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Продовольственная и сельскохозяйственная организация Объединенных Наций
Organización de las Naciones Unidas para la Alimentación y la Agricultura

Viale delle Terme di Caracalla, 00153 Rome, Italy Fax: +39 0657053152 Tel: +39 0657051 www.fao.org

Our Ref.: Your Ref.:

EXPERT CONSULTATION ON THE MARKING OF FISHING GEAR

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KEY ISSUES AND CURRENT STATUS

DRAFT

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Appendices

Acronyms Used

AFMA ..... Australian Fisheries Management Authority
AIS ..... Automatic Identification System
BIM ..... Bord Iascaigh Mhara (Irish Sea Fisheries Board)
CPUE ..... Catch Per Unit Effort
EEZ ..... Exclusive Economic Zone
FAD..... Fish Aggregation Device
FAO..... Fisheries and Agriculture Organization (of the United Nations)
GDP..... Gross Domestic Product
GMS..... Gear Marking Systems
GPS ..... Global Positioning System
IALA ..... International Association of Marine Aids and Lighthouse Authorities
ICES..... International Council for the Exploration of the Sea
IFCA ..... Inshore Fisheries and Conservation Agency
IMO..... International Maritime Organisation
ISEFPO ..... Irish South and East Fish Producers Organisation
IUU ..... Illegal, unreported and unregulated (fishing)
M&E ..... Monitoring and Evaluation
MAIB ..... Marine Accident Investigation Board
MARPOL..... International Convention for the Prevention of Pollution from Ships
MCS ..... Monitoring, Control and Surveillance
NAFO..... Northwest Atlantic Fisheries Organisation
NEAFC ..... North-East Atlantic Fisheries Commission
NM ..... Nautical mile (equal to 1.825 kilometres)
NSRAC ..... North Sea Regional Advisory Council
NWWRAC.... North Western Waters Regional Advisory Committee
PLN ..... Port Letter Numbers
RACs..... Regional Advisory Committees
RFB ..... Regional Fisheries Body
RFID ..... Radio Frequency Identification Device
SEAFO..... South East Atlantic Fisheries Organisation
SFPA..... Sea Fisheries Protection Authority (Ireland)
TOR..... Terms of Reference
UNFSA ..... United Nations Fish Stocks Agreement
USAID ..... United States Agency for International Development
VMS..... Vessel Monitoring System
WGFTFB ..... Working Group Fishing Technology and Fish Behaviour

Introduction

1.1 Background

With almost every waterbody on the Plant Earth – from the seas and oceans to lakes and rivers – being subject to fishing in some form or other, the potential impact to both the natural environment as well as the human users of these waterbodies from this activity is considerable. Broadly speaking fishing gear includes devices operated directly by the fishers (e.g., hand lines), static gear that may or may not be attached to the fishing vessel (e.g., nets, traps and longlines) and mobile gear that is towed by a vessel (e.g., trawls and dredges). This gear, especially if it is not attached to the fishing vessel when in use, can act as a potential navigation hazard and if abandoned, lost or discarded can cause the continued catching of target and non-target species, the alteration to the benthic environment, act as a navigational hazard, contribute to beach litter, introduce synthetic material into the marine food web and generate a variety of costs related to clean-up operations and impacts on business activities.

It is evident that the marking of fishing gear can assist reduce the incidence of vessel interactions with fishing gear and prevents its loss through subsequent damage. If the marking of gear is extended to the main components, it will also allow the identification and subsequent management of abandoned, lost or discarded fishing gear (ALDFG). The marking of fishing gear can also assist in the fight against illegal, unreported and unregulated (IUU) fishing by allowing control authorities to identify and verify the use of fishing gear in waters under their jurisdiction.

1.2 Progress to date

Following the considerations of an *ad hoc* Working Group on a standardized system for the marking of fishing gear, an expert consultation prepared guidelines for the marking of fishing gear in 1991[1]. Following discussion by the FAO Committee on Fisheries (COFI) a proposed system for marking fishing gear was included in the 1996 FAO Technical Guidelines for Fisheries[2]. Annex V of the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) also includes requirements for the utilization of fishing gear identification systems which were updated in 2012. More recently a Convention on Biological Diversity (CBD) expert workshop in late 2014 examined the role of ALDFG in marine debris and urged further action for the adoption of gear-marking systems[3]. Finally concern was expressed at COFI 31 (July 2014) over ghost fishing by ALDFG and that greater attention should be paid by Members, RFBs and regional fisheries management organizations (RFMOs) to mitigate ALDFG impacts, noting that cost effective technologies and practices are available.

[1] FAO (1993)

[2] FAO (1996)

[3] CBD (2014)

2 KEY ISSUES ASSOCIATED WITH THE MARKING OF FISHING GEAR

The purpose of this first discussion area is to explore and analyse the main issues associated with the use of fishing gear, the consequences of not being able to locate and identify fishing gear and the benefits of doing so. This is examined over two main areas, these being abandoned, lost and discarded fishing gear and illegal, unreported and unregulated fishing.

2.1 Abandoned, lost and discarded fishing gear (ALDFG)

Abandoned, lost or otherwise discarded fishing gear (ALDFG) is of increasing concern due to its numerous impacts. The ability of ALDFG to continue to fish (often referred to as "ghost fishing") has detrimental impacts on fish stocks and potential impacts on endangered species and benthic environments. Fishing gear has been abandoned, lost or otherwise discarded since fishing began, but increases in the scale of fishing operations and technologies used in recent decades mean that the extent and impact of ALDFG debris have increased significantly with the use of synthetic materials, the overall increase in fishing capacity and the targeting of more distant and deep water grounds.

