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NSAC Advice to Commission on Circular Design of Fishing Gear and endorsement of the NWWAC Multi-AC Advice on the implementation of the Single Use Plastics Directive and operational aspects of the Fishing for Litter Scheme from 15 July 2020

This advice paper was approved by the NSAC Executive Committee on 22 July via written procedure.

1 Background

In April 2019, following a decision in the Ecosystem Working Group on 19 March 2019, the North Sea Advisory Council (NSAC) established a focus group on Circular Design of Fishing Gear. The aim of the focus group was to apply comprehensive horizontal approach to the Single Use Plastics Directive (SUP)[1] in relation to the different legislative acts related to marine litter and fishing gear. Due to overlapping of topics and initiatives, the focus group was stirred together and across other ACs carrying out similar work, namely NWWAC, PELAC and BSAC. The four Advisory Councils organised a Workshop on Re-imagining Fishing Gear in a Circular Economy and, based on the outcome of the workshop, the NWWAC and the NSAC prepared two pieces of advice covering both, the SUP and PRF[2] Directives in relation to marine litter and circular design of fishing gear.

In the framework of the Single Use Plastics (SUP) and Port Reception Facilities (PRF) Directives, implementing acts are being developed on methodology and reporting on the fishing gear placed on the market, waste fishing gear collected in ports and reporting on passively fished waste delivered to ports. The relevant implementing regulation is due on 2nd July 2020, and the study is planned to develop harmonised rules based on existing good practices and technology.

The SUP Directive stipulates the development of a standard for circular design of the fishing gear. A request to develop a standard will be drafted by DG MARE by the end of 2020 and proposed to DG GROW, who is positioned to send an official request to the European Standardization Organization CEN-CENELEC[3] to develop the standard. In order to prepare this draft request, DG MARE has launched a study (managed by EASME) with a contractor to inform itself on the state of play of fishing gear recycling in Europe, on best available technologies and practices, on gear classification and to obtain recommendations on gear design best fit for recycling. Following the desk research, interviews were conducted with

[1] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019L0904&from=EN
[2] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019L0883&from=IT
[3] https://www.cencenelec.eu/standards/ESOs/Pages/default.aspx

broad range of stakeholders, such as authorities, fishing sector (some of the POs are NSAC members), scientists, gear manufacturers and recyclers, and certifiers. To validate the findings, workshops[4] were organised for the Commission to be able to draft a request with the best existing knowledge and relevant stakeholders' input. The study, due end of 2020, will distinguish two main gear categories: fishing gear that is brought to port at their end-of-life stage by the fishers, and the fishing gear that is retrieved after staying in the sea for a longer period of time. In the second stage of the project contractors will look into gear classification options for the purpose of recycling. It is important to determine what is currently in use and what sort of classification would be relevant and useful. While this work is still ongoing, the NSAC will aim to provide insight and relevant input on the topic in a form on this advice paper.

Concretely, this paper explores preconditions, possibilities and challenges in handling of abandoned, lost or otherwise discarded fishing gear (ADLFG), provides a clear description of the complex situations, possibilities and solutions to the problems faced when it comes to recycling of gear, and a concise classification of plastics used in the fishing gear.

Hereby, the NSAC also endorses the NWWAC Multi-AC Advice on the implementation of the Single Use Plastics Directive and operational aspects of the Fishing for Litter Scheme adopted on 15 July 2020. Endorsement was granted by the NSAC Executive Committee on Friday, 10th July, via written procedure.

2 Classification of Gear

Experts differentiate between static gears (gillnets, traps and pots), pelagic trawls and demersal trawls, each serving different purposes and posing different challenges related to collection, storage and recycling of end-of-life, lost or discarded gear.

In its 2009 report on Abandoned, lost or otherwise discarded gear[5] the Food and Agriculture Organisation of the United Nations (FAO) states that at an international level, the impact of ADLFG on marine ecosystem are thought to have become increasingly problematic over the past 50 years due to increased fishing pressure and durability of synthetic materials used in net designs. Lost or so-called 'ghost' gear namely continues to fish when lost or discarded, posing a potential hazard to fish stocks, endangered species and benthic environment. Moreover, ADLFG results in significant economic and social costs, associated with compliance, retrieval, and/or research costs associated with ALDFG, and poses navigational hazard and safety issues in offshore and coastal areas (FAO 2009, 1).

