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Abandoned, Lost or Discarded
Fishing Gear (ALDFG) - What is the
problem and what are the solutions?

A case study in Newlyn, Cornwall,
UK.

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Acronym table:

25 Year Environment Plan - 25 YEP	Deposit Return Scheme – DRS
Abandoned Lost or Discarded Fishing Gear - ALDFG	Extended Producer Responsibility – EPR
Centre for Environment, Fisheries and Aquaculture Science - CEFAS	Fishing For Litter – FFL
Cornwall Fish Producers Organisation - CFPO	Global Positioning System – GPS
Department for the Environment, Food and Rural Affairs - Defra	

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Abstract

This report details research conducted on fishermen's behaviours towards ALDFG (Abandoned, Lost or Discarded Fishing Gear) in the UK. The research has two aims; 1. To use fishermen's interviews to build a better understanding of the reasons behind the occurrence of ALDFG and the actions currently used to reduce ALDFG and 2. To ask fishermen to suggest solutions for reducing ALDFG and to assess the acceptability and effectiveness of interventions according to fishermen. 10x Cornish fishermen representing both mobile and static gear and 1x Newlyn Harbour Authority representative participated in semi-structured interviews with questions on gear sourcing, loss, retrieval, mitigating actions and future solutions to minimising ALDFG. The main reason for gear loss in mobile gear was snagging on obstacles (exacerbated by worn gear) and for static gear, mobile/static gear conflict. Current management to tackle these reasons include use of technology (GPS) and improved communication (via producer organisations). Fishermen spoke of changing social norms around marine litter influenced by awareness raising schemes (like Fishing For Litter - FFL), media programmes and from within their communities' social networks. Solutions suggested by the fishermen favoured improved communication, enforcement and recycling facilities.

Fishermen's views on suggested interventions; Deposit Return Schemes (DRS), litter collection via Fishing For Litter (FFL), technology, recycling and incentives (monetary and non-monetary) were influenced by the cost and practicality. The figures for ALDFG from scientific surveys of EU/UK waters were juxtaposed with fishermen's perceptions of current low-level gear loss. Perceptions of low gear loss could be due to Newlyn's sustained engagement in the FFL scheme. This research was limited to one case study area, to address the discrepancy between estimated figures and fishermen's perceptions of gear loss and to examine the effect of FFL, further research is required in other UK ports engaging and not engaging with interventions.

Chapter 1: Introduction

The negative impacts marine plastics are having on our seas, wild life and health have recently received widespread media and political attention. On a global scale, surveys of the Pacific Ocean high seas state that 46% of all marine litter is fishing gear (Lebreton, 2018). A comparable figure is not available for the UK. However, there are EU studies which state that, proportionally the UK seas could currently contain approximately 106,000 metric tons (MT) of fishing-related plastic litter, with an estimated annual increase of 2,668 MT (Viool, 2018*). Plastics in the marine environment cause negative impacts on marine life (ingestion, entanglement) and to ecosystem services minimising economic and social benefits to humans (Beaumont et al. 2019). For example, fish ingesting and becoming entangled in plastics can minimise the fish stock leading to knock on economic and social impacts on the fishing sector.

Governments across Europe are implementing steps to reduce the amount of plastic entering the marine environment. In the UK, the 25 Year Environment Plan (25 YEP) sets out an ambition to eliminate all avoidable plastic waste by 2042**. To work towards this visionary target the Department for the Environment, Food and Rural Affairs (Defra) are exploring ways in which the amount of Abandoned Lost or Discarded Fishing Gear (ALDFG) in our seas can be managed and minimised. Under the EU Single Use Plastics Directive 2019/904, EU Member States have obligations to implement Extended Producer Responsibility (EPR) on certain products, including fishing gear containing plastic. A key principle of EPR is that manufacturers cover the full net cost (taking account of revenue from the sale of materials for recycling) of managing their product at end-of-life. For fishing gear to be responsibly managed by the manufacturers requires lost gear to be minimised and retrieved and all gear to be disposed of systematically within improved harbour facilities. Another key element of EPR on fishing gear is a drive towards standardising the different types of plastic that are in use.

Important to note here is that all fishermen interviewed in this study were involved in or were aware of the FFL scheme, operating in their homeport of Newlyn. At the end of 2015, FFL operated in 11 Harbours, with 177 vessels across South West England, Newlyn being a major contributor. Since the inception of FFL in 2004, over 1,000 tonnes of litter have been collected, with South West ports contributing 67 tonnes between July 2014 and November 2015 (FFL, 2018). Wyles et al. 2019 (in press) surveyed fishers (n=97) and stakeholders (n=22) in the UK to investigate perceptions of FFL. Overall, FFL was evaluated very positively (7.85/10). Fishermen participating in FFL reported less environmentally harmful waste management behaviours than non-FFL fishermen. Stakeholders and fishermen who were part of FFL rated the scheme overall significantly higher than fishers who were not part of FFL. The same pattern was found for the objective to remove litter, with stakeholders and fishermen participating in the scheme stating it was more successful than non-FFL fishermen did. Therefore, the responses for this report could be representative of fishermen engaging with FFL and not generalised to express the views of non-FFL fishermen or the entire UK fishing fleet.

