A preliminary Investigation on Shelf Edge and Deepwater Fixed Net Fisheries to the West and North of Great Britain, Ireland, around Rockall and Hatton Bank.

By

Nils-Roar Hareide[1], Greta Garnes[1], Dominic Rihan[2], Myles Mulligan[2], Peter Tyndall[2], Maurice Clark[3], Paul Connolly[3], Robert Misund[4], Philip McMullen[5], Dag Furevik[6], Odd Børre Humborstad[6], Kjartan Høydal[7], Tom Blasdale[8].

1) Hareide Fishery Consultants, Støyleråsa 3, 6065 Ulsteinvik, Norway
2) Bord Iascaigh Mhara, Crofton Road, Dun Laoghaire Co Dublin, Ireland
3) Marine Institute, GTP Parkmore Galway, Ireland
4) The Norwegian Directorate of Fisheries, PO box 185, Nordnes, 5817 Bergen, Norway
5) Sea Fish Industry Authority, St. Andrews Dock, Hull, HU3 4QE, UK.
6) Marine Institute, Nordnesgaten 50, P.boks 1870 Nordnes, 5817 Bergen, Norway.
7) NEAFC, 22 Berners Street, London W1T 3DY, UK
8) JNCC, Dunnet House, 7 Thistle Place, Aberdeen, AB10 1UZ, UK

Summary

Since the mid-1990s, a fleet of up to 50 vessels have been conducting a gillnet fishery on the continental slopes to the West of the British Isles, North of Shetland, at Rockall and the Hatton Bank. These vessels, though mostly based in Spain are registered in the UK, Germany and other countries outside the EU such as Panama. The fishery is conducted in depths between 200 and 1200 meters, with the main target species being monkfish and deepwater sharks. These fisheries are not well documented or understood and they seem to be largely unregulated, with little or no information on catch composition, discards and a high degree of suspected misreporting. It is reported that fishing effort by longlines, trawl and gillnets has increased significantly since the development of the fisheries. During the same period of time stocks of deepwater sharks have been falling to ~ 20% of original levels in less than ten years.

Vessels currently participating in the fishery are reported to use up to 250km of gear, and the nets are left fishing unattended and hauled every 3-10 days with trip lengths varying between 4–8 weeks. The total amount of nets constantly fishing at the same time by the fleet is conservatively estimated at between 5800 and 8700 km and the vessels leave their gear fishing whilst they land their fish**.** Some vessels work in groups of two or three so that there is some tending of the gear while the other vessels return to port to land.

The amount of fishing gear used in the fisheries, the lengths of the fleets, and the fact that the nets are unattended much of the time, make it very likely that a large quantity of nets are lost, while there is also evidence of illegal dumping of sheet netting. The vessels are not capable of carrying their nets back to port and only the headline and footropes are brought ashore while the net sheets are discarded, either bagged on board, burnt or dumped at sea. These vessels are competing on the same grounds as demersal trawlers and long liners. There is obvious conflict between the sectors which is strongly suspected of adding to the amount of lost nets.

The total amount of loss and discarding of nets is not known, although anecdotal evidence suggests up to 30kms of gear are routinely discarded per vessel per trip. It is not known how much and for how long these nets are fishing after they are lost. Norwegian investigations in the deep slope gillnet fishery for Greenland halibut have shown that gear losses can be significant and that the nets can fish for at least 2-3 years and sometimes even longer.

The long soak times in these fisheries result in a high proportion of the catches being unfit for human consumption. The Norwegian Coastguard from their inspection of a UK vessel in Norwegian waters observed high discard rates of monkfish. The percentage of the catch that was discarded varied between 54 and 71 % per fleet (average fleet 19km) with an average 65% of the monkfish being discarded. This was from nets that had been deployed with soak times of between 4-10 days (96-240 hours). Only data for the monkfish catch were recorded during these inspections and there is only limited information available on discarding of other species but it is suspected to be similarly high.

Table of Contents

List of Figures

List of Tables

1. Introduction

Between 1995 and 2002 a number of European Institutes carried out research into the phenomenon of lost fishing gear ("ghost net fishing") (MacMullen & al 2004). The projects called '**Fantared I and II**' (Fantared = redes fantasmas or ghost nets) were part funded by the European Commission with partners from Norway, Sweden, UK, France, Spain and Portugal involved. The work carried out included surveys of fishermen on the nature and extent of gear loss, gear retrieval, simulation studies of the effects of lost gear as well as monitoring of net and catch evolution. Most significant European and Norwegian fisheries were covered and the level of industry involvement was very high and at a final workshop held in Gatwick, UK recommendations on a range of mitigation strategies were drawn up.

The most important conclusions of the FANTARED studies were as follows:

- The causes of gear loss were consistent, predictable and quantifiable but these aspects, and the evolution of nets and their catches were fishery-specific.
- Ghost fishing in inshore fisheries (water depths <200m) was not a big problem. The life of lost nets was limited, catch levels were very low compared to discards by trawlers and most problem areas were best dealt with by local-based initiatives.
- The Norwegian partners, from many years' experience of targeted retrievals of lost nets in deepwater, showed that these nets could continue fishing for many years. Also in some areas conflict with towed gears – and consequent levels of gear loss – were high and ghost fishing was a serious issue that needed to be addressed.
- Similarly it was identified that there were significant problems in the slope fisheries starting at ~400m depth in the northeast Atlantic, although these fisheries were not fully investigated during the FANTARED projects.

The deepwater gillnet fishery for Greenland halibut in the Norwegian slope was covered by the Fantared 2 project and some conclusions and comparisons from these investigations can be made to the NE Atlantic gillnet deepwater and slope fisheries. These fisheries developed in the mid-1990's, with a fleet of up to 50 mostly Spanish based vessels, registered in the UK, Germany and other countries outside the EU such as Panama. These fisheries, mainly targeting monkfish (*Lophiidae)* and deepwater sharks (*Centroscymnus coelolepis* and *Centrophorus spp.),* remain poorly understood. The estimated levels of fishing effort and lost gear are felt to represent a considerable threat to the species being targeted. The FAIR deepwater project (Gordon 1999*)* covered most slope and deepwater fisheries in this area, but provided little information on gillnet fisheries, only a brief description of the Norwegian gillnet fishery for ling, tusk and Greenland halibut. The ICES Working Group on Deepwater Fisheries (Anon 2004) give a brief description of the NE Atlantic fisheries but again pointed to little or no information being available. The ICES Elasmobranch Working Group (Anon 2004) has revised and updated landings statistics from these fisheries, but found the data very incomplete and totally unreliable. In fact that there is almost no relevant data available from this fishery meaning that the catch and effort data are largely excluded for stock assessments for the species involved. It is also evident there is little or no management of these fisheries and existing control and enforcement regulations have little or no impact. **Essentially these fisheries remain totally unrestricted**.

2. Objectives

As a result of the serious implications of these conclusions a project was set up, instigated by the Norwegian Fisheries Directorate who provided funds to engage a consultant to coordinate the initiative. Contributions in kind came from the Marine Institute and Bord Iasciagh Mhara in Ireland and the SFIA in the UK.

This project, called "DEEPNET", has the main goals of producing an overview of existing information specifically about the deepwater set net fisheries in the NE Atlantic, to collect as much new data as possible and to make the case for a larger, international project. Following initial dialogue the partnership has been expanded and currently comprises:

- Marine Institute, GTP Parkmore Galway, Ireland
- Bord Iascaigh Mhara, Crofton Road, Dun Laoghaire Co Dublin, Ireland
- The Norwegian Directorate of Fisheries, PO box 185, Nordnes, 5817 Bergen, Norway
- Marine Institute, Nordnesgaten 50, P.boks 1870 Nordnes, 5817 Bergen, Norway.
- Sea Fish Industry Authority, St. Andrews Dock, Hull, HU3 4QE, UK.
- NEAFC, 22 Berners Street, London W1T 3DY, UK
- JNCC, Dunnet House, 7 Thistle Place, Aberdeen, AB10 1UZ, UK

The agreed objectives of the project were as follows:

1) Review the "Anglo-Spanish" gill and tangle net fisheries.
2) Gather fisheries data in order to improve assessments of deepwater stocks and especially of deepwater sharks.
3) Identify problems thought to be caused by the fishery including discard rates, the use of excessive soak times and stripping and dumping of unwanted nets.
4) Identify the amount of gear loss and collect information, which could be used for future retrieval surveys.
5) Propose mitigating measures in order to develop the fishery in a responsible way.
6) Recommend to EU and NEAFC measures to improve the management of these fisheries.

3. Information Gathering.

Since so little is known about these fisheries, it was necessary to collect information directly from the industry and related businesses such as net makers, fish buyers etc. in order to get an overview of the current status, gear being used, number of vessels and level of effort. Two gillnet skippers, one agent, two net makers, eight harbour masters in British Ports, one Fishery Officer in an Irish port, three PO managers, eight Scottish trawl skippers, five Norwegian longline skippers and two Spanish longline skippers were interviewed. The interviewers had several years of experience as fishermen in addition to a scientific background and therefore were able to address technical issues relating to gear and fishing operations as well as biological data. The interviewees were guaranteed anonymity in all cases.

Data on vessels participating in the fishery were taken from the Fishing Industry for Britain and Ireland (Anon, 2002-2003), and personal information from Institut für Seefischerei

(Germany), cross referenced with other information received from a variety of sources. The full list of vessels is shown in Appendix I.

Data on landings and effort were collected from the various Marine Institutes and also from ICES. Logbook data from the fleet registered in Great Britain was provided by the Scottish Fishery Protection Agency, while The Irish Naval Service provided sightings data and limited VMS data on groups of vessels. VMS data was also received from the Norwegian Directorate of Fisheries and information from inspections of two British registered vessels in the Norwegian EEZ in 2003 was provided by the Norwegian Coastguard. The report of one of these inspections is given in Appendix III.

4. Description of the Fisheries

4.1 History

The set net fisheries can be divided into a deepwater fishery and an upper slope fishery. The deepwater fishery (800-1200 m) targets the Leafscale gulper shark or false "siki" shark (*Centrophorus squamosus*) and Portuguese dogfish or "siki" shark (*Centroscyllium coelolepis*). The upper slope fishery (200-600m) targets monkfish (*Lophiidae)* (Figure 1). By-catch in both fisheries include Forkbeard (*Phycis blennoides)*, Blue Ling (*Molva dyptergia)*, Ling (*Molva molva)*, Rays (*Raja spp.)* and Deepwater red crab (*Chaceon affinis).*

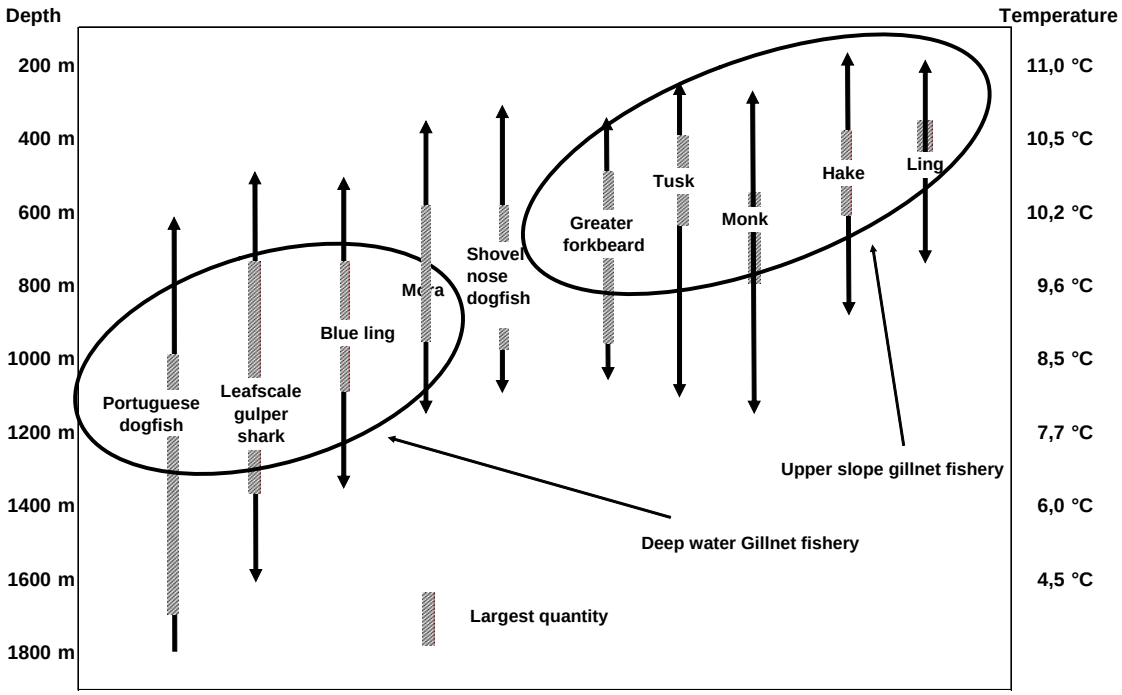

Figure 1 Distribution of fish species and gillnet fisheries by depth and temperature in the continental slopes to the west of The British Isles

In addition to these fisheries there is a gillnet fishery along the shelf edge for hake (*Merluccius merluccius)* from Sub Divisions VIIb-k. This fishery is not covered by this report.