According to FAO (2009, 29), lost gear can remain operational for an extended period anywhere from six months to several years when well anchored or stuck on rocks, corals and shipwrecks. In general, however, ghost fishing catches are probably very low compared to fishing (Brown et al. in FAO 2009, 29). This also depends on the gear type. Dead fish caught in nets attracts scavengers, who then also get caught, resulting in cyclical catching by the

[4] DG MARE study on reporting under SUP and PRF Directives (18 January 2020) and MRAG/OSPAR workshop (19-20 January 2020)

[5] http://www.fao.org/tempref/docrep/fao/011/i0620e/i0620e.pdf

gear. Synthetic gear is durable and can have a detrimental impact on sea birds, turtles, seals and cetaceans, by entanglement or ingestion of parts of the decomposing plastics.

Static gear, such as gillnets, seems to be most frequently lost and become ghost gear. Being relatively cheap it offers little incentive for fishers to find and retrieve the lost gear as new gear is widely available and can be imported from third (mostly Asian) countries at significantly lower costs. Despite this, many coastal fisheries and artisanal fishers are keen on keeping their fishing grounds clean and often participate in voluntary clean-up schemes and activities to remove plastics and ALDFG from their fishing area.

The high cost of trawl nets and other mobile gear, on the other hand, incentivises fishers to retrieve larger lost nets or fragments. However, their nature of being dragged on seabed makes it prone to wear and tear on rocks or shipwrecks (FAO 2009, 17). And repairs at sea can lead to net sections to be lost when they are left unattended on deck.

There are two regulations on international and EU level dealing with marine litter and lost gear. At International level, Annex V of the International Convention for the Prevention of Pollution from Ships (MARPOL) (IMO, 1973)[6] deals with the prevention of pollution by garbage from ships and entered into force on 31 December 1988. At EU level, the CFP[7] (2013) gives provisions on ALDFG. Among other things, it requires fishing vessels to carry equipment to retrieve gears in case of loss. MARPOL convention has been taken into account in the development of the PRF Directive.

It is worth noting, that fishers are for the most part conscious of these provisions and have taken voluntary actions in, for instance, Fishing for Litter schemes.

3 Plastics used in fishing gear

The 2009 FAO[8] report estimates that abandoned, lost or discarded fishing gear in the oceans makes up around 10 percent (640 000 tonnes) of all marine litter. In the EU, nearly 30% (or 11.000 tonnes annually) of all retrieved litter from beach clean-ups is fishing gear, only 1,5 % of which is recycled.[9] In order to facilitate waste management, it is important to identify the types of plastics the fishing gear is made of.

According to Meenakumari[10] (2002) synthetic fibres are defined by the type of polymer:

- Polyamide (PA) fibres are manufactured in two different types, PA 66 and PA 6. PA 6 is produced for fishing net purposes in the trade name Nylon. ii.
- Polyester fibres (PES) are manufactures from polycondensation of terephthalic acid and the alcohol, ethylene glycol. Chemical compounds of an acid and alcohol are known as esters. The trade name is Terylene.

[6] http://www.imo.org/en/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Prevention-of-Pollution-from-Ships-(MARPOL).aspx
[7] https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1547133726973&uri=CELEX:32013R1380
[8] http://www.fao.org/news/story/en/item/19353/icode/
[9] https://ec.europa.eu/fisheries/new-proposal-will-tackle-marine-litter-and-%E2%80%9Cghost-fishing%E2%80%9D_en
[10] http://drs.cift.res.in/bitstream/handle/123456789/884/fishing%20gear%20materials..pdf?sequence=1

- Polyethylene (PE) is the polymer of the monomer ethylene, which is normally obtained by cracking petroleum.
- Polypropylene (PP) is the polymer of propylene obtained in the same way.

The continuous thread composed of fibres is called ‘yarn’, which relates to a term covering all linear textile products. All synthetic polymers can be made into four different types of yarn. The following yarn types are characteristically used in the fishing industry.