The first step in moving towards minimising ALDFG in the UK is to develop a baseline understanding of the evidence available. The Centre for Environment, Fisheries and Aquaculture Science (CEFAS) and MRAG Ltd were commissioned to explore the evidence, and identified the following data gaps:

- The availability of literature on ALDFG focused on the UK is exceptionally small and focused on impact to specific marine organisms.
- Little information exists on factors that lead to abandonment and loss of fishing gear in the UK and therefore what management measures will be effective. It was suggested that fisher's surveys would enable this evidence.
- A lack of understanding of the economic costs and or potential effectiveness of incentives as part of rigorous actions to minimise ALDFG in the UK. With associated limited understanding of the potential environmental and economic benefits of removing existing ALDFG. Suggested action to overcome this includes an examination of the cost and benefits associated with: enforcement, management, gear replacement, health and safety, boat damage and time at sea etc.

To help to address these data gaps this project aims:

- To use fishermen's interviews to build a better understanding of the reasons behind ALDFG and the actions currently used to reduce ALDFG.
- To ask fishermen to suggest solutions for reducing ALDFG and to give their perspective on the effectiveness of other interventions: Deposit Return Schemes (DRS), litter collection via Fishing For Litter (FFL), technology, recycling and incentives (monetary and non-monetary).

This report will now detail the method, findings and concludes with areas for future research.

*UK proportions of EU estimates. **Plastic waste is 'avoidable' when the plastic could have been reused or recycled; when a reusable or recyclable alternative could have been used instead; or when it could have been composted or biodegraded in the open environment.

Chapter 2: Method

A qualitative approach to data collection was adopted for this research. Qualitative data collected by interviews enabled interpretation of the phenomena of ALDFG from the views and in-depth knowledge of fishermen and Harbour Authority representatives. Interviews were constructed around a life cycle framework, considering the life of the fishing gear to waste disposal or recycling, giving participants the freedom to speak of their experiences regarding ALDFG. Rich qualitative data adds human real-world experience to Defra's evidence base however there are limitations. Qualitative data is limited in its ability to establish causation and in generalising to a wider population. Qualitative data collection can also be time and resource consuming and requires reflexivity to manage subjectivity. Considering reflexivity and transparency in data presentation, researcher bias is now detailed.

This research was conducted in Newlyn, Cornwall, with participants being mostly Cornish Fishermen. The researcher is also from Cornwall and has professional and family connections with the Cornish fishing community, which aided in participant recruitment and in enabling trust relations to be built. Cultural and community connections could have biased the research. Although, the researcher set-out to deliver a balanced report, using their expertise in marine conservation, policy and research methods. This research was conducted in April-May 2019. Newlyn was chosen as the study site as it is a major port participating in the FFL Scheme and because of existing networks and relationships with the Cornwall Fish Producers Organisation (CFPO) and Defra arms-length bodies. Participants were recruited purposefully, with fishermen representing different fishing gear types (mobile/static) approached to take part. Fishermen and Harbour Authority representatives were asked to participate either directly via direct contact with the researcher or with the CFPO acting as a gatekeeper.

The interviews were face-to-face, semi-structured, between 25-40 minutes in length and took place within Newlyn Port, the CFPO office or at Cadgwith Cove. Each participant was given an information sheet detailing the study and gave informed consent (see appendix). Questions were posed to gather information from Fishermen via a no blame approach with the option to pause or stop the interview at any point. The interviews were recorded via Dictaphone and manually transcribed by the researcher. 10 fishermen were interviewed including 4 mobile gear (single and twin stern trawling and beam trawling) and 6 static gear (shellfish pots, gill nets, tangle nets and hand-lining). 9 of the fishermen fish from Newlyn and one from Cadgwith Cove. The fisherman from Cadgwith Cove was selected due to his experience and as a comparison of location. One interview was conducted with the Newlyn Harbour Authority to get a holistic view on the port infrastructure regarding waste and recycling facilities. The data was analysed using thematic analysis and is presented detailing the life cycle of the fishing gear, from sourcing via suppliers to disposal or recycling. This report has been produced for Defra to enhance current evidence on ALDFG, with a focus towards filling the evidence gap on fishermen's attitudes and behaviours. It is also hoped this report will be accessible to the participants themselves, to demonstrate the route from participation to consideration in future policy decisions.

Chapter 3: Findings

In this chapter, key findings are detailed and discussed under the following topic headings; gear sourcing, maintenance, loss, reasons for ALDFG, Fishermen's behaviour, mitigation and future actions.