Upper slope fishery

This fishery started in 1994-1995 in ICES Sub Divisions VIIb-k and was very profitable at that time. Vessels were landing 3-400 tons of fresh monkfish per year and in 1995/96 about 15 vessels were participating in the fishery. All of the vessels were owned by Spanish companies but registered in the UK, Germany and other countries outside the EU such as Panama. In the first 2-3 years, vessels of 20-30 meters length were used, with the catch landed fresh. In the period 1996-1999 vessel size increased to typically 30-40m in length. These vessels tended to be in excess of 25 years old and generally in poor condition. Most also installed freezing facilities on board to allow increased trip length. The skippers and engineers tended to be Spanish or from the UK with the crew mainly from the poorer regions in Spain, Portugal or African countries, particularly Morocco. These developments made it possible to work and carry more nets and to work more days at sea, while keeping operating costs to a minimum. When landing fresh fish, trips were typically 10-14 days and the vessels lost potential fishing time through having to make frequent landings. The fishery expanded to areas VI and IVa from 1996 onwards and vessels also began fishing in international waters at Hatton Bank and west of Rockall. At its peak there were up to 50 vessels involved in the fishery. As fishing effort increased CPUE decreased to unprofitable levels and in 2000/01 approximately half of the fleet moved to Brazil under private agreements between the Spanish owners and the Brazilian Government. There are currently around 16 vessels participating in the fishery, 12 UK registered and 4 German registered. Many of the vessels have changed their names on numerous occasions over the last number of years, making them difficult to track. One vessel the "*Crystal*" has changed her name no less than 7 times.

Deepwater fishery

The static gear slope fishery started with longlines targeting deepwater sharks in 1991. The fishery soon diversified to include a gillnet fishery, which started in 1992 in ICES Sub Division VII. Initially only the sharks' livers were landed, but a limited market for fresh shark developed for fish caught in the last days of a trip. Normal catch rates were 40 metric tonnes of deepwater sharks per week. Gradually the meat of the fish has become the main product and from 1999 all deepwater sharks were landed for human consumption, initially into the French market and more recently as frozen siki "backs" into the Spanish market that has developed. All the vessels are now freezers and normal trip length is 4-6 weeks, or until the liver tanks or the fish hold is full. This has been known to take up to 100 days. The number of participating vessels peaked at about 15 in 2000 but half the fleet (7-8 boats) left in 2000-2001. They are similar in specifications to the upper slope fleet, designed for long trips and being able to carry the maximum amount of nets on board with the same crew structure. Many vessel owners were pessimistic at that time (2000) but the reduced fleet has had a positive effect on the market and the fishery became profitable again. Some boats have since returned and the fleet is now back to 10-12 vessels, 11 registered in the UK and 1 in Germany.

One of the main by-catches in this fishery has been the deepwater crab *Chaceon affinis*, and with the development of a market for frozen crab meat, two British and one German vessel have now started a directed fishery with pots for this species. It is targeted from September to

February and demand for this frozen product is good. This change has been positive for the remaining vessels targeting “siki” sharks as the volume on the markets have been reduced.

4.2 Fishing grounds and areas

The fisheries covered by this report are conducted on the continental slopes between 150 and 1200 meters from south of Porcupine Bank (49 ° N) to Tampen (61°N) and the Rockall and Hatton Banks (see Figure 2). The VMS data and sightings data from the Scottish and Irish Navy and logbook information have provided a good insight into the general fishing areas. Information on fishing grounds, depth and target species for British registered vessels supplied by the Scottish Fisheries Protection Agency is given in Appendix II. Sightings data showing the positions of UK registered vessels and also VMS data showing the movements of several German deepwater vessels are shown in Figures 3a & 3b. Both of these datasets indicate that fishing is spread over the entire continental shelf area from North of the Shetlands to SW of Ireland. In the Faeroes, Shetland Channel and the Rockall Trough and Bank the target species are monkfish and ling in depths between 200 and 450 meters. In depths between 600 and 1200 meters deepwater sharks and deepwater crabs are the main target species. At Hatton Bank the main target species is monkfish between 500 and 900 meters. Deeper than 800 meters the “siki” sharks are the main target species. Information on target species and by catch by area and depth are indicated by SFP data taken from inspections at sea and ashore. Inspections by the Norwegian Coastguard on one of the vessels showed the catch composition to be mainly monkfish with a by-catch of ling and different species of ray (see Appendix III).

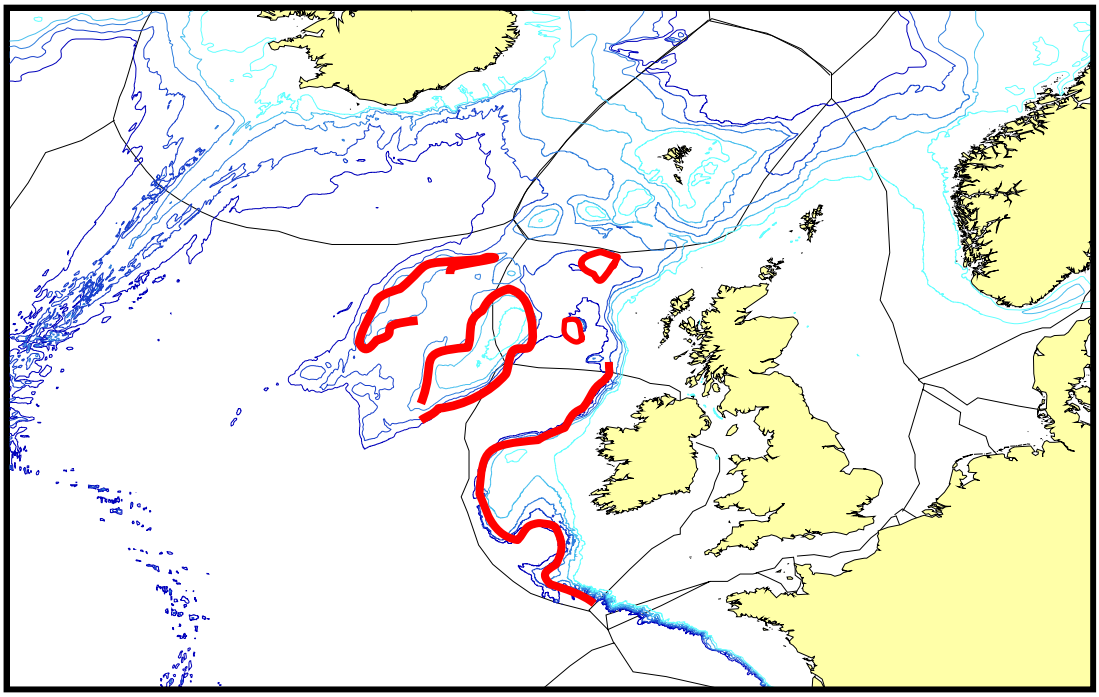

Figure 2 North East Atlantic waters with EEZs, (Depth contours 200 , 500, 1000, 1500 and 2000 m). Lines in bold show approximate positions of fisheries.

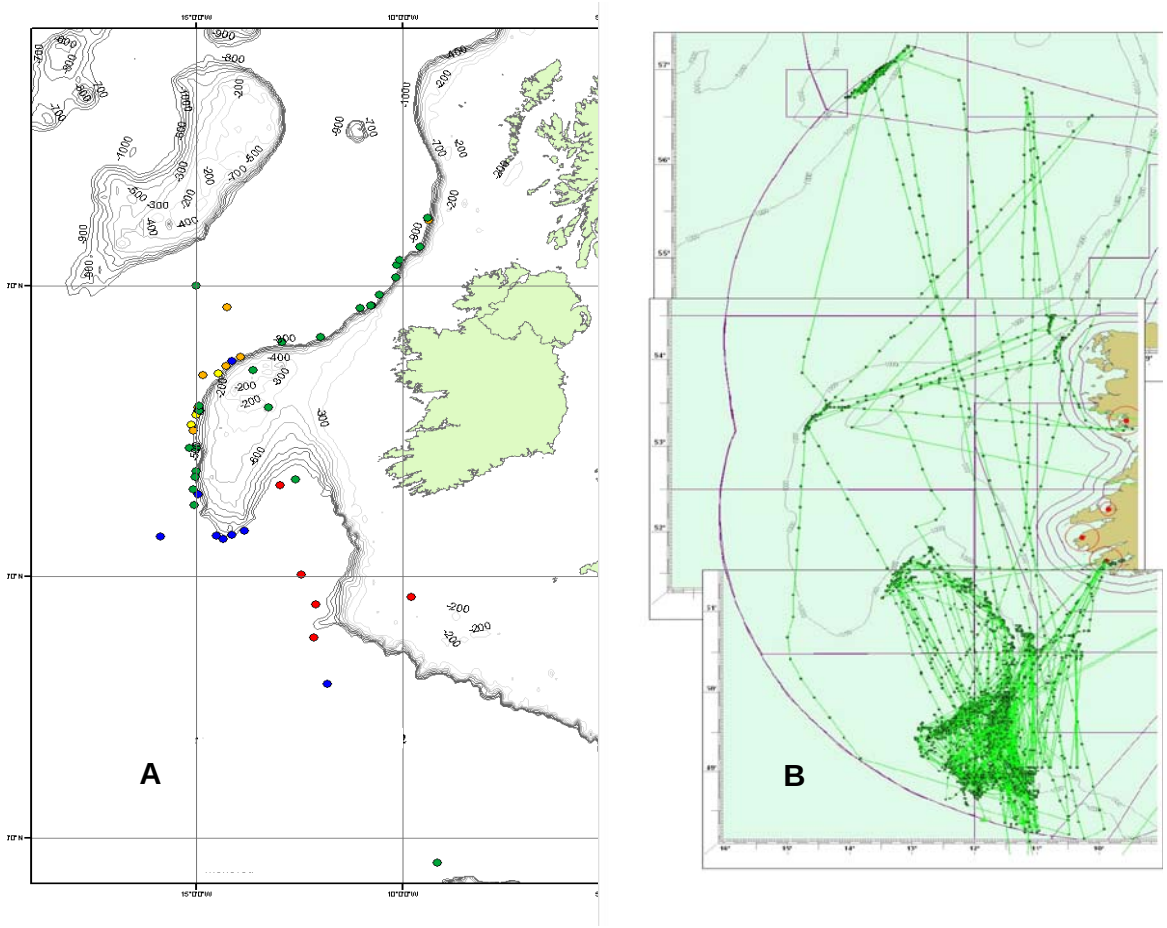

Figure 3(a) Sightings data for UK Registered deepwater vessels, 2002, 3(b) VMS Data showing German Deepwater gill netters, 2003 (supplied by Irish Naval Service)

4.3 Catch and landings data

Target species for the fisheries are as indicated but generally there is very limited scientific data available for either fishery. No observer data are available and only limited data on catch and effort or catch composition. One institute has sent out an observer on one trip, but due to confidentiality these data was not available to be used for this project. The fact that most of these vessels also land their catch frozen either as "tails" for monkfish or as "backs" in the case of deepwater sharks make port sampling and monitoring virtually impossible. Only data on landing compositions recorded by the Fisheries Research Service (FRS) into Scotland ports for 2003 were available. Table 1 shows the recorded catch compositions for different métiers. The Outer Banks include areas outside the Scottish territorial limits and includes landings from Faeroe Bank, Lousy Bank, Hatton Bank, Porcupine Bank and Rockall. The continental shelf is restricted to landings from the shelf edge, primarily spurdog landings but also monkfish. The other deepwater and upper slope fisheries are as defined in Appendix II.

Table 1 Recorded landings in 2003 (metric tonnes) by Gill-netters into Scotland

	Outer Banks	Upper Slope	Deepwater	Shelf	Total
Red crabs	246	34	32		312
Leafscale gulper shark	12	19	78		109
Kitefin shark		7	22		29
Spurdog	19	1	5	11	36
Gulper shark	4	28	20		52
Monkfish	89	466	124	44	722
Portuguese shark	33	6	237		276
Total	403	560	518	55	1536

The ICES Elasmobrach Working Group (ICES 2004) has revised and updated landings statistics from the deepwater shark fisheries, and found the data very incomplete. The Working Group has, however, been able to compile data for landings of the shark species combined for Germany and the UK (Tables 2 and 3). The data show a dramatic increase in landings of deepwater shark corresponding to the expansion in the deepwater gillnet fleet.

Table 2 German landings (t) of various dogfish.

These data are mostly deepwater squalid sharks, *Centrophorus squamosus* and *Centroscymnus coelolepis*. (Anon 2004)

	Vb	VIa	VIb	VII	VIII	XII	Total
1995	10	44	36	148			238
1996	31	5	110	160			306
1997	29	25	39	23	11		127
1998		12	12	63			87
1999		15	100	79		21	215
2000		1	177	86			264
2001		8	34	390			432
2002			44	474			518
2003	1	21	10	608			640
Total	71	130	562	2031	11	21	2826

Table 3 UK landings (t) of various dogfish.

