
ENVIRONMENT WASTE FUTURE P
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contents

introduction

I'm a white-water kayaker and although I've noticed that my fellow paddlers are pretty switched on to environmental issues, there is little information available about what our kayak manufacturers, suppliers and retailers are doing to minimise waste associated with the manufacturing of our kayaks and what we can do to dispose of our worn or broken boats in a more sustainable way.

Between the three major kayak manufacturers in the UK more than 30,000 plastic hulled kayaks are produced each year. Many of these boats will have long lives and will be enjoyed on the water for years to come, but eventually they will break or become too old to pass on…so what happens then?

I started to dig around and found some brilliant schemes for dealing with our old and broken plastic kayaks, some of which I've outlined here. The problem is, we've still got a long way to go before recycling our boats becomes as easy and accessible as it should be.

Photo: Andy Hurford

Reducing our waste and managing it more effectively has clear benefits. It can save us money and ensure that we're getting the best use out of our resources whilst minimising damage to the places where we live.

We should all be taking more responsibility for the waste associated with our sport, so I hope that by reading this it will encourage paddlers from all disciplines to think about options for disposing of their plastic kayaks in a sustainable way and encourage manufacturers, suppliers and retailers to realise the commercial benefits associated with minimising waste and encouraging recycling. Between us, we don't have all the answers just yet, but hopefully this guide will help to stimulate discussion about how we can all 'do our bit' to help…

resource efficiency is all about managing raw materials, energy and water in order to **minimise waste** and thereby **reduce cost.**

businesslink.gov.uk

ok, so what are the main problems?

There are lots of good reasons why we should be thinking more carefully about the way we dispose of our waste. Some of the key reasons are outlined below and these are the main drivers that will encourage change within the kayak manufacturing and waste management industries over the coming years.

firstly, landfill space is running out...

Historically we've been very reliant on sending our waste to landfill - a recent study by the Local Government Association (LGA) showed that households in the UK send almost 19 million tonnes of rubbish to landfill every year.

Although modern landfills are well engineered and carefully regulated to prevent the escape of liquids and gases, landfill doesn't present a long term option for managing our waste. The LGA warns that we will run out of landfill space in less than eight years time unless we boost our recycling rates and reduce the amount of rubbish we dump into the ground[1].

...and it's becoming more expensive too

In June 2010, the Government announced that landfill tax would continue to rise by £8 per tonne each year until at least 2014 and would not fall below £80 per tonne from April 2014 until at least 2020. Although this announcement provided some financial certainty for people investing in new, sustainable, alternative technologies for disposing of our waste, it has had the immediate effect of increasing the cost of landfill. In order to save our money, we really need to divert more waste materials away from landfill.

landfill bans may be introduced

In order to reduce the negative impacts of managing waste, the Government has recently been considering the introduction of bans that would prevent certain materials from being disposed of to landfill. Plastic is one of the materials that has been assessed for such a ban, which could mean that in the future landfill may not even be an option. Although the Government has not opted to go down this route in the short term, it could be a real possibility in the future.

but most importantly - energy and raw materials can be saved by recycling

The Government's Waste & Resources Action Programme (WRAP) recently investigated the environmental benefits of recycling for a number of materials. Their work demonstrated that mechanical recycling is the best waste management option for plastics, mainly through avoiding the production of virgin (brand new) plastics[2].

[1] Local Government Association (2010),Eight Years Left of Landfill, *http://www.lga.gov.uk/lga/core/page.do?pageId=12347120*

[2] WRAP (2010), The Environmental Benefits of Recycling, *http://www.wrap.org.uk/downloads/Environmental_benefits_of_recycling_2010_update.fe18de0c.8816.pdf*

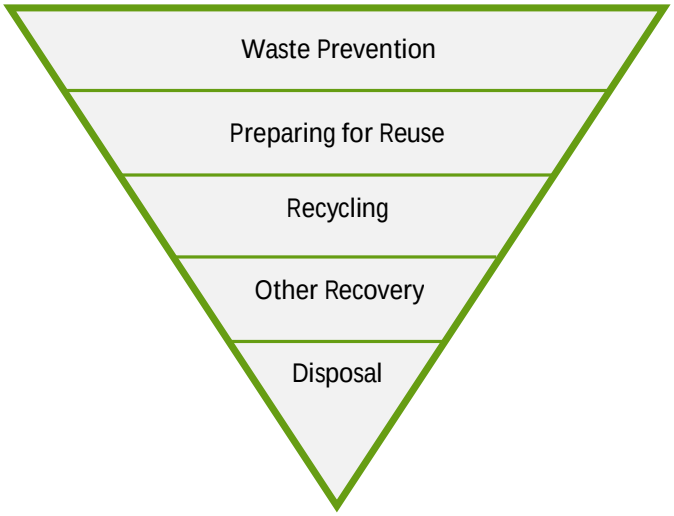
Note: Photographer details were unavailable for images on this page.

key waste management principles

OK, so reducing the amount of waste we produce and finding suitable alternatives to landfill is really important, but what guidelines can we follow to ensure that our waste is actually being managed in the best way possible?

All waste policy within the UK is based around the waste hierarchy, which sets out the order in which options for waste management should be considered based on their environmental impact. Those options at the top of the hierarchy are the most desirable for disposing of our waste, and those at the bottom are the least desirable.

We need to push our waste from plastic kayaks up the hierarchy, as most of it is currently down at the bottom - being disposed of to landfill:



the waste hierarchy is a useful framework that has become a cornerstone of sustainable waste management.

Waste Strategy for England 2007, Defra

In addition to this, we also need to think about how far our waste is being transported to be treated or disposed of. As waste collection vehicles can churn out a lot of harmful gas emissions, looking at where waste facilities are located can help us to decide upon the most appropriate ways to manage our waste. This is where we also apply the 'Proximity Principle' to find the most suitable waste processing facilities close to the source of waste generated.

