introduction of an innovative container would influence recycling rates and yield a cleaner material stream, the results of the survey which supported the assessment program indicate that the interactive functionality of the Strobe would have a positive effect on those individuals who participated in the survey.

One of the innovative features which the Strobe container possesses is the ability to see what materials are actually being collected inside of the containers. Like shopping for food, consumers who like to see the products they are purchasing, individuals who recycle are encouraged to see what materials are being recycled alongside the packaging they dispose of for recycling too.

The survey demonstrated that 95% of those who were questioned were influenced to recycle more by being able to see what was actually being disposed of for recycling.

Despite the age ranges of those surveyed, it is clear to see that the appearance of the Strobe container, coupled with its innovative features has the ability to influence behaviour patterns and encourage a greater level of participation towards recycling.

8.0 Findings

The trial demonstrated that the Strobe containers work effectively and can make a real difference to the quality and quantities of recyclate collected. Were recycling schemes to be introduced from inception using the Strobe containers then the innovative nature of them would certainly enhance participation rates and derive an increase in higher quality recycling.

The key findings from the trial are:

- The Mixed Recycling collection scheme at Swansea University effected the performance of the Strobe containers at Swansea due to its different approach to collecting recyclables
- The visual appearance of the Strobe containers encouraged positive recycling
- Bangor University's better performance was largely due to fact that the Strobe complimented the existing source segregated recycling scheme
- Strobe containers collected more material from external locations than internal locations
- Contamination found was typically food and drink related
- Consumer feedback is very high and positive towards the Strobe container
- Strobe container proved that it has the ability to influence behaviour change and enhance recycling rates
- Lack of consistency towards recycling is a barrier. The Strobe containers had a genuine impact in certain areas of each campus. Were there a greater level of consistency then arguably the impact would have been greater still

Taking all of these key findings into consideration and recognising that over the entire trial period, the Strobe container achieved an 88% recycling rate it is proven that the container and the trial as a whole was a success.

9.0 Conclusion

This report concludes that the trial implementation of a series of bespoke manufactured containers integrating various elements of innovativeness has been a success. An 88% recycling rate for the strobe containers was achieved across the duration of the trial period.

The trial has collected substantial volumes of material from the introduction of only 10 containers, all of which are distinctly different in their appearance to those containers which currently exist across each of the two Universities participating in this trial. Had the trial been undertaken across several months of term time when all the students were on campus, it would be anticipated that the volumes of materials collected would be even greater than those which this trial collected.

What this report is unable to conclude is whether the interactive elements of the Strobe container has been a contributory factor in the volumes of material collected and the impressively low levels of contamination which were present during the assessment periods.

A further trial could have been tested by isolating each of the individual innovative features of the strobe container. This wasn't done during this trial period principally because of the students being absent from the campuses during the summer months. Had the trial been undertaken during a period of continual student attendance then this would have been an additional feasible study to have delivered.

Where the strobe container has been a success has been through its visibility and ease of use for the consumer at the point of disposal of recyclable materials. The design of the container leaves the consumer in no doubt as to what materials it is collecting and how it should be engaged with.

Were the trial to have supported the implementation of the Strobe containers with a communications programme then this would have acted as a beneficiary too.

From the information gathered through the consumer surveys, coupled with the assessments which were undertaken, it is clear to see that the container has the ability to influence behaviour towards recycling. The landscapes in which this trial has been undertaken, whilst identical in their nature of being academic institutions are vastly different in how they currently operate a recycling collection scheme.

In order to fully assess whether the Strobe containers alone are able to influence the behaviour patterns of consumers, this report recommends adopting further trials with the ability to remove existing recycling containers and replacing them with the Strobe containers. The ability of the Strobe to be customised to suit any given location makes it a market leading container and one which will have a hugely significant impact upon locations and environments in the future.

The consumer feedback gained through the surveying process supported the theory that the Strobe container could genuinely make a difference were it implemented fully across either of the locations. With its ability to influence consumers through its innovative features as well as providing consumers with the opportunity to see directly into the recycling receptacles, the container has all the facets to make it a market leading container which could have significant impacts upon a whole variety of locations and environments wherever it is implemented.

10.0 Appendix 1

10.1 Baseline Data

In advance of the implementation of the innovative containers into both Bangor and Swansea universities, a dataset of recycling information was provided by both establishments, providing a breakdown of what materials are currently recycled with the organisations and to what volumes.

For the purposes of this report and the project as a whole, the datasets which have been referenced solely relate to those material streams which will be directly affect by the project. In addition to those material streams (Plastic Bottles and Cans); datasets have also been referenced to include glass and paper.

These four material streams are the embodiment of the most prevalent streams which staff, students and visitors to the universities will dispose of whilst they are working within the university buildings.

The datasets only represent the volumes of the material streams which were collected directly from the university buildings themselves and do not include associated buildings such as student accommodation or in the instance of Swansea University, the Welsh National Pool.

Provision of this data has been supplied directly by the waste management company's responsible for the respective universities and therefore is finalised and verified.

