4. Reasons why fishing gear is abandoned, lost or otherwise discarded

INTRODUCTION

The causes of ALDFG are important both in terms of affecting lost gear evolution and for developing appropriate prevention and mitigation measures that fit with and address the principal causes. As with the magnitude of ALDFG, the causes of ALDFG vary among and within fisheries. When one considers that gear may be a) abandoned, b) lost or c) discarded, it is clear that some ALDFG may be intentional and some unintentional. Correspondingly, the methods used for reducing abandoned, lost and otherwise discarded fishing gear may therefore need to be different (Smith, 2001).

The impacts of ALDFG vary significantly due to numerous variables, including the vulnerability and sensitivity of the receiving environment, and therefore there is no clear correlation between type of ALDFG and its impact. Figure 9 does, however, show the different types of ALDFG, the reasons and motivations for each type, and the key pressures at play that result in each type. The impacts of ALDFG vary significantly due to numerous variables including the vulnerability and sensitivity of the receiving environment and therefore there is no clear correlation between type of ALDFG and its impact.

Despite the division of causes of ALDFG into discrete subsections, in most fisheries, fishing gear is probably lost, abandoned or discarded for a number of different reasons (Figure 9). Swarbrick and Arkley (2002), for example, found that in shellfish trap fisheries in the United Kingdom (pots and creels), bad weather was the primary cause of loss (43 percent), while the secondary cause of loss was due to other fishing activities (26 percent). Other causes included other marine traffic, their own fault/mistakes and "something else" (usually theft).

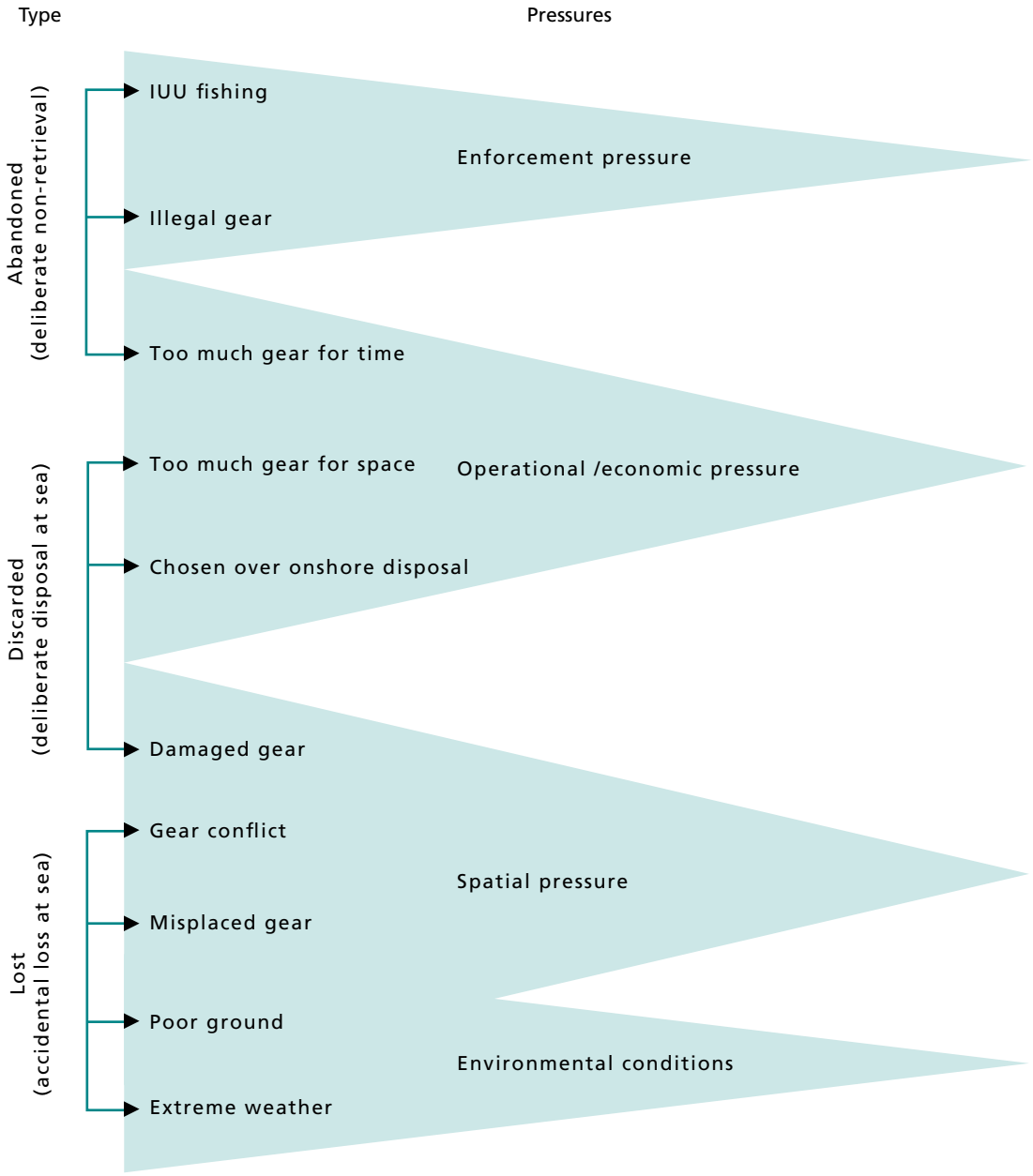
During the EC-funded research project on ghost fishing conducted by IEEP and Poseidon (Brown *et al.,* 2005), a small survey was conducted with vessel owners in three fisheries in the European Union.

