

Recycle Môr



RECYCLING END OF LIFE FISHING GEAR IN PEMBROKESHIRE

PILOT PROJECT REPORT





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Introduction

End of Life (EoL) Fishing Gear is a well-known problem that causes vast amounts of damage to wildlife and to the economy (Nikiema & Asiedu, 2022). Wales and Pembrokeshire in particular, heavily relies upon the marine environment for its economy (Matzarakis et al., 2004). Lost and discarded fishing gear is known as ghost gear as despite not being in use, continues to catch fish, which attracts other fish, creating a vicious cycle that continues until the lost gear is retrieved or degrades (Derraik, 2002). Once broken down into microplastics, the plastic then damages the industry from the bottom of the food chain, contaminating the primary consumers and working its way up the food chain to the end consumer products (Hernandez-gonzalez et al., 2018). Despite this, there is poor management of the waste in Wales with many harbours having inadequate or no waste facilities for commercial fishers. If there are waste facilities present, very little is being recycled.

Recycle Môr aims to reduce this problem by providing free to use, easily accessible, EoL fishing gear recycling bins in all commercial harbours, regardless of size. Most of the largest harbours around the UK have recycling bins for their EoL fishing gear already but smaller harbours in more rural areas such as Pembrokeshire make up much of the fleet but are not provided for. The Recycle Môr project aims to cover this gap and is piloting this scheme in 6 harbours across Pembrokeshire. To help fund the project and use the EoL fishing gear for the high-quality material it is, the EoL fishing gear is recycled into new, useful, and high-quality products.

The project is being managed by Sea Trust Wales, a registered charity, based in Goodwick, Pembrokeshire. The charity's main aim for the project is to reduce the amount of plastic and ghost gear in the ocean to improve the environment and conserve Pembrokeshire's wildlife. Sea Trust has a history of working with local fishers and through this connection a local fisher alerted Sea Trust to the extent of the problem with fishing waste in the local area after he spent four hours clearing his lobster pot lines of fishing industry waste. Sea Trust is working in partnership with Waterhaul, an environmentally conscious social enterprise that recycles EoL fishing gear into products such as sunglasses, litter pickers, knives and litter picking rings. Sea Trust is a member of the Wales Clean Seas Partnership, a partnership formed to reduce marine plastic pollution involving all major interested organisations with a clear action plan that has clear objectives that support the work of the Recycle Môr Pilot. The project is being funded by the Pembrokeshire Fisheries Local Action Group (FLAG) via the European Maritime & Fisheries Fund (EMFF) and is also funded by visitors to the Sea Trust aquarium.

There is a lack of data on the type, amount and quality of waste material that originates from the fishing industry and specific harbours across Wales. A recent report by the Welsh Government started to answer these questions (Government et al., 2020). Our report will dive deeper into this topic and show data from six specific harbours in Pembrokeshire. This data can then be used to inform future movements and aid in the proper collection and recycling of the waste created.

Aims

The project has two main aims:

- Engage with the local fishing communities to encourage recycling of EoL fishing gear
- Create a low-cost system that collects and recycles EoL fishing gear from small fishing communities across Pembrokeshire

Methodology

To achieve these aims we will create a basic collecting, storage, cleaning, and sorting methodology to add value to the material that can be replicated across Wales using volunteers on a small budget. To add further value, we will recycle the material collected to the highest possible standard using our partner Waterhaul. The future goal will be recycling the material back into fishing gear, working towards a circular economy.

The project is quite simple, and the bulk of the project includes four steps: collecting, recording, sorting, and dispatching. The main challenge is interacting with the harbours and fishers to get permission to place a bin and encourage the fishers to use the bin correctly. To serve as a reminder and to provide information to the fishers and harbour masters we created digital artwork to be printed as stickers and added to the harbour side bins.

Engagement

Engaging with fishers, stakeholders and the public is crucial to the success of the pilot, to do this we have created attractive and eye-catching artwork, developing a trustworthy brand image.