Each university handle their recyclables in different ways and as such the information reported within this document represents the differences between the source segregated collection methods of Bangor University and the mixed recycling collection (DMR) methods of Swansea University.

The baseline data upon which this report is founded reads as:

University	Plastic Bottles	Cans	Glass	Paper/ Card	Mixed
Bangor	3.71	2.97	28.13	57.28	
Swansea			34.78	9.08	93.86

In addition to the datasets provided, Swansea University are supplied with a further breakdown which records the volumes of contaminated recyclables collected. This dataset indicates those materials which were collected for recycling but have had to be removed from the recycling stream due to over contamination. This report makes provision for the contaminated material in order to give a balanced comparison when compared to Bangor University.

The likelihood for the substantial volume of contaminated material, almost 18% of all the collected material, is due to the collection methods. Whilst a DMR collection scheme has its obvious advantages, it is proven that from a quality of recyclate perspective, disposing of the material in a source segregated manner will always provide a far cleaner recycling stream.

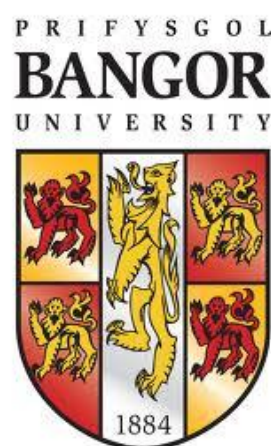
University of Bangor Data

Bangor University is a Welsh University based in the city of Bangor in the county of Gwynedd in North Wales. It received its Royal charter in 1885 and was one of the founding Member institution of the former federal University of Wales.

It was officially known for most of its history as the **University of Wales, Bangor**. From September 2007 the University became known as **Bangor University**, having become independent from the Federal University of Wales. In the 2008 Research Assessment Exercise, almost 50 per cent of all research at Bangor University was assessed as world-leading.

Bangor is ranked 251 of the world's top universities. It is also rated top in Wales and is in the top 15 of UK universities for teaching excellence according to the Sunday Times University Guide 2012.

Admin. staff	2,000
Students	16,605
Undergraduates	8,460
Postgraduates	2,055
Other students	6,085



The University of Bangor collect all of their dry recycling in a segregated manner. The datasets which have been collected from the university represent the four key material streams which the university collect.

These are

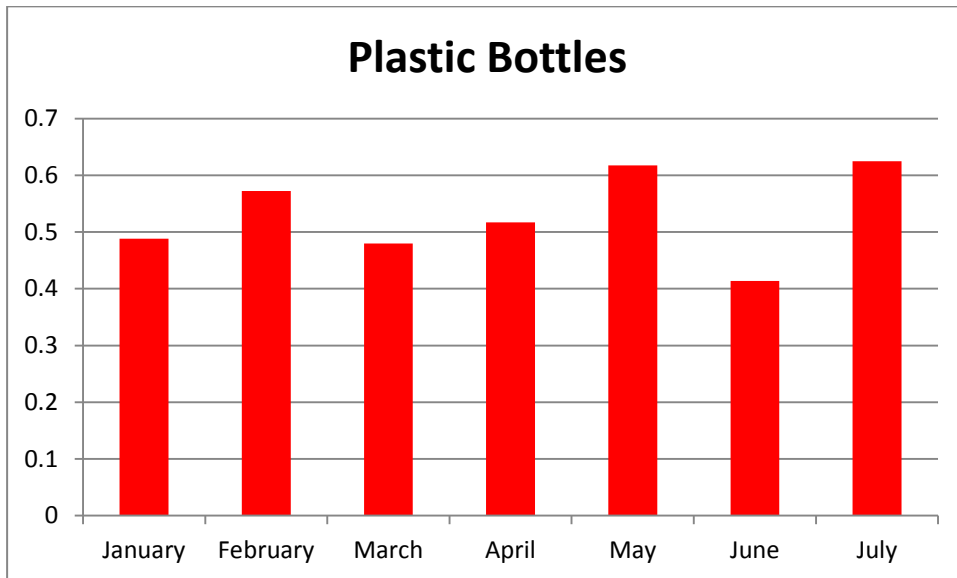
- Plastic Bottles
- Cans
- Paper
- Glass

In addition to these material streams, the university also recycles Wood, Green Waste, Food Waste, Metals and WEEE. However for the purpose of this project, these additional material streams and their associated data is not required.

The data which has been supplied by the university covers the period January – July 2012. For this period, the university achieved **an overall recycling rate of 34.6%**, which equates to **235 tonnes** of recyclate collected and forwarded for onward recycling. The total tonnage of the materials recycled, which are referenced in this report equate to **92.08 tonnes**.

As the University collect their recyclables in a source segregated manner, the data which has been supplied gives an insight into how much volume of material is being collected across the University buildings. It should be noted that this data is representative of the University buildings alone and **does not** cover any of the student accommodation buildings.