Surveys were completed in:

- the Baltic cod net fishery of Sweden and Denmark;
- net fisheries of Greece; and
- the English and French net fishery in the English Western Channel.

While the survey numbers were small and not equally representative, they nevertheless provide some interesting results. In addition, while the deepwater net fisheries of the northeast Atlantic were not surveyed, some information on causes of ALDFG in this fishery is available (e.g. Hareide *at al*., 2005). Information on causes of ALDFG is also available from the FANTARED project reports, also focusing on EU fisheries. Apart from the above-mentioned sources, most of the other literature on ALDFG only deals with causes of ALDFG in a very cursory manner, if at all. The APEC workshop (2004), for example, hardly touched on the issue of the causes of ALDFG, concentrating instead only on the impacts and measures being taken to address the issue. The text below draws on literature that is available, while also providing some anecdotal, but nevertheless interesting, evidence in text boxes from fisheries around the world, based on communication made by the authors with individual contacts known to them.

FIGURE 9
Reasons why fishing gear is abandoned, lost or otherwise discarded



Source: Poseidon, 2008.

GEAR CONFLICTS

ALDFG is often the result of conflict between different types of gear, and is therefore dependent to a certain extent on the range and mix of gears being used in any one area. ALDFG from gear conflict is most commonly reported as being due to trawled/mobile gear passing through an area in which static gear is positioned. Anchored gillnets may also be lost as a result of merchant shipping. In the United Kingdom, FANTARED 2 (2002) reported that the most significant net losses in tangle net fishing are described as being whole fleet or partial fleet losses from gear conflicts. A partial fleet loss varied from one net to several nets and a whole fleet loss would be on average 30 nets. The amount of netting used in this netting operation is very great, with an average of 12 km

hauled per day. The vessels involved patrol their nets at night but are not able to do this while hauling operations are ongoing. This leaves the nets vulnerable to fishing vessels engaged in towing operations. The approach of the vessel towing either trawl, scallop dredge or beams usually determines whether a whole or partial net loss will occur. Dahns and end ropes are particularly vulnerable to shipping, especially in areas of intense activity, such as the English Channel, and can on occasion be cut leaving, the entire fleet without any positional indication on the surface. However, where this is likely to happen, the use of intermediate buoy lines can be used to minimize the risk.

The extent of gear conflicts may also vary over time in any one location. In some areas such as the Baltic Sea (Brown *et al.,* 2005), losses of static nets due to trawling have been reduced in recent years due to improved communications between skippers in the two sectors. In other areas, conflicts and resulting ALDFG may have intensified. FANTARED 2 (2002) reported that hake net fishers in the English Channel and Western Approaches reported greater losses than previously because of developments in ground gears for trawls, which have resulted in trawlers being able to tow in many areas previously inaccessible to them. Trawlers, beamers or scallopers using modern technology (particularly sonar, 3-D mapping software and differential GPS) are now able to fish within 25 m of wrecks[18].