These data are mostly deepwater squalid sharks, *Centrophorus squamosus* and *Centroscymnus coelolepis*. (Anon 2004)

	Vb	VIa	VIb	VII	VIII	XII	Total
1995							
1996				54			54
1997		7	41	6			54
1998		51	27	67			145
1999	18	53	2			1	74
2000	11	425	50	27			513
2001	9	484	500	457		161	1611
2002	1	832	189	415		54	1491
2003	76	1473	415	1624		5	3593
Total	115	3325	1224	2650		221	7535

The knowledge of basic biological parameters such as the location of spawning grounds, breeding behaviour, seasonal trends in condition and maturation is limited for most species taken in deep-water nets and particularly for sensitive species such as the deepwater sharks. Anecdotal information, which is nonetheless thought to be reliable, suggests that the biomass of some of the shark species impacted by these fisheries has already fallen to ~20% of original levels in less than ten years.

4.4 Description of Gear

It is understood that two net makers provide most of the nets to these fleets. Both of these firms are based in Spain. Details on dimensions of ropes mesh size and prices were collected from one of the main suppliers of nets in La Coruña. (Figure 4)

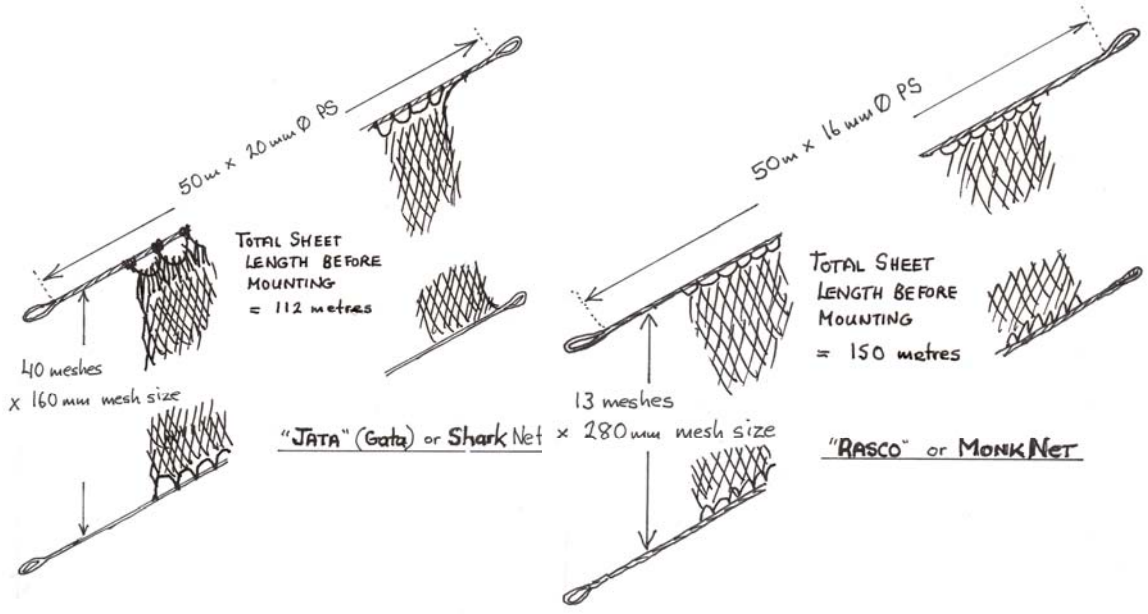

Figure 4 Details of monkfish and shark nets

Dimensions of ropes and other details

A "Rasco" or Monk net consists of:
1 x sheet of monofilament netting, dimensions 0.60mmØ x 280mm mesh size x 13 meshes deep and 150m in length mounted between:
1 x 50-metre length of 16mmØ PP/PE Polysteel rope as the "Corcho" or head-rope
And 1 x 50 metre length of 16mmØ leaded PP/PE Polysteel rope (~15kg) as the "Plomo" or footrope. The normal mesh size for monk and for shark is 380 mm (full mesh).

A "Jata" or Shark net consists of:
1 x sheet of monofilament netting, dimensions 0.70mmØ x 160mm mesh size x 40 meshes deep and 112m in length mounted between 1 x 50-metre length of 20mm PP/PS Polysteel rope as the "Corcho" or head-rope and 1 x 50 metre length of 20mmØ leaded PP/PE Polysteel rope (~30kg) as the "Plomo" or footrope..

Costs relating to gear

Shark net / "Jata"	
20mmØ PP/ PS Polysteel Rope	€ 40.00
20mmØ PP/ PS Polysteel Leaded Rope	€ 80.00
1 x sheet of monofilament netting:	
Dimensions 0.70mmØ x 160mm mesh size x 40 meshes x 112m	€ 25.00
Mounting twine	€ 8.00
Labour by net-supplier	€ 15.00
Net mounted and ready to shoot (including labour) by Supplier	**€ 160.00**
Net mounted and ready to shoot (mounted on-board)	**€ 153.00**

Monk net / "Rasco"	
16mmØ PP/ PS Polysteel Rope	€ 19.20
16mmØ PP/ PS Polysteel Leaded Rope	€ 35.00
Mounting twine	€ 3.80
1 x sheet of monofilament netting:	
Dimensions 0.60mmØ x 280mm mesh size x 13 meshes x 150m	€ 9.00
Labour by net-supplier	€ 12.00
Net mounted and ready to shoot (including labour) by Supplier	**€ 72.00**
Net mounted and ready to shoot (mounted on-board)	**€ 67.00**

Mesh size

According to the suppliers the mesh size used in Monk nets are 280 mm (140 mm half mesh) and this is confirmed by the report from the Norwegian Coastguard, who measured mesh size on six fleets of nets from a vessel inspection. Twenty nets were measured from each fleet and the average mesh size per fleet varied between 142.5 and 149.4 half mesh, giving an average mesh size of 147.3 mm for all fleets combined. Inspection data from the Scottish Fisheries Protection agency shows an average mesh size mesh size range of 220 to 285mm (Full mesh).

According to one of the net suppliers in the deepwater shark fishery the average mesh size used is 160mm (80 mm half mesh). This contradicts EU regulations in that under Annex VI of Regulation 850/98, the minimum mesh size used for deepwater species (included in "*All other marine organisms*") is ≥ 220mm. There was only limited inspection data available from the Irish authorities from a recent inspection, which showed an average measured mesh size of 220mm. The mesh size being used in this fishery needs further confirmation

4.5 Description of Fishing Practices

The fishing strategy in both the monkfish and deepwater shark fisheries are very similar. The vessels which participate have, in recent years, tended to freeze their catches onboard to allow extended voyages. From the skippers and agents interviewed, trip lengths of 18 days to 105 days were noted. Shorter voyages tend to concentrate on only one of the grounds with vessels doing longer trips being nomadic, fishing grounds both inside and outside EU limits all along the shelf edge. The voyages often commence and finish in Spain, with time in port varying greatly from 1 day to 68 days based on the records obtained from 2003. Generally turn around time was less than 10 days between voyages. (Scottish Fisheries Protection Agency, pers inf.) Vessels typically set gear in ICES Area VIIb,c on passage from Spain, before proceeding to Scottish waters in Area VIa to retrieve gear left at completion of the previous voyage. The vessels land most of their catches in La Coruña, but the British and Irish harbours of Ullapool, Scrabster, Mallaig, Lochinver, Milford Haven, Falmouth, Killybegs, Fenit, Castletownbere, and Dingle are also used. Sometimes this landing pattern seems random but there is a need for vessels to maintain their 'economic links' with the country of registration. (see Figure 3b).

Normal fishing strategy is to shoot fleets of 50 -100 nets x 50m as a trial, then if fishing is reasonable, deploy fleets of 300 - 1000 nets x 50m (15 - 50km length). Details will depend on the boat, the weather and the crew but generally the vessels work around the clock with the crew split into two shifts (pers. info. from active gillnet skipper). Reports from the Scottish Fisheries Protection Agency gave estimates of fleet length ranging from 10 to 20 kilometres. The Norwegian Coast guard reported similar lengths of gear from inspections of two vessels in the Norwegian EEZ. Fleets varied in length of between 310 and 450 x 50m nets (15.5 and 22.5 km), with an average length recorded of 19.4 km. One of these vessels in total had deployed 2710 nets (135.5 km) solely in the Norwegian zone (see Figure 5). The vessel had also deployed nets in EU waters, but how many is not known.

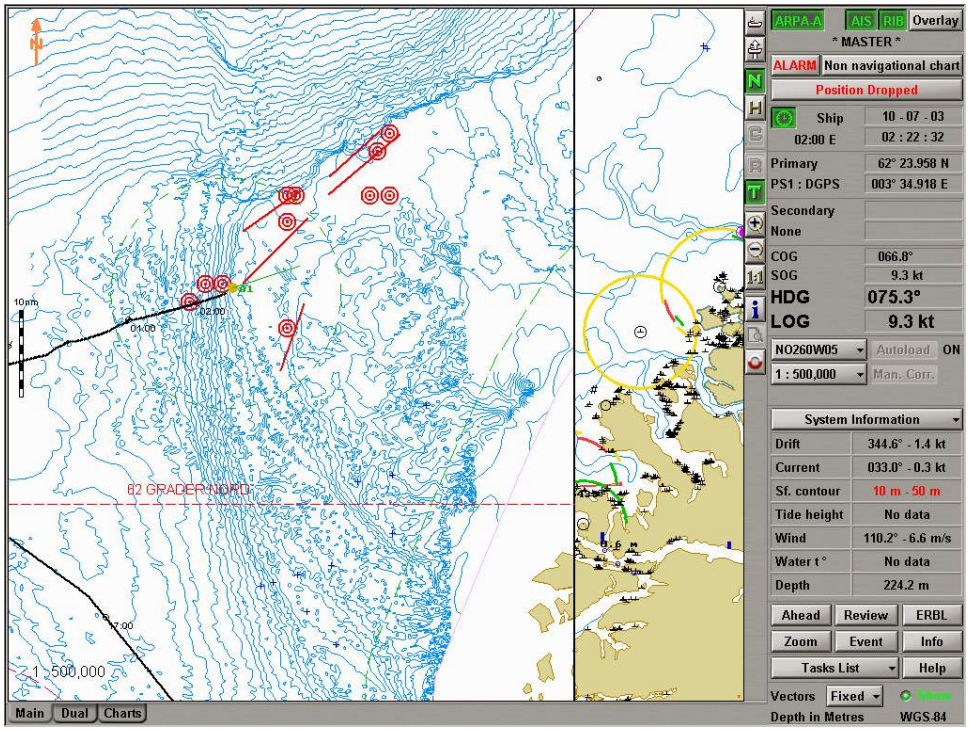

Figure 5 Positions of gillnets fleets deployed by a British registered gill-netter in Norwegian waters (supplied by Norwegian Coastguard, 2003)

Information on total amount of gear worked has been collected from a number of different sources but it has been impossible to come up with an absolute figure as the gear is fished constantly, with nets in damaged fleets stripped and discarded and good nets shot back immediately. For the upper slope fishery, estimates from the agents, net suppliers and skippers indicate that the vessels are each using between 4000 and 7000 nets (200 – 350 km). The Scottish Fishery Protection Agency, from their inspections over the last few years, maintain that each vessel is using approximately 5000-8000 nets, a total length of 250 - 400 km or 160-250 miles.

4.6 Soak Time

Soak time has an important influence on effort, catch quality and discard rates. Information from the skippers interviewed indicated soak times of 3-4 days, and that vessels are able to haul and shoot between 800 and 1200 nets per day, giving an indicative total time to haul and shoot all their nets in the region of 5 days (120 hours). Obviously bad weather and steaming between grounds will slow the work down and therefore more realistic soak times are in the order of 5-10 days (120-240 hours). From their inspection data the Scottish Fisheries Protection Agency (SFPA) has estimated the soak time for both deepwater and upper slope fisheries to vary between 24 and 72 hours (1 – 3 days) (Table 6). Data from Norwegian inspections from two vessels recorded soak times between 4 and 10 days (Appendix III). From interviews with the skippers and other sources, it was established that the vessels cannot physically take all of their nets ashore when they are landing and therefore they have to leave them fishing. According to SFPA, generally the time in port was less than 10 days between trips. Given the steaming time to and from ports of between 1-4 days for steaming to UK or Irish ports and 6-10 days steaming to Spanish ports, then soak times for nets left at sea between trips could be anything between 1-3 weeks and as a worst case scenario up to 5 weeks.

These long soak times result in a high proportion of the catches being unfit for human consumption. The Norwegian Coastguard from their inspection of a UK vessel in Norwegian waters observed high discard rates of monkfish. The percentage of the catch that was discarded varied between 54 and 71 % per fleet (average fleet 19km) with an average 65% of the monkfish being discarded. This was from nets that had been deployed with soak times of between 4-10 days (96-240 hours). Only data for the monkfish catch were recorded during these inspections and there is only limited information available on discarding of other species but it is suspected to be similarly high.

Very little information is available on the relationship between discard rates and soak time in gillnet fisheries. Unpublished data from IMR (Norway) show discard rates in the gillnet fishery for ling (*Molva molva*) on the Norwegian slope in depths between 150-450 m (Figure 6). The results shows discard rates between 20 and 70 %, with the highest rate at a soaktime of 3 days. Data for soaktimes of 1-3 days are not available.