Plastic Bottles



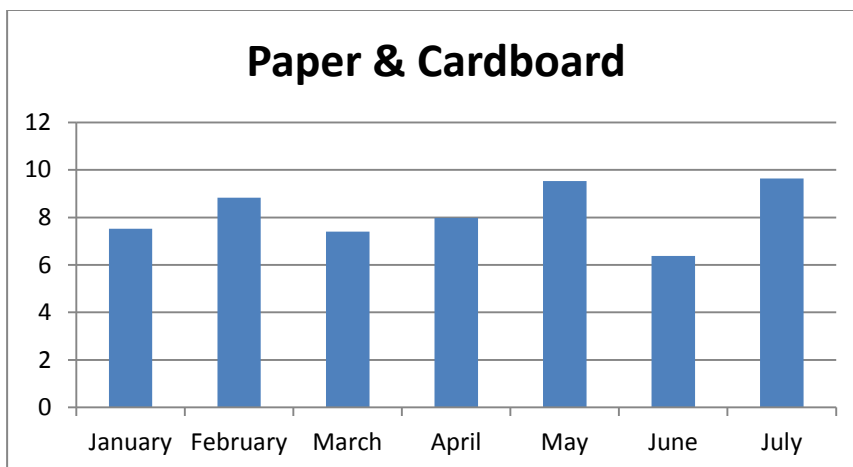
Plastic bottles represent arguably one of the easiest material streams to be collected for recycling. By their very nature, they are clean and contaminate free (unless still holding fluids) at the point of their disposal.

The recycling tonnage for plastic bottles across the university appears to average around ½ tonne per month of plastic bottles collected across the university buildings with a total of **3.7 tonnes** collected across the reporting period. A tonne of plastic bottles equates to approximately 22,000 bottles, this information indicates that between 10,000 and 15,000 bottles are regularly being collected on a monthly basis. *That is less than 1 plastic bottle per student per month which is actively being collected for recycling.*

With the installation of the new containers as part of this project, it is anticipated that the visibility which the containers will have will provide an extended opportunity to significantly increase this recycling rate and influence the students and staff alike to recycle more of their bottles whilst they are within the university buildings.

Paper / Cardboard

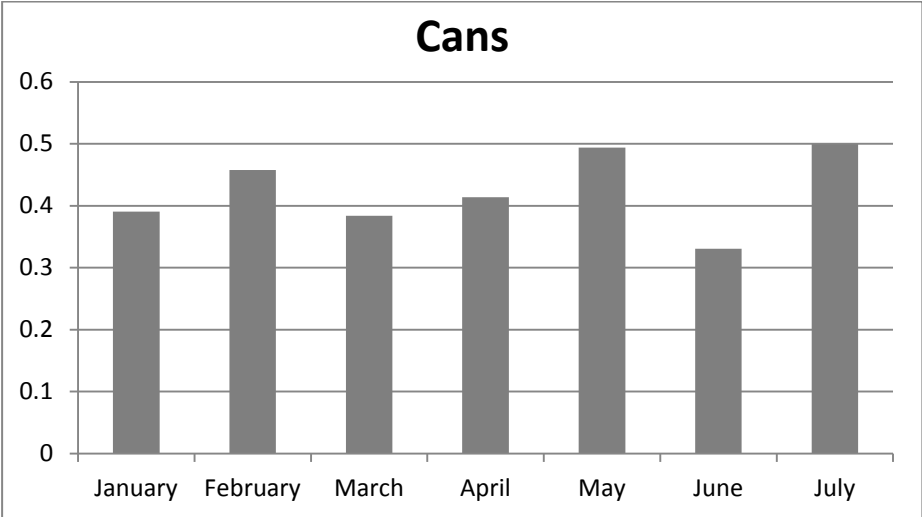
The University collects its paper and cardboard for recycling together, co-mingled and present it to their waste contractor as one material stream. As such, there is no split recycling data between paper and cardboard. Until 2011 the university collected both cardboard and paper separately.



The volumes of paper and cardboard which the university recycles on a monthly basis is substantial and represents the largest material stream recycled across the entire university, accounting for over a 1/3 of the total materials collected for recycling.

On average the university is recycling **8.1 tonnes** of paper and dry cardboard per month. Across the reporting period, the university recycled **57.2 tonnes** of paper and cardboard.

Cans



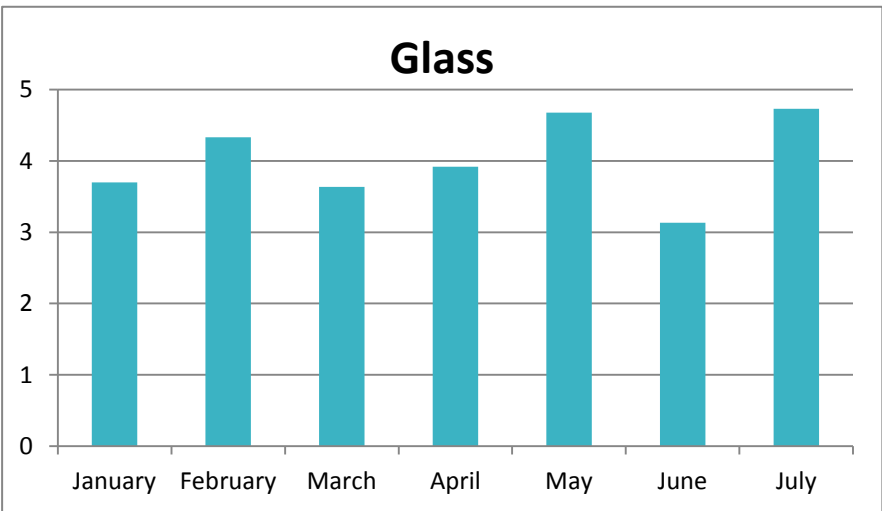
Across the reporting period, the university collected **2.9 tonnes** of cans for recycling.