Logo

The first stage of creating a positive project image is to create a logo that can be used on different media. Figure 1 shows a few examples of the logo artwork professionally designed to ensure a high quality finish.



Figure 1. Various logo designs



Bin Signage

Once the logo was finished, we could then add this to our essential signage. Figure 2 shows the main signage created, a clear permanent notice to show what the bin was used for, what items could be placed in the bin to be recycled and who was running the upkeep of the bin.



Figure 2. Bin information stickers in Welsh & English.

Additional signage was created later on in the project to help encourage public and fisher participation to reduce costs and engage further. While collecting the material from the bins, interest was generated, developing into conversations inspiring offers of help from the public in terms of volunteering, collecting and delivering material from their local bin to the sorting area as well as donating to the project to help continuation after the pilot study. To continue this support when there wasn't a member of staff present and collecting material, more bin signage (figure 3) was created showing people how they could help the project succeed.



Figure 3. Bin stickers to show people how to help with the project.

Throughout the pilot it was becoming clear that we need to reduce costs to ensure the long term sustainability. One way of achieving this is minimizing collections of bins that are not full. Another bin sticker was created asking fishers and harbourmasters to notify us when the bin was full (figure 4).



Figure 4. Bin sticker detailing what to do if the bin is full or if there are any problems.



Public Engagement

As Sea Trust is a charity, we already engage with the public through events, social media and at our headquarters at the Ocean Lab, Goodwick where we host over 5000 visitors per year. To engage with the public, a bilingual floor to ceiling banner sign was created displaying a complete overview of the project encouraging participation and help with the project. The artwork for the banner can be seen in figure 5.

Figure 5. Project information banners for visitors to the Ocean Lab in English & Welsh.

Collection Methodology

To give an overview of how the physical aspects of the project were completed, below is a description of how each stage of the process was completed from collection of the material, to recording and sorting it, to finally dispatching to be recycled by our project partners. As well as the physical methods of the project, a large portion of the project time and resources was allocated to time spent at the various harbours talking to the fishers, learning about their wants and needs and building a relationship.

Collection

- Drive to each harbour with a trailer (Saundersfoot, Tenby, Neyland, Solva, Porthgain and Lowertown Fishguard).
- Empty bin by hand using gloves and put contents into a dumpy bag loaded on the trailer as seen in figure 6.
- Have a separate dumpy bag for each location to keep amount separate for data collection.
- Record notes on how the bin has been treated, what items have been deposited, unusual or potentially recyclable items of most interest. Also make a note of how full the bin is, this can inform future decisions on frequency of collections.
- Drop off at collection area at the Ocean Lab.



Figure 6. Bin collection at Lowertown - Fishguard.

Recording

- When collecting from harbours, record the date, harbour, material collected and any comments from fishers.
- When dropping the collections off at the Ocean Lab, sort the collections into separate materials and record the weight of each material individually.
- When sending off the material, record how much of each material is delivered to Waterhaul each time.

Sorting

- Sort the waste with gloves into separate dumpy bags (figure 7) for rope, monofilament net, HDPE trawl net, bait bags and rigid plastic (see figure 8 for examples).
- Make a note of common plastics and their material so tests do not have to be done in future.
- Spray paint numbers onto dumpy bags for reference.



Figure 7. Volunteers sorting waste at the Ocean Lab.



Dispatching

- Weigh bags using engine lift and stack onto pallets (figure 9).
- Break up a spare pallet to create supports or use a gaylord giving the structure a solid base as seen in figure 10.
- Use ratchet straps to secure.
- Move pallets using forklift onto tarmacked area for pick up (figure 10).



Figure 9. Staff & volunteers weighing



Figure 10. Waste sorted & ready for dispatch to Waterhaul.

Processing

Material received by Waterhaul at their Cornwall hub was evaluated, further segregated, and then fed into their respective recycling streams. Most of the materials from the pilot were combined with fishing gear collected from other locations by Waterhaul for recycling to make up economical batch sizes, however, it is hoped that as the scale of the project increases it will become viable for specific Recycle Môr batches to be processed separately which could add value to the recycled material, particularly for products which could be sold to the Welsh market.