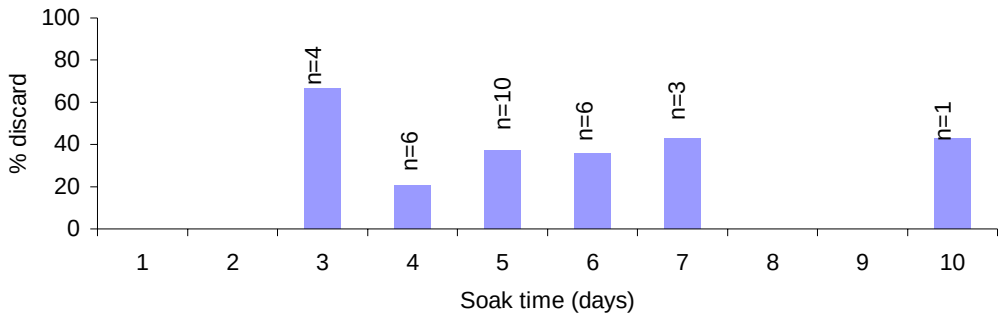

Figure 6 Discard rates against soak times in the gillnet fishery for ling (*Molva molva)* on the Norwegian slope in depths between 150-450 m (n = number of fleets)

5. Fishing Effort

Data on fishing effort has been collected for 2003 as a reference year. Taking all information, 29 vessels were reported to be active in the fishery in 2003, of these 23 were registered in the UK and 6 in Germany (Tables 4 & 5). Two Panamanian registered vessels "*North Sea Coast"* and "*Badminton*" were also reported to have fished in 2003 but there are no catch or effort figures available. One of the German vessels has reported only deepwater fishing with pots in 2003.

Table 4 British registered gillnet vessels 2003 -2004

Vessel	D. Water	U. slope	Comb. Upper slope and deep	Crab pots
Arwyn		x		
Atalaya	x			
Ayr Dawn		x		
Blue Gate		x		
Brosme	x			
Cibeles			x	
Crystal	x			x
Eder Sands			x	
Greenwich	x			
Idena	x			x
Lady Laura		x		
Mar Azul			x	
Mar Blanco			x	
Maria H	x			
Meey		x		
Menorca	x			
Meridian	x			
Norte	x			
Persorsa Uno	x			
Shark[1]	x			
Suffolk Chieftain		x		
Tahume			x	
Yanez		x		
Total 23	11	7	5	2

1) Changed name from "Squalo" during summer 2004

Table 5 German registered gillnet vessels 2003 -2004

Vessel	D. Water	U. slope	Comb. Upper slope and deep	Crab pots
Rodas	x			
Lady Beatrice				x
Belen		x		
Pesorsa dos		x		
Nordsee		x		
Pesorsa tres		x		
Total 6	1	4		1

It is very difficult to quantify an exact amount of effort for these vessels given that the gear is left to fish unattended, activity straddles a number of jurisdictions (Ireland and UK) and much of the effort is outside EU waters in NEAFC areas. Estimated effort details for UK

registered vessels fishing in Scottish waters based on recorded logbook effort are given in Table 6. This indicates total effort by the UK registered vessels of 1078 days in 2003. Given that gear is not hauled every day clearly the actual effort will be in excess of the total number of effort days, and the actual number of effort days is estimated at least double the number of recorded days. Figure 7 and 8 provides a graphic display of effort days for each Statistical Rectangle for the 2 distinct fisheries.

Table 6 Effort details for UK vessels in Scottish waters, 2003

FISHERY	TOTAL EFFORT DAYS IN 2003	RANGE OF VOYAGE LENGTH (days)	ESTIMATED TIME BETWEEN GEAR HAULS (hours)	NUMBER OF VESSELS INVOLVED IN FISHERIES	NUMBER OF SFPA INSPECTIONS 2003
UPPER SLOPE	545	30 to 55	24 to 72	7	3
DEEP WATER	533	18 to 87	24 to 72	9	2

Data on effort from the German vessels were provided by the Institut für Seefischerei in Hamburg, for 2003 by ICES rectangles, as shown in Table 7. The effort is given in hours, which are calculated by the time between shooting and hauling of the gear. This is probably a fairly crude estimate of fishing effort but gives a total effort of 19,279 soak hours – equivalent to 803 days.

Table 7 German effort (hours soak time) by metier and ICES Sub Divisions

Metier	IIa	IVa	Vb	VIa	VIb	VII	VIII	Total
Crab					775	2583	977	4335
Monkfish	960	1222	144	1378	1166	5444		10313
Shark						4632		4632
Total	960	1222	144	1378	1941	12658	977	19279

Data on effort from international waters were not available for this project. However positions of deepwater gillnet vessels between October 12 and November 02 2004 were given by the Greenpeace vessel MV Esperenza (Johnston pers comm) (Figure 9). Two of the vessels observed by Greenpeace were registered in Panama. A Norwegian longliner observed the British registered gillnetters ”Idena” and ”Cibeles” in international waters at Hatton bank in May 2004.

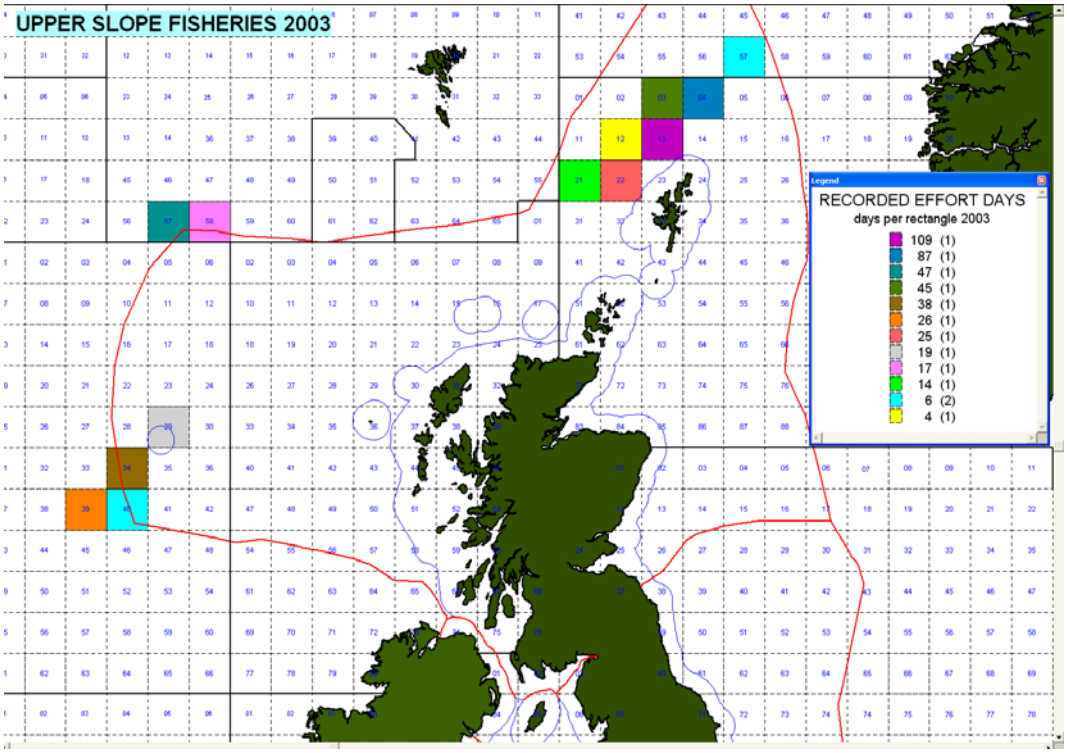

Figure 7 UK registered deepwater gillnet vessels - Upper Slope (supplied by Scottish Fishery Protection Agency, 2003)

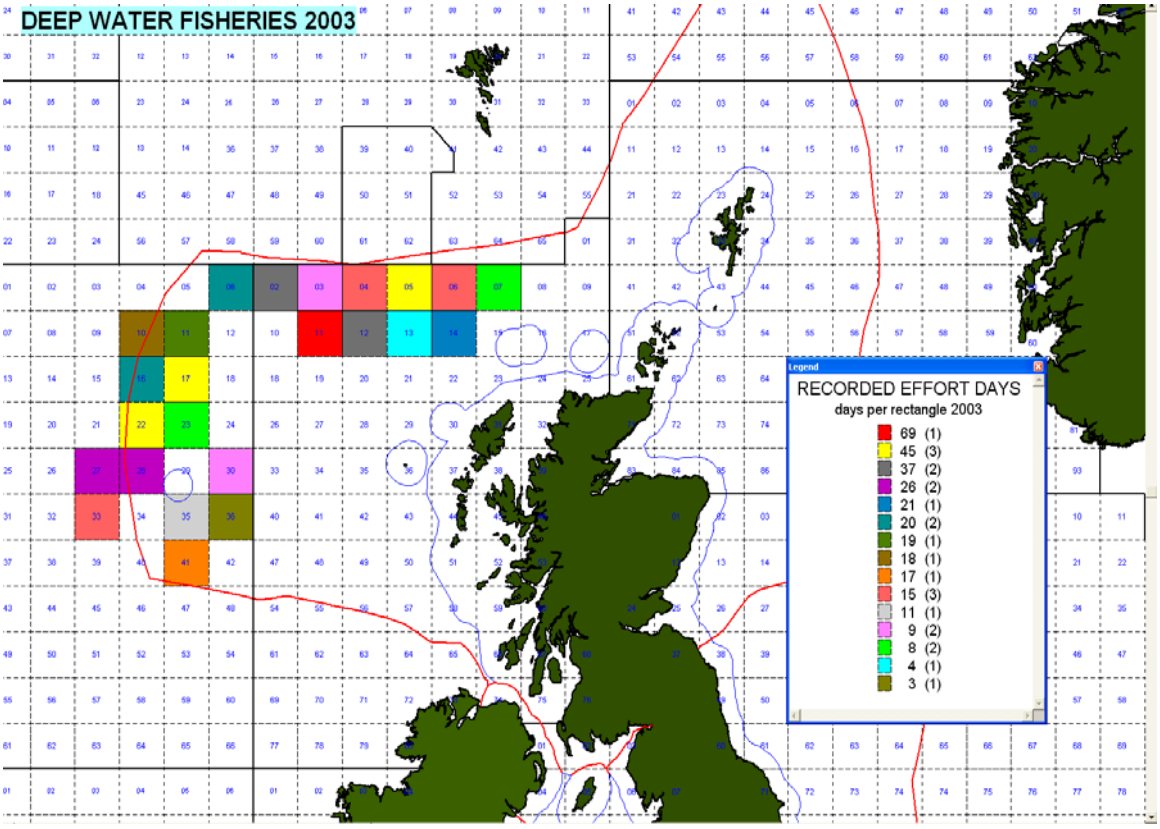

Figure 8 UK registered deepwater gillnet vessels – Deepwater (supplied by Scottish Fishery Protection Agency, 2003)

Taking the two figures from Tables 6 and 7 gives estimated effort in days of 1,881 days but this is felt to be a poor estimate of real effort. Alternatively in terms of nets being fished, if as reported from the skippers interviewed, these vessels have their nets deployed permanently, then taking the average amount of gear being fished as ~3,500- 4,000 (175-250km), a conservative estimate is there is something between 5800 and 8700 km (3600 – 5400 miles) of nets constantly fishing.

With more information from VMS and logbooks it would be possible to make a much better overview of effort on a spatial and temporal scale, although this needs to include NEAFC data given the international dimension to these fisheries. It is recommended that investigations should be carried out in order to establish a standard method for measuring effort in gillnet fisheries.

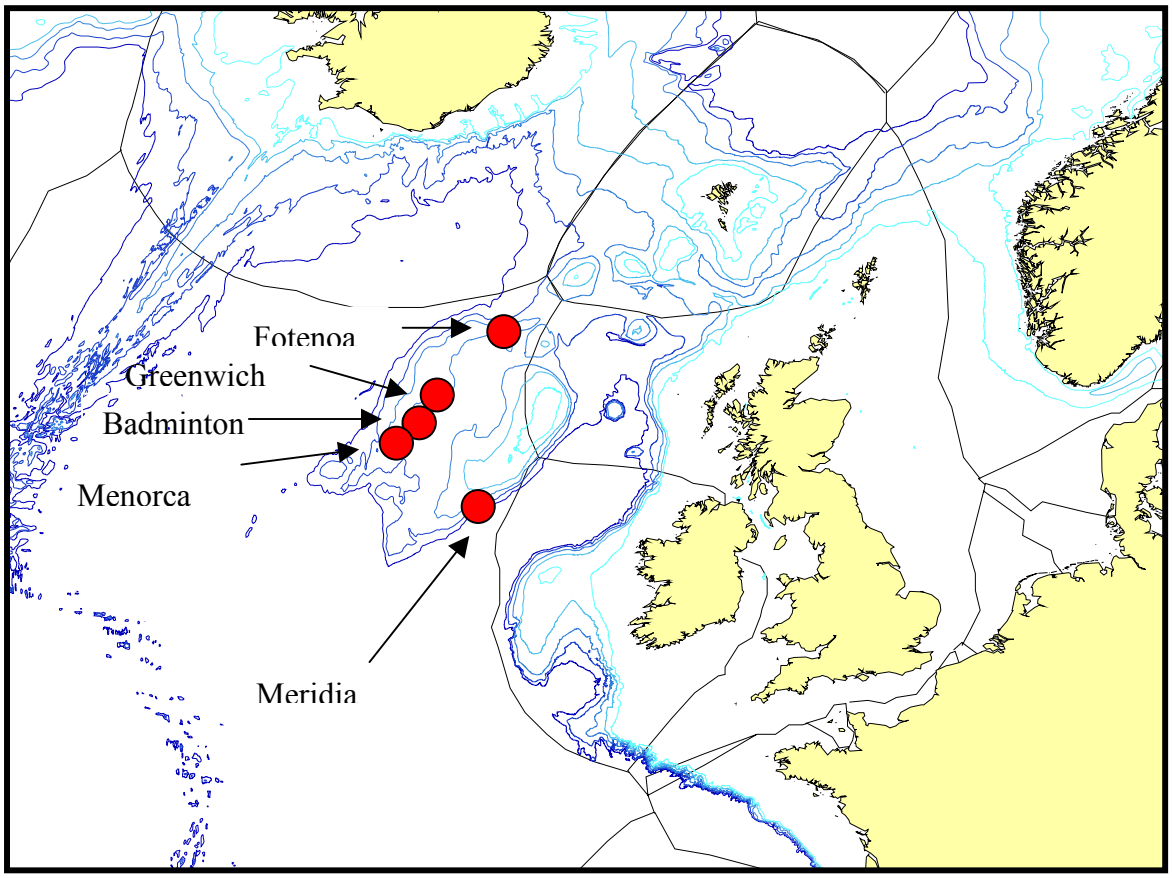

Figure 9 Positions of deepwater gill-netters in international waters (observed by the Greenpeace vessel MV Esperenza between October 12 and November 02.2004)