3.1. Sourcing

Questions were asked on where gear was sourced and what qualities the fishermen looked for when sourcing gear. These questions were aimed at investigating whether gear was sourced prioritising cost or quality. Findings state that, depending on the gear type, gear was sourced from different countries. However, gear sourced from European countries, in particular Portugal, was said to be of better quality. This finding was also backed up in conversation with a local net repairer who physically demonstrated the strength of the European gear in comparison to a Far-East counterpart. According to fishermen, sourcing good quality gear is important in terms of marine litter, as weak nets break more frequently, resulting in increased gear loss.

“the bulk of this netting gear will come from the far-east, China I think most of it comes from, there is slightly better-quality stuff comes from Portugal” – Tangle net fisherman.

Discussion - This finding could have potential implications for future implementation of mitigating actions. Fishing gear used by the UK fishing fleet is often imported, therefore, new regulation on the standards or specification of gear will require implementation by the country of manufacture. These changes could have implications for UK trade or create business opportunities for the UK to produce a greater proportion of fishing gear. In turn, nets produced in the UK or changes to the standards of fishing gear (to minimise loss) or standardisation of materials (e.g. to improve recyclability and traceability) could increase gear prices.

3.2. ‘Make do and mend’– Gear maintenance

Gear maintenance was shown to be an essential task for all fishermen, constructing gear sets or repairing damaged gear themselves to ensure continued use and to reduce financial overheads. Regular gear maintenance was considered by the fishermen as an action to help reduce ALDFG. The most common maintenance was cutting out sections of tattered or damaged monofilament net and replacing with new. All fishermen stated that once sections were removed, they were placed in bags provided by FFL or recycling companies (GWR Polymers, Fishy Filaments – see figure 1 on p.25) to go for recycling. Relevant to note is that this facility is not available at every UK port, with Newlyn acting as a hub for all of Cornwall.

Tangle gear fishing is only conducive to basic repairs to the rope work, due to the net’s larger mesh size (>10mm). Therefore, once the Nylon monofilament in tangle nets has reached end of life it is sent for recycling in bulk, not replaced in sections. As this type of fishing was felt to be growing in popularity among fishermen, this route to recycling may be vital to stop an influx of gear entering the marine environment.

Mobile trawling fishermen stated that they undertook structural maintenance however unlike monofilament net, trawl net cannot be recycled due to the mixed Polypropylene construction, resulting in disposal to landfill.

Discussion - Without recycling facilities (such as those provided by GWR Polymers and Fishy Filaments) being available it is plausible that monofilament net would go to landfill or be discarded over board more frequently. Although this statement could not be explored in this short study, it highlights that the importance of effective waste management and recycling facilities to managing ALDFG is a current gap in knowledge. Improving the recyclability of trawl nets and other gear made from mixed materials also needs further exploration.

3.3. Is gear loss an issue?

The fishermen were asked for their opinion whether gear loss was an issue. From the fishermen who said gear loss was not an issue, this was because they either stated they do not personally experience gear loss, or they considered that when gear was lost it became a structure for biofouling or marine life to inhabit. For the fishermen who felt gear loss was an issue, this was either from a first-hand perspective, because it was a financial burden regarding gear cost and lost catch or because of the potential damage it can cause to their vessel or fishing practice.

Although 'ghost fishing' (fishing gear that is abandoned, lost or discarded that continues to fish without capture) was not a term used by the researcher, the fishermen were aware that ghost fishing has received major media and political attention and did raise this in interviews. Opinion was split as to whether ghost fishing was an issue. Mobile fishermen stated that newer monofilament nets that get lost would continue to fish while static fishermen described this as a temporary issue. Trawlers did not think trawl nets posed a risk of ghost fishing as it was "too heavy".

"certainly the biggest problem most people have is thinking its ghost fishing, that nets keep continually fishing when they get lost but that might be the case with gill net on particularly hard ground that just didn't get rolled up but eventually the crabs will crawl into it and it will come down, any net that is lost and discarded will eventually stop fishing and... very quickly because it just rolls up because we only fish the neap tide cycles because when the spring tide cycles come in you just can't fish" – Tangle net fisherman.

Discussion - Fishermen's perceptions that ghost fishing is not an issue in UK waters could impact on stakeholder buy-in and success of interventions framed as reducing ghost fishing.

3.4. The reasons for ALDFG

As many fishermen gave different reasons for gear loss these have been separated into mobile and static gear. The reasons should be considered accidental unless they are identified as intentional reason for **discarding**.

Table 1 shows the accidental and intentional reasons for gear loss as expressed by participants.