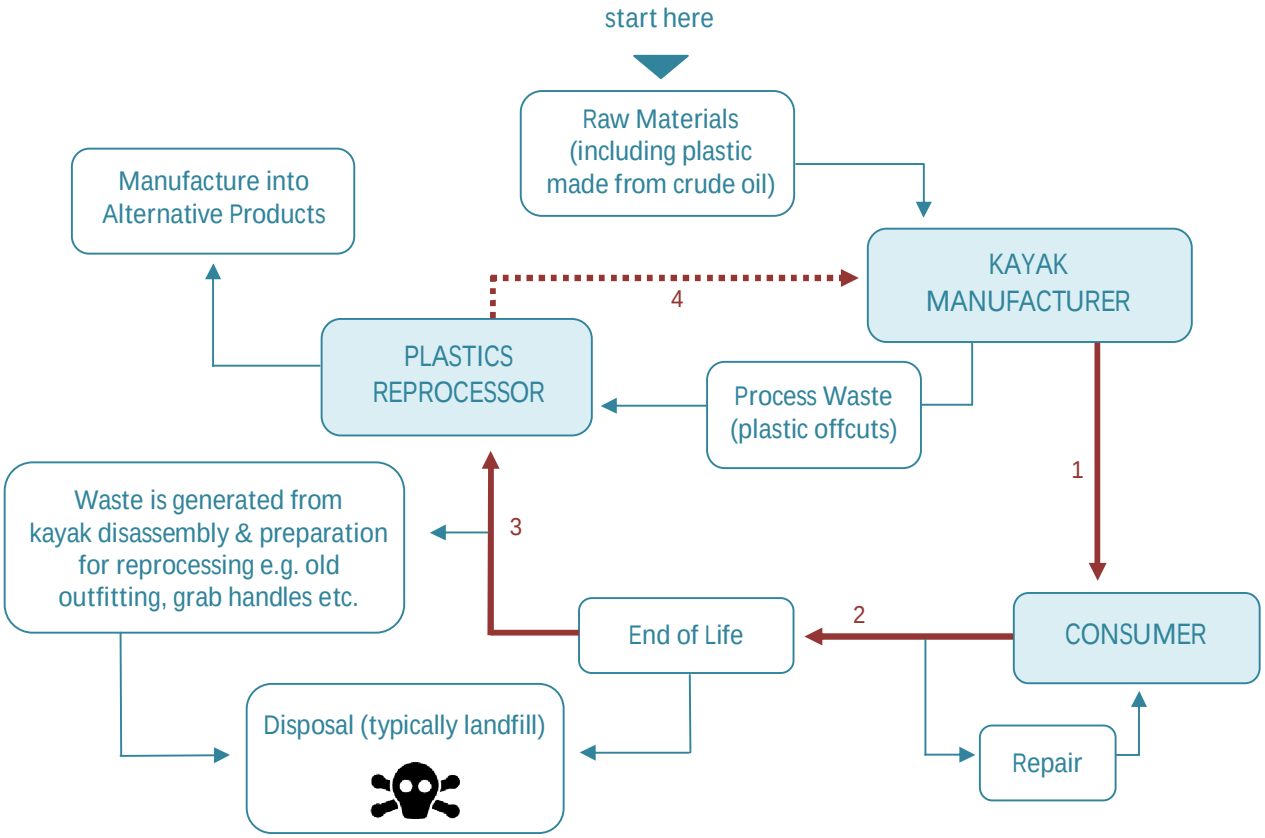
Although this project focuses on the issues surrounding plastic kayak recycling, the framework and principles that we take into account when choosing a waste management option are the same for any waste material.

the ultimate loop (not just a freestyle move!)

Most virgin plastics are produced from crude oil, which is found trapped in sedimentary rocks in the Earth's crust. Millions of years ago, plant and animal remains on the sea bed were covered by layers of silt and sand. Over time, these remains were buried deeper and deeper; under immense temperature and pressure, the remains were turned into oil and gas.

We call crude oil a non-renewable resource, as it took millions of years to form and we're using it up much faster than it can be replaced. As a result, it's really important that we make best use of the oil once it has been extracted in order to help conserve this valuable natural resource.

Check out the 'ultimate loop' below - it shows the recycling processes that we could consider below to see how we might be able to close the loop for recycling our kayaks, and help to ensure that the plastic doesn't get wasted...



In the diagram above, stages 1 & 2 happen regularly - new boats will be sold and older boats will reach the end of their life. Occasionally a boat will make it through to stage 3, where it will be recycled into a new, alternative product, such as a water butt or drainpipe. At the moment, stage 4 isn't happening; this is 'closed loop' recycling, when a product reaches the end of its life and is reprocessed into an identical product (for example, glass bottles being recycled back into new glass bottles). So, what are the challenges to closed loop recycling? Is it even possible to turn an old kayak into a new kayak? And what more can we do to make sure that our old and broken boats don't end up filling holes in the ground?

In the following chapters we'll explore all the links in the chain - looking at what recycling initiatives our manufacturers are trying, understanding how plastics reprocessors deal with our waste, hearing what schemes retailers and local authorities are working to put into place to make recycling easier and checking out how you guys have been using your imagination to bring new life to old and broken boats...

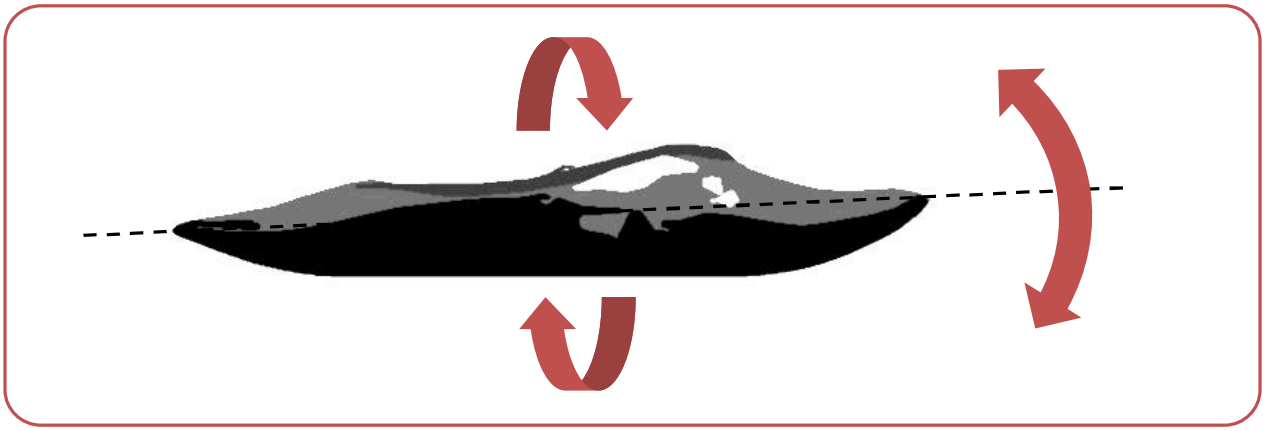
how was my boat made?