Much of the rope collected was identified as polypropylene. This is a useful material for Waterhaul as it is used in many of their products such as [litter pickers](#) and some [sunglasses](#) models. This is a great EoL gear to collect as ropes and lines are known to present a significant threat to marine life as ghost gear. One of the advantages of ropes is that contamination is limited to the outer surface of the rope, but the bulk of the material is protected from contamination and UV damage.

The bulk of the netting recovered was HDPE. This netting also poses a significant threat as ghost gear. Contamination rates are slightly higher; however, this is offset as the properties of the HDPE fibres which make up the netting are more easily washed than fibres of other polymers. It is also a useful material which Waterhaul use to create products, such as [litter picking equipment](#).



Figure 11. Shredded polypropylene fibres from rope

The viability of recycling the polypropylene bait bags at scale is awaiting further investigation, as other materials have been prioritised first. Waterhaul is awaiting the arrival of a new specialist piece of machinery due late in 2022 / early 2023 which is expected to make the processing possible. However, heavily contaminated bags are unlikely to be commercially viable as intensive washing is required with low material reward (a bait bag weights approx. 43 grams but could contain 20+ grams of contamination).



Figure 12. Shredded HDPE fibres from trawl net

The monofilament netting recovered, although a valuable material, required significant decontamination and segregating. One netting panel contained three different polymers, all of which needed to be segregated which was time consuming and would make it unviable at a larger scale using current methods.

To recycle, the material is first shredded into fibres and then washed in its fibre form. Specialist machinery is then used to densify the fibres allowing them to feed into a plastic extrusion machine for filtration and pelletising.

These pellets then become a raw material suitable for injection moulding into new products. Waterhaul completes this process in Italy for its eyewear, or in England for its litter picking equipment. At the end of these products' lifetime (their eyewear frames come with a lifetime warranty); this material can be fed back into Waterhaul's recycling streams which improves the circular economy of the process.

Results

Materials by weight

To measure the results of the project, the different types of plastic collected from the fishers were sorted, weighed and recorded. The total amount of recyclable material collected in 5 months between 6th December 2021 and 8th May 2022 was 2732.499 kg. This was more than expected and shows the extent of material that was previously going to waste at landfill. A major proportion of the material collected was in the form of rope (2,008.8 kgs), followed subsequently by

polypropylene (PP) and polyethylene (PE) net (280.3kgs), monofilament netting (192.1 kgs), rigid plastics (181 kgs) and polypropylene bait bags (70.3 kgs). This can be seen in figure 13.