Reasons for gear loss for mobile fishermen	Reasons for gear loss for static fishermen
Foreign trawlers losing gear: French trawl gear is lighter and easier to break Less concern over gear loss or discarding	Leaving gear unattended (mainly shellfish pots than can be out all year, but also nets which fish for 48 hours)
Trawls snagging on obstructions on the sea bed including telecommunication cables or hard ground Trawls encountering wrecks Discarding of gear over wrecks	Trawlers towing gear (accidental or intentional) – amount lost based on angle of trawl, whether the trawlers have cut off one or two end and whether markers remain Ships towing gear or damage via anchor chains Ships anchoring over shellfish pots
Gear conflict: With static gear fishermen Trawlers cut static nets if caught on trawls and discard overboard	Gear conflict: With mobile gear fishermen With foreign mobile gear fishermen Trawler fishermen fishing over static gear purposefully to capitalise on catch No phone signal or internet connection to communicate location of gear to mobile or foreign fishermen
Bad weather	Bad weather
Gear near end of life gets damaged	'Risky behaviour': Static fishermen deploying gear on softer trawling ground Gill netting over high risk ground (hard ground)
Beam trawls are discarded as there is no recycling facilities for mixed materials	EMFF pot funding – too many pots at sea and cheaper cost to fishermen to replace pots
Inexperienced fishermen	Inexperienced fishermen
	Shellfish pots placed in singles – which are harder to retrieve if markers get lost Wreck fishing

Mobile and static gear encountering one another was the most frequent reason for damage to fishing gear and in some cases subsequent loss. Static gear is affected more than mobile gear due to the nature of fishing practice, one more powerful vessel towing heavier gear and one with lighter weight static gear in the water column or on the sea bed.

“the biggest problem of losing gear is to the trawlers and that’s probably one of the most, the only reasons fishermen lose gear. Is from another fisherman, usually foreigner, lack of communication, two different types of fishing come together” – Mixed static gear fisherman.

The most common reason for mobile gear becoming lost was snagging on an obstruction (hard ground, wrecks, telecommunication cables), with the probability of gear loss increased when gear near 'end of life' is damaged.

“last time we lost one (whole trawl net) it was just really unfortunate, we just happened to be coming near the end of the life of the towing attachment with the bridle, it was very poor weather, come fast in a place that we thought was clear and the combination of weather, broke the bridle and left the net behind. We tried creeping for it, tried getting it back but we just couldn’t get it, couldn’t get it back” – Twin stern trawl fisherman.

Discussion – It is important that there is an incentive to bring back gear that is coming to the end of life, before it gets broken. There is increased likelihood of gear loss with gear that is coming to the end of life but, there is currently a lack of incentive in place (e.g. a deposit return scheme). This causes knock on effects for the amount of fishing gear that ends up in landfill. This suggests that fisheries management (via mixed fisheries agreements) could reduce gear conflict and ALDFG.

3.5. Gear retrieval

If gear is purposefully discarded, then retrieval will not be attempted however if gear gets lost accidentally there are two main methods used for gear retrieval. The technique that is most widely used due to the considered effectiveness for both mobile and static fishermen is ‘creeping’ with a grapple hook. The other method for retrieval is setting additional gear to tangle with lost gear. The chances of retrieval via either method is enhanced by the use of Global Positioning System (GPS) technology. Gear retrieval is incentivised by the cost of gear and by lost fishing time or catch. The cost of gear loss can vary from hundreds to tens of thousands of pounds:

“I don’t give up, I do keep coming back, because a pot costs £100” - Mixed static gear fisherman.

“over the years something approaching £30,000 of lost gear” - Tangle net fisherman.

When asked how long they would spend trying to retrieve lost gear, fishermen’s responses varied significantly:

- Pots - 10 minutes to 5 hours creeping, up to 2 weeks with use of other gear
- Trawls - 1 to 48hrs
- Tangle nets 1-7 days or up to 2 weeks with use of other gear

Multiple factors can contribute to the length of time spent retrieving lost gear, including these barriers:

- Weather
- Ground type (hard ground makes retrieval difficult)
- Time – loss of fishing time/daylight/tidal cycle/reduced probability of retrieval
- Small surface area to hit (single pots)
- Potential damage to boat
- Loss of deck space if retrieving others larger gear
- Wrecks (very unlikely to retrieve and risk of losing creep)
- Lost warp (Trawlers)
- Loss of marker buoys on ends of pot strings or net
- Not allowed to creep over telecommunication cables
- Age of gear – less time spent on retrieving gear nearing end of life

Discussion - Whether more expensive fishing gear that is stronger or easier to recycle or gear that is circulated within a DRS would incentivise longer retrieval times would depend on the barriers above and associated behavioural changes of fishermen towards retrieval.

3.6. 'End of life' gear

Gear is considered as having come to 'end of life' when it no longer fishes efficiently. There is little data available on how much fishing gear is purchased for use in UK waters. In interviews fishermen were asked how long their gear lasted to gain a basic understanding of their frequency of purchasing. However this case study provides a limited scope, with lifelines dependent on gear materials, individual fishing practices and maintenance techniques and does not provide a representative account for the UK fishing industry.