Understanding how a product is made in the first instance can help to identify areas for reducing waste during the manufacturing process and determine the best way to deal with the product at the end of its life. By understanding the various technical limitations when manufacturing a kayak, we can also answer questions about 'closed loop' recycling.

The three major kayak manufacturers in the UK - Palm, Perception and Pyranha - currently produce over 30,000 plastic hulled kayaks each year. A large percentage of these are produced at the Palm manufacturing facility near Bristol, and they have been looking seriously into options for reducing their waste and improving their recycling performance...

about kayak manufacturing

Plastic hulled kayaks are manufactured through a process called rotomoulding (rotational moulding). Plastic powder is placed into an open mould. The mould is then closed before being heated in a large oven. As the mould is heated, it is rotated about two axes to help spread the plastic evenly on the inside surface of the mould. The mould is then cooled before the plastic product is ready to be removed from the mould.



Within the oven, the kayak is turned over and over whilst being rocked up and down to spread the plastic evenly within the mould

Most plastic hulled kayaks produced in the UK are made from superlinear high density polyethylene (HDPE), which is a similar material to a plastic bucket that you might have at home, except that the plastic used for kayaks is higher density. Choosing the right plastic polymer type is important, as higher density plastics can make the boat stronger, but if the density becomes too high this can make the boat brittle. This means that that when the plastic is impacted it would shatter rather than puncture, making it much harder to repair.

Some kayaks have been made using a slightly different plastic, known as cross linked polyethylene (XLPE). The benefits of using XLPE are that the boats can be slightly stronger and more durable. However, there are some drawbacks in using this material, for example, XLPE is a strong smelling resin that would require much more rigorous climate control within the factory. In addition, once the boat has been produced, the nature of the plastic means that it cannot be repaired if it cracks and the boat is non-recyclable.

Different coloured plastic powders ready to be used for manufacturing new boats

The plastic arrives at the factory in powder form and each 20kg bag contains roughly enough plastic to make one boat. The plastic supplier is able to mix the right balance of ingredients to give the specific properties important for manufacturing a robust kayak, including excellent impact resistance and durability, high stiffness, good mouldability and resistance to damage from UV light. The plastic powder is also 'compounded', which means that the coloured pigments are added before being extruded in such a way that they don't interfere with bonding of the plastic molecules during the manufacturing process. All the manufacturer needs to do is add a release agent which helps to stop the plastic from sticking to the mould.

Before the plastic is used to make a boat, the quality of the material must be tested through an internationally agreed standard. Test moulded samples are produced and cut into small squares before being placed into a freezer for 24 hours, bringing the plastic down to a temperature of -40°C. The plastic is then subjected to an impact test which shows the strength of the material and its suitability for use. Each plastic batch is given a quality control sheet which indicates the material tolerances and helps to trace any possible defects that may occur later in the manufacturing process.

GRP (fibreglass) can be used to produce moulds for prototype boats, however, these tend to degrade quite quickly. GRP provides a cheaper method for designers to produce small runs of prototype boats for testing on the water before committing to a full production aluminium tool, which can cost tens of thousands of pounds.

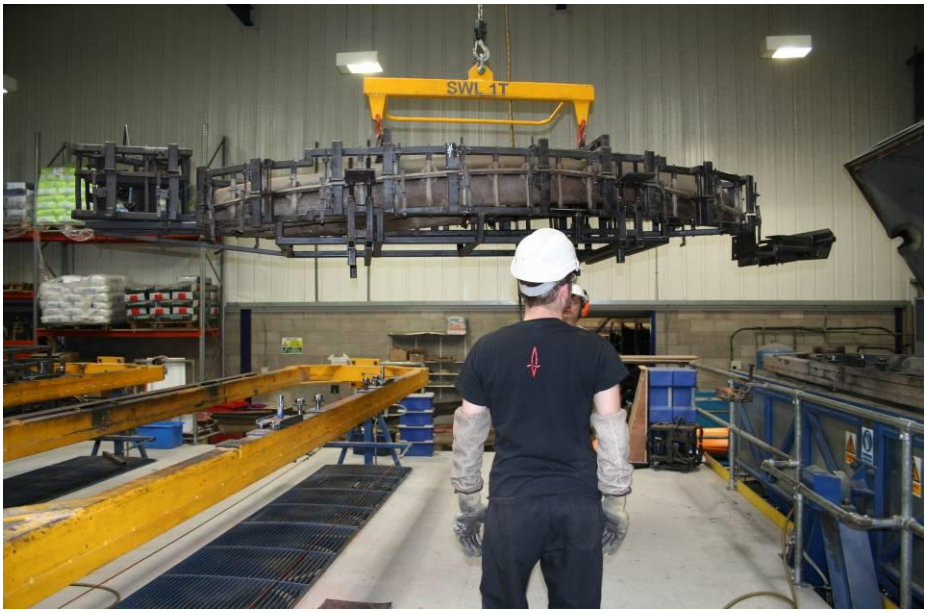
The Oven!

The oven is quite an impressive machine! Its burner capacity is rated at 4 million Btu's, which is equivalent to a power rating of approximately 550 electric kettles! Inside the oven, temperatures exceed 300°C, but understanding what is actually happening inside the mould is really important too; a *493K Paq temperature monitoring device* is used to measure the real time temperatures inside the mould and give a better indication of how the plastic is responding. The monitor shows that the kayak will reach temperatures of around 210°C. And just like when you're baking a cake, the kayak will keep 'cooking' after it's taken out of the oven - the plastic will reach its peak temperature about three minutes after being taken out.