The volume of cans collected within the university buildings is relatively low although remarkably comparable to the volume of plastic bottles collected which seem to indicate a number of possibilities as to why this is so:

- There are very few opportunities to recycle these material items throughout the building
- The number of outlets selling these items of packaging across the university are limited and therefore the consumption rate is relatively low
- The majority of cans sold and consumed are simply disposed of rather than collected for recycling.

Alupro reference that between 50,000 and 60,000 cans represent 1 tonne. Based upon the volumes of cans collected across the period, Bangor University is averaging a collection volume of 0.42 tonnes or 20,000 - 24,000 cans per month, *just over 1 can per student per month*.

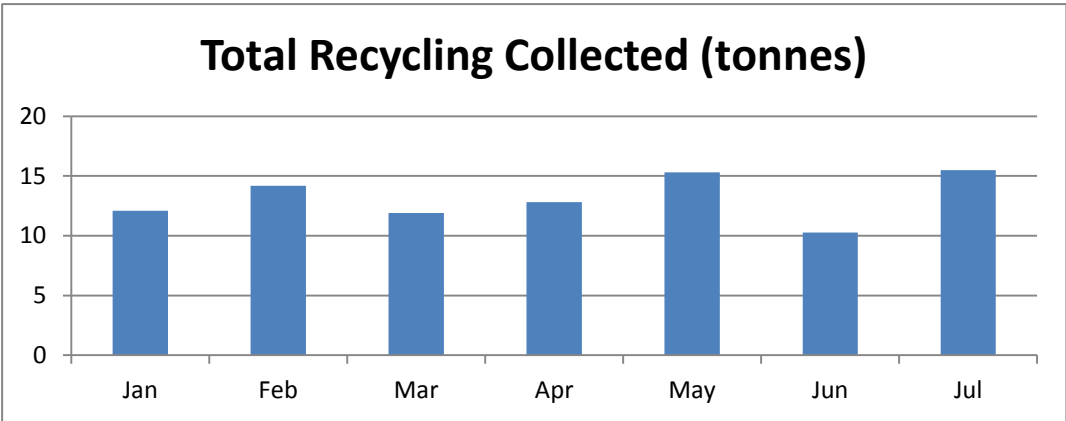
Glass



The volume of glass collected for recycling when compared to the other recyclables collected is extremely high. Naturally the weight of the material would reflect upon the volumes which are collected, however when consideration is given to the fact that none of these datasets represent materials collected across the student accommodation areas, then it is very surprising indeed. As a total for the reported period, **28.12 tonnes** of glass were collected in a segregated manner and then forwarded for onward recycling.

Total Recycling Data

When compiled together as a complete dataset, the volumes of recyclable materials which the University of Bangor have collected would appear to be relatively low. However, whilst the overall levels are seemingly low, it is anticipated that the quality of the material would be extremely high due to the fact that it is collected in a source segregated manner. Each material stream is retained segregated until it is presented to the waste management contractor.



For the period January to July 2012, the university collected a total of **92.08 tonnes** of recyclable material, based upon the 4 material streams which are referenced within this document. As an average, the university collected **13.15 tonnes** of material per month. The graph showing the monthly breakdown indicates that with the exception of June (a time when the majority of students would be absent from the university buildings) the collection rates are almost parallel on a monthly basis.

Without the consumption rates of items such as cans and plastic bottles, it is difficult to assess whether the volumes which this report indicates are being collected are encouraging or not.

11.0 University of Swansea Data

Swansea University is a university located in Swansea, Wales, United Kingdom. Swansea University was chartered as **University College of Swansea** in 1920, as the fourth college of the University of Wales. In 1996, it changed its name to the **University of Wales Swansea** following structural changes within the University of Wales. The new title of **Swansea University** was formally adopted on 1 September 2007 when the University of Wales became a non-membership confederal institution and the former members became universities in their own right.

It is the third largest university in Wales in terms of number of students. The university campus is located next to the coast at the north of Swansea Bay, east of the Gower Peninsula, in the grounds of Singleton Park, just outside Swansea city centre. Swansea was granted its own degree-awarding powers in 2005 in preparation for possible changes within the University of Wales.

Admin. staff	2,500
Students	18,445
Undergraduates	11,730
Postgraduates	2,145
Other students	4,570



Unlike the University of Bangor, Swansea University provide their students, staff and visitors with a DMR (Dry Mixed Recycling) collection scheme. This means that all the material streams referenced within this report, with the exception of glass are shown as a single dataset.