2.1.1 The impact of ALDFG

The consequences of ALDFG are both environmental and economic and can be summarized as follows:

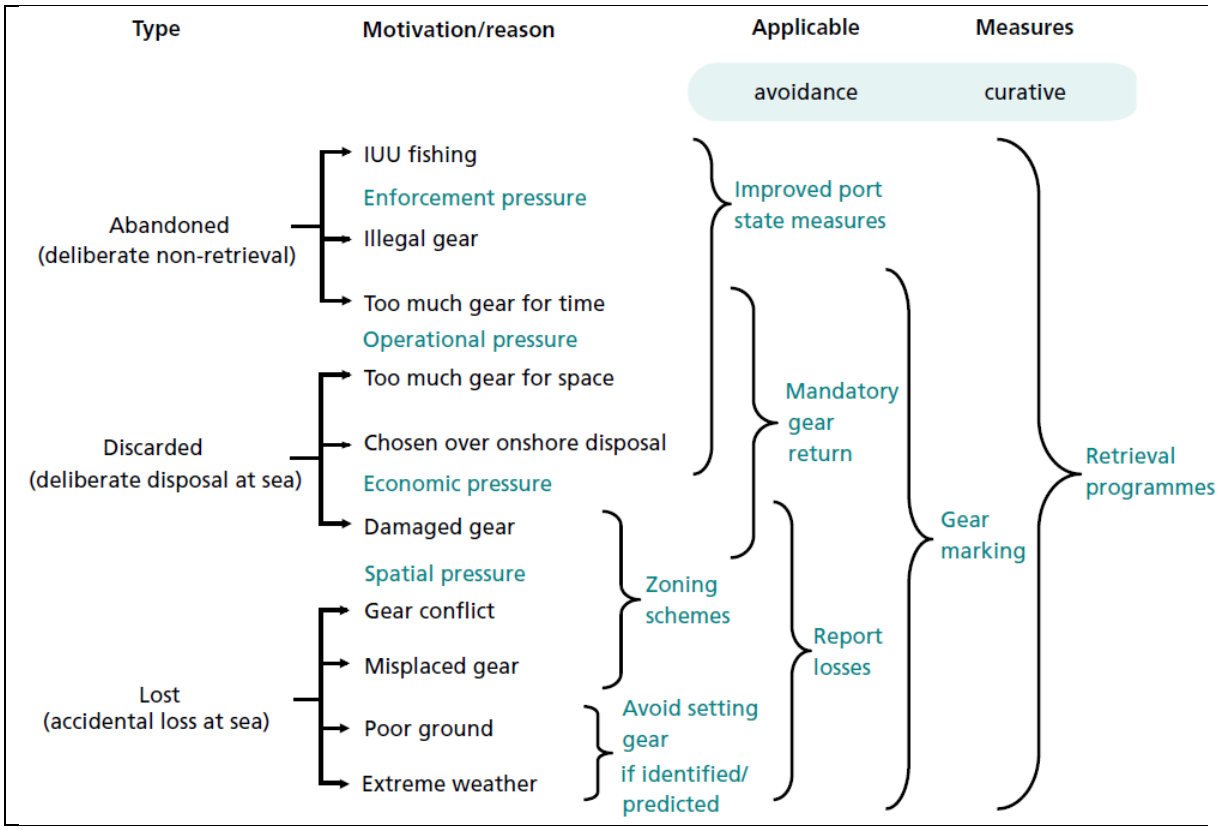
- **Continued catch of target and non-target species.** Even out of the control of fishermen, fishing gear can continue to catch fish, although this depends on the state of the fishing gear when control is lost. Whilst most gear will lose fishing efficiency over time as the gear disintegrates or becomes incorporated into the bottom sediment, it may continue to fish for many years. Abandoned traps may continue entrapping fish that may also encourage scavengers to be attracted and caught resulting in cyclical catching by the fishing gear.
- **Interactions with threatened/endangered species.** ALDFG, especially when made of persistent synthetic material, can impact marine fauna such as sea birds, turtles, seals or cetaceans, particularly through entanglement or and occasionally by ingestion.
- **Physical impacts on the benthos.** Abandoned, lost or discarded net fragments e.g., gillnet or trawl panels may be dragged along the bottom by strong currents and wind, potentially harming fragile organisms like sponges and corals. Nylon line from both commercial and recreational hook & lines and longlines may have a low post-loss capture function but may entangle around both marine animals and habitats, especially in complex inshore habitats such as reef structures. Accumulation of litter in offshore sinks may lead to the smothering of benthic communities on soft and hard seabed substrates.
- **Introduction of synthetic material into the marine food web**. Plastic fishing gear will gradually disintegrate through abrasion, movement and other processes. Modern plastics can last up to 600 years in the marine environment, depending upon water conditions, ultraviolet light penetration and the level of physical abrasion. Much of the abraded material exists for many years as microscopic plastic fragments and fibres that can be incorporated into the food chain and may such adsorb, release or transport chemicals and their toxic effects.
- **ALDFG also results in both economic and social costs that can be significant**. A key socio-economic impact is the navigational dangers of ALDFG to marine users. It is very difficult to rate or compare the magnitude of the wide range of socio-economic, as literature is very scarce and there are particular problems in quantifying and comparing social costs. Estimating the costs associated with compliance, rescue, and/or research costs associated with ALDFG is complex, and does not seem to have been attempted to date.

- **ALDFG can act as a navigation hazard**. Ropes and nylon line can foul propellers, drive shafts, jet drives and water intakes, thus affecting vessels propulsion and ability to manoeuvre. This can lead to operational delays and in extreme cases, injury and loss of life.

2.1.2 Gear marking and ALDFG

The lack of gear marking is one of a number of contributing factors to ALDFG (see Figure 1 below), where it can have both direct and indirect causal factors. These are generally related as to whether gear is deliberately abandoned or discarded, or accidently lost.