Gear conflicts are not restricted to static and towed gears. In some areas netters, liners and potters can all be in competition for fishing grounds. These conflicts, however, are generally considered to be much less serious, and the gears are not usually moved any distance, making it easier for gear that was lost temporarily to be found.

Brown *et al.* (2005) reported that gear conflict was a main cause of ALDFG in both the Baltic cod net fishery and in many Greek fisheries (both between mobile and static gear, and between part-time/recreational and professional fishers). Hareide *et al., (*2005) also suggested that gear conflicts are an important determinant of lost gear in the deepwater net fisheries in the northeast Atlantic. However, conflicts were found to be less frequent in the English/French Western Channel net fisheries due to communication between vessel skippers and producer organizations (see heading "Spatial management (zoning schemes)" page 63 for more on fishers' agreements). There is a formal gentleman's agreement between the French and English associations whereby "blocks" are allocated to either static or mobile gear – these are then swapped periodically (every six weeks). This arrangement functions well and reduces gear loss considerably (Norman Graham, personal communication, 2008). For the most part, ALDFG from gear conflicts can be viewed as being unintentional.

OPERATIONAL FACTORS AND THE NATURAL ENVIRONMENT

Operational factors and the natural environment are a very significant cause of ALDFG. Sometimes gear loss may be unintentional, while at other times intentional but unavoidable. Some operational factors may provide an economic incentive to deliberately discard fishing gear. However, it is important to recognize that due to the environment in which fishing takes place and the technology used, some degree of ALDFG is inevitable and unavoidable.

Poor weather and differing natural environments in which fishers operate (with differing currents, sea-bed conditions, temperatures, strong winds and swell) may have huge impacts on the operational ability of vessels to successfully deploy, work and subsequently retrieve fishing gear.

[18] Nathan de Rozarieux (skipper), personal communication, 2007.

BOX 5
The case of the *Radiant* in Scotland

In the late evening of 10 April 2002, the fishing vessel *Radiant* was fishing about 45 miles northwest of the Isle of Lewis, off Scotland, when she became snagged on an underwater obstruction (fastener). About 1 735 m (950 fathoms) of warp was out and the water depth was about 730 m (400 fathoms). It was apparent that only the port warp was fast, indicating that the port trawl door was snagged. *Radiant* effectively became anchored to the seabed when her port net snagged on a seabed obstruction and power was lost to the winches. There was now a heavy load on the port warp, causing a large list to port. The engine room flooded, and, eventually, the vessel capsized while trying to free the fishing gear. During the abandonment, one of the crew was lost, the other five were successfully rescued.

Source: Report on the investigation of the capsizing and foundering of *Radiant* PD298. Marine Accident Investigation Branch (MAIB). Report No 2/2003. January 2003.

Weather and operational factors combine to cause ALDFG

In some fisheries, a common reason for permanent losses appears to be a combination of rough bottom and strong currents that result in the snagging (or "hooking") of the nets on the bottom. Brown *et al.* (2005), for example, suggested that in the English/French Western Channel net fisheries, causes of gear loss (although not significant) were mainly caused by weather and bottom snagging, and very little was reported as loss due to gear conflicts. Net losses may be in the form of fragments or pieces of netting, or larger quantities when fishing vessels need to cut gear adrift for safety reasons (often in very bad weather conditions) or when they have snagged an underwater obstruction and are unable to free the gear. Lost or otherwise snagged gear may be dangerous or difficult to retrieve, especially in bad weather, and "fishing gear" loss may take the form of losses of complete vessels (see Box 5).

Gear loss may also occur as a result of poor weather combined with the quality and/or age of the gear being used. This may be the case particularly when old gear, which is more likely to break or tear, is not replaced. An interesting example involving a fishery in Sri Lanka is provided in Box 6. In the Gulf of Mexico wire trap blue crab fishery, it is also suggested that old or improper gear use is a cause of pot loss, with deterioration of buoys/lines/knots, negligence in assembling and maintaining gear, and the use of plastic jugs/bottles as floats as important causes (Perry *et al.*, 2003). However, the use of old gear as a cause of ALDFG is also relevant to developed country fisheries; wherever fishing activity is financially marginal there may be a reluctance or inability of fishers to invest in upgrading the fishing gear they use.