Heat sinks on the outside of the aluminium mould

The outside of the moulds have numerous metal spikes, or 'heat sinks', which draw heat to certain areas, helping the plastic to thicken. This may be needed at the bow, stern and hull of the boat where impacts are likely to be greater. Insulation, such as fibreglass or additional metal, is also used to minimise plastic in certain areas of the mould (such as the cockpit or hatches). This helps to reduce waste during the manufacturing process.

Typical moulding times for HDPE boats are around 23 minutes. The boats are slightly 'overcooked' to ensure that any bubbles within the plastic material are fully expelled and that the plastic molecules are well bonded for strength and durability. The boats could actually be manufactured slightly faster, but by speeding up the process this reduces the amount of control that the manufacturer has over the process and increases the risk of distortion and other defects.



The new kayak is removed from the oven and placed on a rotating table to cool

Once the boat has been cooked in the oven, it's removed and allowed to cool slowly over a 30 minute period. The boat, still within the mould, is placed on a large rotating table (shown in yellow) which keeps turning the boat over during the cooling process; this ensures that there are no problems with plastic settling in certain areas of the mould whilst it cools.

For the first three minutes, the boat is cooled by six large fans. Low pressure air is then blown into the mould to help retain the shape of the boat as it pulls away from the mould's inside surfaces. During the final 10 minutes of the cooling phase, any inserts (such as for bung holes and screws) are removed; by leaving this towards the end of the process it helps to ensure that the plastic doesn't tear as the inserts are removed.

Removing the new kayak from the mould

After initial cooling within the mould, the boat can then be removed and placed on a stand until it reaches room temperature. When the boat is first removed from the mould, the plastic is still very hot and malleable; the boat is monitored to ensure that there is no distortion as it cools. As the boat cools, it also shrinks slightly. The amount varies anywhere from 2% to 4% depending on shape, contour and what material it's made from. Interestingly a blue boat shrinks slightly less than a red boat.

what can be done with waste generated during the manufacturing process?

Palm work to reduce waste during the manufacturing process by ensuring that their moulders are provided with good training and that the manufacturing process is well monitored. Rotomoulding can be quite a 'black art' - perfecting the technique can take time!

Palm manufacture around 130 plastic boats each week and of these, one or two may be of seconds quality (i.e. they may have suffered minor distortion). Common defects during the manufacturing process include faulty graphics, distortion and problems with brass inserts moving during the process (i.e. those used to make bung holes). The failure rate is low (around 0.5%), with around 35-50 boats per year not meeting the factory's high quality standards. Palm have found that they seem to suffer the most scrap in blue boats due to a specific chemical found within the blue pigment which can cause complications. 'Scrap' boats are cut into large pieces using a jigsaw on site, before being shredded ready for collection by their plastics reprocessor for re-grinding and recycling.

Careful application of graphics to the mould can help to minimise manufacturing defects

Offcuts are generated from cutting out plastic for hatches

For each boat that is produced, approximately 0.5kg - 1kg of waste is generated through offcuts. The amount of waste produced varies according to the boat design, for example, sit on top kayaks will generate the least waste, with only ~0.25kg generated from cutting out the hatches.

The offcuts are collected and shredded on site to a 10mm particle size before being sent away to a plastics reprocessor. Palm need to stockpile about a tonne of shredded material to meet the minimum quantity that will be collected by their reprocessor.

Plastic offcuts from the manufacturing process are collected and shredded on site

The shredded plastic is sent to a plastics reprocessor, who grinds the material into fine powder. The plastic must be ground very slowly to stop it from getting too warm and melting. The reground plastic powder can then be used to manufacture a new kayak in virtually the same way as virgin plastic powder is used.

It's really important that the same type of plastic polymer is collected and processed together, as each polymer reacts differently when processed. When Palm were looking into manufacturing a kayak made from their process offcuts, they had problems with one batch of recycled material - a plastic helmet had accidentally been placed into the shredder for recycling; as this was made from a different type of plastic and couldn't be separated easily, it contaminated the load and meant that the plastic wouldn't mould properly in the oven.

The key with any recycling scheme is finding a way to make products that are of good quality and of a consistent standard. This provides product designers and customers with confidence in the material that their products will be made from. In addition, there must be a market for the recycled materials - if nobody will buy a product made from recycled plastic, then it will be very difficult to justify and fund a recycling scheme.

introducing the Dagger Fiesta - made entirely from recycled plastic!

After trialling the use of plastic offcuts to make a new boat, Palm delivered an industry first - a kayak manufactured entirely from recycled plastic! The Dagger Fiesta was released in 2010 and is a great boat for recreational paddling. Due to the mix of different coloured plastic offcuts used to manufacture the boat, the Dagger Fiesta may be a speckled grey/blue or brown colour. The Palm factory produces enough scrap to manufacture about 300 recycled kayaks per year, and this quantity hasn't yet managed to meet their customer demand for the Dagger Fiesta.

The Dagger Fiesta - Palm's pioneering kayak manufactured entirely from recycled plastic

When the Dagger Fiesta first hit the market some concerns were raised about its durability. It is true that the recycled plastic used for manufacturing the Dagger Fiesta isn't as strong as plastic made from virgin materials; this is mainly due to the fact that a large number of anti-oxidants which prevent degradation during processing are used up during manufacture first time round. Impact testing at very low temperatures (-40°C) typically showed that virgin plastic materials would fail anywhere from 100-125 joules, whereas for the recycled plastic this was much lower, at around 20-50 joules.

Although this difference may seem significant at these low temperatures, the durability of the recycled plastic couldn't be questioned after the '2lb lump hammer test'! Confident in the performance of the recycled plastic material, Palm invited people to try their hand at breaking the boat using a 2lb lump hammer…even after a month of abuse, the Dagger Fiesta was still in one piece (although somewhat dented!).