Gear lifelines varied between gear type used:

- Pots – 6 -20 years
- Trawl net – 3 months to 2 years. Trawl ropes – 1 year. Chain mats and shackles – 1 month
- Gill net – 1 year
- Tangle net – 6 months – 1.5 years (depending on ground type)
- Ropes – 5-12 years
- Hand line – 1 month

3.7. Is fishermen's behaviour regarding ALDFG changing?

3.7.1 - A sign of the times:

Reducing the amount of ALDFG in our seas requires fishermen to minimise the amount they lose and/or discard, increase gear retrieval and manage waste and recycling responsibly, with the help of associated Authorities. This will require sustainable behaviour to be enhanced or adopted. During the interviews fishermen with over 20 years in the industry spoke about attitude change reflecting less discarding than when they started fishing.

"I don't know anybody now who doesn't partake in that Fishing For Litter scheme, in some way or other... I really don't know where we could improve it to, because most people do take part in that and it is just a natural progression thing isn't it, once you start doing it, you tend to do it then, as a natural thing to do, don't you, because once it was natural to throw it over the side for some, now it is natural for them to pick it up and save it and there's facilities for them to lift it off in the Harbour and get rid of it, so that made it a lot easier I think"

- Gill net fisherman.

Adopting more sustainable behaviours could also spill over to or originate from considering broader plastic pollution sources, such as domestic waste. This can be seen as influenced by the media, such as the BBC Programme, Blue Planet and promoted by an ease of use management system (like that provided by FFL).

"Everything used to go over the side, everything. But now it has changed. After watching Blue Planet and everything like that, everything goes in the skip with us. All our plastic bottles are put in separate little bags and all put ashore. Nothing is put in the sea no more. All our waste is put in bin bags and put ashore on the Quay" – Beam trawl fisherman

3.7.2 – Like father like son

An interesting finding was how ‘generational influence’ (encouragement by either father or son to adopt sustainable practices) could be raising awareness and changing the social norms regarding marine litter. The influence of family members from different generations could be relating specifically to ALDFG or taking a broader perspective incorporating other sources of marine plastics.

“our father drove into us when we were younger... never leave gear in the water where...you can’t get to the gear. One to be able to retrieve the gear before the fish gets soiled and gets wasted and two never to leave gear in the water where there is a high risk of it being damaged or lost through weather issues” - Gill net fisherman.

“My son being... he’s 24... that generation find it really disgusting. And he’s picking up any piece of plastic that ever came aboard the boat. And it’s all gathered up and he’ll put it in the bin every day and good on him. Usually, a few years ago I’d have picked it up and thrown it back over the side again. “That’s not my bloody rubbish. I’m not carrying that round the boat”. But he has definitely changed my way of thinking on that... even if it’s just a carrier bag. It all comes aboard now. Every single bit we catch in the net, it comes to shore and it goes in the bin” – Mixed static gear fisherman.

Broadening out from family relations, certain Skippers try to influence the behaviour of their crew by educating them on sustainable practices, appealing to the crew’s moral conscience.

“it’s ethics isn’t it...I mean OK I am old school now but there is still a lot of old school out there now who say “oh sod it and chuck it”...They can’t be bothered, you know my crew, you have to educate them, say “hang on, don’t go chucking that bottle over the side, stick it in there”, it has got to be done hasn’t it? You know it is people’s future” – Beam trawl fisherman.

This seems to be dependent on the Skipper and how their experiences over a number of years have shaped their attitude towards plastic litter. There was indication that seasoned fishermen would be supportive of improved training, indicating that increasing awareness and education of the impacts marine plastic could be an effective method, encouraging responsible sustainable practices.

“Well, I’m a SEAFISH instructor, I teach Health and Safety and I do talk about MARPOL and all that. Yes, a little...certainly I could do that myself, 10 minutes on how plastic breaks down and how we shouldn’t have it in the water column” – Mixed static gear fisherman.

3.7.3 – The public’s perception of fishermen

The public perception of fishermen influenced how fishermen felt about marine litter, with a small number of fishermen explicitly linking the influence of social media with the public’s negative perceptions of the fishing profession.

“I don’t think if you are going to pull somebody out of the street in London or in a city and ask their opinion on fishermen, the way we are portrayed I don’t think is very nice...it’s a strange situation for, I think it is so powerful isn’t it, you click on Facebook and just flip through and see things, you don’t know if it is true or not do you”

– Shellfish potting fisherman.

The following quote follows a fisherman talking about the effect social media campaigns can have on how the public perceive them. The campaign dialogue was to stop people eating fish on account of the amount of ALDFG in our seas.

“I mean it’s that type of bad news that comes out that we get blamed for, and government should say, look we’ve been supporting this (Fishing For Litter) for 12-15 years...and just plug it and say in actual fact we have been doing this for many years and we’ve brought X amount of tons in...I mean a lot of people are signed up to it and fishermen are doing it... change the culture a bit more, get more people doing it and also...you know if you are buying from a fishing fleet which is responsible in that sense” – Twin stern trawl fisherman.

Fishermen said that they felt blamed for the marine litter in the seas, realising they need to ‘do their bit’ to minimise gear loss but that they are part of a bigger system with influence on marine litter (incl. waste from domestic origins, cruise liners and container ships).