Figure 1: Types of ALDFG, their causes and measures to address



Source: Macfadyen *et al.* 2009

Gear may be deliberately abandoned whilst in the water. Given the cost of most fishing gear this is not an ideal situation, but maybe forced under pressure from enforcement activities when either illegal gear is being used or fishing activity is taking place illegally in protected areas. In many such instances fishing gear is deliberately unmarked so as to prevent its association with particular vessels, or the failure to mark gear may itself be a form of IUU fishing (see next section for more discussion on this topic).

Fishing gear may be deliberately discarded by fishers. In most cases this results from damage during deployment or retrieval, where it is cheaper and less effort to discard at sea than responsibly on land. In some cases the incentive for discarding even functional fishing gear maybe down to a lack of space on board and a desire to replace all or parts of the gear (e.g., gillnet panels) with low-cost new components. Whilst this practice is both irresponsible and unethical, it is difficult to prosecute offenders unless gear, including sub-components, are marked or traceable back to the owners.

The largest component of ALDFG is from accidently lost gear. This can happen through a variety of reasons including:

- **Extreme weather**: whilst most commercial fishing operations are used to operating in poor weather, extreme conditions such as storms, surges and tsunamis can all cause a substantial loss of fishing gear. Climate change may possibly be contributing to the frequency and ferocity

of extreme weather events and thus the loss of fishing gear. In such cases the marking of fishing gear is irrelevant, although it may be useful to know the origin of recovered gear, especially if linked to oceanographic research.

- **Snagging on the ground**: both static and mobile gear are subject to damage and loss from poor ground. This risk in increased in deep water areas, or those with strong currents or tidal streams, as well as the nature and scale of the gar being deployed. Again the marking of gear is less relevant here, although it may assist the return of recovered gear to its owners.
- **Operator error**: in some cases gear may be lost due to operator error, in particular misplacing static or drifting gear. Evidently the marking of gear with sufficient surface equipment (e.g., a Dhan buoy, radar reflector or light) is essential, as well as recording the position of static gear with GPS and other navigational aids. Marking of the identity of the operator will again assist the return of the gear if found by another vessel.
- **Theft and vandalism**: although a minor overall contributor to ALDFG, theft and vandalism can be an issue on some fisheries. Theft and vandalism are most likely to take place, if at all, in inshore areas where fixed/static gear or aquaculture production systems conflict with recreational marine use, or where some fishers engage in such activities to the detriment of their peers. In most cases this is the deliberate cutting or removal of surface marker buoys resulting in the loss of the sub-surface fishing gear. It is possible that the theft of gear components could be discouraged through permanent marking systems that ensure the original owner's identification cannot be erased or removed.
- **Gear and navigational conflicts**: with inshore fisheries often consisting of multiple gear types working over common and often restricted ground, gear conflict is a frequent cause gear loss. Dahns and end ropes are particularly vulnerable to shipping, especially in areas of intense activity. This happens most when mobile gears are used in static fishing grounds, where trap strings or gillnet fleets can be towed away. In many cases this can be reduced through zoning and good communication, but is always a risk in multiple use areas. This issue is not restricted to fishing gear on gear incidents, as non-fishing vessels transiting fishing grounds may destroy gear. In addition aquaculture facilities maybe vulnerable to collision by merchant vessels, possibly resulting in lost buoys and other equipment. The marking and if fishing at night the lighting of fishing gear is obviously a key factor in such conflicts, although spatial management is an important alternative or additional approach.

It is clear that both the marking and identification of fishing gear is important for both preventing the loss of fishing gear in the first place and allowing the owners of lost gear to be traced if it is subsequently recovered. In particular, the effective marking of fishing gear in busy multi-user sea areas is key to preventing its possible loss. This said, other approaches such as spatial zoning and good communication are equally important. One of the more challenging aspects is that the loss is gear is rarely of whole sets, but more usually of individual components and fragments. This inevitably complicates solutions to the cost-effective tracing of vessels that lose gear.

FAO believes that there are multiple pathways to reducing the impacts of ALDFG. These include: (i) development and broader use of reliable, cost-effective tools to reduce the possibility of ghost fishing occurring; (ii) implementation of standardized markings for fishing gears to identify fishery of origin and to increase gear visibility; (iii) supporting implementation of harmonized "no-cost" reporting of ALDFG by the fishing industry; (iv) development of best practices to locate and remove (when appropriate) ALDFG from the aquatic environment; (v) promoting and raising awareness of the impacts of ghost fishing on biodiversity, safety at sea and loss of wealth; and (vi) provision of adequate, safe, onshore disposal facilities that accept ALDFG. Furthermore, increased use of experienced fishing masters and crews is considered as an integral and key element of ALDFG mitigation work.

2.2 Illegal, unreported, and unregulated (IUU) fishing

Illegal, unreported, and unregulated (IUU) fishing remains one of the major challenges to fisheries management worldwide, with an annual cost in 2005 estimated to be USD 2.4 billion (MRAG, 2005). A number of initiatives have been taken to quantify and combat it, notably the 2001 FAO International Plan of Action on IUU Fishing.

Box 1: Definitions of Illegal, Unreported and Unregulated (IUU) Fisheries

3.1 Illegal fishing refers to fishing activities:

3.1.1 conducted by national or foreign vessels in waters under the jurisdiction of a State, without the permission of that State, or in contravention of its laws and regulations;

3.1.2 conducted by vessels flying the flag of States that are parties to a relevant regional fisheries management organisation but operate in contravention of the conservation and management measures adopted by that organisation and by which the States are bound, or relevant provisions of the applicable international law; or

3.3.3 in violation of national laws or international obligations, including those undertaken by cooperating States to a relevant regional fisheries management organisation.