This clearly shows that the boat is fit for purpose: the Dagger Fiesta is a recreational touring boat and is perfectly suited for use in calm waters, such as open lakes or canals. The end use for the kayak doesn't demand the high levels of durability and impact resistance that is required of some boats, such as those used in white-water, and as a result designing for this high level of impact resistance really isn't necessary.

The Dagger Fiesta is a success story - it has shown that using process offcuts to make a new kayak is technically feasible and that manufacturers can reduce their waste and create a product that has real market value.

what about other parts of the boat?

We all know that a kayak is made up of more than just a plastic hull. Waste is also generated through outfitting the boat and packaging it for safe transport to the retailer and customer. Dealing with this waste can also be a big challenge...

thermoformed parts

The plastic kayak seats are also produced from HDPE, similar to the boat plastic. This material comes in large flat sheets and a significant amount of waste is generated - for every 5kg of plastic, only 1.5kg of material is used in the final product. This means that around 70% of the material is wasted. At present, all of these offcuts are stockpiled and sent to a plastic reprocessor for recycling into alternative products, such as underground pipe junctions or manhole covers.

Palm have looked into boosting the recycled content of their thermoformed parts and have managed to incorporate up to 10% recycled material. They tried using plastic with higher recycled content, but this led to limitations in the amount that the plastic sheet could draw (stretch), causing brittleness and generating additional waste.

Seats are vacuum formed (left) and waste offcuts are collected for reprocessing (right)

Minicell Foam

Minicell foam is used for creating reinforcing pillars within kayaks and the large volume of waste generated though foam offcuts presents a real problem. Palm estimate that they produce approximately half a skip of this material each week, which is currently non-recyclable.

Although Palm has investigated possible outlets for waste Minicell foam, such as crash pits at children's playgrounds, skate board parks and insulation, they've not yet managed to find a suitable solution for reusing or recycling this material.

Minicell foam presents a real waste problem during the manufacturing process

Packaging

In order to ensure that the new kayaks reach the retailer and customer in the best condition, they need to be packaged appropriately. At present, the ends of the boat are usually protected with bubble wrap and the boat is sealed into a plastic, polyethylene sleeve. Virtually all of this packaging goes straight into the bin when it reaches the retailer or customer, and represents a significant waste of material - Palm have estimated that across the three major retailers around 60 tonnes of polyethylene packaging could be going to waste every year!

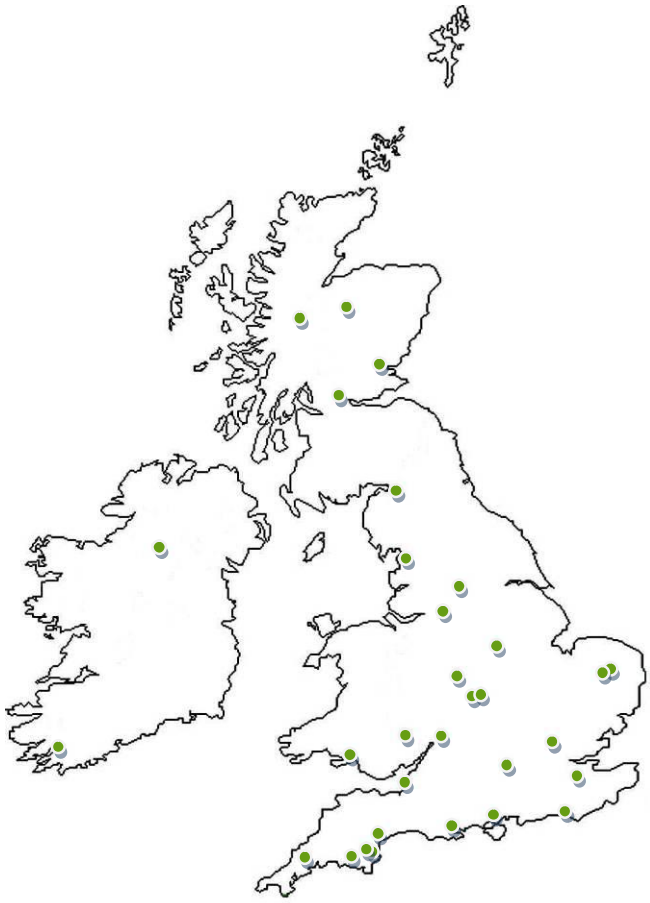
Palm have tried packaging their boats in reusable hessian sacks, but the trial was unsuccessful as bags were not returned. A new packaging scheme is needed that could be easily adopted by all of the manufacturers and would gain the support of retailers - by reusing packaging, this would help to cut waste and save cash throughout the chain - at the moment manufacturers have to pay for packaging which the retailer then has to pay to dispose of!

Tonnes of bubble wrap and polyethylene are wasted every year through packaging the boats - is there a better way?

the role of our retailers

Retailers play an important role in the waste management chain. Not only do they have the ability to liaise with manufacturers and suppliers to encourage better waste management practices, but they also have direct access to us - the customer.

One of the limitations of existing kayak recycling schemes is accessibility. The map on the right, however, shows the locations of some of our key canoe and kayak retailers...could this network be used to support a national kayak recycling scheme?



Retailers are well positioned for closing the loop when it comes to recycling. They are more widely distributed across the country and have the opportunity to use their existing logistics infrastructure to return broken boats to manufacturers.

There's no doubt that offering a kayak recycling scheme costs a retailer time in managing the process and may add some additional cost in terms of transport and logistics. However, finding a local plastics recycler could easily resolve this issue. If old boats are to be returned to the manufacturer to be recycled in a closed loop system, could this be linked with the retailer's existing logistics scheme for collecting new boats from the factory?

It may be that the logistics of such a scheme has deterred some retailers for the time being, however, some have recognised the benefits that can be realised - in addition to improving the sustainability credentials of the business, offering a kayak recycling scheme can bring us (the customers) back into the shop at the right time when we may be looking for a replacement boat.

An example of this is the retailer Desperate Measures, who supply kayaking, canoeing and safety equipment to individuals, organisations and businesses throughout the UK and across Europe. They operate a kayak recycling scheme, where old plastic boats can be manufactured into new, alternative products - check out the advert for their scheme on the next page. What is stopping other retailers from introducing similar recycling schemes?