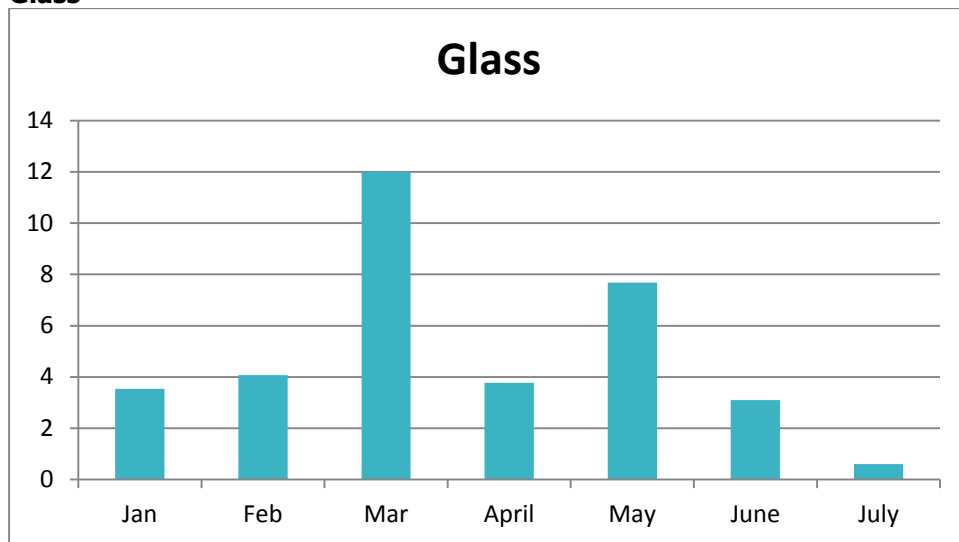
The collection of recyclables as DMR rather than source segregated has its obvious benefits. From an operative's perspective, it simply means emptying one container rather than several to collect up the same material items. It also means that fewer containers are required to collect the recycle, which in itself becomes a cost saving.

However, where quality of recycle collected is concerned, a DMR collection scheme is far more likely to be subject to an increase in contamination. The reason for this is perception. Any person engaging with a DMR collection unit, unless the communications plan which underpin the scheme is explicit in outlining exactly which materials are to be collected, is left to make a judgement in terms of what can and cannot be placed within the container.

The scheme at Swansea University is a proven case study where a DMR collection scheme is subject to high proportions of contamination.

With the exception of glass, all of the other material streams which this study is focusing on are collected as part of the Dry Mixed Recycling (DMR) scheme.

Glass



The graph shows that the university has collected a greater volume of glass when compared with the University of Bangor. Where the volumes collected differ, is that there are no obvious consistencies.

A total of **34.7 tonnes** of glass were collected over the reporting period, with 2 months where the average volumes were doubled or even tripled. This is almost certainly due to a specific event being hosted within the University building during the months of March and May respectively.

All of the glass collected was done so in a segregated manner, which ensures that the material stream is of the cleanest quality possible, prior to forwarding for onward recycling.

Dry Mixed Recycling

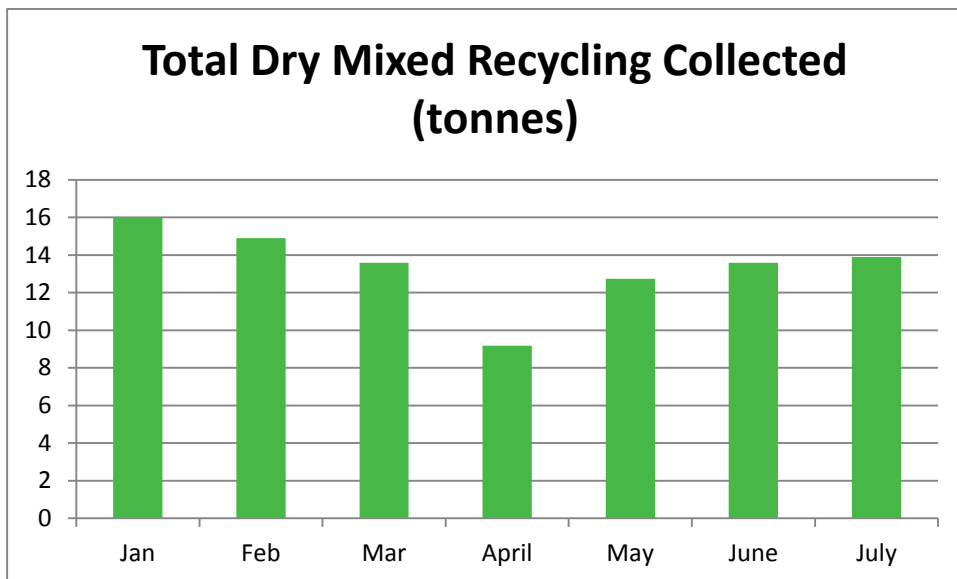
The Dry Mixed Recycling (DMR) collection scheme across the University collects the following material streams:

- Plastic Bottles
- Cans
- Paper (including newspaper and magazines)
- Cardboard

The generation of cardboard via students and staff throughout a typical day is likely to be minimal and as such the inclusion of cardboard into the collection scheme is one factor which can lead to increased contamination. Many food based products which are sold for immediate consumption such as sandwiches as pizzas will be housed within cardboard packaging.