“it isn’t my job to be picking up other people’s rubbish, but you do. To me...the plastic, the rubbish in the ocean is a far bigger problem than lost fishing gear. Far bigger problem. If I found somebody’s lost net once or a crab pot, a bit of rope once a year would be the most of it. I’m picking up plastic in the nets every hour, every ten minutes...I get that feeling no matter what is going on in the Ocean. Whatever problem, it’ll come around to fishermen” – Mixed static gear fisherman.

A distinctive feature of certain sectors of the UK fishing community is the commitment to keep traditional practices alive and enduring superstitions relating to working at sea. As the Fishermen were speaking about gear loss they acted out ‘touching wood’, showing although they were speaking hypothetically about gear loss scenarios, they did not wish to tempt fate of that happening in reality.

“As long as the warp hasn’t parted then we can creep for it and get it back, as long as it is not in a wreck, touch wood, I don’t like talking about things like that, but not for a long time, long time. It is not what we aim to do” – Beam trawl fisherman.

Discussion – Behavioural insight science could provide a new, useful perspective on fishermen’s attitudes and behaviour around ALDFG. One element of behavioural change is ‘timeliness’ of interventions (Tregebov, S. & Kirkman, E. 2017; RARE and BIT, 2019). The concept of timeliness could also be adopted when new recruits join the fishing industry.

3.8. Mitigating actions

Due to the range of fishing practices and gear types in use in the UK, each has had to adapt to reduce gear loss that can have knock on financial impacts relating to gear, loss of catch, fishing time or vessel damage. During the interviews, fishermen shared current actions they incorporate to mitigate against gear loss, including their reasoning.

“the financial costs of losing your gear is a big thing to cover so everybody looks after their gear as best as possible” - Shellfish potting fisherman.

- Giving box positions to the CFPO to e-mail to foreign PO's and other vessels.
- 'Risk aversion' via not setting static gear on high risk ground (mobile or hard ground, wrecks).
- Using technology including GPS and Marine Traffic (AIS) to plot the location of gear and communicate your location to others.
- Not using gear near end of life, as more likely to break and fish less efficiently.
- Being knowledgeable about the weather – retrieving gear before storms and using slack tides.
- Re-using materials, e.g. chain matting from trawls turned into anchor for smaller vessels.
- Using gear innovation to reduce damage. Net droppers on gill nets break the net to the footrope, as to not lose the whole net, and dollies on trawls protect the net from contact with the sea bed.
- Pure Nylon monofilament is collected and recycled free of charge (to fishermen) by GWR Polymers and Fishy Filaments.

3.9. Future actions to minimise ALDFG

As future interventions regarding ALDFG will involve the UK fishing community, fishermen participating in this research were given the opportunity to suggest un-prompted solutions to the issues associated with ALDFG.

Table 2 shows suggestions as listed under gear type (mobile or static) and those from the Newlyn Harbour Authority:

MOBILE FISHERMEN	STATIC FISHERMEN	HARBOUR AUTHORITY
<p>Stop EMFF pot funding, reducing shellfish pots in number</p> <p>Limit shellfish pots seasonally or with time limits</p>	<p>Improved communication between all vessels, UK and Foreign. Requires further improvement to communication between UK and Foreign PO's and vessels</p> <p>Gentlemen's' agreements have proven successful between local Newlyn vessels</p>	<p>Improve recycling facilities at Harbours</p> <p>Better education on recycling options</p> <p>Investment from the Maritime Coastguard Agency to minimise costs to fishermen</p> <p>Stricter control of Harbours to the public</p> <p>Current barriers to improving Harbour recycling facilities are:</p>
<p>Improve enforcement:</p> <p>Limit effort of foreign vessels in UK waters</p>	<p>Improve enforcement:</p> <p>More responsibility placed on foreign vessels</p> <p>Compensation fund for gear loss – UK/French government responsibility to manage</p> <p>Video capture of towing incidents – to prove cause of gear loss and allow prosecution</p>	<p>Cost – of building storage facilities</p> <p>Law (requirements to waste management not strict enough)</p> <p>Limited knowledge on options for recycling ALDFG</p> <p>Not enough storage space</p>
<p>Remove retired communication cables out from 12nm - requires marine industry support</p>	<p>Placing a levy on nets – if suitable cost</p>	
<p>Improve recyclability of Polypropylene trawl net – if cost effective and as efficient as current spec</p>	<p>Extend the life of gear – make Nylon monofilament net more UV resistant and improve longevity of rubber on shellfish pots</p>	
<p>Promote sustainable behaviour with improved recycling facilities in harbours</p>	<p>Implement a local closed system for Nylon Monofilament - recycle nets into fishing accessories that can be used on vessels</p>	

The fishermen were also asked to give their opinion on actions considered in the scientific literature or via policy recommendations to minimise ALDFG.