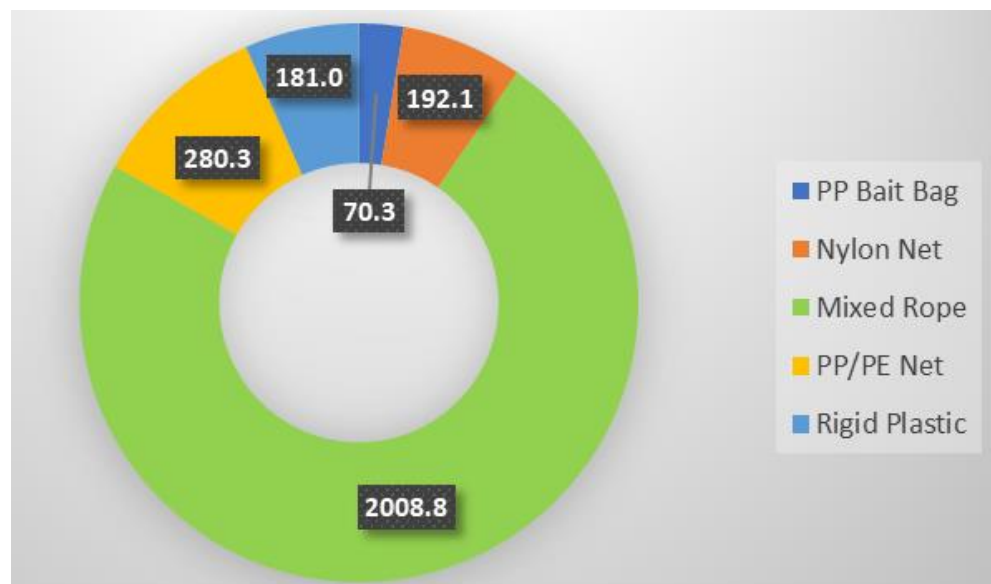


Figure 13. Total weight (kg) of each material collected over 5 months (Dec 2021 – Apr 2022)

Total Waste Weight by Location

Total weight of material from each bin location was compared throughout the project (figure 14). This showed a few surprising results as the expectation was that the larger the harbour, the more waste would be collected, however this was not the case, and the smaller harbours had more waste collected. This might suggest that the smaller harbours had better engagement, therefore the bins were more heavily used in those locations.

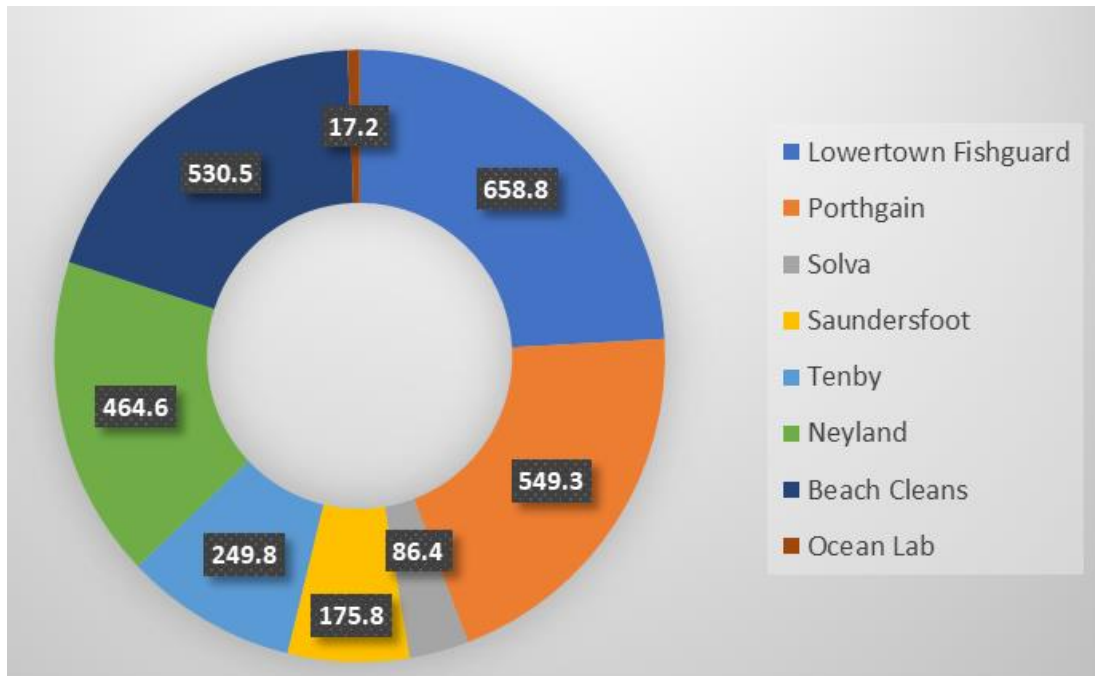


Figure 14. Total weight (kg) of material collected over 5 months from each location

Material weight by Location

This shows the quantity collected from beach cleans to be the second highest source of fishing gear collected. This shows the importance of accepting fishing gear that has been collected on beach cleans.

Figure 15 compares how much of each individual material was collected from each location.