3.2 Unreported fishing refers to fishing activities:

3.2.1 which have not been reported, or have been misreported, to the relevant national authority, in contravention of national laws and regulations; or

3.2.2 undertaken in the area of competence of a relevant regional fisheries management organisation which have not been reported or have been misreported, in contravention of the reporting procedures of that organisation.

3.3 Unregulated fishing refers to fishing activities:

3.3.1 in the area of application of a relevant regional fisheries management organisation that are conducted by vessels without nationality, or by those flying the flag of a State not party to that organisation, or by a fishing entity, in a manner that is not consistent with or contravenes the conservation and management measures of that organisation; or

3.3.2 in areas or for fish stocks in relation to which there are no applicable conservation or management measures and where such fishing activities are conducted in a manner inconsistent with State responsibilities for the conservation of living marine resources under international law.

These definitions are directly sourced from paragraph 3 of the International Plan of Action to Combat, Deter and Eliminate Illegal, Unregulated and Unreported Fishing (IPOA-IUU). FAO, Rome. 2001.

2.2.1 The impact of IUU fishing

IUU fishing has consequences for both fish stocks and the supporting marine environment, as well as the communities' dependent upon them. These can be briefly summarised as follows:

- **Impacts on fish stocks and the marine environment**: IUU fishing usually contributes to unsustainable impacts on both target species and the ecosystem. Fishing in general has the capacity to damage fragile marine ecosystems and vulnerable species such as coral reefs, turtles and seabirds. Regulation of legitimate fisheries aims to mitigate such impacts, but IUU fishers seldom comply with such requirements. This is likely to reduce productivity, biodiversity and ecosystem resilience. This in turn is likely to lead to a reduction in food security for artisanal fishers, and to a reduction of future catching opportunities.
- **Direct economic loss of revenue resulting from lost catch value due to IUU catches**. This can include direct and indirect losses of income and employment in other industries and activities in the supply chain upstream and downstream from the fishing operation itself.

- **Unfair competition to responsible fishers**. IUU fishing vessels often have lower costs and fewer social responsibilities than licensed fishing vessels, which drives them to exploit resources irresponsibly. The current overcapacity of the world fishing fleet (both in terms of numbers of vessels and technological power), has contributed to the problem. Many vessels have no fishing opportunities within regulated fisheries. This can also lead to direct conflict between IUU and other fisheries users, especially in areas where the fishing grounds are narrow ad close to the shore, thus bringing artisanal and industrial fishing into close proximity.
- **Social impacts.** IUU fishing may have a number of consequences at the community and household level, including impacting food security as fish becomes less available, lower employment opportunities in fishing and ancillary businesses, and a gender impact through disrupting on shore fishing by women and on the marketing opportunities for women who in many societies have an important role in basic fish processing and marketing.

2.2.2 Gear marking and IUU fishing

Gear marking is an important mechanism for assisting regulate legal – and illegal – fisheries. If gear is well marked and has sufficient identification so it can be linked to vessel or gear registers, this is evidently a useful tool for enforcement agencies checking on gear set in certain areas. Conversely if, say, a fisheries patrol picks up unidentified fishing gear in a location where all gear must be marked and linked to a vessel / gear registry, it is a reasonable assumption it is being illegally operated and appropriate action can then be taken.

3 CURRENT STATUS OF FISHING GEAR MARKING STANDARD

The following section provides a brief summary of key standards and legislation pertaining to the marking of fishing gear from different parts of the world. It does not pretend to be an exhaustive analysis, and largely consists of updates to the collation of legislative instruments provided in BIM's 'Evaluation of various marker buoy techniques for the marking of passive fishing gears' (BIM, 2009). See also a summary of gear marking systems by country in **Appendix B**.

3.1 International instruments

Relevant international fisheries instruments such as the **United Nations Agreement for the Implementation of Certain Provisions of the Convention on the Law of the Sea** of 10 December 1982 relating to the **Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks** (Fish Stocks Agreement), the FAO **Code of Conduct for Responsible Fisheries** (the CCRF) and the **Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High** Seas (Compliance Agreement) require that vessels be marked in a manner that will make them easily identifiable. Only the former two international fisheries instruments require that fishing gear be marked for the same reason. The requirement in these instruments for vessel and gear marking for easy identification is based on flag state responsibility.

Article 18 of the **Fish Stocks Agreement** provides that the measures to be taken by a State in relation to vessels flying its flag shall include "*requirements for marking of fishing vessels and fishing gear for identification in accordance with uniform and internationally recognizable vessel and gear marking systems, such as the Food and Agriculture Organization of the United Nations Standard Specification for the marking and identification of fishing vessels*". The significance of vessel identification in particular is underlined further by article 21(11)(f) which provides that concealing the markings, identity or registration of a fishing vessel is a serious violation. The Compliance Agreement in Article III provides, in respect of the requirement for vessel markings, that "*each Party to the Agreement shall ensure that all fishing vessels entitled to fly its flag that it has entered in the record maintained under Article IV are marked in such a way that they can be readily identified in accordance with generally accepted standards, such as the FAO Standard Specifications for the Marking and Identification of Fishing Vessels*."

The FAO **CCRF** requires in Article 8.2.3, in respect of markings of fishing vessels that "*fishing vessels authorized to fish on the high seas or in waters under the jurisdiction of a State other than the flag State, should be marked in accordance with uniform and internationally recognizable vessel marking systems such as the FAO Standard Specifications and Guidelines for Marking and Identification of Fishing Vessels*". In respect of gear markings, Article 8.2.4 requires that "*fishing gear should be marked in accordance with national legislation in order that the owner of the gear can be identified*" and that "g*ear marking requirements should take into account uniform and internationally recognizable gear marking systems*".