- PA: Multifilaments, staple, monofilaments as singles; no split fibres.
- PES: Multifilaments; no split fibres.
- PE: Monofilaments (twisted); no staple fibres; no multifilaments. Split fibres are available but not common.
- PP: Multifilaments, split fibres and monofilaments for ropes.

If the material is to be recycled, two options of recycling methods are currently employed: mechanical recycling and chemical recycling. During mechanical recycling, the material is cleaned and sorted to achieve a quality close to virgin polymer fibres, which can be molten into high-quality recyclates. During chemical recycling, the fibres are dissolved in chemical solvents. Sorting into polymer types is also required, but the procedure is not as sensitive to residual disturbances such as sediments.

Given the different properties of these synthetic materials, different solutions are needed for their dissolution, namely:

- PA is soluble in 37% Hydrochloric acid in 30 minutes at room temperature.
- PA and PES are soluble in sulphuric acid 97-98% in 30 minutes at room temperature.
- PE and PP are soluble in Xylene on boiling for 5 minutes (Inflammable).

(Meenakumari, 2002)

Fishing gear composed of different types of plastics with different characteristics poses a challenge when it comes to dismantling and recycling. The following chapter explains in detail the obstacles and challenges in collecting, dismantling and recycling of fishing gear.

4 Collection, dismantling and recycling

Collection

There are three crucial steps in recycling fishing gear: collection, dismantling and recycling. Retrieved fishing gear is often historic (30-35 years old) since the fishers nowadays are discarding and losing less equipment due to its economic value, raised awareness, and GPS allowing to avoid obstacles when towing gear. The remainder of the discarded parts of gear (net cut-offs) comes from repairs, carried out both, in the harbour and at sea. There are differences in implementation of collection of gear between countries and ports. While some offer compensation to fishers bringing the litter to shore, others charge them for doing so. It is commonly agreed that compensation is not needed for disposal of end-of-life or passively fished gear where appropriate facilities and services are established. In such cases fishing harbours should be discouraged to charge for disposal of litter brought to shore as this would

pose a counter-incentive to fishers. In some countries, such as Indonesia, active litter collection projects where fishers go out at sea with a sole mission of collecting litter are compensation based, in order to help cover fuel, boat repairs, disposal of litter, personnel costs etc.

Dismantling

The most challenging phase is dismantling, which is often done at a location different than that of the reception. It is common for fishers to buy different types of netting and assemble the gear themselves. Disassembly before decommissioning takes a substantial amount of time and effort. While demersal fleets usually do it in their workshops, with the help of fishers' friends and families (financial compensation is needed), pelagic fleets hire companies to do it for them. At the end of life, fishers tend to dispose the entire gear. Recycling industry, or in some cases (e.g. Denmark) ports, are usually responsible for dismantling of the nets, which is costly and time consuming, because most of the work cannot be automised and is carried out manually. EPR scheme suggests these costs be borne by gear producers, where this is applicable. if a generic disposal scheme will become available, this will then only be paid by the 'professional' gear makers, and no contribution form the 'home made' gear by fishers themselves, which is unbalanced.

Recycling

Recycling is defined as processing items into equally high-quality products that are marketable. Research is currently being done on the use of biodegradable materials for fishing purposes, however some gear parts are less appropriate for the introduction of biodegradable materials than others. Further investigation and research are needed in production of biodegradable nets that retain their functionality and purpose (e.g. dolly rope, as recycling of lost dolly ropes is not considered feasible).

In order to recycle the gear two aspects are crucial. Firstly, the purity of materials - some materials, such as nylon, polypropylene and polyethylene need to be 99% pure for mechanical recycling. With lost fishing gear perfect purity is almost impossible, as long-lost gear is retrieved with other materials entangled, such as sand and clams attached to it. The priority should, therefore, be put on ensuring that the gear does not get lost in the first place and is kept in the circle for immediate recycling. Another problematic aspect is the lack of adequate facilities for collection of end-of-life gear in ports and harbours.

Three loops should be considered when it comes to product circularity: a short loop represents 'reuse', medium loop the 'refurbishment', and long loop the 'recycle' process. The shorter the loop, the better. However, short loops are generally less appropriate for gillnets. The reason for this is that the thin monofilament is not sturdy enough and needs to be replaced when it breaks. In practice, fishers change parts of gears themselves and only eventually buy a new one. This is especially true for gillnets, while trawls nowadays are mostly taken back for repairs by net manufacturers.