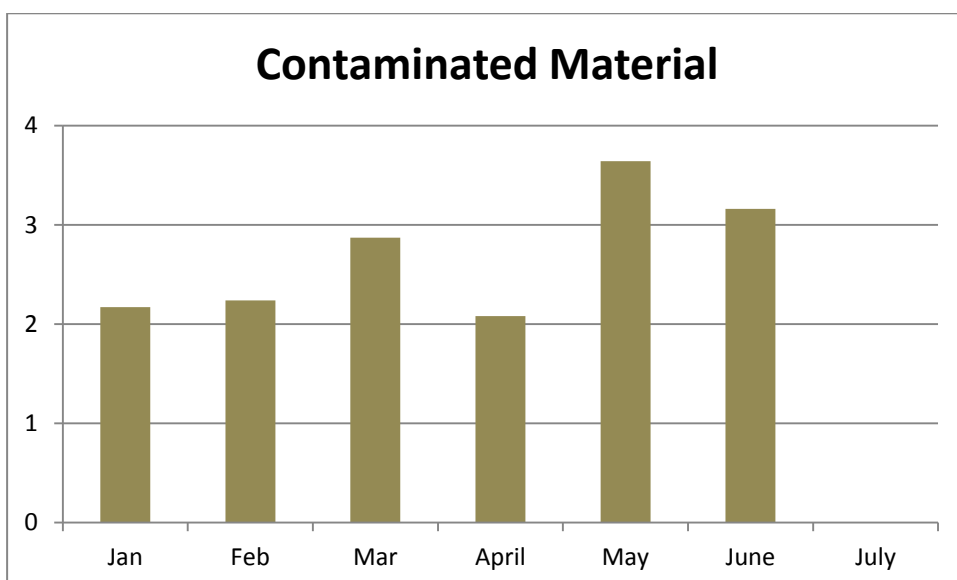
The food residues which would be prevalent within those boxes which will ultimately cause contamination across all of the other materials which have been placed into the container for collection.

The data which the University has collected demonstrates an impressive level of material collected across the buildings. This dataset purely relates to the university buildings alone and does not include any recyclables collected within the student accommodation buildings, nor does it account for any material collected within the Welsh National Pool which is adjacent to the university.



The total volume of recycling collected through the DMR scheme across the reporting period was **93.8 tonnes** of material.

This Figure represents the total volumes of all materials placed within the DMR containers, including any contamination which will have been present.



Whilst **93.08 tonnes** of mixed recycling was collected, the graphic above highlights the volumes of contamination which was found within that material.

A total of **16.1 tonnes** of contaminated material was reported by the waste contractor, averaging at 2.5 tonnes of contamination per month. This contamination is almost certainly likely to be caused through a lack of communications materials to assist the scheme in its operation which results in assumptions being made about what materials the containers can and cannot collect.

The strobe unit deployed across Swansea University was explicitly marked with which material streams there are collecting. It is this type of container that will almost certainly yield a higher quality of recycle collected.

Paper

Whilst paper is collected as part of the DMR scheme, there are a couple of areas across the university which collect paper separately from the comingled scheme.

The table below shows the volume which has been collected across the reporting period.

Month	Tonnes
January	0
February	0
March	4.56
April	0
May	0
June	0
July	4.52

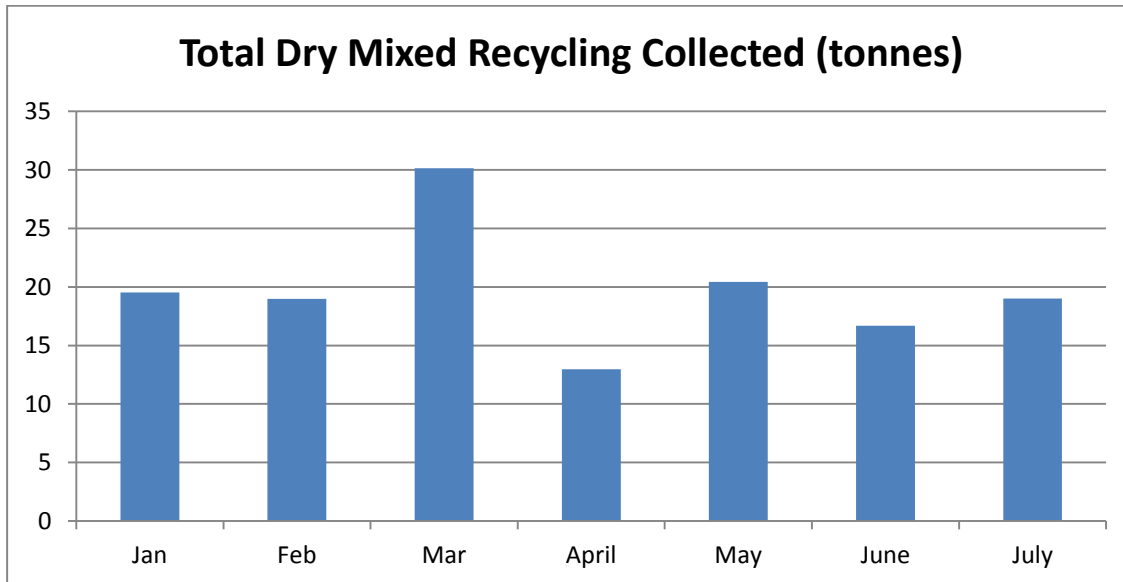
A total of **9.08 tonnes** of paper was collected and forwarded for onward recycling.