The **International Plan of Action to Prevent, Deter and Eliminate Illegal Unreported and Unregulated Fishing** (IPOA-IUU) contains requirements relating to vessel and gear markings and that vessels' fishing gear should similarly be marked in accordance with internationally recognized standards (see paragraph 47.8). The FAO **Technical Guidelines for Responsible Fisheries 9, Implementation of the International Plan of Action to Prevent Deter and Eliminate Illegal Unreported and Unregulated Fishing** (IPOA-IUU Guidelines) re-emphasises this requirement. It also encourages States to cooperate with others including

through regional fisheries management organizations (RFMOs) to prevent, deter and eliminate IUU fishing.

3.2 Europe

European Union: regulations for the marking and identification of fishing gears were first introduced into EU fisheries under Article 2 paragraph 2 of Commission Regulation (EEC) No. 1381/87. This article very much followed on the general provisions within the 1967 Convention on Conduct of Fishing Operations in the North Atlantic (see **Section 3.1.1)** but did not specify any of the detail included within Annex IV of the Convention. Article 2 stated:
"*Marker buoys and similar objects floating on the surface and intended to indicate the location of fishing gear shall be clearly marked at all times with the letter(s) and number(s) of the vessel to which they belong*".
Article 5(c) of the EU Control Regulation ((EEC) No. 2847/93 as amended) provides that detailed rules should be adopted as necessary on the marking and identification of fishing vessels and their gear. Article 20a (3) of that Regulation provides for the adoption of provisions for the identification of static gear. As discussed above, in 2005 the European Union's Commission Regulation (EC) No 356/2005 of 1 March 2005 laid down detailed rules for the marking and identification of passive fishing gear and beam trawls in EU waters outside of territorial waters (e.g., outside 12 nm). This regulation came into force in October 2005 and requires gillnet fishermen to mark each end of their gear and also use intermediary buoys. For the purposes of this regulation, passive gear is defined as gillnets, entangling nets, trammel nets, drifting gillnets and longlines. These regulations are very detailed with a variety of components required based largely on the 1967 Convention. This regulation was enacted by the European Commission as it was felt that updating gear marking regulations was necessary for the effective monitoring and inspection of fishing activities. Buoys constructed to the specifications contained in the regulation are similar to those constructed to comply with the 1967 Convention (if constructed for deployment in both daylight and darkness).
This regulation was amended by Commission Regulation (EC) No 1805/2005 of 3 November 2005 detailing the frequency of deployment of intermediary marking buoys (see Box 2 below). This was followed by a mass of Member State legislation enacting these regulations at national levels in EU waters.

Box 2: Highlights of Commission Implementing Regulation (EU) No 404/2011 relating to gear marking

Article 9 of the regulation sets out a series of general rules for the marking of 'passive gear' and beam trawls as follows:

> 1. The provisions contained in Articles 9 to 12 of this Regulation shall apply to EU fishing vessels fishing in all EU waters and the provisions contained in Articles 13 to 17 of this Regulation to EU waters outside 12 nautical miles measured from the base lines of the coastal Member States.
>
> 2. It shall be prohibited in EU waters as set down in paragraph 1 to carry out fishing activities with passive gear, buoys, and beam trawls, which are not marked and identifiable in accordance with the provisions of Articles 10 to 17 of this Regulation.
>
> 3. It shall be prohibited in EU waters as set down in paragraph 1 to carry on board:
>
> (a) beams of a beam trawl which do not display the external registration letters and numbers in accordance with Article 10 of this Regulation;
>
> (b) passive gear which is not labelled in accordance with Article 11(2) of this Regulation;
>
> (c) buoys which are not marked in accordance with Article 13(2) of this Regulation.

Sub-article 3 makes it an offence to carry on board un-marked gear. This is an offence of strict liability meaning that the state of mind of the accused person is not relevant: it is sufficient for there simply to be unmarked gear on board.
Subsequent articles go on to provide detailed provisions for the marking of beam trawls (article 10) and passive gear (article 11) as well as rules for labels (article 12), rules for buoys (article 13), rules

for cords (article 14), rules for end marker buoys (article 15), rules for fixing end marker buoys (article 16) and rules for intermediary marker buoys (article 17).

Commission Implementing Regulation (EU) No 404/2011 amended this to include pot and trap fisheries in EU waters outside of 12 nm, as well as all beam trawls and passive gear within all EU (inc. territorial) waters. The amendments also reflected some of the findings of a study carried out by BIM into the practical difficulties in implementing the previous Commission Regulation (EC) No 1805/2005. This resulted in some new Member State legislation to reflect this change. Some of these are briefly discussed below.

United Kingdom: the UK's Sea Fishing (Marking and Identification of Passive Fishing Gear and Beam Trawls) (England) Order 2006 sets out measures to reflect Commission Regulation 356/2005, as amended by 1805/2005 and covers English vessels (wherever they may be) and all other vessels including Welsh, Scottish, Northern Irish and foreign vessels in English waters as appropriate. As part of the process, a formal impact assessment was carried out where a range of replies was received from stakeholders. Some, particularly industry-based groups, opposed the proposal in its entirety on grounds of cost, impracticality, and the additional regulatory burden (see Section 4.1.1 for more information). Others were in favour, recognising that it would aid enforcement procedures, but still expressed concerns about the financial burdens it would place on small inshore boats for the purchase and maintenance of these gears. The impact assessment concluded that, given the majority of negatively affected stakeholders were within 12 nm and would thus not be covered by the order[1], the EC regulation should be implemented in full. For inshore vessels, under the Marine and Coastal Access Act 2009, the Inshore Fisheries and Conservation Authorities (IFCAs) can make byelaws to regulate the marking of fishing gear boxes, such as the Northumberland IFCA 'Marking of Fishing Gear and Keep Boxes' byelaw. However most other IFCAs do not have any providing for gear marking in coastal waters, although they are anticipating these will be required in the near future (Robert Clark, CFO Southern IFCA, 15 September 2015, pers. comm).