Currently recycling technology exists for the four main polymers, which means that, in principle, up to 80% of gear could currently be recycled. As with all plastics, the prerequisite for recycling would be that different polymer types are separated, implying that fishing gear made of different components needs to be dismantled to facilitate recycling. When buying from chemical companies, net makers are aware of the type of plastic they acquire. The EU producers specialise in high molecular polyethylene (characterised by stability, elongation, tenacity) and Polyamide-6 ("Nylon") (ensuring flexibility, strength, durability) to meet market demands. However, lots of materials are still being imported from outside the EU (especially cheaper grades of PE, PP, PET, PA). Although there are many different types and grades of materials available, a general consensus is that only around ten different grades of the main four polymer types are being used in net making and that the rest are simply variations of colour or additives.

Many different types of ropes are currently in use, with each of them having various pigments, colours, additives. Chemical recycling does not need a completely pure input (less effort upon manual dismantling/separation of the net) and can produce output of high plastic quality (suitable for multiple reoccurring material circulations). The downside of this is the cost of the operation and the need to return to the monomer-step in the process. Mechanical recycling, on the other hand, requires purer input in order to obtain good quality output (e.g., down to the type of low- or high-density PE). If different types of plastic are mixed in the input, the mechanical recycling can only be on a downgrading slope, giving low quality plastic that will not itself be recyclable.

Considering this, it is important to have information on the composition of the material marked on the gears. Affordable technology already exists to scan plastic and determine which kind of plastic a material is made of. Dyneema, frequently used in ropes to replace typhoon wire ropes, for instance, is not suitable for mechanical recycling as it burns in the process, rather than melts. Theoretically, it would be possible to make oil from this via chemical recycling and reuse this feedstock for production of new materials.

It is already possible to recycle certain end-of-life gear in two European facilities, Plastix[11] in Denmark and Aquafil[12] in Slovenia. The logistics surrounding collection and recycling must be economically viable, and transportation costs and carbon footprint to these facilities must be evaluated. The volume of material for recycling should be investigated to create a viable industry for net recycling. In order to encourage more professional recycling facilities, it is crucial to centralize and scale fishing gear dismantling and material sorting, and to provide figures of collected end-of-life volumes.

There is a market for recycled material from fishing gear, which provides a potential to make the use of recyclable materials a legal requirement. This is an important incentive for the fishers and a way to see the value of their contribution to recycling. It is worth noting that the aim of recycling should be full circularity (recycling back to basic material from which fibers for yarn for new gear can be made). However, this is quite optimistic and not always viable, making any other recycling only a partial endeavour.

[11] https://plastixglobal.com/
[12] https://www.aquafil.com/

While it is recognised that recycled materials are currently more expensive than virgin materials, there is the view that consumers should be willing to contribute financially to covering the costs of collection, recycling and re-use of gear. This is not a reality for fishing gear, as fishers are the price-takers. In the case of fishing gear, the increase in price will not translate to increased end-product price (marketed fish), as it usually does with other products (e.g. price increase of components result in price increase of the end material). In this sense, fishers can only cover the potential price increase when using recycled input materials in new netting on their own account, without realistic market compensation.

5 Current work and initiatives

Denmark

In Denmark it is common practice for fishers to bring marine waste and any lost or end-of-life gear to port for proper disposal. However, little is registered on the amount and type of marine litter. Former Fishing for Litter projects are good initiatives and give some insight, but it does not necessarily provide an overview of the different kind of waste landed in ports and their recyclability. From a Danish perspective continued focus on marine litter and lost gears are important and current work in relation to this would be.

- Ongoing cooperation between Danish fishers and ports to ensure better information on the marine litter landed in ports by Danish fishers i.e. get a better overview of the amounts of different kinds of waste and their recyclability. Ports are expected to report on the amount in tonnage and possibly their likely source. Derelict fishing gear are being delivered in port and sent to recycling, where possible (e.g. to Plastix). Ports are key collaborative partners responsible for handling of waste and ensuring possible reuse.
- Project on mapping areas with lost gear and how to possibly remove of these.
- Project on biodegradable set nets. Biodegradable fishing gears are also desired by other parties for other sustainability purposes, but without a focus on circularity.
- Meetings with Danish management authorities on how to best implement both the PRF and SUP directive.
- Campaign on best practices on handling waste at sea for Danish fishers[13] to reduce loss to the marine environment.