Total Recycling Data

The total volume of all material collected for recycling by Swansea University is an impressive **137 tonnes** of material. The graph shows the monthly break down of all the collected materials

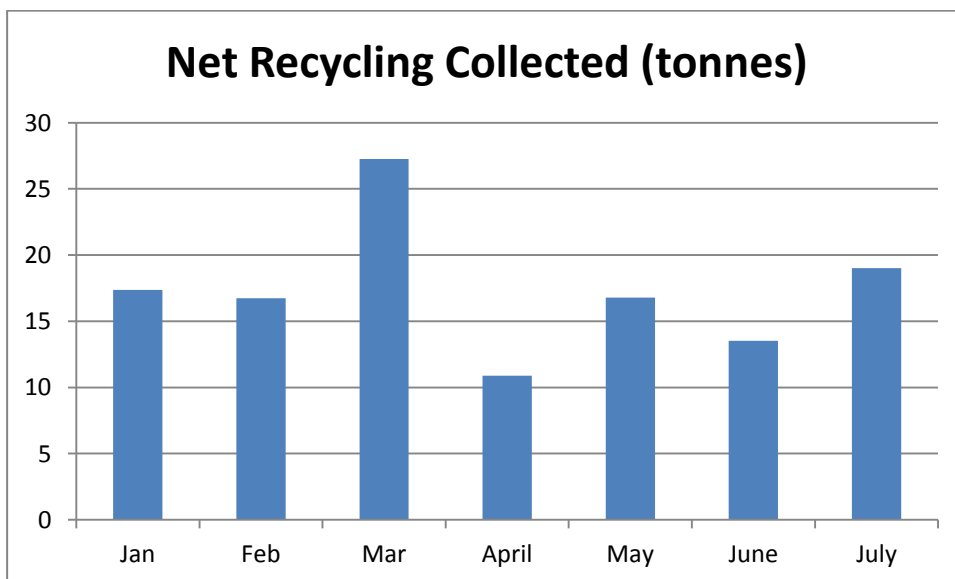
Dry Mixed Recycling materials include:

Plastic Bottles, Cans, Paper, Cardboard and Mixed Plastics (such as sandwich cartons and plastic packaging).



The above graphic shows the entire volumes of material collected as recycling. This data also includes the volumes of contaminated materials, which would be discounted as the likelihood is that the waste management contractor, having deemed them to be contaminated, would be unlikely to process them for recycling and therefore they would be committed to landfill.

The revised graph below shows the net recycling data once the contaminated materials have been discounted.

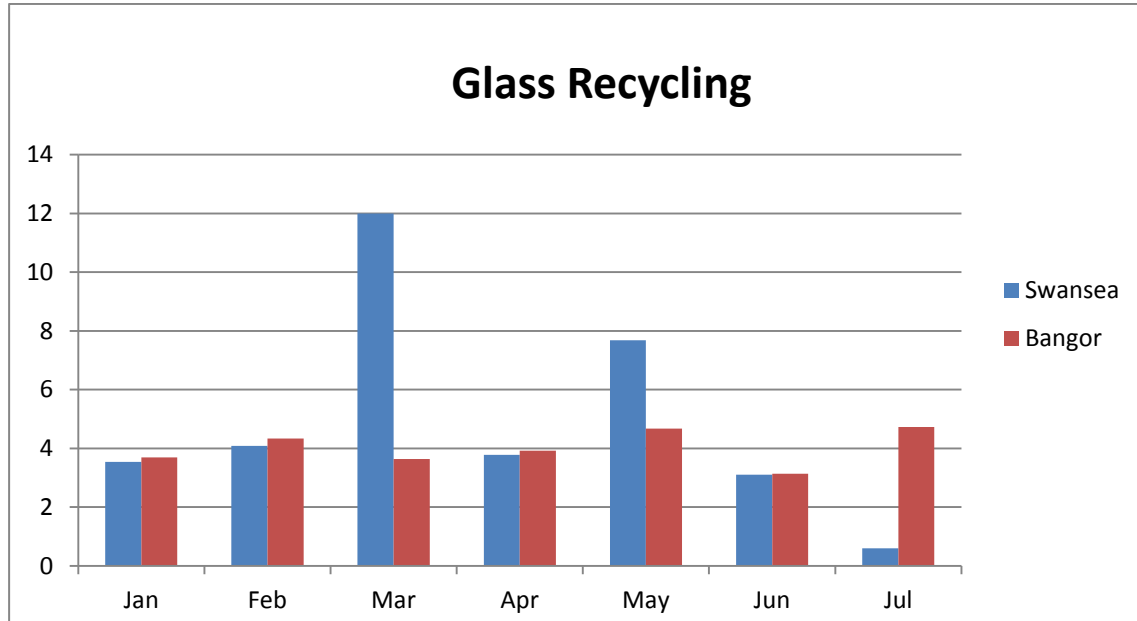


When subtracting the volume of contaminated recyclate from the total material collected, the overall net recycling volume becomes **121.56 tonnes** of material which would have been forwarded for onward recycling.