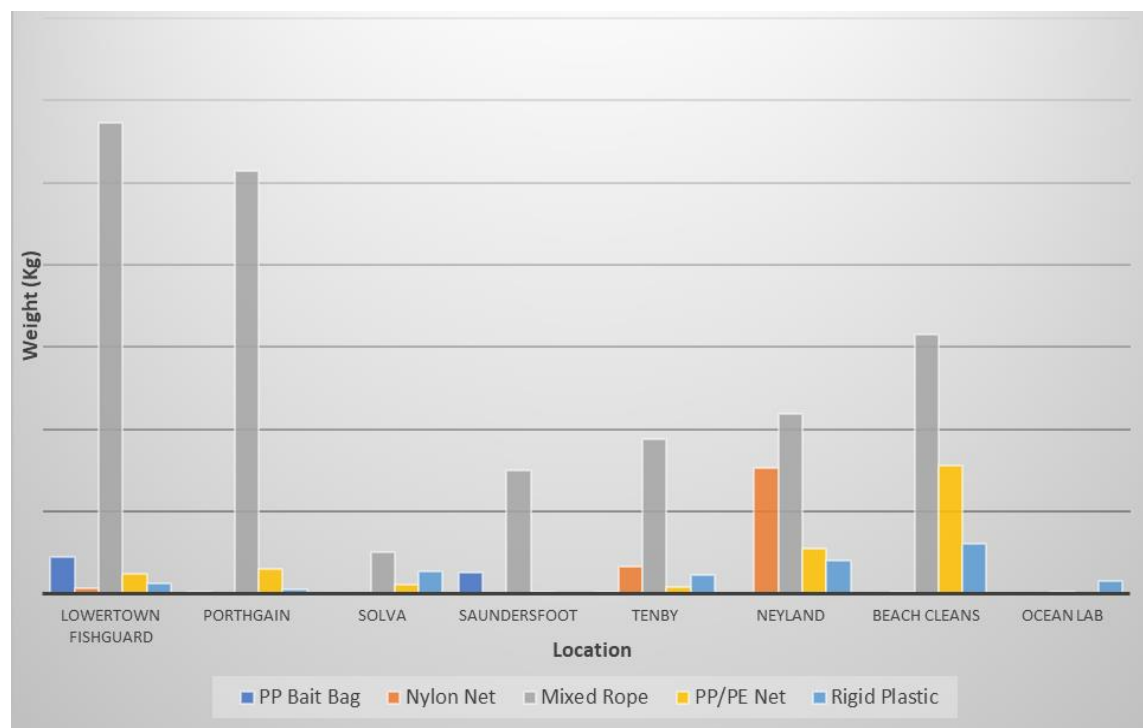


Figure 15. Weight (kg) of each material collected from each location (over 5 month period).

This shows rope as being the most common item to be recycled across all locations except the Ocean Lab which was used as a place for fishers or the public to drop off fishing gear but did not have a bin installed. The other materials varied from location to location and a longer collection time for the data would improve these results.

The harbours each had the bins installed soon after permission was given so that collection could be started as soon as possible, this does mean however that a better comparison of the collection rates of each harbour is to average out the amount collected over the length of time the bin was installed at the location. When locations were compared by collections per month (figure 16), the results changed and indicated Neyland as the biggest collection location but they were known to have a backlog so this should also be taken into consideration.