Ireland: the Sea Fisheries (Community Control System) Regulation of 2012 (SFPA, 2012) puts into national law the requirements of Commission Implementing Regulation (EU) No 404/2011 requiring all passive fishing gear and beam trawls to be marked and identifiable. Furthermore any of these gears extending more than one nm should be permanently marked at intervals of no more than one nm.

Norway: In Norway the main item of fisheries legislation is the Marine Living Resources Act 2008 which seeks to ensure sustainable and economically profitable management of the resources. Section 16 of the Norwegian Marine Resources Act provides that the Minister may adopt regulations on the conduct of 'harvesting operations', which is defined to mean 'harvesting and other utilization of wild living marine resources', including provisions on 'the design, marking, use and tending of gear and other devices used in connection with harvesting'. Under Norwegian legislation, Chapter XVI specifies detailed regulations for the marking and identification of fishing gears. This regulation represents the most up to date instrument for regulating Norwegian fisheries and is similar to the EU regulations, containing many of the same provisions regarding the use of radar reflectors, lights, height of buoys and use of intermediary buoys. It applies in the internal waters, territorial seas and EEZ of Norway with specific provisions outside 4 nautical miles and also in the capelin fishery. Local districts can also adopt local regulations on the placing and marking of fishing gear. The Norwegian Maritime Authority is responsible for Regulations No. 488, adopted on 30 May 2012 concerning environmental safety for ships and mobile offshore units. Among other objectives

[1] Despite Commission Implementing Regulation (EU) No 404/2011 including the marking of fishing gear used within territorial waters, the UK has never required this in national law.

these regulations seek to apply MARPOL Annex V with regard to Norwegian registered vessels as well as foreign vessels in waters under Norwegian jurisdiction.

North-East Atlantic Fisheries Commission (NEAFC): Annex IV of the 1967 Convention is used as the basis for the gear marking requirements set out in the North-East Atlantic Fisheries Commission (NEAFC). NEAFC came into force in 1963 but was reformed in 1982 under the Convention on Future Multilateral Co-operation in the North East Atlantic Fisheries. At present NEAFC has 5 contracting parties; EU, Denmark (in respect of Faroe Islands and Greenland), Iceland, Norway and the Russian Federation. Cooperating non-contracting parties include New Zealand, Japan and Canada. The NEAFC regulatory area is FAO area 27 in international waters. This Scheme was transposed into EU law by Council Regulation (EC) no 2791/1999 of 16 December 1999 laying down certain control measures applicable in the area covered by the Convention on future multilateral co-operation in the north-east Atlantic fisheries. The provisions for gear marking and identification are included Article 7 of the NEAFC Schedule of Control and Enforcement, which came into force in July 2008.

3.3 North America

Northwest Atlantic Fisheries Organisation (NAFO): Annex IV of the 1967 Convention is also used as the basis for gear marking requirements by the North Atlantic Fisheries Organisation (NAFO). The NAFO Convention Area encompasses a very large portion of the Atlantic Ocean and includes the 200-mile zones of Coastal States jurisdiction (USA, Canada, St. Pierre et Miquelon and Greenland). Management by NAFO, however, applies only to the areas straddling and outside the EEZs (Exclusive Economic Zones). The provisions for gear marking and identification are included in Article 17 of the NAFO Control and Enforcement Measures (NAFO, 2015), which was adopted in 1979 and are updated annually. Article 13 uses the same wording as in Article 6 of the NEAFC Control and Enforcement Schedule and based on the 1967 Convention on Conduct of Fishing Operations in the North Atlantic.

Canada: Regulations for gear marking and identification in Canada are contained in the Fisheries Act (SOR/93-53) Fishery (General Regulations). The regulations are fairly general and other than specific requirements for numbering of buoys are not specific in terms of types of marking systems used. The latest edition of this regulation came into force in May 2015 and the relevant provisions are included in Part III, paragraph 27. The Canadian Coastguard also warns fishermen that “they cannot expect favourable consideration of claims for damage to their nets, traps and trawls, attributed to Government vessels, unless they are marked in a manner so that, under prevailing conditions, the markers are visible to a ship's lookout in sufficient time to avoid fouling their gear” (Notice to Mariners, Annual Edition April 2015 – 2016).

USA: The Magnuson-Stevens Fishery Conservation and Management Act of 1996 (US Government, 1996) is the framework for US fishery management. State and federal legislation under the Magnuson-Stevens Act is enacted through eight US Fishery Council Areas. Within each of these areas, there are a vast number of quite diverse gear marking regulations in place. Many of these concentrate more on the physical tagging of individual pots and nets and merely require buoys to be marked with the vessel identification details and licence numbers with no specification requirements for the buoys used. Others are more prescriptive and give detailed specifications. One other piece of gear marking legislation has a completely different purpose than control and enforcement in that it seeks to use gear markers as a way to protect marine mammals.

3.4 Latin America and the Caribbean

The Organisation of Eastern Caribbean States (OECS) Draft High Seas Fishing Act (undated) makes provision for: "80 (2) The Minister may attach such other conditions and restrictions to each high seas fishing permit as are necessary and appropriate to carry out the obligations of

[country] under the Compliance Agreement and the Fish Stocks Agreement, including, but not limited to, the following: …. (e) the marking of gear. To our knowledge this has been transcribed into national legislation only in Belize, where Fishing Vessels Circular FVC 08/03 (2008) proposes the implementation of "*the FA0 Proposed System for the Marking of Fishing Gear, the FA0 Proposed Standard System of Lights and Shapes for the Identification and Location of Fishing Gear as well as the relevant Resolutions/Recommendations of Regional Fisheries Management Organizations (RFMOs) on this topic*". This applies to all Belize-registered fishing vessels "with immediate effect", irrespective of which waters they are fishing.