In other cases, the retrieval of fishing gear may simply be technically too complicated or time consuming and the results too variable and uncertain to warrant much effort, for instance, when only pieces of netting and/or ropes, or large bundles of badly tangled nets, are likely to be recovered. In such cases, ALDFG may be more intentional and caused in part by an economic incentive, for example, if it is quicker to discard entangled gear to avoid interfering with hauling and to maximize fishing time while at sea, or when the value of temporarily lost gear that might be retrieved has no or little economic significance, or when it costs more than it is worth to retrieve. Likewise, floating FADs may be deliberatively abandoned.

However, the considerable investment that fishers often make in fishing gear means that typically they do not want to permanently lose or abandon it. Fishers may therefore spend significant amounts of time trying to find lost gear. Recent developments in, and

BOX 6
Causes of gear loss in the Sri Lankan spiny lobster fishery

In Sri Lanka, one fishery that has raised some concern regarding ALDFG and ghost fishing is the bottom-set net fishery conducted for spiny lobsters. In the south (mainly in Hambantota district), there is a seasonal fishery conducted by 6–7 m open-decked and outboard-powered fiberglass boats, and targeting spiny lobsters. These boats use bottom-set gillnets, often made up of old and discarded nets (mesh size 4½ to 6") originally used for pelagic drift-gillnet fishing for skipjack and immature yellowfin tuna. The nets are typically set in the evening and collected the next morning. However, when the seas are rough they may remain in the water for a few days, and since the nets used are already old, when laid and retrieved from rocky areas there is increased risk that parts of the gear may be broken/torn and lost.

Source: Dr Leslie Joseph (consultant), personal communication, 2007.

use of, GPS have increased the ability of fishers to find temporarily lost gear, at least in the case of many medium- to large-scale fishing vessels, and especially in the developed world.

There is a clear economic incentive to more readily abandon low-value gear when it is lost, compared to very high-value gear, because of the difference in replacements costs. This also means that fishers may spend more time and effort to recover different parts of gear that have different associated costs/values and life spans. For example, cheap net sheets with a short operational life span may be cut loose, while floats and ropes with higher values and/or longer life spans are retained. It should be noted that items with a short operational life span, nevertheless often have a long residence time in the environment, such as synthetic netting. Data on gear costs indicating the wide range of a) gear costs and b) contribution of gear costs to total investment costs among different vessel types and fishing methods are available in a number of FAO Fisheries Technical Papers (e.g. Lery *et al.,* 1999; Tietze *et al.,* 2001).

ALDFG from operational factors

Some gear may be lost irrespective of the weather, and simply due to the operational characteristics of particular vessels and fishing methods. In the deepwater net fisheries of the northeast Atlantic, which are thought to be a particular problem in terms of ALDFG and ghost fishing, conflict between towed and static gear sectors is important as noted above, but so are many operational factors. These include the depth in which fishing takes place, the hardness of the ground being worked, the quality and appropriateness of the specified gear, and the amount of gear being worked in relation to the time available for hauling (Hareide *et al.,* 2005). Working more gear than can be hauled may result in very long soak times, especially when considering the time period vessels may spend in port between trips, thereby increasingly the likelihood of nets being dislodged by trawlers or lost for other reasons. It also implies that some operational losses, while not necessarily explicitly intentional, may nevertheless be expected.

In United Kingdom wreck net fisheries, some net loss is also generally expected. As reported in the FANTARED 2 project (2002), the main type of net loss in wreck netting is described as being pieces. A piece of net could vary from just a section 0.5 m^2 to a whole sheet of netting. The construction of wreck nets includes drop straps every 30 to 40 yards, which allow the netting to tear off at that point, leaving the rest of the frame intact. Drop straps are ropes that join the headrope to the footrope and enable retrieval of ropes even if the footrope is hitched and then parts. Due to the height of the

BOX 7
Gear loss in Indonesian handline fisheries

"My name is Renaldi Safriansyah. I fish in my 2 GT inboard engine boat operating from Sabang, Pulau Weh. I fish using panjung (hand line). I fish on reefs for grouper, snappers, little tuna, bluefin tuna, Spanish mackerel and jackfish. If I fish close to the reef I usually catch higher-value reef fish such as tiger grouper. When I do this, I snag my lines about two times out of ten, but the rewards are good. Most of the time, I snag my lines and hooks on corals. I know this because I can usually see through the clear water."