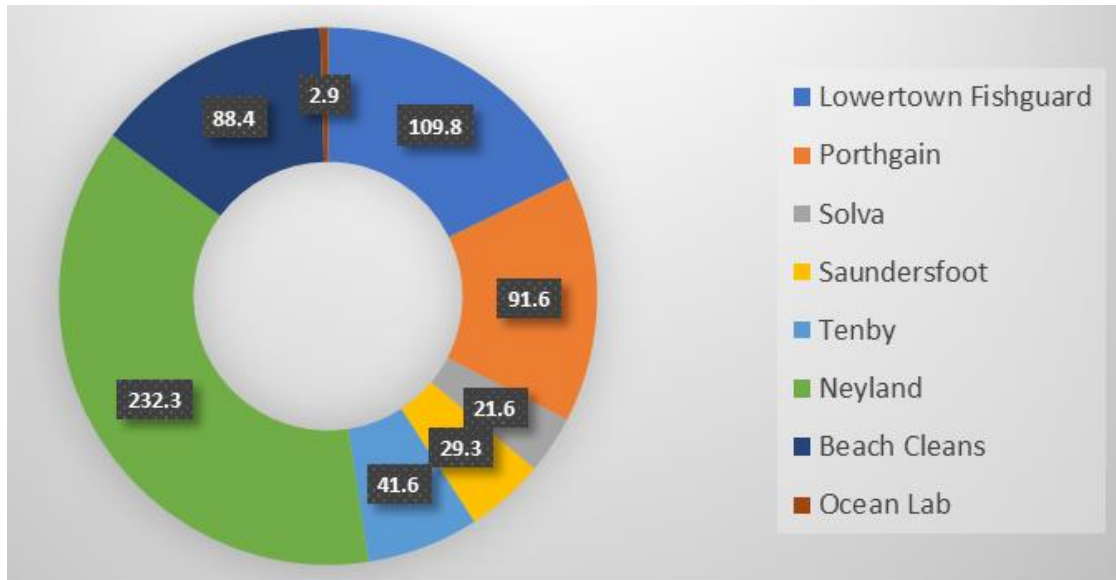


Figure 16. Average weight (kg) of material collected per month from each location.

Total Collected Material Over Time

The total material collected over time was analysed to see whether the amount of fishing gear increased as the project progressed. As seen in figure 17, the quantities collected increased throughout the duration of the project suggesting that the engagement with fishers by the project officer and the promotional material were successful. The funding for the project ended in April and the Project Officer was not able to spend much time on engagement which could be the reason for the reduction in waste collected in May.



Figure 17. Total material weight (kg) collected between 6th December 2021 and 8th May 2022.



Outreach

A major result from the project was the outreach through social media, branding and exposure on national television. This was not only beneficial for the project but great to spread awareness on the harmful effects of ghost gear and why projects like Recycle Môr are vital.

The Project Coordinator Lloyd appeared on ITV news talking about the project – <https://fb.watch/g9c6VNe8IU/>. The project reached over 17,000 people on Facebook through five separate posts with 643 reactions. We also engaged with over 3,000 people on Twitter and Instagram over 7 different posts. This was vital to gain awareness of the project and support from the local public which was essential to the success of the project.

The project also created its own video which acted as a tool to share the main aims of the project and inspire the public, fishers, and stakeholders to support the project by presenting it in a more understandable way. The video (https://www.youtube.com/watch?v=B2xBwXHcWiU&ab_channel=SeaTrustWales) reached over 2000 people, provoking 125 reactions across social media platforms.

As well as social media, the project created two press releases, at the start of the project and with the project video. This was released in over 6 different publications, locally and nationally, some examples of the publication that are still live:

- <https://www.thenational.wales/environment/19806594.sea-trust-waterhaul-launch-recycle-mor-pembrokeshire/>

- <https://www.westerntelegraph.co.uk/news/19804615.sea-trust-goodwick-launches-recycle-mor-across-pembrokeshire/>
- <https://www.tivysideadvertiser.co.uk/news/20020659.video-sea-trust-waterhauls-recycle-mor-project/>
- https://uk.movies.yahoo.com/video-pembrokeshire-fishing-waste-gets-152700068.html?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xILmNvbS8&guce_referrer_sig=AQAAAIYVjpXYWQxpJ26J2BvBqLAc8r_5sZMmMFgeeJB6b3G2y2TM8l8T0o1NKRE_NfY6_Wc7bbQhvmff-OJkwq0o4d3zbZ_gAY19HVMnhGgkfeOaktSt3NlxAh2L1A-LhBR9GXiwYsL80PJaNHt1HM9At4OrKHg2aKI8le691DCiJax
- <https://www.narberth-and-whitland-today.co.uk/news/recycle-mor-fishing-gear-project-in-pembrokeshire-504840>
- <https://www.pressreader.com/>