6. Gear loss

Drawing on experience and analogy gained during the Fantared studies referred to previously, it is clear that the main causes for gear loss are:

- conflict between the towed and static gear sectors
- water depth
- working hard ground/hauling in poor weather
- poorly made and inappropriately specified gear
- working very long fleets

- working more gear than can be hauled regularly

Consequently the amount of fishing gear used in these fisheries, the length of the fleets, and the fact that the nets are unattended much of the time combine to make it very likely that a large quantity of nets are lost. As well as these losses there is also evidence of illegal dumping of sheet netting. The effects of lost gillnets on the ecosystem are not well understood, although limited investigations have shown that gillnets lost in deepwater (>400m) can fish for years after they are lost because there is very little bio-fouling or water movement in depths below 400m. Very little information is available about the impacts of abandoned sheet netting.

The amount of lost and discarded nets is not known for the NE Atlantic fisheries, although anecdotal evidence from one shark vessel suggests from a typical 45 day trip approximately 600 x 50m sheets of net (30km) are routinely discarded after having been damaged. Taking the level of effort to be in the region of 1,881 days (based on the German and UK effort data), then a crude estimate of gear loss by these vessels would be in the region of 1254km of sheet netting per year.

In the Norwegian gillnet fishery there is a clear connection between water depth and loss rates (MacMullen & al 2004) (Figure10). In the Norwegian fishery for Greenland halibut in depths between 550 and 700m the number of lost nets was 0.14 – 0.17 % of the number of deployed nets during the season. It is therefore likely that in the deep slope fisheries studied in this report the amount of lost gear should be at a comparable level. If that is the case then these vessels lose approximately 15 nets (750 m) per day.

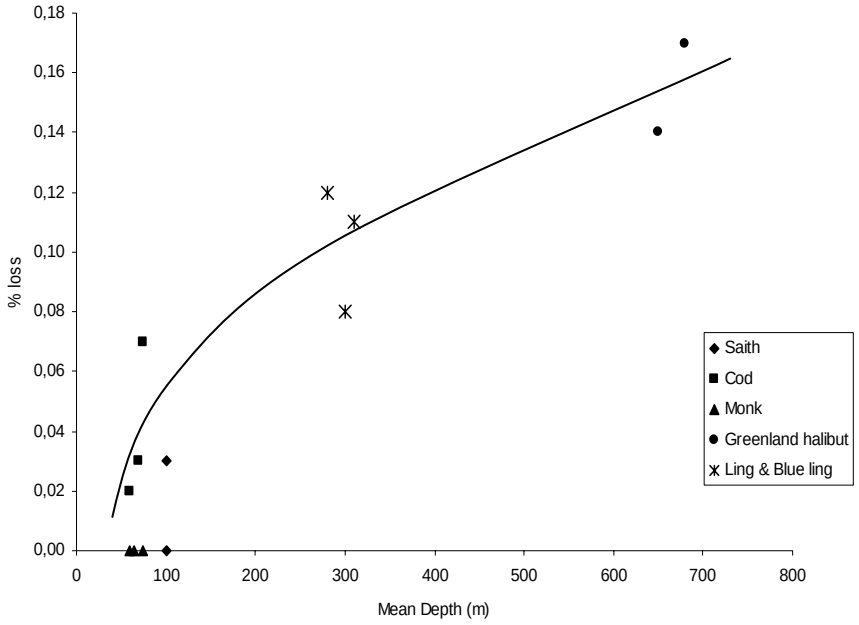

Figure 10 Loss of nets (% of deployed nets) by depth in Norwegian gillnet fisheries for the years 1998 – 2000 (Hareide in MacMullen & al 2004)

The Instituto Espanol de Oceanografia (IEO) sampled the level of lost nets found in survey trawl gear during a national groundfish survey carried out in Area VIIb,c at the Porcupine Bank in 2001. The survey covered depths between 266 and 670 meters and lost nets were found in 27.5% of the tows. The density of lost gillnets were calculated to 2.82 items per km^2 at the Porcupine bank (MacMullen & al 2004).

The results from these investigations and interviews show that the areas where lost nets are encountered by other sectors have been indicated as:

- The slopes of the Porcupine bank (51° N – 54° 30 N, 280 -1300 m depths)
- The slopes around Rockall Bank (56° N – 58° 30, 180 -1300 m depths)
- West of The Hebrides (56° N – 60°, 600-850 m depths)

Figure 11 shows the main areas of fishing effort of the Norwegian longline fleet in 2003, with the area where most lost nets are encountered indicated. This region is west of St Kilda off the west coast of Scotland in around 600m

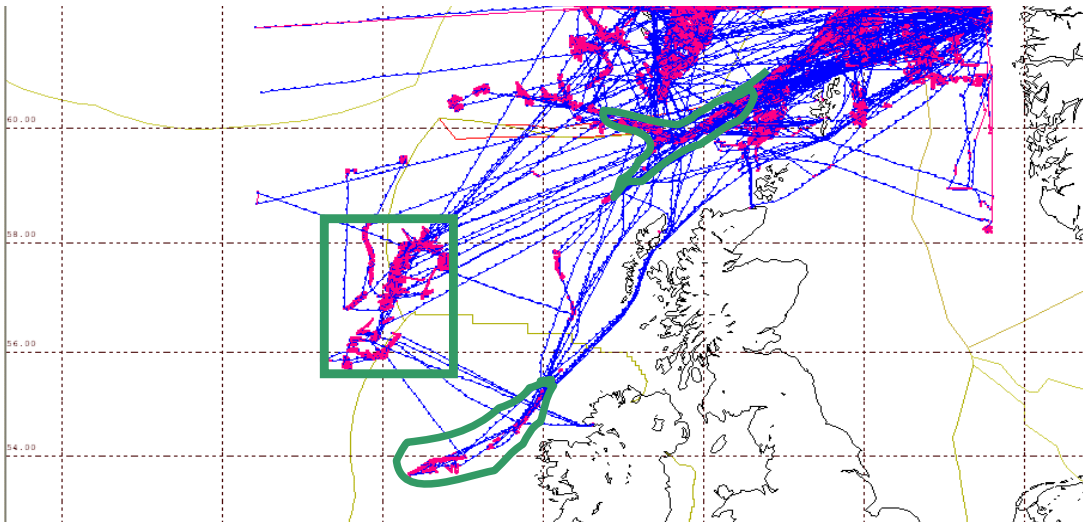

Figure 11 Norwegian longline fleet fishing operations in 2003 (areas where most lost nets are picked up are indicated)

It has also been confirmed from the interviews that the vessels involved in the deepwater fisheries are not capable of carrying their nets back to port and only the headline and footropes are brought ashore while the net sheets are discarded, either bagged on board, burnt or dumped at sea. The report received from the Norwegian Coastguard on the vessel detained, clearly shows large quantities of stripped netting on board (Appendix III). They observed fish being cut out of the nets by knife, and most of the headline and footropes of the nets being stripped after hauling. Initially the netting was burnt in a drum on deck, but the Norwegian Coast guards forbid this practice during their inspections due to environmental concerns. Subsequently there was no room for all nets onboard the vessel and the coastguard ended up taking the nets onboard and bringing them ashore for disposal.

These vessels are competing on the same grounds as Scottish, Irish, French and Spanish demersal trawlers and also Norwegian and Faroese longliners. The gillnetters do try to recover lost nets but this is not easy, especially in bad weather. There is obvious conflict between the sectors which is strongly suspected of adding further to the amount of lost nets. A number of Scottish and Irish trawlers from time to time have brought ashore large quantities of lost gear, which they have snagged in their trawl gear. Reports from these fishermen provide further evidence that these nets have been dumped as the gear recovered is often tied up in large bails (see Figure 12).

A further complicating factor here is the obvious inconvenience of carrying large volumes of netting on the deck of a working fishing boat. In Scottish waters the carriage of monofilament netting is also illegal. Then, once brought ashore, some port authorities charge for the disposal of unusually large amounts of netting. All these factors provide strong disincentives for fishermen to act responsibly as required by Annex 5 of the MARPOL Convention. Notes on this part of the investigation are contained in Appendix V.

Figure 12 Gillnets picked up by a Scottish trawler West of The Hebrides at 600 meter depth, 2004

It is not known how much and for how long these nets are fishing after they are lost. The Fantared report, however, identified that energy levels at the site in question are the main determinant of the extent of ghost fishing. Sancho *et al* (2003) found that abandoned nets (monkfish) showed similar catch rates after 135 days after they were lost, but ceased to capture monkfish after 224 days. The experiments were carried out in the Cantabrian sea (northern Spain) in depths between 117 and 135 m. It was also shown that nets abandoned in shallow water ceased to capture fish much sooner than in deepwater. Humborstad & al, (2003) found that the catching efficiency of gillnets decreased with soak time, presumably due to weight of the catch causing the headline height to decrease. After 45 days efficiency was only 20-30% of equivalent nets in the commercial fishery, but it stabilized on this level and the nets continued to fish for long periods of time. Other investigations on the Norwegian deep slope gillnet fishery for Greenland halibut have shown that gear losses can be significant and that the nets can fish for at least 2-3 years and sometimes even longer. (Furevik and Fosseidengen 2000).

7. Fishing management Issues and Legislation

7.1 Current Legislation

General provisions for vessels operating in the deepwater gillnet fisheries including access to waters, quota entitlements and VMS requirements are set out in Council Regulation (EC) No. 2731/2002, supplemented by a number of other EU regulations relating to control and enforcement measures. Also of relevance is the recent Regulation (EC) No. 1954/2003 fixing the maximum annual fishing effort for certain fishing areas and fisheries, covering the West coast of Ireland and Scotland and the new "Irish Box". This regulation sets out a number of specific provisions in relation to the level of effort in kW days, the responsibilities of the Member State to better monitor and regulate the activities of its vessels in other Member State waters, as well as establishing lists of fishing vessels authorised to fish in the different management areas.

Council Regulation No. 850/98 of 30 March 1998 sets out technical measures for the protection of EU fisheries, including minimum mesh sizes, minimum landing sizes, regulations for the use of nets and selectivity devices, as well as special restrictions for different species. Limited Technical Regulations for gillnets are specifically included in Articles 11 and 12 and Annexes VI and VII of this regulation. These measures prescribe the minimum mesh sizes for different species and also sets out catch composition limits for vessels using gill, tangle and trammel nets. Table 8 below summarises the mesh size regulations for the species covered. The regulations in both Regions 1 and 2 (covering ICES Areas IV, VI and VII, XII and the North Sea) and Region 3 (Areas VIII and IX) are given for comparative purposes.

Table 8 Mesh Size and Catch Composition Regulations

(Taken from Regulation 850/98 for Fixed Nets)

Target Species	Minimum Mesh Size (mm)[1]	
	Region 1 & 2	Region 3
Hake	120mm	≥100mm[2]
Deepwater Shark & other Deepwater Spp	≥220mm	≥100mm
Monkfish	≥ 250mm[3]	≥220mm[4]

1. *The catch composition on board for each of the mesh sizes listed above is 70%. (A full list of permitted species that apply to each mesh size is given in Annex VI and VII of regulation 850/98).*
2. *In ICES Areas VIIIc and IX a mesh size of 80-99mm can be used for hake.*
3. *A minimum mesh size of 250mm is required in ICES Areas VI and VII if more than 30% by weight of the catch on board is monkfish.*
4. *A minimum mesh size of 220mm is required in ICES Areas VIII if more than 30% by weight of the catch on board is monkfish.*

Regulation 850/98, however, contains no restrictions on the length of gear, soak times, materials or even marking of the gear and in indeed a proposed consolidated version of 850/98 presented by the Commission in 2002 did not propose any new regulation of static gears.