Table 3 shows responses to a DRS, FFL scheme, Recycling, Technology innovations and Incentives (monetary and non-monetary):

Intervention	Positive	Negative	Neutral	Improvements
Deposit Return Scheme	Levy on fishing nets suggested by gill net fishermen. Dependent on levy being set at a suitable price, suggested amount by participant 50p per net.	Gear will be very poor quality, particularly pots. Will result in fishermen footing costs. Local recycling facilities are required, not abroad. Net manufacturers from far-east will not participate in the scheme. Gear from different material and origins get mixed together, time intensive to disassemble. Lack of awareness on recyclability of the gear. Action needs to be self-driven.	---	---
Fishing for Litter Scheme	Ease of use. Provides facilities on Quay. Improves education of issues with marine litter. Highlights the issues of ALDFG. The amount of plastic brought in is reducing.	Selectivity of what items go into the skip – skewing amounts. Retrieved Fishing for Litter going into the general Harbour skip. Litter not found at sea being placed into the Fishing for Litter skip. 1-ton bags are not practical for smaller vessels. Collection of waste from where vessels land is not effective.	Harbour provides free management of waste system. Fishermen brought litter in anyway before the scheme started.	Promotion of the scheme. Resourcing a full-time co-ordinator. Better signage on skips. Smaller bins closer to where landing fish. A telephone number to call to arrange collection of Fishing For Litter bag.
Recycling	Recycling important to personal status and satisfaction of ‘doing our’ bit. Ease of use of monofilament net recycling. Harbour Authorities duty.	Changing the spec of trawl net is costly and influences the practicality of using the nets. Mixed materials not easily recyclable. Pots are difficult to recycle as they disintegrate over time. Rope made from part recycled materials can be poorer in quality and lead to more frequent purchases.	---	Improved facilities for recycling in the Harbour with no additional costs to Fishermen.
Technology: Acoustic tracking Biodegradable gear GPS	Acoustic tracking shows towed gear location. Will support if cost suitable and practical (as strong as current spec). GPS positive for reducing ALDFG due to pinpointing co-ordinates for gear and high-risk areas.	Cost and practicality. Cost and practicality – not strong enough or break down to quickly when using or in storage. Entirely nylon trawls although easier to recycle were said to be too expensive and suffer from shrinkage. Innovation into new materials is expensive.	Query on how many acoustic trackers would be needed per string of net. No compensation for chain on trawl nets.	---
Incentives: Monetary Non-monetary	A way to bring in extra money. Reasons for already minimising ALDFG: bring in gear due to potential damage to shipping. Duty to look after the sea.	Would incentivise fake collections of ALDFG and unsafe behaviour trying to collect gear that was too large for vessel. Already doing what can be done. ---	Depends on how payment is standardised, by weight? ---	--- Additional quota for smaller vessels to bring in marine litter and organise collection.

3.10. Port infrastructure for waste and recycling of ALDFG

There was limited knowledge on waste and recycling of fishing gear once it left the Harbour in Newlyn. The majority of fishermen interviewed stated that although they were aware that there was waste (harbour skip and FFL skip) and recycling (Nylon monofilament net recycling) facilities available in Newlyn, they had no further knowledge on where the gear goes once leaving the Harbour. Portraying uncertainty relating to what fishing gear ended up in landfill, the scope of recycling mixed materials (Polypropylene trawl nets) and the efficiency of current recycling efforts (Nylon monofilament nets).

“No, I am not sure what they do with the waste that is not put in the Fishing for Litter skip, I don’t know what happens to the Fishing for Litter stuff either, where does that go, landfill?” – Shellfish potting fisherman.

“It is difficult to say, answer that really without knowing the potential of recycling the nets themselves. Like they say, gill nets seem to be willing enough to recycle them but sheet, trawl netting I don’t know, it seems to be a shame you know, the amount of energy that goes into manufacturing” – Single stern trawler fisherman

“No because where you spoke to us the other day, you did see the big bags of waste net going in there so. How successful this recycling is, I don’t know. Because we just basically cut out, put new in and all that stuff is just bundled and chucked into those bags. Yeah it does disappear but how, how well it is working I don’t know to be honest” – Hand line fisherman.

Discussion – Waste management processes for fishing gear at end of life is an area to understand more about in the UK context and to raise awareness of among fishermen. Any changes to the efficiency of waste and recycling facilities will require fishermen’s co-operation to ensure success.

Chapter 4: Conclusion

This research has addressed the aims to build a better understanding of the reasons behind ALDFG in the UK and investigate fishermen’s views on solutions to tackle ALDFG. This report was structured by a life cycle framework, from sourcing to disposal or recycling of fishing gear.

Summarising key findings, starting from gear sourcing, the impact of EPR on manufacturers and gear quality will need to be carefully considered. Gear maintenance is practiced by all fishermen and helps to reduce ALDFG. Easy to use recycling pathways, such as the recycling of Nylon monofilament at Newlyn, are vital to minimising ALDFG. Trawl nets constructed from mixed materials (including a Polypropylene net) are not currently viable for recycling due to their low economic value (compared with Nylon) and subsequent lack of recycling facilities. Trawl nets are sent to landfill, along with major proportions of the harbours’ general waste and FFL skips.