Retailers also need to consider the impacts of packaging on their business, which can represent a hefty cost to dispose of. Of course some packaging is needed to protect products during transit, but are we using the best packaging materials available? Are there reusable options? And realistically, are we using more packaging than is really necessary? It makes sense for retailers to work alongside manufacturers to cut the costs of excess packaging and waste.

Example of a kayak recycling scheme operated by the canoe shop Desperate Measures.

recycler

A new life for an old canoe…

Do you know a kayak that's just had enough? Cracked. Worn out. Unwanted. It's crawled off to the bottom of your garden or slunk away to your club boat shed. It's full of snails and you've stolen its footrests. It's sad and lonely and it's never going to see the water again.

But you can make it happy. Sure, it'll never float again, but you can give it a purpose. All you need to do is enrol it in Desperate Measures' recycling scheme.

We'll take it in, grind it up and melt it down. A few hours in the oven and it'll come out with new meaning in its life. It might be a drain liner. It might be a diesel tank. A lucky few might even make it as roof tiles. But it won't be land-fill. And it means a few more litres of crude oil left in the earth.

Can you help it? All you need to donate is a bit of time. No more than a few minutes. Clean out the crap. Pull out the padding. Bring it to Nottingham and drop it off with us. We'll give it a home and a purpose. And we'll give you a free demo boat to use at Holme Pierrepont for a day.

But we're not miracle workers. Reincarnation, yes, but we can't do everything. Multi-layer open canoes are beyond our help. Glass fibre and Kevlar are also lost causes. And if it's aluminium? Then the caring thing to do is squeeze it into your local alucan recycling bin. And send us a photo so we can see how you do it.

To learn more about this life-changing scheme visit desperate-measures.co.uk, call our kayak protection hotline on **0115 981 6815**

DM

I WANT TO MAKE A DIFFERENCE:

- ☐ Tell me more about recycling my kayak
- ☐ I want a free subscription to Plughole

Name:

Address:

Postcode:

Email:

Phone:

DESPERATE MEASURES THE CANOE SHOP

what happens to the plastic?

Avanti are one of the UK's leading plastics recyclers. They operate a state of the art Plastics Recycling Facility in Merseyside which processes material collected from across the UK. They were able to show how waste plastic from bulky items, such as kayaks, could be prepared, ready for turning into new products...

Firstly, the plastic is tested to establish its Melt Flow Index. This test gives the reprocessor a better understanding of the physical properties of the plastic, meaning that they can treat it in the correct way and monitor material quality. The waste plastic is then put through a six stage process:

Shredder This shreds the plastic into 50mm^2 pieces.

Filtration and Metal Separation This helps to clean out some of the contaminants and remove any ferrous and non-ferrous metals.

Granulator The plastic is then granulated to make chips of about 6mm in size.

Metal Separation The material undergoes a second round of metals removal to capture any unwanted metals that may have been missed in stage 2.

Filtration This may be a wet, dry or combination process to remove dust which can present problems further down the line when the plastic is melted to make new products. This phase is also called 'fines extraction'.

Packaging Finally, the cleaned chips are packaged, ready to be manufactured into a range of new products.

Manual or mechanical loading of the plastic shredders

Photos: Avanti Environmental

At the Avanti sites, each of their reprocessing plants are able to process over 1 tonne of plastic per hour, meaning your 15kg plastic kayak could go through the whole process in less than one minute!

Once processed, the plastic chips are collected in large bags ready for distribution to plastics manufacturers

If the plastic material was to be turned back into another kayak, the plastic chips would be sent to a micro-milling facility where the granules are slowly ground down into a fine powder suitable for use in the rotomoulding process.

As with most recycling processes, problems can arise when the input material becomes contaminated with other, unsuitable materials. In the case of recycling a plastic kayak, we need to take out as much 'contamination' as possible, which means removing any plastic or foam outfitting and metal grab handles. This helps to ensure that the kayak can be recycled successfully and doesn't cause any problems when the material is reprocessed. The recycling equipment needs to be looked after and unwanted materials, such as metal grab handles, can wear down or may even break the shredder blades. We also need to make sure that we're not putting any other plastic types through the process, such as plastic packaging, otherwise the mixed polymer may be unsuitable for recycling.

The cost of virgin polymers is typically around £1,400 - £2,000 per tonne. Lighter coloured polymers tend to be more expensive. With 30,000 plastic boats being produced by the three biggest manufacturers each year, that's an annual cost of more than three quarters of a million pounds! Recycled material can save around 30% compared to the cost of the virgin polymer, so it makes sense to think of the financial benefits as well as the environmental benefits associated with recycling.

Photo: Avanti Environmental

local authority schemes

Local Authorities are responsible for finding the most sustainable and cost effective ways for collecting and disposing of our household waste. Some councils are able to provide facilities at their Household Waste Recycling Centres (HWRCs) specifically for recycling bulky, rigid plastics, such as plastic garden furniture, children's toys, water butts, piping and guttering.

I was interested to see whether we could recycle our kayaks this way and spoke with Mark Simpkins, Waste Operations Manager at Hertfordshire County Council to find out more about options in their area...

Could kayaks be recycled through your local authority rigid plastics waste recycling scheme at HWRCs?

HDPE kayaks can be recycled through the rigid plastics stream at the HWRC. However, I must stress this route is only available for householders who are looking to dispose of their own kayaks. Kayaking clubs and organisations would need to set up their own arrangements for this type of recycling, but a number of the recycling companies within the South East should be able to provide a container for anyone looking to recycle a bulk load.

What criteria would need to be met for the waste material, as I understand that you would need to keep contamination to a minimum?

The maximum length that can be accepted into the rigid plastic recycling scheme is 1.5m, so any kayak that is longer would need to be cut up and any metal handles etc. would need to be removed. The age of the material is generally not a problem, but we would always ask that people use their common sense in this respect.