In 1994 the need for regulation of these issues in static gear fisheries was highlighted in a report from the Commission (Com (94) 235 Final) but despite proposals being brought forward by the EU on several occasions since then Com (94) 481 and more recently in 2001, no additional technical measures over and above 850/98, have been introduced for the regulation of gillnet fisheries. These proposals have centred mainly on rules for the marking and identification of fishing gear including the use of permanently attached labels indicating the total length of gear, bar length and mesh size. They also proposed detailed regulations for the marker buoys used at each end and in the middle of deployed nets.

Specifically relating to deepwater species two regulations came into force in 2002. These were Regulation 2340/2002, which fixed TACs for certain deepwater species and 2347/2002, which establish specific access requirements and reporting conditions for deepwater fisheries and stocks. With regard to the deepwater gillnet fisheries, only the second regulation is directly relevant, as only black scabbard fish, blue ling, greater silver smelt, ling, orange roughy, red (blackspot) seabream, roundnose grenadier and tusk were included in the quota net for the period 2003 and 2004 and there were no limitations on the catches of deepwater sharks. Regulation 2347/2002, however, requires Member States vessels targeting a much more comprehensive list of deepwater species (see full list in Appendix IV), which includes deepwater sharks, to:

a) Issue Fishing Permits for vessels catching more than 10 tonnes of deepwater species;
b) Cap effort at the aggregated power and volume of deepwater vessels for any one of the years 1998, 1999, 2000;
c) For vessels using fixed nets, to record in the EU logbook, the mesh size, average length and height of nets, fishing depth, as well as soak time;
d) Require vessels to land quantities of deepwater species in excess of 100kg, only into designated ports;

e) Require Member States to submit Sampling Plans covering the deployment of scientific observers on licensed vessels and sampling at ports

More recently, there are indications from the EU Commission possible amendments to these regulations, including the introduction of TACs for deepwater sharks at a level of 50% of the recent reported catch levels. For Area V, VI, VII,VIII and IX this would mean a TAC of the order of 2,700 tonnes.

One other regulation that should be noted in relation to these fisheries is Council Regulation (EC) No 812/2004, which provides for measures to prevent the incidental catches of cetaceans. Article 2 and Annex I identify fisheries in which the use of acoustic deterrent devices is to be made mandatory. This includes bottom-set gillnet and tangle net fisheries in Area VIIe,f,g,h and j from 1 January 2006. Under the provision of these regulations a vessel fishing with 60km of gillnets in these areas, for example, will have to have 300 acoustic deterrent devices ("pingers") fitted on the gear at all times. In addition Article 4 and Annex III also requires Member States to deploy observers on board gillnet and tangle net vessels in Area VIa, VIIa, VIIb, VIII a,b and c and IXa during 2005.

Outside EU fishing limits in international waters, management and regulation of fisheries is the responsibility of the North East Atlantic Fisheries Commission (NEAFC). No specific regulations are presently in place for the deepwater gillnet fisheries but of particular relevance is a recommendation for Ad hoc and temporary conservation management measures for deep-sea species agreed in 2003 at the NEAFC Annual Meeting, and to be effective from March 2004. These measures included a commitment that:

1. Each contracting party undertakes to limit the effort for 2004 put into fishing deep-sea species in the NEAFC Regulatory Area. The contracting parties include Estonia, EU, Faeroes, Greenland, Iceland, Norway, Poland and Russia;
2. Effort should not exceed the highest level put into deep-sea fishing in previous years for a list of species, which includes deepwater shark species;
3. Effort should be calculated as aggregate power, tonnage, fishing days at sea or numbers of vessels participating in the fishery.

7.2 Potential Management Initiatives

There are a number of fundamental difficulties in the application of TACs and Quotas for deepwater species, the main management tool currently being proposed by the EU. Management by TACs is not consistent with the scientific advice from ICES (which for most species is a reduction in effort) and STECF, which clearly states that TACs are unlikely to be an effective management tool for deepwater stocks. Also under present EU policy of basing quota share-out on track record, the division of any future TAC's will merely reward the "depleters" and do nothing to protect stocks.

In considering the alternative management approaches, it is considered appropriate to recall the main features of the fisheries to be addressed:

- There is a species and habitat dimension;
- The fisheries are mostly mixed and to a certain extent have a quota and non-quota element;
- Many of the fisheries are characterised by having high discard rates of non-target species and also high grading;
- The mixture and the extent of it varies between ICES Areas;
- Many of the fisheries straddle international waters and are prosecuted by EU and non-EU vessels;
- In some critical fisheries there are local populations and aggregations which have been depleted through heavy fishing and which require local area protection.

Longer-term stock management measures need to be tailored to the characteristics of these fisheries and the species being exploited and would include objective measures to prevent local stock depletions. Such a system, it is suggested, would require development in time but should probably include such components as a restrictive licensing system, effort limitation and an effective observer programme. In terms of effort limitation, however, the use of kW days as a measurement of effort in gillnet fisheries may not necessarily be the most appropriate unit given that engine power of such vessels has a poor relationship to fishing mortality, and a measurement of "net surface area *days" would seem better suited to these fisheries.

From a shorter term perspective apart from the mesh size regulations, which have the obvious anomaly of allowing vessels to carry two mesh sizes for two different areas, there are no limitations on the length of gear, soak time or even marking of gillnets. It is felt that this has contributed to the increase in effort, in terms of amount of gear being used and changes in fishing operations apparent in these fisheries over the last number of years, given the unrestricted nature of the fisheries. The vessels themselves are also generally in poor condition and do long trips at sea, making the placing of observers on board difficult. The fact that most of these vessels also land their catch frozen either as "tails" for monkfish or as "backs" in the case of deepwater sharks make port sampling and monitoring virtually impossible. Information is thus almost exclusively from logbook data and landing returns, while control is limited to entry/exit reporting, landing in designated ports and VMS requirements.

It is therefore recommended that remedial actions be considered in order to improve the management of these fisheries. Some suggestions, in addition to licensing, effort limitation and better monitoring through observers, are indicated in Table 9:

Table 9 Possible Management Measures

Recommendation	Positives	Negatives
The introduction of restrictions on the length of gear deployed at a given time either by overall length or per fleet of nets. Such restrictions were introduced in the NE Atlantic drift net fisheries for Albacore tuna.	Reduce fishing effort	Difficult to enforce and hard to monitor, although VMS does provide a level of control.
The certification of fishing gear through labelling	Provide better information of fishing effort	Legal responsibility, problems with damaged or repaired gear and potentially easy to circumvent
A requirement that vessels cannot leave gear at sea whilst landing.	Reduces discarding through extended soak times	Difficult to enforce and hard to monitor, although a combination of VMS and adequate marking of gear will provide a level of control.
Mesh sizes for fixed gears in Region 3 to be harmonised with Regions 1 and 2, in particular for hake and monkfish.	Stop the use of small mesh sizes in Region 1 and 2	None
All gears to be marked clearly at either end	Reduce the amount of lost gear and also reduce hazard to other fishing vessels	Difficult to enforce and original EU proposals were too complex to be enforceable
The introduction of measures, which stop the practice of stripping the headline and leadline of nets and dumping of used netting at sea.	Reduce the dumping of nets at sea.	Difficult to enforce and potentially could have the opposite effect.
The spatial management of effort by gear sector, separating towed and static fishing gears	A proven method of reducing the amount of gear conflict and net loss	Probably difficult to administer and enforce in offshore areas and international waters.
Closed areas to protect ecologically sensitive habitats, such as hydrothermal vents, deepwater corals or other characteristic habitats e.g. seamounts.	Reduce the amount of lost gear and protect sensitive habitats	Difficult to monitor and enforce if areas are too small but VMS will allow monitoring of bigger areas. Widespread objection from other sectors of the industry

8. Discussion

Throughout the DEEPNET project there seemed to be a deep reluctance to talk about this fishery, in fact, almost "an unwritten law of silence" seems to exist. Information has been collected from as many reliable sources (both anecdotal and control agencies) as possible to allow a general description of the fisheries and to provide estimates of fishing effort. It has been difficult however, to collect any meaningful data on catch levels, catch composition and discarding rates due to the lack of scientific observer data or port sampling and also access to landing and sales information.

Despite the regulations described both in EU and International waters, in reality there is little or no specific regulations that control the activities of vessels involved in the deepwater gillnet fisheries. There is no doubt that there is misreporting in the monkfish fishery and information from one vessel showed it to be landing in excess of the whole quota for the Producer Organisation the vessel is affiliated too. The inspections carried out by the Norwegian Coast Guard on one of the vessels, which was fishing in EU waters and Norwegian waters showed reported landings each time she was inside the Norwegian zone even after only shooting nets. The motives for this are not altogether clear but it is suggested it is to log quota fish in Norwegian waters, where EU quotas do not apply.

While there are no quota issues regarding deepwater sharks, as they remain a non-quota species, the gillnet fishery for deepwater shark represents a serious threat to the future of shark stocks that are recognised by ICES to be among the most vulnerable fish species known in the North Atlantic. The low fecundity and slow growth make these species very susceptible to heavy exploitation and the current level of effort seems far in excess of what could be considered to be sustainable. Due to the excessive soak times reported the levels of discarding in the fisheries are unacceptably high, given that most of the fish discarded are of a marketable size.

Establishment of the actual levels of "ghost netting" in the fisheries has also been difficult to estimate because of the lack of information available. The sources interviewed, however, suggest that it is very high and that there is also widespread evidence of illegal dumping of damaged gear. On the basis of Norwegian studies the effects of lost nets on fish stocks are known to be significant. There have only been sporadic attempts at the retrieval of nets lost in these fisheries in Ireland (Anon, 2002), and these were largely ineffectual given the huge area, over which these fisheries are conducted. The need for a better understanding of the level of lost gear and the introduction of retrieval surveys is felt to be urgent.

Every year nets are lost in the Norwegian gillnet fisheries and to alleviate the impact of this lost gear the Directorate of Fisheries has organised retrieval surveys annually since 1980. In all 9689 gillnets of 30m standard length (approximately 290km) have been removed from Norwegian fishing grounds in the period 1983 –2003. In 2004, 589 nets were picked up, mainly from the deep slope areas (500-800 m). These nets contained 8650 kg fish (Kolle & al 2004). It is very clear from the Norwegian experience of retrieval that the key to success is accurate positional information hence well targeted retrieval effort. This is only possible within a scheme that is supported by fishermen and operated with a broad consensus as to its value.

On this basis there have been several meetings between Norway and UK to develop a code of good practice for avoiding gear conflicts and hence reducing gear loss. During the DEEPNET project the idea of a retrieval survey has been discussed with the Industries in the UK, Norway and Ireland. All are very positive towards the idea of an annual retrieval survey using the Norwegian model. They appear readily willing to cooperate, both in providing positional information for lost nets and in organising the survey.

In this respect it is interesting to note the comments of two of the sources as part of the project as follows:

"*One would think that some of your objectives could have a negative effect on our business but this is not true. Speaking with years of experience not only in the sale of gear but also having other interests within the industry, we think, simply that controls should be applied on the number of nets per vessel and that the use of nets for the capture of deepwater sharks should be banned. Longlining for sharks is a more selective method and does not have the same side effects as nets. It obliges the vessels to haul quickly and thus prevent gear being in the water permanently as is the case now with the majority of the fleet. (*pers. comment from Spanish net supplier)

"It is quite possible that you won't believe me, but it's about time that people are looking into this matter. Yes, I realise that it maybe double edged but I, for one, would rather have a future than not have. At this moment in time, Rasco, monkfish netting is not a viable fishing method and there is a lack of fish on the ground. All in all there are only 6 or 7 vessels involved in this fishery, at least to my knowledge, and some of these are working up to 5,000 nets, permanently in the water. There is no control where they should be, as is always the case. Regarding Gata (deepwater sharks), well, nets should be banned as you can get just as good a fishing with the hook, remember the hook is no good for monk ! And since the gata boats started netting, shark catches have dropped way down while effort is away in the clouds!" (pers. comment from Ship manger and fish sales agent).

9. Conclusions

DEEPNET I has reviewed and identified a number of serious issues relating to the deepwater gillnet fisheries in the NE Atlantic and highlighted the need for closer examination of many aspects of these fisheries. In particular the study has shown that:

- there are large amounts of gear lost and also suspected widespread dumping of netting in this fishery;
- there is a need for retrieval surveys and mitigation measures to reduce the effects of ghost fishing; and
- excessive soak times and gear lengths in the fishery have been shown to lead to high discarding; so that
- the lack of effective management measures is reflected in declining catch rates and the poor stock status of the species being targeted.

The overriding conclusion from the study is that there is an urgent need to find a resolution to the challenges of managing these fisheries as the data collected indicated strongly that these fisheries are not being conducted in a responsible way.

It is therefore recommended that remedial actions be considered to better manage these fisheries in the context of a longer term management plan.

10. References

Anon, 2002**.** Preliminary assessment of the scale of ghost fishing off the Irish coast November – December 2002. BIM internal Report. 8pp.

Basson M. Gordon J.D.M., Large P., Lorance P., Pope J., Rackman B. The effects of Fishing on Deep-water Fish Species to the west of Britain. JNCC Report No.324. ISSN 0963-8091

Com (94) 235 final "Fishing with Passive Gear in the Community. The need for management, its desirability and feasibility". Communication from the Commission.. 10th November 1994. 47pp.

Com (94) 481 Final. Draft Regulation Amending Regulation No, 3094/86 ON Fisheries Conservation

Commission Regulation (Draft) (EC) 12 September 2001 on laying down detailed rules for the marking and identification of fishing gear.

