COMMISSION OF THE EUROPEAN COMMUNITIES

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COMMISSION STAFF WORKING PAPER

REPORT OF THE SCIENTIFIC, TECHNICAL AND ECONOMIC COMMITTEE FOR FISHERIES

Deep-sea Gillnet Fisheries

STECF opinion expressed during plenary meeting held in Ispra from 6-10 November 2006

This report does not necessarily reflect the view of the European Commission and in no way anticipates the Commission's future policy in this area

CONTENTS

1 BACKGROUND

Deepwater fisheries developed in Community waters in the late 1980s and early 1990s. Research work focused on description of fisheries, biology of the species caught and assessments of the state of these stocks. Most of this work took place in the mid and late 1990s. In addition there were a number of studies investigating the effects of lost and abandoned gillnets in European fisheries, though these did not specifically cover deepwater fisheries. It became clear that no information existed on gillnet fisheries for deep-water species. In response to this, a research consortium from UK, Ireland and Norway conducted a study called DEEPNET to investigate fixed net fisheries for deepwater species in the NE Atlantic.

Based, largely, on the results of DEEPNET, Council Regulation 51/2006 Annex III, Paragraph 8 introduced a ban on gillnetting in waters deeper than 200 m in 2006. This regulation stipulated that Community vessels should not deploy gillnets, entangling nets or trammel nets at any position where the charted depth is greater than 200 m in ICES Divisions VIa, VIb, VIIb, VIIc, VIIj and VIIk and ICES Sub-area XII east of 27^0 W. This ban only applies until the end of 2006. NEAFC also introduced these measures on a complimentary basis in the NEAFC Regulatory Area. The NEAFC ban is indefinite, pending adoption of agreed management measures.

A derogation from Council Regulation 51/2006 was introduced in June 2006, allowing for the reopening of targeted gillnet fishing for hake (941/2006) in the above ICES Sub-areas and Divisions, in waters of charted depths less than 600 m.

This meeting was convened by the Commission in order to review the information available on gillnet fisheries in depths of more than 200 m, to define these fisheries and to propose management measures.

The group had the following terms of reference:

1) *Identify the fisheries that use trammel nets, entangling nets and bottom-set gillnets in waters in the ICES statistical areas that have a charted depth of greater than 200 metres, describing their seasonal and spatial distribution, the characteristics and selectivity of the gears used, the species targeted, the major by-catch species, and estimates of discard rates.*
2) *Suggest appropriate descriptors that would allow the different fisheries to be reliably delimited, with a view to applying appropriate management measures to each of them.*
3) *Recommend measures to regulate each of the fisheries identified, taking into account the difficulties of monitoring and control, notably to ensure good selectivity, to avoid excessive soak-times and to ensure that lost or abandoned nets can be quickly retrieved.*
4) *To assess the possible consequences of introducing the new regulatory measures, such as the diversion of effort to other fisheries.*

2 STECF RECOMMENDATIONS

STECF adopts the report of the Ad hoc Working Group and endorses the recommendations presented. The main points of these recommendations are presented below. The main parameters identifying these fisheries are presented in Table 2-1.

The main recommendations regarding individual species are outlined in Table 2-2. The main recommendations are to maintain the closure of shark gillnetting, and to permit hake and monk netting in waters shallower than 600 m. The 600 m depth limit is best to avoid the main deepwater shark species being caught. STECF does not consider that gillnet fisheries for

crabs should be allowed. Instead crabs can be targeted by pots in a very selective manner. The recommended soak time for monkfish (72 h) should be examined by conducting further experiments in the future.

STECF was aware of new information from the NWWRAC that suggests that 120 mm mesh size could indeed select smaller hake than 100 mm mesh nets. This is contrary to what is to be expected from such studies. However, STECF was not able to fully evaluate these studies, but instead recommends that the Commission refer the matter to ICES for consideration at the ICES/FAO Working Group on Fish Behaviour and Fishing Behaviour.

STECF was also aware of a study of the socio-economic implications of implementing the ban on gillnets in 2006 (Franquesa and Moruelo, 2006)[1] This report contained much detailed information and STECF was unable to fully evaluate it at present.

[1] Franquesa, R., and Mourelo, A. 2006. Assessment of the new regulation socio-economic impact on community fishing vessels of static deep sea gillnets. Barcelona: Universitat de Barcelona. Unpublished report. 32 pp.