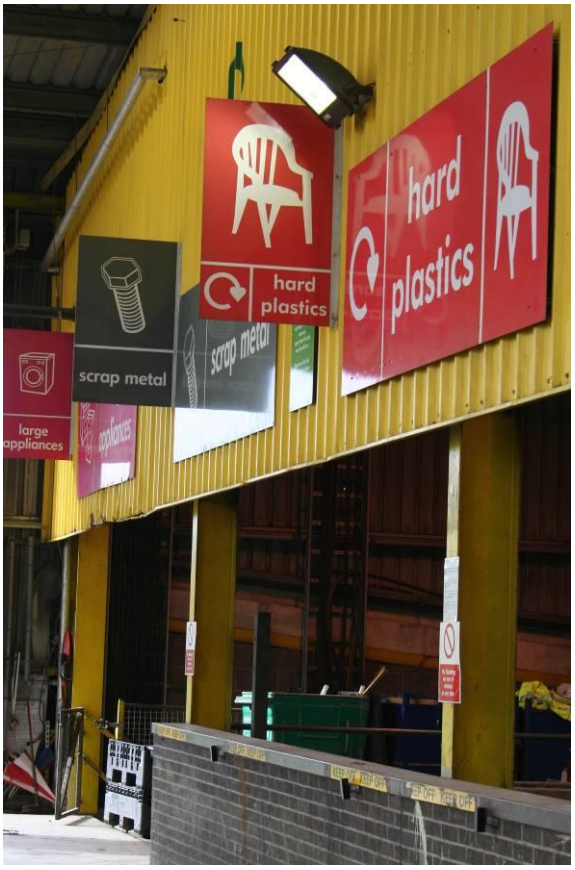
What would happen to the material once it reached the plastics reprocessor?

Once the material leaves the HWRC it is currently transported to Pearce Recycling in St Albans. They in turn bulk the material up and transport it to a processing plant in the Midlands, where they wash and then chip into plastic granules.

What products would be made from the recycled plastic?

These granules are sent around the world to plastic product and component manufacturers, who melt down and remould the granules into their products. These can be anything from garden furniture to construction pipe work.

The availability of rigid plastics recycling schemes varies across the UK; some Local Authorities may have different criteria for the items that they will accept or they may not even be able to offer a rigid plastics recycling service at the moment. Each Council is different - to find out more about whether your Council could recycle your kayak and any conditions that would need to be met in order for it to be processed successfully, please contact your Council's Waste & Recycling team directly.



Rigid plastics recycling is also provided by Wigan Council; pictured above is their Kirkless HWRC

so, what can I do with my old or broken boat?

For a boat that's a little bit old, but in good order...

- Could your local community group benefit from use of the boat? Could you advertise the boat on a community reuse network, such as Freecycle? ...you could make somebody's day by passing on your old boat for free!
- There are plenty of options for selling your boat - through your local canoe shop, newspapers, online forums and websites.

umm...it's broken and needs a bit of TLC...

- If your boat needs new outfitting, contact your local canoe shop or manufacturer - quite often there are spares or outfitting kits that you can buy. Check out online kayaking and canoe forums for second hand spares too.
- If your boat hull is a little bit broken, try repairing it! You can fix small splits in the hull quite easily by shaving a little plastic from areas such as the cockpit rim and carefully re-heating it to fill the crack. Though take care to ensure that any safety features, such as grab handles, are still properly fitted and safe to use - get advice if you're not sure.

I'm not suggesting that you take measures as drastic as Mickey's epic repair job (right), but it does go to show that a little imagination can go a long way when it comes to rescuing your boat...!

For larger cracks and damaged hulls, please be aware that this could compromise the safety of your boat. Be sensible if you take on repair jobs and make your own judgements about the safety of your kit.

Photos: (Above) Split hull repair (Rich), (Right) Bow reconstruction (Mickey)

nope....it really is beyond repair...

- If your boat is beyond repair, could you give it new life?! Here are some of examples of people being creative with their old kit!

Photos: (Clockwise from top left) Pimm's fountain (Chris), Hanging basket (Sam), Can crusher (Unknown), Foamy made from Outfitting (Rich)

seriously, if your boat is on its last legs...

- Try contacting your local kayak shop or manufacturer to find out whether they operate a kayak recycling scheme and whether they can accept your old boat. Make sure that you've cleaned it up a bit first so it's ok for recycling.
- Also try contacting your local Council - they may be able to help you to recycle your boat locally. Be aware that kayak recycling is a bit new and unusual so you may need to explain what you mean! They will probably ask you to remove any outfitting and may even require that you chop the boat in half...!

where do we go from here?

We've established that there are some options for minimising waste during the manufacturing process, through carefully considering materials and using process offcuts to make new products. In some areas, recycling schemes are available for dealing with old and broken boats, either through retailers or local councils. The problem is, the financial and environmental cost of waste is too often ignored and recycling isn't as accessible as it should be...so where do we go from here?

During the course of this project, I was lucky enough to speak with a whole range of businesses about the issues and opportunities associated with kayak recycling. I was surprised by the stark differences in approaches, with some cautious and reluctant to discuss waste and others showing a real enthusiasm and passion for the project by sharing their own ideas and innovations. This openness and enthusiasm is the first step towards making positive change and this needs to be found throughout the whole kayak manufacturing and recycling chain.

As paddlers, we also need to be considering how we dispose of our broken equipment in a sustainable way and looking for the best options for repairing and recycling our kit.

For retailers and manufacturers, introducing a kayak recycling scheme can be a challenge and is ultimately secondary to the businesses' main function - selling new products to customers. However, manufacturers and retailers need to be taking more responsibility for the products that they put on the market place and supporting their customers in disposing of the products in a sustainable way. Legislation is already driving this change in other industry sectors through Producer Responsibility Obligations, which means that the consumer can legitimately return certain products to the manufacturer for disposal at the end of the products' life. This is already the case for large electrical items, such as fridges and washing machines. Those in the kayak manufacturing industry need to catch up in order to protect their businesses and be in a strong position to influence how they are regulated in future.

Responsibility for waste in our sport lies with all those involved - this includes designers, manufacturers, retailers and paddlers.

By improving our own practices and working with the other links in the chain, we can push for positive change.