Source: Interview by Poseidon/Gomal H. Tambunan (NACA/ETESP), personal communication, 2007

headline above the wreck, snagging (and parting) of the headline is very rare and when this happens, boats generally simply go to pick up the other end of the gear. However, some net loss does occur and is an accepted part of wreck netting. But skippers in this sector try very hard to keep lost netting to a minimum because of both gear costs and their awareness that lost gear can ghost fish for a limited length of time and therefore damage their future fishing. Gear in this fishery is never abandoned or disposed of on a wreck as this may indicate the location of the wreck to competitors (Nathan de Rozarieux (skipper), personal communication, 2007).

Further anecdotal examples of unintentional gear loss are provided in Boxes 7, 8 and 9. In the case of longlining described in Box 8, however, while some aspects of gear loss may be unintentional and to a large extent unavoidable, the discarding of offal is clearly intentional and can have serious impacts.

ALDFG from poor weather

Poor weather can cause ALDFG irrespective of operational factors. Extreme weather events such as tsunami or hurricanes can cause catastrophic losses in coastal areas, and these losses extend to the fisheries sector.

The NOAA Marine Debris Program's Gulf of Mexico Mapping Project was established to address the impacts of hurricane Katrina in 2005, which deposited large

BOX 8
Gear loss in bottom longline fishing

Bottom longlining gear is rigged in two principal ways: a single line set automatically from which snoods and hooks hang; or a double line, with a main line holding the snoods and hooks and a hauling line to which it attaches. Hooks and lines are regularly lost through contact with the sea bed – for instance when they are caught around rocks or other projections. In shallow water the line is usually buoyed at regular intervals so if it breaks it is generally possible to recover it. In deep water, however, it is only buoyed at the ends. A break may be recovered by hauling on the other end, but often sections of lines or even whole lines are lost. A certain amount of gear may be recovered when other longlines get caught on them. Balls of monofilament and hooks may be discarded by vessels with poor environmental records and these can end up either sinking or, if they are mixed with offal, attracting seabirds. Offal itself is usually discarded and, from longliners, poses a serious threat to seabirds since such offal (e.g. heads) will often contain hooks.

Source: David Agnew, MRAG, personal communication, 2007.

BOX 9
Gear loss in pelagic longline fishing

Many tuna longline vessels store their mainline on a line drum that may hold in excess of 80 km of monofilament line. In many cases, the line is pulled off the drum as the vessel proceeds at high speed. Although hydraulic and manual braking can to some extent control overrun of the line, the presence of knots (extremely common) in the line and "burying" of the line (as a result of tension) in the spool often results in the line becoming snagged. Since the drum continues to turn at high speed even though the line is snagged, several hundred metres of line may become entangled around the spool (this is called a bird's nest). Often, the fastest way to remove the bird's nest is to sever the line in multiple places, retie the line and discard the short pieces. Since the vessel is midway through shooting, there is often no time to store the monofilament, which is often thrown overboard. The repaired line will have a greater number of knots than before and thus the problem of snagging tends to increase with the age of the fishing gear.

Source: Frank Chopin, FAO, personal communication, 2007

amounts of debris over large areas of the Gulf Coast, causing myriad new and uncharted navigation and fishing hazards. An extensive survey and debris recovery programme were initiated to support the re-establishment of a viable commercial fishery. Figure 10 shows that lost fishing gear contributes to the recovered debris.