South Pacific Regional Fisheries Management Organisation (SPRFMO): this RFMO manages all species (except high migratory species) in the southern Pacific. As yet there are no regulations or provision for gear marking (Mauricio Galvez Larach, Departamento de Pesquerias Subsecretaria de Pesca y Acuicultura Gobierno de Chile, pers. comm., 06 October 2015).

3.5 Africa

South East Atlantic Fisheries Organisation (SEAFO): the South East Atlantic Fisheries Organisation (SEAFO) is a regional fisheries management organisation in South East Atlantic Ocean, although the Convention Area excludes the EEZs of the coastal states in the region. The Convention includes the requirement that that contracting part will "*ensure that gear used by its fishing vessels and fishing research vessels authorised to fish in the Convention Area is marked as follows: the ends of nets, lines and gear anchored in the sea shall be fitted with flag or radar reflector buoys by day and light buoys by night sufficient to indicate their position and extent. Such lights should be visible at a distance of at least two nautical miles in good visibility*" and that "*Marker buoys and similar objects floating on the surface and intended to indicate the location of fixed fishing gear shall be clearly marked at all times with the letter(s) and/or number(s) of the vessel to which they belong"* (Section 2, Art. 3). Interim measures relating to gear marking are included in paragraph 12 of Conservation Measure 07/06, which came into force in October 2006. They are identical to the provisions used by NEAFC, NAFO and CCAMLR given above. SEAFO recommends a ban on the use of gillnets in the Convention Area. It has a specific Conservation Measure (CM 19/10) on the retrieval of lost fixed fishing gear but gear marking is not mentioned in this CM which has been subsequently repealed.

3.6 Australasia and the Pacific States

Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR): the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) came into force in 1982 and established a commission to manage the marine living resources of the continent of Antarctica and the waters surrounding it. With respect to gear marking and identification, regulations came into effect in 1998 and are almost identical to the NEAFC and NAFO provisions. Conservation Measure 10-01 (2014) (Marking of fishing vessels and fishing gear) of the CCAMLR Convention states that "Marker buoys and similar objects floating on the surface and intended to indicate the location of fixed or set fishing gear shall be clearly marked at all times with the letter(s) and/or numbers of the vessels to which they belong".

Western Central Pacific Fisheries Commission (WCPFC). In 2003 the WCPFC prepared a background paper on possible components of a regional vessel and gear marking system. The principal reference document for the fishing gear marking element was the FAO Recommendations for the Marking of Fishing Gear (FAO 1991) which formed the basis of a set of proposed 'Standard Specifications for the Marking of Fishing Gear in the Guidelines on

Fishing Operations' (Annex III, WCPFC, 2003). As of 2013 no gear marking requirements had been required by WCPFC (NOAA, 2013).

Australia: The marking of fishing gear in Australian waters is the responsibility of the various state fishery agencies and the Australian Fisheries Management Authority (AFMA). The state fishery agencies manage fisheries to the 3 nautical mile mark from the shoreline and AFMA manages all Commonwealth fisheries which are usually past the 3nm mark. At the state level fisheries regulations are contained in the Fisheries Management (General) Regulations which seem to have been developed independently. In Southern Australia there are requirements on the size, material and marking of buoys and tags (Fisheries Management (Vernal) Regulations 2007), in New South Wales the use of buoys for different fisheries (Fisheries Management (General) Regulations, 2002) and under the Queensland Fisheries Regulations (2008) there are general provisions for the marking of set nets and crab pots.

New Zealand: under the 1996 Fisheries Act in New Zealand the requirements for marking of fishing vessels and fishing gear for identification in accordance should be uniform and internationally recognizable vessel and gear marking systems, such as the Food and Agriculture Organization of the United Nations Standard Specifications for the Marking and Identification of Fishing Vessels.

3.7 Synthesis

Although it has not been possible to undertake a rigorous analysis of all gear marking standards from around the world, the above analysis provides sufficient evidence to come to the following preliminary conclusions:

1. FAO's technical guidelines on a "Proposed system for the Marking of Fishing Gear" and "Proposal for the Application of a Standard System of Lights and Shapes for the Identification and Location of Fishing Gear" (FAO, 1996), together with the earlier Convention on Conduct of Fishing Operations in the North Atlantic(UK Government, 1967) have formed the basis for most current legislation for the marking of fishing gear, such as the EU's Commission Regulation (EC) No 356/2005 (and later amendments and implementing legislation).

2. The only comprehensive study to update the 1996 FAO technical guidelines was provided by BIM in Ireland in 2006 who proposed a new gear marking system using smaller buoys and various other changes to reduce the perceived complexity and cost of the existing guidelines was made (see Section 4.1.2 for more details). The level of uptake of these proposals by EU Member States is uncertain.

3. A limited number of RFMOs have adopted these guidelines. In the North Atlantic (e.g. NEAFC and NAFO) have adopted the recommendations of the 1967 Convention on Conduct of Fishing Operations in the North Atlantic. Some other RFMOs e.g. SEAFO and CCAMLR have similar recommendations to NEAFC and NAFO. However it appears that many RFMOs, especially in tropical ocean regions, do not have any advice or requirement for the marking of fishing gear under their jurisdiction.