ALDFG was not perceived as a prominent issue by fishermen, as gear loss was considered minimal, gear that was lost was thought to roll into a ball (not ghost-fishing) and provided a habitat for marine animals. Reasons for loss varied for mobile and static gear types, the main reason for mobile gear loss was snagging on obstructions and for static was gear conflict with UK/foreign mobile vessels. Loss of static gear was amplified by 'risky behaviour' of fishing high risk areas (wrecks, hard ground) incentivised by better catches and subsequent higher income. Retrieval of lost gear is undertaken by two methods; creeping using a grapple and entanglement with own gear.

Behaviour change of fishermen regarding ALDFG was discussed with focus on awareness raising, involving schemes such as FFL, media programmes or via other fishermen within social networks. A 'timely' moment for awareness raising and promoting sustainable social norms could be during training of new recruits into the industry. To promote sustainable behaviour amongst fishermen it is important to understand factors that influence their daily decisions. Influential factors uncovered in this research involve negative public perceptions of the fishing profession and traditional practices including superstitions. A negative public perception of fishermen could impact their willingness to engage.

Fishermen currently undertake mitigating actions to reduce ALDFG, the main action for static fishermen is communicating box positions with UK/foreign trawlers (facilitated by CFPO) and, for mobile fishermen, bringing in end of life gear for disposal in harbour (as opposed to discarding at sea). Port facilities play a vital role in reducing ALDFG although the understanding of where waste goes after initial handing over of responsibility is limited. Solutions, either suggested by the fishermen or Harbour Authority or by the researcher were considered based on how costly and practical they were to compliment fishermen's daily routine.

4.1. Future research

This small-scale study has enabled an insight into fishermen's behaviours towards ALDFG in the UK but to improve on these findings future research is required. A suggestion for future research is to have a comparative study in a non-FFL area to investigate the effect this scheme has on fishermen's responses. The researcher for this study took a purposeful approach to represent all the different gear types used in Newlyn. One gear type that was not included was seine netting; this was because seine netting is not a widely used method and is pelagic, therefore unlikely to contact the sea bed. However, incorporating this gear type would enhance the evidence base. Any consultations on future government policy should use available evidence from both qualitative and quantitative sources to inform decision making.

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Appendix

Information sheet and consent form for research participants:

Information sheet (for you to keep)

Fishermen's perceptions on Abandoned, Lost or Discarded Fishing Gear (ALDFG).

Case study – Newlyn, Cornwall, UK.



Department
for Environment
Food & Rural Affairs

Purpose: The main aim of this research is to build an understanding around lost and discarded fishing gear in the UK, based on fishermen's views and experiences in Newlyn, Cornwall. The research will aim to develop knowledge about the sourcing of gear, reasons for gear loss/discard, retrieval of gear, and recycling/waste facilities for lost or end of life gear. This research will also allow fishermen to share their ideas on solutions and opinions on options currently used by other countries, to minimise gear loss and increase retrieval. The information collected will be used to inform policy development around reducing marine litter.

Interview recordings will be shared with the wider Defra research team to support transcription of this interview. Following transcription, all personal information will be removed before analysis and the interview recordings deleted. Whilst we will remove directly identifiable information, please note that it may still be possible to identify you through the broader information you provide, given the research is limited to Newlyn.

About us: Betheny Wills: I am a visiting Social Science Researcher at DEFRA Marine and Fisheries (from the University of Surrey). As a visiting researcher, my purpose is to provide government with impartial and reliable advice based on evidence. Whilst the work informs policy, I am not involved in creating policy.

What is required from you: Taking part is **voluntary** and you can withdraw from the research, however information will be kept if the researcher is not notified within 7 days of interview. Taking part means being interviewed. You will need to commit about **30 minutes** of your time. You agree to providing information on **your occupation, the gear type you use, the organisation you work for, and/or where you work (Newlyn)**. We will ask your permission to record the interview on a Dictaphone.

We agree to:

- **answer any questions** you have regarding the research
- **respect your wishes** to end participation in the research (for up to 7 days after interview)
- publish a **summary report** of research findings that will be made publicly available

Time frame: Interviews will be conducted between **Tuesday 23rd April and Friday 3rd May 2019**.

Contact details: **Removed for report.**

AGREEMENT TO PARTICIPATE (*Researcher's Copy*)

I, (*insert name*) confirm that I have read the information sheet provided to me by the researcher (Betheny Wills) and understood the purpose of the study.

I agree to participate in the interview and

- for this to be recorded using a Dictaphone and transcribed later (please tick)
- for notes to be taken during the interview (please tick)

Signature of Participant:.....

Code number (given by researcher):

.....

Date:

.....

Participant contact details (e.g. email address, phone number):

Signature of Researcher:.....

Date:

.....

Figure 1. Photograph taken by the researcher, showing collected Nylon monofilament net in Newlyn Harbour, to be sent for recycling.



OGL

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