The Netherlands

- The majority of Dutch fishing organizations are members of the so-called Green Deal Fisheries for a Clean Sea[14][15]. This Green Deal is a partnership-agreement between the fishing industry, the government, commercial fishing ports, waste management companies and NGO's, which facilitates interaction and cooperation. The Green Deal runs from 2014 – 2020, after which a continuation of the partnership is in the making.

[13] https://mst.dk/natur-vand/vandmiljoe/havet/havmiljoe/sammen-om-et-hav-uden-affald/
[14] http://visserijvooreenschonezee.nl/
[15] https://www.greendeals.nl/green-deals/visserij-voor-een-schone-zee

Within the Green Deal consortium, partners work together on local and national projects improving fisheries-related waste management and decrease of fisheries-related marine litter.

- In 2014 a project named 'DollyRopeFree' (dolly rope in Dutch: *pluis*) started, aiming at finding alternatives for the use of dolly rope. A broad array of materials have been tested since (of which most were unsuccessful). The most promising materials are yak-hide and (in seawater) biodegradable polymers, conveniently called 'biopluis'. This '*biopluis*' (produced by Senbis Polymer Innovations BV) has been further tested during the first months of 2020 and seems very promising, it does what it's supposed to do (protect the net) and seems to be more durable than conventional dolly rope. The costs and fixation are still issues that need to be addressed, as well as unknown speed of biodegradation in summer time (subject to further testing).
- A lead-free[16] sports fishing equipment project, replacing lead fishing weights with composite weights. A research done by Vlaams Instituut voor de Zee (VLIZ)[17].
- There are several initiatives to separately collect and dispose of dolly rope. The fishers on the island of Texel have worked out a system for dismantling, in any case for dolly rope, but also usable metals and plastic are separated from the net. This system is based on awareness but also leans on social interaction and control amongst the fishers themselves. By actively separating the re-usable or recyclable components, and disposing of the components adequately, time is saved and the efficiency of recycling is increased.
- Campaigns on waste management and information about port reception facilities per (fishing) port, mostly lead by local (port) authorities or producer organizations.

Belgium

- In the Belgian fishing sector, the Flemish Fisheries Cooperative (VVC Equipment) examines how gear can be recycled. The recycling of nets, ropes and dolly rope is challenging because there are several aspects to take into account such as the type of gear, different materials etc. VVC has invested in metal cages in which the fishing nets can be stored until sufficient amount has been collected for transport to a processor. Corajec, a Belgium recycling plant, started to collect the fishing nets since the end of 2019. There are also contacts with other Belgian recycling companies for possible collaboration.
- The Public Flemish Waste Agency (OVAM) is responsible to implement the SUP- and PRF-directive into law. Meetings on a regular basis with the different involved partners, being VVC, OVAM, the federal government in charge of Environment, the Province of West-Flanders and Rederscentrale, have been organised to tackle the challenges of the implementation of the two European Directives.

[16] https://www.loodvrijvissen.nl/
[17] https://www.vliz.be/nl/news?p=show&id=8131

Germany:

- The German Environmental Agency is supporting measures to further the aims of the MSRL of good environmental status, including the search and retrieval for lost fishing gear. Individual projects carried out in Germany at this time are coordinated by non-governmental organisations, fisheries associations or companies as detailed below.
- The Thünen Institute for fisheries research develops together with the North Sea shrimp fisheries alternative designs which allow shimp trawling without dolly ropes. in the DRopS[18] (Dolly Rope Suspension) project. The aim of the project is not to replace dolly ropes by other materials, but to add bouyancy through floats and alternative gear designs which lead to less seafloor contact, abrasion, collection of heavy sediment/rocky material, such that degradation of the netting is reduced without the need for cod end protection through dolly ropes.
- WWF Germany has developed an ecologically viable methodology[19] for lost fishing net searches with sonar technology, retrieval with fishing and working vessels, waste management for fishing gear retrieved from the Baltic Sea, and is currently (2020) working on the political implementation in collaboration with the state of Mecklenburg-Vorpommern and with additional support from the Federal Environmental Agency (UBA) and the German Ministry for the Environment (BMU).
- WWF Germany was a partner in the European INTERREG MARELITT[20] Baltic (2016-2019) which developed supportive material for ALDFG searches, retrievals and prevention through practical experience, including an environmental impact assessment for retrieval actions at sea, processing guidelines for retrieved gear, and The Baltic Sea Blueprint as an overview document.
- NABU coordinates the Fishing for Litter project in Germany, including ALDFG collected during regular fishing activities (usually small fragments) and all types of marine plastic litter. In a similar approach to WWF to enable end-of-life gear recycling, NABU has also started collection of end-of-life fishing gear, yet both organisations have not found a good solution for transport and regular recycling of the net materials characteristically used in the German coastal fishery.
- CuxTrawl is a net manufacturer producing PE netting for offshore trawlers. The company collaborates with Plastix in Denmark for PE/PP net and rope recycling.

Sweden

- The awareness of the problem of litter and plastics in particular among the demersal fishers is generally high. It is common for fishers to collect marine litter during fishing activities and bringing it ashore. Thereafter, the litter is either sent for professional recycling or left at a recycling station. The individual fishers take over the costs of

[18] https://www.thuenen.de/en/of/projects/fisheries-and-survey-technology/reduction-of-plastic-waste-from-the-brown-shrimp-fishery-through-gear-modifications-drops/
[19] https://www.wwf.de/themen-projekte/projektregionen/ostsee/geisternetze/
[20] https://marelittbaltic.eu

collection themselves. This work is done in an unorganised way during everyday fishing activities.

- Projects have been completed on identification of areas where gear was lost and possible removal of lost gears from hotspots where lost gears accumulate.
- Fishers have since long been taking active part in organized projects aimed at collecting ALDFG around the Swedish coastline. These projects have been successful over the years. Recently, SFPO launched a new project that focuses on three geographical areas. The project is the result of active work from the fishery and will be conducted by the fishery against financial compensation.
- SFPO has a well-functioning unformalized co-operation with the leading recycler of fishing gear in Sweden. SFPO also has been actively promoting fishers to leave used old gears to the recycler (Fiskareföreningen Norden, https://www.ffnorden.se/).

France

- Project TEFIBIO (Parc naturel marin des estuaires picards et de la mer d'Opale & FROM Nord), started in 2020 and dealt with defining and prototyping a biodegradable, bio-sourced, recyclable and microplastic free fishing net (gillnet).
- Project PECHPROPRE (Coopération Maritime), which was on from 2016 to 2018, dealt with assessing, at a national scale, the quantity of used fishing gears (trawls and nets) thrown away annually. This project also identified local and national recommendations to be implemented in a near future in order to establish a voluntary ERP aiming to improve collecting of used fishing gears, recycling and valorisation.
- Work has been ongoing with the fishing gear retailers in France to set up a voluntary REP with an eco-organism piloting all the collection, transport, treatment, recycling and valorisation of used fishing gears.

6 Advice

Designing gear

Fishing gear is often comprised of various materials, from different types of synthetics, to metal, and if retrieved from the sea, often includes sediments. Purity of the materials being a crucial factor for recycling, mixed material nets pose a challenge to the recycling phase. One of the solutions for increased recyclability is a reduction of the number of materials used in gears, while not compromising its functionality. Most mixed material gear seems to be used by fishers out of habit, rather than pragmatism, possibly making the potential move to reduced use of different materials straightforward and effective without the risk of resistance from fishers due to reduced functionality of the gear.

Discussion should be ongoing with the trawl binders and producers on the source of materials, design and composition of gears. Moreover, insight should be gained on the responsible-design of products in terms of lower impact on the marine environment and easier dismantling of the end-of-life gear, as well as on the functionality of the re-designed nets for different gear parts.

To spur behavioural change, financial incentives seem to be widely accepted as means to encourage the move to circularity, however non-financial incentives, such as stimulating social triggers, are equally important. Pilot projects to explore reduction of materials, easier and faster disassembly and testing of gear functionality could be established to aid the gradual transition.