Discussion

Bin Installation & Material Collection

The first challenge was to work out what specific items we could accept in the bins for recycling. Working with our main recycler Waterhaul, they agreed to collect rope, net, and bait bags. Bait bags were a new item for Waterhaul to recycle and initial tests seem promising, however more work needs to be done to determine whether it is sustainable. The main issue with collecting the bait bags was the leftover bait on the bags which had a very unpleasant smell. This is something that the harbourmasters complained about as it made the harbour smell in between collections. It also resulted in an unpleasant smell at the Ocean Lab where the waste was being stored before transport. To improve this, Sea Trust staff were washing the bait bags before storage and transport, however this was labour intensive. Further discussions with the fishers led to them agreeing to wash the bait bags before placing them in the bins. This made a huge difference to collecting and storing the bait bags and is a good example of the importance of engagement with the fishers.

Securing permission to have a bin placed in locations across Pembrokeshire was challenging. Many landowners were sceptical of the success of the bin and feared it would be used incorrectly by dog walkers and tourists, however the lock on the bin has so far proven this not to be an issue. Recycle Môr bins can be found in six locations across Pembrokeshire in Saundersfoot, Tenby, Neyland, Solva, Porthgain and Lowertown Fishguard. There were some issues with fishers forgetting the bin lock code, the solution was to leave the padlock on but unlocked to deter the public using the bins but allow the fishers to use it without remembering the code. There have been problems with people placing general rubbish next to or on top of the bins. Further work needs to be done to prevent this from happening.

An additional source of material was fishing gear collected from beach cleans. This was a welcome additional source of material and the groups and individuals that dropped off the material were extremely helpful and have been looking for a recycling outlet for items they find on the beach for a while. This material can offer problems as it is often heavily degraded and contaminated, but the donors are often easier to communicate with and are happy to help sort before it is dropped off. This keeps the option open and during the pilot we received 530kg of recyclable material, which is more than most of the harbours and only looks to increase.

Sorting & Recycling of Waste

One of the major successes is the method of collection, and identification of the different plastics. This has been an ongoing process as the materials used in the industry are constantly changing but with ongoing feedback from Waterhaul on the material delivered to them, improvements were able to be made. Waterhaul analysed the first load of waste and provided the following feedback:



- The PE trawl net was the best material for recycling
- The PP rope was good for recycling with some exceptions:
 - o The small bits of rope contaminate some of the larger pieces. The problem with the tiny bits of rope is that each individual piece needs checking and identifying, so lots of work for little product, they also matt up into one big mess. There were a few examples of rope that was too far gone, when bent you can see the fibres that break easy.
- There were a few pieces of nylon rope which is great, the really fine soft fibres are characteristic.
- The beach clean material is useful if it is large pieces of net or rope. However, there was quite a lot that was just too mixed, small, and contaminated.
- The bait bags look good in terms of low contamination. More testing is required to determine how they shred and feed. There is concern that they are too lightweight.
- The monofilament nets are difficult to separate out the different fibres.

This feedback from Waterhaul was then passed on to fishers and beach cleaners so that only the correct material was collected.

The project would not have been possible without a team of volunteers to help, sort, weigh and pack the materials once collected. Due to the small scale of the project budget, machinery could not be used so the manual labour was carried out carefully by Sea Trust staff and volunteers. This time-consuming aspect of the project will be phased out as the project grows to a scale where industrial machinery becomes economical to use for the quantity of waste collected.

The weight collected from the bins is likely to be higher than the final weight recycled due to most material collected being wet. To improve the accuracy of the results, the waste is given at least a week to drain and evaporate before being weighed. The water content of the waste can make a big difference to the results. Letting the waste drain and evaporate before handling increases the efficiency while reducing the costs. The total weight of 2732.5 kg was recorded after the waste had dried and is therefore a more accurate representation of the material collected.