Com (2002) 672 final. Proposal for a Council Regulation for the conservation of fishery resources through technical measures for the protection of juveniles of marine organisms. 2002/0275 (CNS).

Council Regulation (EC) No. 2347/2002 of 16 December 2002 establishing specific requirements and associated *conditions applicable to fishing for deep-sea stocks. OJ L351, 28.12.2002, p.6.p.59*

Council Regulation (EC) No. 2340/2002 of 16 December 2002 fixing for 2003 and 2004 the fishing opportunities for deep-sea fish stocks. OJ L356, 31.12.2002,p.1.

Council Regulation (EC) No. 2731/2002 of 20 December 2002 on the conservation and sustainable exploitation of fisheries resources under the Common Fisheries Policy. OJ L358,

Council Regulation (EC) No. 1415/2004 of 19 July 2004 fixing the maximum annual fishing effort for certain fishing areas and fisheries. OJ 258, p.1.

Furevik D.M. and Fosseidengen J.E. (2000) Investigation on naturally and deliberately lost gillnets in Norwegian waters. Working Document to the Fisheries Technology Fish Beahviour Group. Harlem Netherlands, April 10-14, 2000.

Gordon J.D.M.(ed) (1999)Developing deep-water fisheries: data for the assessment of their interaction with and impact on a fragile environment Final Consolidated Report for periodfrom 01.12.95 to 31.05.99. FAIR CT 95 0655

Heessen, H.J.L. (editor) 2003. Development of Elasmobranch Assessments DELASS European Commission DG Fish Study Contract 99/055, Final Report, January 2003

Humborstad O-B.,Løkkeborg S., Hareide N-R., Furevik D.M. (2003) Catches of Greenland halibut (Reinhardtius hippoglossoides) in deepwater ghost-fishing gillnets on the Norwegian continental slope. Fisheries Research 64 (2003) 163 – 170.

ICES 2000. Report of the Study Group on the Biology and Assessment of Deep-sea Fisheries Resources. ICES CM 2000/ACFM:8, 206 pp.

ICES, 2002. Report of the Study Group on Elasmobranch Fishes. ICES CM 2002/G:08. 123 pp.

ICES, 2003. Report of the Working Group on Elasmobranch Fishes.
ICES CM 2003/G:09. 151 pp.

ICES, 2004. Report of the Working Group on Elasmobranch Fishes.
ICES CM 2004/G.

Kolle J., Olsen V.J., Hareide N.R., 2004: The Norwegian Retrieval Survey for lost Gillnets 2004. Cruise report from The Norwegian Directorate of Fisheries 2004 7 pp.

MacMullen P. H., *et al* 2004: Fantared 2, A study to identify, quantify and ameliorate the impacts of static gear lost at sea – the final report of EU Study Contract FAIR2 CT98 4338, Seafish technical report ISBN 0 903941 97 X

Sancho G., Puente E., Bilbao A., Gomez E. Arregi L. (2003) Catch rates of monkfish (Lophius spp.) by lost tangle nets in the Cantabrian Sea (northern Spain). Fisheries Research 64 (2003(129-139.

appendices

Appendix I.

Gill-net vessels listed in the Fishing Industry Handbook for Britain and Ireland
(Year 2002-2003)

Vessel Name	**PLN**	**RSS No.**	**Former names**	**Year built**	**Place built**	**Base Port**	**Target Species**	**Method**	**Comments**
ARWYN	FH 566	A 17149	Robrisa	1968	Spain	Sapin	Monk	Netter	Fishing
AR BAGEERGAN	PZ 287	A 21705		1971	France	Newlyn			Vessel laid up Newlyn 12/02
ATALAYA	FH 698	C 17363		1973	Spain	Spain	Shark	Netter	Fishing
AYR DAWN	AR 92	A 19033	Ocean Dynasty, Boston Defiant, Deeside	1966	Lowestoft	Spain	Monk	Netter	Fishing
BADMINTON	NOT REGISTERED!/ PANAMANIAN						Shark	Netter	Fishing
BEN LOYAL	WK 3	A 13786		1960	Peterhead	Newlyn	Changed to hake fishery		
BLUE GATE	BM 254	A 14917	Canarte	1975	Spain	Spain	Monk	Netter	Maybe scrapped
BROSME	FH 680	A 19315	Sasoeta	1974	Spain	Spain	Monk/ Shark	Netter	Always changing Fishing
CABO ORTEGAL	AR 865	B 14430		1991	Spain	Spain/ Lochinver	Monk	Netter	Doesn't land into Coruna Fishing
CIBELES	M 1107	A 16450	Orion Star	1970	Netherlands	Spain	Monk/ shark	Netter	Fishing
CRYSTAL	M 1082	A 18986	Dawn Warbler, Sea Horse, Autumn Swallow, Dawn Warbler, Warbler, Carlton Queen	1961	Lowestoft	Spain	Shark	Netter	Fishing
CURTIS	M 1038	A 10796	Gem	1965	Spain	Spain	Tied up		

Vessel Name	PLN	RSS No.	Former names	Year built	Place built	Base Port	Target Species	Method	Comments
GAZTELUTARRAK	FH 539	A 17135		1969	Spain	Spain	Stoped fishing in 2001Last heard she was caught drug-running		
GLENELG	BCK 272	A 10665		1972	Aberdeen	Spain	Fishing in Mauritania		
GREEWICH	FH 673	A 22995	Swift, Ben Glas	1961	Aberdeen	Spain	Shark	Netter	Fishing
HERMANOS YANEZ	AR 870	B 13955		1987	Spain	Spain	Monk	Netter	No information on current activity
IDENA	FD 325	A 16740		1975	Goole	Spain	Shark	Netter	Fishing
JUNO	M 567	B 12652	Ama Anxine	1972	Spain	Brazil	Presently in Brazil. Same company as Titan/ Royalist		
LADY LAURA	M 662	B 13372	Elizabeth, Queen Elizabeth 11, San Rafael	1969	Spain	Spain	No knowledge/ Tied up		
LEPHREETO	PH 401	A 21219	Maria Celia	1961	Spain	Spain	Vessel sank in Bay of Biscay (2002?)		
MAR AZUL	AR 858	B 13308	Dani	973	Spain	Spain	Monk / shark	Netter	Fishing
MAR BLANCO	AR 857	B 13307	Carronero	1989	Spain	Spain	Monk	Netter	Fishing
MENORCA	AR 777	B 12177	Haponica, Japonica	1961	Gateshead	Spain	Shark	Netter	
MERIDIAN							Shark	Netter	
MEEY									
MONTE MAZANTEU	AR 862	B 13756		1989	Spain	Spain	Monk	Netter	Presently in Brazil
NORTH SEA COAST	PANAMANIAN		Regina, Suffolk Crusader	1968	Appledore		Shark	Netter	Moved to Brazil, licence sold, now fishing international waters
PESORSA UNO	M 48	A 19126	Playa de Recati	1970	Spain	Spain	Shark	Netter	

Vessel Name	PLN	RSS No.	Former names	Year built	Place built	Base Port	Target Species	Method	Comments
PORT OF AYR	AR 863	B 13822	Txoritxu	1974	Spain	Spain	Monk	Netter	Moved to hake fishery
ROSELAND Changed her name	Changed to French register		Perla de Carino	1990	Spain	Spain	Monk Hake	Netter	Moved to France
ROYALIST	FD 24	A 16680		1960	Beverley	Brazil			Presently in Brazil.
SOUTH COAST	PANAMANIAN						Shark	Netter	
SERRANO HEVIA	M 1	A 19096		1969	Spain	Spain	Tied up/ Licence sold		
SUFFOLK CUIEFTAIN	LT 372	A 18989		1968	Appledore		Monk		
Squalo	TN 99		Maria H				Shark	Netter	

Appendix II Effort Data from UK registered Vessels

FISHING GROUND	ICES AREAS	STATISTICAL RECTANGLES	DEPTH OF WATER (METRES)	TARGET SPECIES	BY – CATCH SPECIES	NUMBER OF VESSELS INVOLVED
Wyvile Thomson Ridge	Via VIb Vb	02, 03, 04, 05, 06, 07, 13, 14 06 61, 62	1000 – 1400	Portuguese Dogfish Leafscale Gulper Shark	Gulper Shark Kitefin Shark Dogfish – L Nose velvet Blue Ling	3
Rosemary Bank	Via	11, 12	750 – 1000	Red Crab	Portuguese Dogfish Leafscale Gulper Shark Anglerfish	3
George Bligh Bank	VIb	10, 11, 16, 17	600 – 1000	Red Crab	Portuguese Dogfish Leafscale Gulper Shark Anglerfish Skate Forkbeard Redfish Blue Ling	3
Rockall Bank (deepwater)	VIb	22, 23, 27, 30, 33, 35, 36, 41	800-1000	Spurdog Anglerfish	Red Crab Portuguese Dogfish Forkbeard Blue Ling Skate Redfish Ling Witch	6

Appendix III Information from the Norwegian Coastguard

Summarized by Nils-Roar Hareide

Introduction

The Norwegian Coastguard inspected one British registered gillnet vessel in Norwegian economical zone in July 2003.

The vessel was licensed for fishing in EU waters and the Norwegian zone south of 62°N. The vessel was targeting monkfish and had nets fishing both in EU waters and in Norwegian zone at the same time. When the inspection was carried out the vessel had 7 fleets deployed in Norwegian zone.

Fishing depths

Fishing depths varied between 175 and 450 m.

Length of fleets and effort

The fleets varied between 310 and 450 nets. Each net was 50 meters and thereby the fleets varied between 15.5 and 22.5 km. The average length of fleets was 19.4 km. In total the amount of nets deployed in Norwegian zone were 2710 nets (135.5 km). The vessel had also deployed nets in EU waters, but how many is not known.

Mesh size

Mesh size was measured on six of the fleets and was measured as half mesh. Twenty nets were measured on each fleet. The average mesh size per fleet varied between 142.5 and 149.4 mm. Average mesh size was 147.3 mm for all fleets combined.

Soak time

The soak time for the nets varied between 4 and 10 days. The fleet that had 4 days soak time was hauled on order from the Coastguard. Average soak time for the other six fleets was 8 days.

Discard

Only the discard of monkfish was recorded. The percentage of the catch that was discarded varied between 54 and 71 %. In average 65% of the monkfish was discarded.

Catch composition

The main target species was monkfish. The second most important species were different skates and ling.

Length Distribution

The total length of monkfish varied between 54 and 134 cm. The mean length was 83.5 cm. The length distribution is shown in Figure 1.

Misreporting

The vessel was three times inside the Norwegian zone for shooting nets, before she started hauling. Landings, however were reported each time she was inside the Norwegian zone. Did the skipper deliberately over report monk from the Norwegian zone where this species is a non quota species?

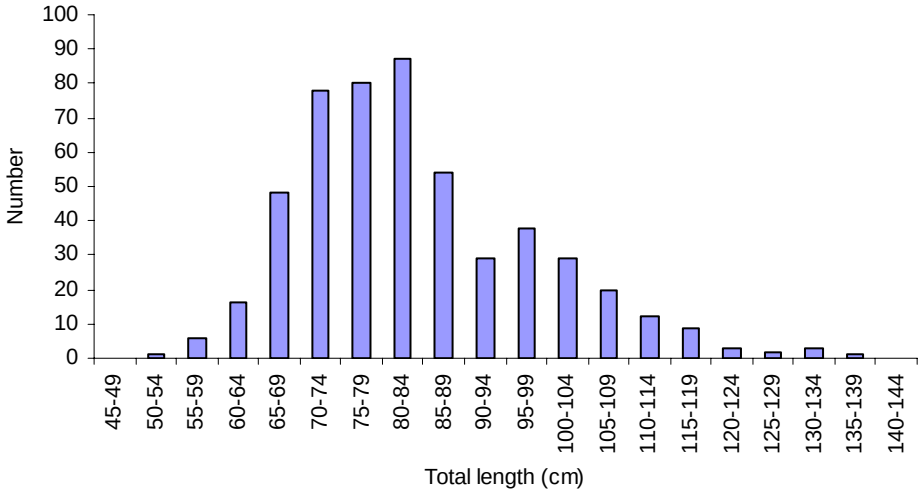

Figure1. Length distribution of monkfish (n=516).

Gear handling

The fish were cut loose from the nets by knife. Most of the nets were stripped after hauling. The mesh was burnt on deck. The Coastguard prohibited this act and hence there was no room for all nets on board the vessel. The nets were moved to the coastguard vessel and brought ashore for legal destruction.