Another issue needing consideration is where in the supply chain the decision on responsible-design is made. Some eco-design companies might already have the knowledge and solutions, yet these have not been accessed by the fishing gear industry yet. It is therefore of utmost importance to link the different stakeholders and facilitate discussions, so as to raise awareness on the different solutions, technologies and innovations existing in the sector. While a top-down participatory approach in the sense of standardisation is important, it is equally crucial to address and incorporate the needs of gear end-users, and to involve them in the development of alternative designs, as is the case in DollyRopeFree[21] and in the German Thünen Institute DollyRope[22] initiatives.

Several aspects regarding the design development of gear were identified during the NSAC focus group and workshop, including design for: disassembly, recyclability, traceability, and/or reduction of harm to the marine environment. These should be taken into consideration along with other socio-economic and environmental sustainability requirements when deciding on standardisation. One of the solutions for increased recyclability could be EU-wide colour coding to facilitate distinction of each polymer type during dismantling as part of the new standard.

Regarding any EPR scheme, there are many varieties in which this could take form in the EU. Voluntary and monetary measures should be further investigated. Examples of good practice, such as the Icelandic model[23], should be looked into and adjusted to EU conditions. When exploring viable technical and economical solutions for designing gear with a circular economy approach in mind, functionality and environmental impact must be fully considered.

Monitoring gear

There is currently no adequate product registration system established for fishing gear. While the Control Regulation sets down requirements for marking of some gears, individual Member States pose additional requirements, such as the marking of steel parts in Belgium. Nets and other gears are registered when sold by the assemblers. These companies usually keep a unique number, and sometimes an RFID chip, for each sold net[24]. For each gear a precise description of material, shape and record of alterations is kept. This is useful for identifying the product as a whole but falls short when parts of gear are lost / nets are torn. While fishers do repair nets, drastic modifications are less common. This is usually done by the net assemblers' in their repair and/or modification workshops in the case of trawls and seines. The situation is

[21] http://www.dollyropefree.com/

[22] https://www.thuenen.de/en/of/projects/fisheries-and-survey-technology/reduction-of-plastic-waste-from-the-brown-shrimp-fishery-through-gear-modifications-drops/

[23] Nordic EPR applied to textile industry: https://norden.diva-portal.org/smash/get/diva2:791018/FULLTEXT02.pdf

[24] Not true for gillnets.

different for gillnets used in European coastal waters. Gillnets are frequently assembled from net sections (“fleets”) by the fishers themselves, and sink and float lines made from different materials than the net body are attached. Here, the turnover, tracing and monitoring of each material type will be much harder, especially as net parts such as floats or sink lines are re-used while other parts, such as the net body, are discarded when a section of the net is torn. Gillnets are also crucial because they characteristically need to be replaced every 2-3 years, while trawl and seine material can be re-used for decades. A similar situation of manual re-assembly and repairs arises for traps and pots, which are traditionally individually custom-made and adapted. Traps are also among the fishing gear more frequently lost in coastal waters, but they are also made of a single netting type which would facilitate recycling.

Current marking requirements do not include information on the material of the gears. New technologies such as electronic marking make it possible to store more information. There is a need to define the term “registration system” as it can mean anything from a simple identification of the boat to which the gear belongs, to the use of sophisticated GPS systems attached to the gear. It is important to support voluntary initiatives that currently exist and not discourage them by imposing strict legislation. Control and enforcement might challenge creativity and goodwill of the fishers. We encourage registration of trawl nets for monitoring of the market, implemented at the level of the “provider” (i.e. net assembler). There is practical complexity of marking nets, as these are being modified and evolve according to the needs of the fishers. Often a net is used with several different cod-ends, contributing to complexity of gear marking. More research is needed on the life span of nets, the frequency and detail of any repairs, and the potential of using one part of the net with a number of additional add-ons.

There are regional and national differences with regards to pro-activity of fishers in gear circularity. In some areas, fishers are willing to take the initiative, while in others top-down regulations seem more adequate. The fact that vessels land in different harbours from their harbours of origin also means that national differences are challenging.