Net is one of the best quality materials for recycling and we had more net than expected based on the information in the APEM report. This could be due to stores of old net, however, if this trend continues the recycling will be more sustainable in the long-term

Collection of the waste from individual harbours is the least efficient and costly part per tonne of waste collected. Centralised hubs could be the solution, but the challenge is renting or buying somewhere within budget for these central hubs to be.

The collection weights increasing with time is expected to be due to awareness of the bins and the amount of EoL fishing gear increasing into the summer season as fishing effort increases. Although the data is an upwards trend, this may be due to stockpiles of waste from the fishers.



To obtain more reliable data, the project should be continued for at least an entire year but ideally over two years which would increase the reliability of data significantly.

Sustainability of the project will be easier and more efficient as it scales up, but this may result in the project losing its personal touch, for example, spending time talking to fishers and gaining their trust which is one of the main reasons for the project's success.

Project Promotion & Communication

The digital artwork created for the project is a real asset to the project and has given the project a strong sense of identity. The digital artwork along with the bilingual publications made the printed assets more accessible and they have worked well in informing fishers on the project and how to dispose of their waste using the bin. This gave the project a modern and innovative feel and gave the project a reliable and professional feel which was continued with our project video - [Recycle Môr](#).

If there was one major point that made the Recycle Môr project a success and separates it from other similar projects is the amount of time and effort spent engaging with fishers on a one-to-one basis on the harbour side. This was crucial in gaining the fisher's trust and informing them properly on how to use the bin. This enabled the Project Officer to encourage the fishers to use the bin and receive feedback on how to make the bin more accessible and about other materials that are commonly used and could potentially be recycled, expanding the project further in the future. The success of this was evident when comparing the larger harbours to the smaller harbours. The larger harbours with more fishers were harder to communicate with, the vessels have a larger workforce, and communication was often done through the harbourmasters team. Comparatively, the smaller harbours were generally controlled by one main fisher who could more easily communicate with the few other fishers in the small harbour, this was evident from the larger harbours collecting less waste of worse quality whereas the smaller harbours such as Lowertown Fishguard had far more material at a higher quality.

Following on from the project video and digital media, a press release was organised to promote the project to the public and the scientific community. This was successful and the story was published in twelve different online news publications as well as shared widely across social media including some small-scale celebrities. This helped the project gain enough traction and ITV Wales news covered the story and interviewed the Project Officer for the evening news which was great publicity.

Sea Trust has an exhibition in the Ocean Lab and provides guided tours to the members of the public as well as school and university groups. We have had approximately three thousand exhibition visitors since the beginning of the project. We have displays about the Recycle Môr project in the exhibition and people are able to see examples of the waste collected outside the Ocean Lab. We also sell some of Waterhaul's products in our gift shop. The interaction with the



public has been very beneficial and helps to promote the project and create a circular economy. After hearing about the project, we have found that many customers go on to purchase the products made from the recycled fishing gear.

Conclusions & Next Steps

The Recycle Môr project has been a huge success and over a 5-month period has prevented nearly 3 tonnes of end-of-life fishing gear ending up in landfill and/or the sea. The engagement with the fishers and involvement of the Project Officer greatly contributed to the success of the project. The partnership with the main recycler Waterhaul was also hugely beneficial as was Sea Trust's ability to promote the project at our Ocean Lab visitor centre as this allows potential customers to see the process of collecting and recycling with the option of purchasing the finished product.

To continue and improve on the success of the Recycle Môr project, Sea Trust aims to scale up the project to encompass all harbours within Pembrokeshire. This can then be used as a model for each county to follow. To achieve this, the project would need additional funding to create the necessary infrastructure and purchase additional equipment to be able to deal with the increased collection, sorting and packing. Based on the data collected during the project, 3,000kg was collected over 5 months from six harbours. If all of Pembrokeshire's 22 harbours produced a comparable amount of waste, the project would need to be able to deal with collecting, sorting, and recycling an estimated 25,000kg's a year.

Whilst additional funding is being sought, Sea Trust will be continuing with the project on a small scale to reduce ghost gear in the local environment but also to continue to collect data to better inform future decisions and plans.

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