Estimates of trap losses from hurricanes Katrina, Rita and Wilma suggest that well over 50 percent of all traps were lost (National Fish and Wildlife Foundation, 2006). Other chapters of this document (Box 2) also report losses resulting from the Asian tsunami in December 2004, which were enormous in both the capture and aquaculture sectors. Regular hurricanes and cyclones in Asia, the Pacific and the Caribbean (see Box 10) are likely to result in considerable amounts of ALDFG. Gear loss and other debris resulting from extreme weather events further interfere with fishing operations (see Box 11).

FIGURE 10
Marine debris, including fishing gear, collected from the Gulf of Mexico

Source: NOAA.

BOX 10
Gear loss in the Caribbean from weather events

In the Caribbean, a project to consider socio-economic data collection examined vessel profitability across a range of gear types. Costs and earnings models suggested that there were large losses associated with reef nets and lobster pots during hurricanes, with losses typically running to around 50 percent of a string of 20 pots once in every three years. Fishers usually tried to recover the pots, but rather unsuccessfully, and reef nets were often almost all lost.

Source: Scales/Poseidon (2001).

BOX 11
Gear loss in Indonesia, resulting from post-tsunami debris

"My name is Ahmad Saiful. I am a skipper of a 20 GT purse seiner, with 16 crewmen targeting skipjack tuna. I am based in Lampulo, Banda Aceh. In the last two years I have lost two purse seine nets. These were damaged in areas familiar to us but on wreckage from the tsunami. Each net is valued at Rp200 000 (US$ 19 000). I recently participated in an ADB-funded sonar mapping programme. This plots debris identified by myself and my other fishing colleagues (around 30 local vessels). We have also been equipped with GPS under the same programme."

Source: Interview by Poseidon/Gomal H Tambunan (NACA/ETESP), personal communication, 2007

In many capture fisheries, operational losses due to severe storms may to some extent be mitigated if fishers are aware of approaching rough weather, as they understandably seek to minimize their own exposure, and that of their gear, to risk. However, aquaculture equipment and gear may be particularly susceptible to loss in poor weather because of practical difficulties or impossibilities of removing gear and product from the sea (see Box 12).

It is widely predicted that climate change is expected to result in more frequent and more extreme weather events. This may lead to bad weather becoming a more significant cause of gear loss than at present. The ability to predict and adequately forewarn of extreme weather events will therefore be increasingly important in avoiding ALDFG.

BOX 12
Gear loss in Indonesian seaweed farming, resulting from bad weather

"My name is Hasan Hanawi, I am a seaweed farmer in Bira, South Sulawesi, Indonesia. I lay 20 longlines of around 60 m, that are anchored to the sea, and have surface floats. Each year I probably lose around 10 percent of my equipment through storm damage. The equipment is washed up onto the land but is not often salvaged. The seaweed attached to these lines, around 30 to 40 kg, is usually lost. My normal gear would usually last around three years."

Source: Interview by Poseidon/Luna Matulessy (IFC), personal communication, 2007.

BOX 13

Disposal practices of French/English Western Channel gillnet fishers

Disposal of unwanted gear in France takes place through a number of mechanisms. It can: go to a waste collection centre for sorting and recycling; be returned to a manufacturer; or be collected by municipal trucks from the city, as "big bags" with unwanted gear inside.

In the United Kingdom, nets may be disposed of in skips in harbours (the costs being absorbed by harbor dues), or be disposed of as industrial waste. However, associated charges for industrial waste mean that nets may be either bagged as normal waste and taken to community tips, or "fly-tipped", that is, illegally dumped on land.

In neither France nor the United Kingdom does it appear that fishers discard unwanted nets at sea.

Source: Brown *et al.* (2005), based on interviews with fishers.

SHORESIDE DISPOSAL OF UNWANTED GEAR

The availability, convenience and costs of shoreside collection facilities for unwanted or old gear are critical issues driving the disposal of unwanted gear by fishers. Most forms of fishing gear have a finite life span, after which time they can no longer be used, and must be disposed of. The adequacy or otherwise of shorebased facilities for safe disposal of unwanted fishing gear, and any related costs of disposal when facilities are available, may be an important determinant in reducing the problem of ALDFG. Box 13 notes disposal practices in France and the United Kingdom.