More data is required to understand the scale and sources of the problem of lost gear. We advise marking and registration of gear to be made compulsory for all users of the sea, including recreational fishers. Monitoring the market at the level of gear manufacturers and conducting research on the topic are crucial in securing an overview of the market. On one hand, the risk of having the costs of the EPR borne by fishers should be avoided. On the other hand, vigilance is needed so as not to create an unbalanced overburden on European producers.

Some netting is imported from outside the EU. For importers, as for other products entering the EU’s single market, we suggest a regulation to apply in the form of a required registration for entry of gear onto the market. This, however, would not prevent nets from being directly bought outside the EU and then used in the EU. Monitoring fishing gear brings with it a number of advantages, from an increased accountability across the value chain, to potential cost reduction through retrieval.

Collecting, dismantling and managing waste fishing gear

A properly managed logistics around waste and end-of-use gear collection should be ensured to assist the fishers in their largely voluntary endeavours. This includes unified collection of

the gear onboard vessels in bags or containers, and provision of adequate facilities in the ports. The ports should support this as part of their service and ensure that there is sufficient storage and capacity available for handling of any materials brought to shore. The stored end-of-life fishing gear that has not yet been dealt with (between the sea and the landfill or incineration plant) should be processed. It is essential that different waste materials are clearly defined under the relevant legislation and that legacy issues around historic nets are addressed appropriately. Additional resources may need to be provided in order to address transportation, separation and disposal. Furthermore, differences in the materials and make up of nets imply the need for customised handling. This may include a separate storage for different gear types. Currently the assignment of responsibilities regarding handling, processing and disposal remains unclear. The main responsibility should lie with the net producers and assemblers when it comes to separation, disposing and recycling of end-of-life gear. Gear contaminated by seawater absorption, dead animals, or sand, should, if possible, be converted into energy through incineration or in cement factories, or, if not possible at all, go to landfill. The logistics around collection and dismantling must be considered, such as the costs involved in dismantling nets for recycling or removal of lead lines for incineration in the case of gillnets.

7 Conclusion

To ensure proper implementation of both, the SUP and the PRF Directives, a clear understanding of expectations and requirements for the fishing sector is crucial. While EPR schemes are a sensible and widely used approach to internalise market externalities, it is essential to identify its holders (producers and importers of the fishing gear), goals (collecting, transporting and recycling fishing gear) and methodology (what scheme is most suitable). Other sectors with implemented EPR schemes, such as packaging or electronics, could serve as a model to be adjusted and applied to the fishing gear sector. However, in the case of fishing gear it would first need to be established whether developing a new recycling technology would be compensated by the amount of gear available for processing.

Knowledge and experience sharing across the gear producing and assembling sector should be enabled and encouraged. The industry and other stakeholders are currently working on developing recommendations on the proposed standardisation in a bottom up approach, granting end-users a sense of contribution to the solution, rather than them being a target of imposed legislation. Involvement of fishers in the process of standardisation is deemed useful in terms of feeding in important user information, as well as ensuring greater compliance with the voluntary standard. A forum for development of best practice with fishers might prove useful as a way of further engagement with fishing gear users. Additionally, more work should be done on communication campaigns with stress on education, awareness raising, role models and advocating against bad practises.

From an economic point of view, it is important to understand the scale of the issue as well as to outline the complexity of the topic. Greater transparency and collection of global data is required. Mapping out the supply chain and monitoring the products is essential in order to identify the sources of materials and their disposal. International discussion on circularity should be encouraged featuring all stakeholders, including, or especially, the rope and netting

manufacturers from third countries. It would be beneficial for fishers to be involved in identifying new materials and designing new gear.

While this is a long-term approach, short-term goals can be achieved through awareness-raising and knowledge sharing through information and communication. These activities can be implemented immediately through individual Producer Organisations, NGOs, Member States and international organisations, such as OSPAR. Fishers' knowledge should feed into establishing the type of research needed and identifying gear functionalities that should be retained.

Some NSAC stakeholders are presently contributing to a future committee to determine what such a certification should look like to best serve the net-makers, the fishers and the environment. More focus should also be put on the social dimension to study what impact the new legislation might have on human behaviour and current practices. Finally, additional incentives and funding should be made available to gain knowledge, share good practices and mobilize resources.