Table 1. Summary table from inspection of UK registered Gillnetter in Norwegian waters

Fleet no	Date deployed	Date hauled	Soaktime(days)	Postion	Postion	Depth(m)	No nets	Length of Fleet (km)	Mesh size (mm)	Monkfish landed (n)	Monkfish landed(kg)	Mean weigth Monk	% unde sized	Monkfish discarded (n)	Monfish discard %
1	2. jul.	9. jul.	7	62°01N	01°56E	370	390	19,5							
2	2. jul.	10. jul.	8	62°25N	03°39E	196	430	21,5	142,5	105	1150	11,0	30,4		
3	3. jul.	10. jul.	7	62°23N	03°54E	175	310	15,5	149,4	104	650	6,3	35,9		
4	4. jul.	11. jul.	7	62°41N	04°18E	185	410	20,5	146,7	87	850	9,8	31,4	101	53,7
5	3. jul.	12. jul.	9	62°42N	04°12E	220	350	17,5	148,9	70	455	6,5	27,5	108	60,7
6	4. jul.	14. jul.	10	62°35N	03°53E	220	370	18,5	147,9	141			29,2	284	66,8
7	9. jul.	13. jul.	4	61°47N	01°48E	350	450	22,5	148,5	95				240	71,6

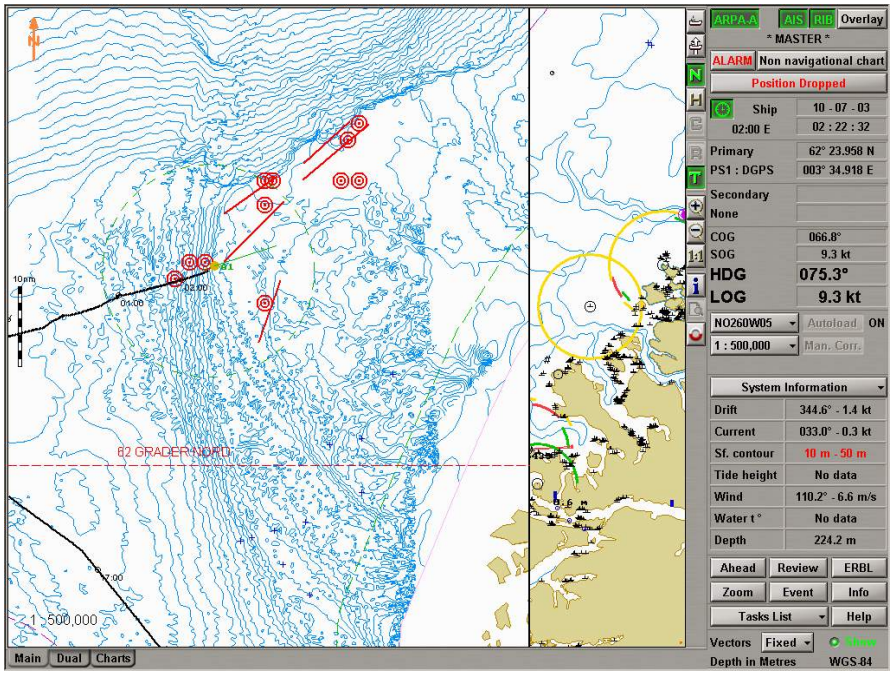

Figure 2. Positions of five of the fleets (red lines).

Figure 3. Stripping nets on board

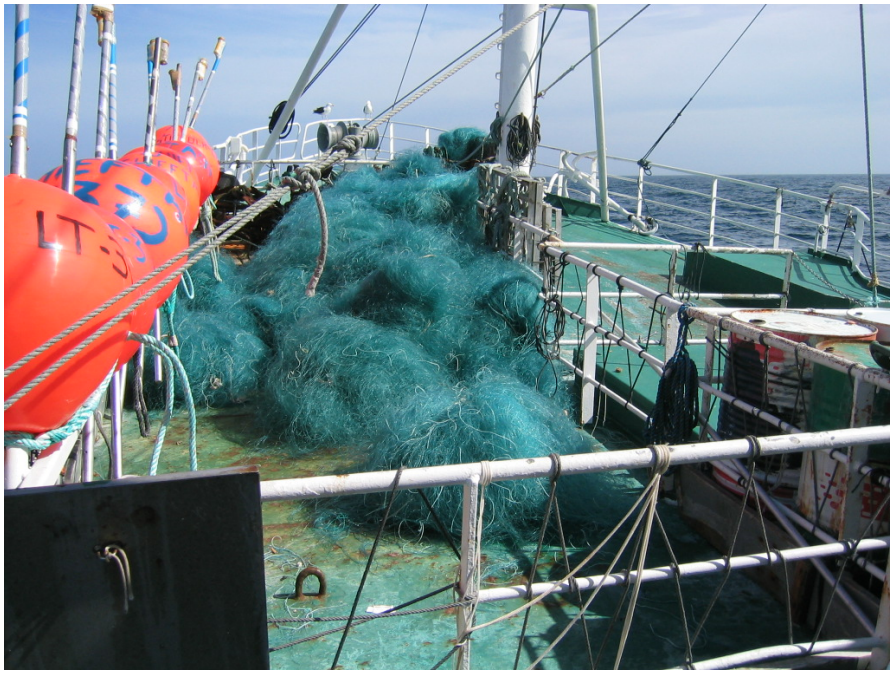

Figure 4. Stripped nets stored on top deck of vessel

Figure 5. Rotten fish being cut from nets

Figure 6. Processing the fish on board

Figure 7. Sample of discarded fish removed from nets

Appendix IV List of Deepwater Species

List of deep-sea species
(taken from Annex I of Regulation 2347/2002)

Scientific Name	Common Name
Aphanopus carbo	Black scabbardfish
Apristuris spp.	Iceland catshark
Argentina silus	Greater silver smelt
Beryx spp.	Alfonsinos
Centrophorus granulosus	Gulper shark
Centrophorus squamosus	Leafscale gulper shark
Centroscyllium fabricii	Balck dogfish
Centroscymnus coelolepis	Portuguese dogfish
Coryphaenoides rupestris	Roundnose grenadier
Dalatias licha	Kitefin shark
Deania calceus	Birdbeak dogfish
Etmopterus princeps	Greater lanternshark
Etmopterus spinax	Velvet belly
Galeus melastomus	Blackmouth dogfish
Galeus murinus	Mouse catshark
Hoplostethus atlanticus	Orange roughy
Molva dyptergia	Blue ling
Phycis blennoides	Forkbeards
Centroscymnus crepidater	Longnose velvet dogfish
Scymnodon ringens	Knifetooth dogfish
Hexanchus griseus	Six-gilled shark
Chlamydoselachus anguineus	Frilled shark
Oxynotus paradoxus	Sailfin roughshark (Sharpback shark)
Somniosus microcephalus	Greenland shark

Additional List of Deep sea species referred to in Article 9
(taken from Annex I of Regulation 2347/2002)

Scientific Name	Common Name
Pagellus bogaraveo	Red (blackspot) seabream
Chimaera monstrosa	Rabbit fish (Rattail)
Marcrourus berglax	Roughhead grenadier (Rough rattail)
Mora moro	Common mora
Antimora rostrata	Blue antimora (Blue hake)
Epigonus telescopus	Black (Deep-water) cardinal fish
Helicolenus dactylopterus	Bluemouth (Blue mouth redfish)
Conger conger	Conger eel
Lepidopus caudatus	Silver scabbard fish (Cutlass fish)
Alepocephalus bairdii	Baird's smoothhead
Lycodes esmarkii	Eelpout
Raja hyberborea	Arctic skate
Sebastes viviparous	Small redfish (Norway haddock)
Hoplostethus mediterraneus	Silver roughy (Pink)
Trachyscorpia cristulata	Spiny (deep-sea) scorpionfish
Raja nidarosiensus	Norwegian skate
Chaecon (Geryon) affinis	Deep-water red crab
Raja fyllae	Round skate
Hydrolagus mirabilis	Large-eyed rabbitfish (Ratfish)
Rhinochimaera atlantica	Straightnose rabbitfish
Alepocephalus rostratus	Risso's smoothhead
Polyprion americanus	Wreckfish

Appendix V: Results from Enquiries in the UK

Two main lines of enquiry were pursued in the UK. The first was to examine the facilities available for the disposal of waste netting in UK ports and the extent to which there may be disincentives for landing this material. The second was to look at ways of compacting netting on board vessels so that it could be transported with less inconvenience than would otherwise be the case.

Most of the information was obtained by telephone interviews with harbour masters, vessel agents, PO managers and Government Fishery Officers.

Port profiles

Scotland

Lochinver and Ullapool
These are the two main Scottish ports that service the deepwater fleets. There are between 2-10 Spanish deepwater gill-netters working from both Lochinver and Ullapool depending on the time of year. Gill net effort seems to be concentrated in the winter months with vessels working through until June. There are also several Spanish liners who land to these ports. The gillnetters target both deepwater species and monk using large mesh gear (250mm+).

There are approximately 11 French vessels and one Anglo-Spanish who regularly work from Lochinver alongside 2-4 Scottish deepwater vessels. Ullapool has 2-3 Scottish vessels, and 15-20 other deepwater vessels (predominately French) regularly landing to the port. Vessels mainly target deepwater species, with a few of the Scottish vessels working twin-rig gear in depth around 700-800m for *Nephrops*.

Both harbours have skips available for the disposal of small quantities of gill nets and lines. Ullapool harbour authorities will arrange for disposal of larger quantities of scrap nets/lines but vessels will be charged for the service. Lochinver harbour will also arrange free disposal of small quantities but were unclear as to the situation for large quantities.

Kinlochbervie
Kinlochbervie has four vessels, all Scottish, that regularly fish the deeper water. Three of these are targeting deep-water species, the other vessel is fishing the deeper water for *Nephrops*. The port has skips available for the disposal of gill nets and other marine waste. There is no charge for this service.

Scrabster and Mallaig
These ports do not tend to service the deepwater fleet. Scrabster occasionally sees the odd deepwater trawler landing and regularly services the Faeroes whitefish trawler fleet. Any gillnet brought in by vessels is either palletised or disposed of in the skips provided (free). Mallaig has skips available, free of charge, although very little is picked up by their resident trawler fleet.

Fraserburgh and Peterhead

The deepwater demersal vessels do not generally use these ports as they are situated to far to the east.

Wales

Milford Haven
There are 15-16 Spanish trawlers landing into Milford on a regular basis. Gillnetters may land there occasionally but they more commonly work and land to the northerly ports. It was noted that the vessels working from Milford tend to work an area to the South and Southwest of Ireland, which has a concentrated level of trawling activity throughout the year. The gill-netters tend to avoid shooting in these areas due to the likelihood of having their nets towed away; hence interactions between trawlers and gill-netters are kept to a minimum. Although very little gill netting has been seen being brought into the port that is not to say it is not being trawled up and dumped at sea.

Discussion

A number of the Anglo-Spanish vessels working gillnets do land their catches in the ports mentioned but more steam up from Spain shooting their nets *en route* then may enter a UK port to make their compliance visit. They then steam out again to retrieve their nets, returning to Spain to land their catch. It is unclear how common each activity is and whether this would effect the vessels' behaviour in terms of net disposal.

It should also be noted that there is a regulation restricting the carriage of monofilament netting by UK vessels within 6 miles of the Scottish coast. This issue is complex because whilst Marpol prohibits dumping at sea, bringing monofilament netting ashore for legal disposal also seems to be illegal.

The overwhelming body of anecdotal evidence is that the majority of the netting picked up by trawlers is just cut away from the gear and dumped over the side. The netting generally found dumped in the shore-side skips is in small quantities and is probably just the netting left attached to the doors or ground gear after the majority has been cut away. It was pointed out by some skippers who have entangled gear that they do keep it on board and then dump it at sea in an area where they do not fish. This is a common behaviour on the East Coast where skippers dump old warps between the gas rigs.

In relation to port-based disposal facilities, there is some uncertainty as to the legal position. In the UK the Merchant Shipping and Fishing Vessels (Port Waste Reception Facilities) Regulations 2003 require UK ports to provide waste reception facilities and require ships calling at those ports - including fishing vessels - to deliver their ship-generated waste to those waste reception facilities. While some of the Regulations cover charging issues, there is an explicit statement in Regulation 3(4) that the key Regulation on charging - Regulation 13 - does not apply to fishing vessels. It is therefore not clear whether ports must, or merely should, provide facilities under these Regulations.

Given this situation it is not clear how port authorities would react if large volumes of netting started to be landed as a result of some new initiative. It is possible that those that are

currently sympathetic would have to look at the costs implications, especially as landfill tax seems set to increase annually for the foreseeable future.

Findings

It is clear that there are significant disincentives for skippers to bring waste netting ashore for proper disposal. It may not be easy, or even safe, to get netting aboard in the first place. The netting can have a very significant volume, such that normal fishing operations are then made difficult. There is the risk, admittedly small, of prosecution for carrying monofilament material. And finally there may be a charge made by the port or local authority for waste disposal.

One of these disincentives could be reduced by the use of manual strapping machines to compact the bulk of netting. There are a number of strapping machines available on the market, most are used for strapping boxes and range from conveyor systems to hand held manual devices. The larger bench style strapping machines generally require 240v power and work by the object to be strapped being placed on the bench. The strap is then either manually or automatically passed round the object and tightened by the machine. These machines are too cumbersome to have onboard a fishing vessel and their need for an electrical supply would render them hazardous when in contact with wet fishing nets.

The manual devices available (see below) are more suitable, being recommended for use with irregular surface packing. They would also be easy to handle on deck and, with the use of the tensioners, netting could be easily compacted into tight bundles. These devices are widely available and are relatively cheap to buy.

Proprietary manual strapping and tensioning machines

Removing the other disincentives would require further investigation, access to funding and, possibly, amendments to existing legislation. It is clear from the information revealed by these modest enquiries in the UK that there is a sound argument to be made in support of improving existing conditions.