Photo: iStock/malerapaso

So what are the key challenges to kayak recycling and how could they be overcome?

- Engaging with the consumer: How can we engage with consumers and encourage them to recycle their broken kayaks? Could manufacturers and retailers promote existing recycling schemes better? How could we make it easier to recycle boats?
- Reducing contamination: Customers need to be aware that in order to recycle their boat, contamination must be kept to a minimum. Depending on the recycling scheme, this may mean that the customer would have to remove any outfitting before returning their broken boat for recycling. The customer needs to do their bit so that the recycling process can be successful.
- Storage & handling: One of the biggest barriers to any kayak recycling scheme is the amount of space required to store old, unwanted kayaks and the issues associated with handling and transporting the kayaks for reprocessing. Would a solution be to offer specific 'Recycle Your Kayak' days, so that sufficient boat numbers could be collected to justify any transport costs? Could backhauling (filling an empty delivery truck for its return journey) be used to prevent the need to make special trips?
- Take-back schemes: Manufacturers may prefer to accept their own kayaks for closed loop recycling because they know exactly how the boat has been manufactured and the type of plastic that has been used. Does this mean that the onus is on the manufacturer to encourage their customers to return their boats at end of life through take-back schemes? Could manufacturers work more closely with regional retailers to implement a suitable kayak collection scheme?
- Collaborative working to save cash: A more co-ordinated approach is needed between manufacturers and retailers - could they work together more to generate packaging solutions that would cut waste and save cash? Are reusable packaging solutions available? Can we challenge consumers about how much packaging is really necessary for their new boat?
- Using process offcuts: The Dagger Fiesta is proof that process offcuts can be used to produce a new kayak…not only that, there is real demand for the boat! Is there a reason why other manufacturers haven't tried this?
- Really old boats: For really old kayaks, the plastic used in their manufacture may have degraded and be of poorer quality. The opportunity for recycling these boats in a closed loop system is reduced, but can they still be recycled into other, lower grade plastic products rather than be landfilled?
- Legislation: Legislation governing waste is getting tighter - by thinking ahead and being proactive, it is likely that the sector will be able to have greater influence over how they are regulated in future.

Image: Beth Ripper

what designers and manufacturers need to do

It's really important that new kayaks are easy for customers to dispose of in a sustainable way. This starts at the drawing board by:

i) Designing for Recycling, for example choosing recyclable materials for your products and avoiding non-recyclable plastics such as XLPE; and

ii) Designing for Disassembly, meaning that the component parts of a product can be easily separated, which helps to make recycling easier at the end of the product's life.

Could manufacturers make better use of waste generated during the manufacturing process? Evidence shows that quality, marketable products can be made from process offcuts - are you missing out?

Could manufacturers work more closely with retailers to avoid unnecessary waste, such as excess packaging? This represents a huge cost for the manufacturer to provide and for the retailer to dispose of. It just makes commercial sense to work together and develop new, practical, reusable packaging alternatives to save cash.

Manufacturers also need to consider offering take-back schemes for their kayaks. Could you be future-proofing your business by considering waste now?

what retailers need to do

How much of your bin is filled with excess plastic and cardboard packaging every week? Could you work better with your manufacturers and suppliers to cut out this cost for your business? Could you separate more of this material for recycling?

Retailers have great access to customers. Could you bring the customer back to your store at the perfect time through offering a kayak recycling scheme? Could you make use of your existing distribution networks to support a kayak recycling scheme?

As customers are becoming more aware of environmental issues, offering a kayak recycling scheme could significantly add to your business' reputation and may provide an opportunity to boost sales. Now is the time to recognise the business benefits of implementing more sustainable practices, and help to protect your business from future environmental legislation.

what we need to do as paddlers

Think about the different routes for disposing old and broken kit. Could your boat be reused or repaired easily? Could it be recycled and turned into something new? Don't be afraid to ask your retailers and local authorities about what they're doing to improve their performance and make recycling easier for you...

Be proactive. Work together.

Think laterally to find solutions.

Don't be satisfied with costly, unsustainable practices.

about the author

Beth Ripper studied Engineering at the University of Southampton, where she first learned to paddle. Beth is now a Waste Management Consultant with WSP and has gained experience delivering a range of planning and research projects on behalf of both public and private sector clients. She is a self-confessed 'bin-spotter', enjoys white-water kayaking with friends and loves a good cup of tea!

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WSP is a global design engineering and management consultancy specialising in Property, Transport & Infrastructure, Industry and Environment projects. WSP works with clients worldwide to create built and natural environments for the future. To find out more, check out: www.wspgroup.com

The British Canoe Union (BCU) is the lead body for canoeing and kayaking in the UK and is the umbrella organisation for Canoe England, Canoe Wales, Canoe Association of Northern Ireland and the Scottish Canoeing Association. The BCU aims to help and inspire people to go paddling. To find out more, check out: www.bcu.org.uk

Palm Equipment International is a paddler-owned company which was founded by Andy Knight and Bob Slee in 1979. Based in the south west of England, Palm manufacture Dagger kayaks for Europe and produce high quality clothing and equipment for paddlers. To find out more, check out: www.palmequipmenteurope.com

Established in 1987, Desperate Measures has been trading from their Nottingham showrooms for over 20 years. They have built a reputation for supplying high quality kayaking, canoeing and safety equipment, along with honest advice, to individuals, organisations and businesses throughout the UK and across Europe. To find out more, check out: www.desperate-measures.co.uk

The Waste Aware Hertfordshire Partnership brings together the 11 County, District and Borough Councils in Hertfordshire to raise awareness of the issues around waste management and how we can reduce the amount of waste we sent to landfill. To find out more, visit: www.wasteaware.org.uk

Avanti is one of the UK's largest environmental management companies. Avanti endeavour to offer sustainable recycling, reprocessing or reuse options in contrast to direct disposal and operate a state of the art plastics recycling centre in Merseyside.
To find out more, visit: www.avantienvironmental.co.uk

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All photographs taken by Beth Ripper unless otherwise stated. Cover photograph courtesy of Tim Ripper.