The lack of convenient harbourside collection facilities can result in fishers having to dispose of unwanted gear in municipal waste facilities. This can involve both time (with associated costs) and charges imposed for disposal, if indeed such disposal is permitted at all. Therefore, incentives may be strong to deliberately discard gear at sea, or to illegally dump it at other land-based locations (see Box 14). Even where convenient shoreside facilities are provided for collection and disposal of unwanted gear, while the principle of "user pays" should be supported, if costs are set "too" high there may still be some economic incentive for fishers to discard unwanted gear at sea.

BOX 14

Deliberate discarding of unwanted gear at sea by vessels in the North Atlantic Fisheries Organization (NAFO)

"As a general rule, for European vessels operating in NAFO, the most common cause of ALDFG was simply loss from snagging on the sea bed. This was purely accidental and greatly regretted by the fishers. However, on return journeys in the mid-Atlantic, I do remember seeing old gear being dumped. I think that dumping in the mid-Atlantic was not an uncommon practice, although not done by all vessels, and I can't quantify it in any way. I know it did occur, though. Dumping seldom took place on fishing grounds as this would be self-defeating, and nets were generally dumped in the open ocean on return to port. However, sometimes gear was deliberately dumped between good patches of fishing ground where vessels knew fishing conditions to be so bad that no one fished there, as on very rough, craggy, boulder-strewn seabed and/or where there were strong deep sea currents. I remember a couple of times vessels going to rough patches of sea bed on the Banks and Flemish Cap expressly to dump gear."

Source: Patrick Boyle (ex-senior fisheries observer), NAFO, personal communication, 2007.

ILLEGAL, UNREGULATED AND UNREPORTED (IUU) FISHING

Deliberate discarding or abandonment of fishing gear may also result from IUU fishing for a range of reasons, which by definition are not well documented or reported, but which are likely to be based around the attempt of fishers not to be caught. These may include:

- a failure to mark/identify gear so as to prevent its association with particular vessels, or failure to mark gear may itself be a form of IUU fishing;
- an unwillingness to communicate with other fishers about activities, thereby increasing the risk of ALDFG from gear conflicts;
- increased risks of losing gear if fishing in poor weather or at night in an attempt to conceal IUU activity; and
- an unwillingness to be apprehended by inspections authorities if vessel has been identified at sea as engaging in IUU.

VANDALISM AND THEFT

ALDFG as a result of deliberate vandalism and/or theft is probably only a minor cause of ALDFG in some specific fisheries, typically pot fisheries. Intentional cutting of buoy lines by vandals is reported as a cause of gear loss in the blue crab fishery in the Gulf of Mexico (Perry *et al.,* 2003), and in pot fisheries in the southwest and northeast of England and on the west coast of Scotland (Swarbrick and Arkley, 2002). 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.

SUMMARY OF WHY FISHING GEAR IS ABANDONED, LOST OR DISCARDED

ALDFG may be unintentional or intentional. There are a wide range of causes of ALDFG that can work together to increase the extent of ALDFG, such as operational factors combined with fishing in poor weather. Gear loss from such factors can potentially be reduced through technical gear developments/changes, through codes of conduct and improved communication between fishers, and through spatial and temporal management of fishing activity.

ALDFG resulting from poor weather, especially in the case of fixed/unattended gears and aquaculture, may be almost impossible to eliminate, but could be minimized with improved severe weather warning systems. Given the increases in aquaculture production globally, and the increased frequency of severe weather events as a result of global warming, gear loss may be expected to increase in the future. Some degree of ALDFG is therefore inevitable and it cannot be expected that the problem will ever be completely eliminated. However, other causes of ALDFG may be intentional and preventable through a range of measures and solutions (if appropriately funded and enforced), as discussed in Chapter 6.

There is limited literature on the causes of ALDFG, which is a potentially significant omission, because it is important to understand in detail what the causes of ALDFG are before one can propose and implement appropriate measures to reduce it. As noted in the text above, there are potentially a wide range of causes (some rather technical in nature) and a high degree of specificity of causes across different fishing methods and fisheries. And in any one fishery there may be multiple causes of gear loss. This means that while some generalized and international measures are certainly appropriate and necessary, it is also likely that great care needs to be taken in specifying solutions to ALDFG that adapt and tailor possible measures to the specificities of the particular fishery concerned.