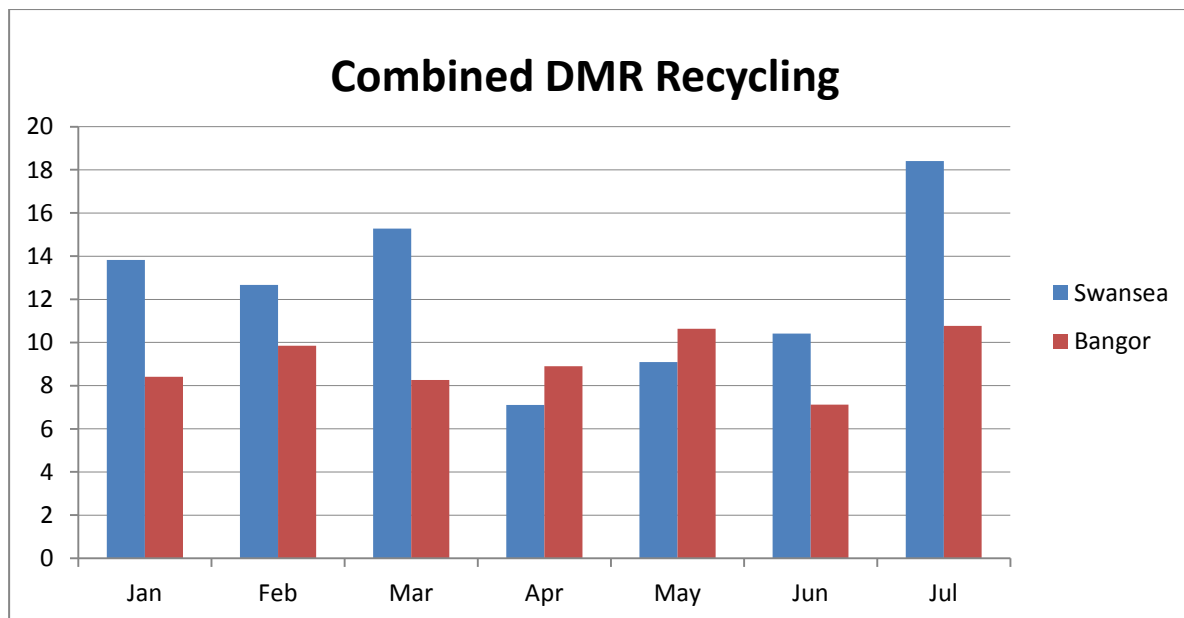
12.0 Comparison Data Sets

The graphs below show a side by side comparison of the material streams collected by each of the universities.

When comparing the data from Bangor University, the material streams of plastic bottles, cans and paper are rounded together to be comparable against Swansea University's DMR collection scheme.



With the exception of March, where clearly there was an exceptionally high volume of glass collected, both universities appear to be collecting very similar volumes of glass throughout the university buildings.



The data shown in the **combined DMR graph** represents the *net recycling volumes collected* from each university. The volumes of contaminated material which were present within the Swansea material have been deducted to produce this comparable graphic.

Based upon the size of each university and its respective population, the recycling rates are highly comparable. There are no known or reported contaminated volumes of material from Bangor University.

13.0 Raw Data Sets

The raw data sets used to compile this report are shown below. All Figures are represented in tonnes.

Glass	January	February	March	April	May	June	July	Total
Swansea	3.54	4.08	12	3.78	7.68	3.1	0.6	34.78
Bangor	3.70	4.33	3.64	3.92	4.68	3.13	4.73	28.13

Swansea University	January	February	March	April	May	June	July
Paper			4.56				4.52
Mixed Recycling	2.6	3.08	2.42	1.05	2.32	2.55	1.2
Mixed Recycling	13.39	11.82	11.16	8.13	10.42	11.03	12.69
Total	15.99	14.9	18.14	9.18	12.74	13.58	18.41

Swansea University	January	February	March	April	May	June	July
Contaminated Recycling	2.17	2.24	2.87	2.08	3.64	3.16	0

Bangor University	Cans	Paper & Cardboard	Plastic Bottles	Totals
January	0.39	7.53	0.49	8.41
February	0.46	8.82	0.57	9.85
March	0.38	7.40	0.48	8.26
April	0.41	7.98	0.52	8.91
May	0.49	9.53	0.62	10.64
June	0.33	6.38	0.41	7.12
July	0.50	9.64	0.62	10.76
Total	2.97	57.28	3.71	63.95

**Waste & Resources
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