4. Uptake of the guidelines at country level is variable. In some regions, such as the EU, regulations have been transferred into subordinate national legislation, thus supporting a common approach to gear marking. However, in most cases this has been enacted outside of territorial waters and whilst encompassing much of the commercial fishing activity, excludes inshore activity that may be both considerable in scope and often subject to gear and navigational conflicts.

Appendix A: References

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Appendix B: Gear marking system specifications by country

From BIM (2007).

Spain

Fishery	Demersal Longline/ Net Fishery >100m	Surface Longline Fishery (Bluefin)
Mast height above sea level	c.2.5m	2m
Mast material	Steel/ Nylon	Radio antenna covered with plastic pipe
Float specification	CC3 Polyform Red	CC3 Polyform Red
Counter weight type	Steel bar twice diameter of dahn pole shaft	solid stainless steel
Weight of buoy	Unknown	Unknown
Reflective band	No	No
Flag(s)	No	No
Light(s)	yes, one white or blue	No
Light specifications	white flashing or blue flashing	None
Western and eastern end of gear identification	No	No
Radar reflector	No	sometimes/ spherical
Other accessory	Radio transmitter (27mhz am)	Radio transmitter (27mhz am)
Ownership markings	Vessel name & reg number	Vessel name & reg number
Cost to construct individual marker buoys	Unknown	Unknown

France

Fishery	Demersal Longline/ Net Fishery >100m	Demersal Longline/ Net Fishery <100m	Surface Longline Fishery (Albacore)
Mast height above sea level	up to 2.5m	up to 3m	2 m
Mast material	Bamboo	Bamboo - in the case of no dahn pole being used, one or two plastic 5 litre bottles	Radio antenna covered with plastic pipe
Float specification	Polystyrene Floats (Various shapes/ forms - 2500gr-12000gr flotation)	Polystyrene Floats (Various shapes/ forms - 2500gr-12000gr flotation)	CC3 Polyform Red
Counter weight type	chain and cement inside a 2-litre plastic bottle	chain and cement inside a 2-litre plastic bottle	solid stainless steel
Weight of buoy	c.4kg	c.4kg	Unknown
Reflective band	Yes	Yes	No
Flag(s)	Yes	Yes	No
Light(s)	No	No	No
Light specifications	None	None	None
Western and eastern end of gear identification	No	No	No
Radar reflector	No	No	sometimes/ spherical
Other accessory	None	None	Radio transmitter (27mhz am)
Ownership markings	Vessel name & reg number	Vessel name & reg number	Vessel name & reg number
Cost to construct individual marker buoys	c. €30.00	€ 0.00 - c. €30.00	

Ireland

Fishery	Gillnet/ tangle net/ wreck net fisheries	Pot fisheries (brown crab) outside 12nm	Pot fisheries (inside 12nm)
Mast height above sea level	1 to 3m	n/a	n/a
Mast material	Bamboo	n/a	n/a
Float specification	Polystyrene	Polyform buoys	Polyform buoys, polystyrene, air filled cartons etc.
Counter weight type	Weight from sash window, scaffolding tube or pieces of scrap metal	n/a	n/a
Weight of buoy	2 to 5kg	1kg	Less than 1kg
Reflective band	Yes	Reflective tape use on buoys	Reflective tape use on buoys
Flag(s)	Yes (1x) red or black	No	No
Light(s)	No	No	No
Light specifications	n/a	n/a	n/a
Western and eastern end of gear identification	No	No	No
Radar reflector	No	No	No
Other accessory			
Ownership markings	Vessel registration number	Vessel registration number	Vessel registration number

UK, Denmark & Turkey

Country	UK	Denmark	Turkey
Fishery	Gillnet/ tangle net/ wreck net	Gillnet/ tangle net/ wreck net	Gillnet/ trammel nets/ longlines (Regulation)
Mast height above sea level	1 to 3m	1 to 3m	Not specified
Mast material	Bamboo	Bamboo	Not specified
Float specification	Polystyrene	Polystyrene	Not specified
Counter weight type	Weight from sash window, scaffolding tube or pieces of chain	Lead weight, metal tube/ scrap metal	Not specified
Weight of buoy	2 to 6kg	2 to 6kg	Not specified
Reflective band	Yes	No	Not specified
Flag(s)	Yes (1x) red or black	Yes (2x) red or black	Yes
Light(s)	No	No	Yes (at night)
Light specifications	n/a	n/a	Not specified
Western and eastern end of gear identification	No	No	No
Radar reflector	No	No	No
Ownership markings	Vessel registration number	Vessel registration number	Vessel registration number
Cost to construct individual marker buoys	£17 each	€20 each	Not specified

Italy, Iceland and Norway

Country	Italy	Iceland	Norway
Fishery	Fixed nets and longlines (Regulation)	Anchored bottom-set nets for cod (Regulation)	Gillnets and longlines outside 4nm (Regulation)
Mast height above sea level	1 to 3m	Not specified	2m
Mast material	Wood	Not specified	Not specified
Float specification	Not specified	Not specified	Not specified
Counter weight type	Not specified	Not specified	Not specified
Weight of buoy	Not specified	Not specified	Not specified
Reflective band	No	Not specified	Mast or buoy or top sign must be equipped with light-reflecting material
Flag(s)	Yes	Not specified	Yes (2x)
Light(s)	Yes	Yes	Yes
Light specifications	Yellow, visible for 0.5nm	White flashing (only if nets set in an area where bottom trawling occurs)	Yellow, flashing, visible for 2nm and 3 sec interval
Western and eastern end of gear identification	No	No	Yes
Radar reflector	No	No	May be substituted for flag
Ownership markings	Yes	District and vessel registration	Vessel registration number
Cost to construct individual marker buoys	Not specified	Not specified	Not specified. Buoy requires type approval from Norway Directorate of Fisheries