Table 2-1 Descriptors of the fishery. This table is based on the Working Group's judgment of the characteristics of these fisheries. Note that crab gillnetting does not have any unique descriptors.

Fishery	Hake (Merluccius merluccius)	Monkfish (Lophius spp.)	Deepwater Shark (Centrophorus squamosus & Centroscymnus coelolepis)	Crab (Chaceon affinis)
Gear Type	Gillnet	Tangle Net	Gillnet/Tanglenet Hybrid	Tangle Net
Name	Volanta	Rasco	Jata	-
Regulation Mesh Size (mm)	120mm	250mm	220mm	220mm
Observed Mesh Size (mm)	100mm/120mm	280mm	160mm	280mm
No. of Vessels	43 (18 both monkfish & hake)	9 (18 both monkfish & hake)	2 (4 both monkfish and shark)	??
Net Height (no. of meshes deep)	100 (12m)	13 (3.64m)	40 (6.4m)	13 (3.64m)
Hanging Ratio (E_r)	0.5	0.33	0.45	0.33
Fleet Lengths (No of Nets x length of Fleets per vessel	25-50 nets (1.5-2.5km) 6-10 fleets	150-450 nets (7-22.5km) 9-14 fleets	130-180 nets (6.5-9km) 3-10 fleets	??
Approximate Total Gear Length per vessel	(~20-25km)	(~100-200km)	(~25-100km)	??
Soak Time (hours)	12-24	72-96	72-96	??
Net Construction (Floatation)	Floats placed at 1.5m spacings (32 floats per net)	No floats on headline	No floats on headline	No floats on headline
Depth Range (m)	100-600	100-800	800-1600	600-1200
ICES Sub-area	IVa, VII, VIII, IXa	IIa, IVa,b, VI, VII, VIII	VI, VII, VIII, IX, X, XII	IVa, Vb, VI, VII, VIII, XII
Catch Composition	~70% hake	~70% Monkfish	~90% shark	~75% crab

General recommendations for the management of deep-sea gillnet fisheries (see Anon. 2006 for more information) are as follows:

1. Permit system for all vessels participating
2. Recording and reporting of gear parameters to be mandatory.
3. Gear to be certified by competent authorities
4. Gears to be adequately marked and using unique identifiers.

5. Vessels allowed only small differences on gear embarked and disembarked.
6. Vessels to attend gear at all times.
7. Unattended gears will be deemed lost or abandoned and subject to removal by authorities
8. Facilities to be made available onshore for disposal of old nets.

In addition STECF notes that the regulation should be extended to cover IVa, IX and X and Madeira in order to avoid shifting of effort to these areas. STECF notes the movement of effort on sharks to West Africa. It is likely that the West African shark populations are linked with those in the ICES area and this may have detrimental effects on shark populations in this region. It is therefore recommended consideration be given to extend the regulation to west Africa, at least until further information on fishing practices and population status is available.

Table 2-2 Specific recommendations of STECF on the management of deep-sea gillnet fisheries.

	Hake	**Monkfish**	**Deepwater shark**	**Deepwater crabs**
Overall	Reopen	Reopen, subject to depth, soak time and length restrictions*	Maintain closure	No target fishery
Net type	Gillnet	Tangle net	-	-
Mes size	120 mm	> 250 mm	-	-
Depth	< 100 meshes deep	< 15 meshes deep	-	-
Hanging ratio	0.5	0.33	-	-
Floatation	Yes	No	-	-
Fleet length	< 2.5km in length	< 10km in length	-	-
Gear length	< 25 km	< 100 km *	-	-
Soak time	< 24 hours	< 72 hours	-	-
Depth	200-600m.	Depths 200-600m	-	-
Shark by-catch	NA	Shark By-catch < 5% by weight.	-	-

* subject to research and observer trip data

ANNEX REPORT OF THE WORKING GROUP ON DEEP-SEA GILLNET FISHERIES STECF ADHOC-06-01 , BRUSSELS, 11-14 JULY, 2006

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REPORT OF
THE SCIENTIFIC, TECHNICAL AND ECONOMIC
COMMITTEE FOR FISHERIES

Report of the
Working Group on Deep-sea Gillnet Fisheries
STECF ADHOC-06-01 , Brussels, 11-14 July, 2006

This report was evaluated by the Scientific, Technical and Economic Committee for Fisheries (STECF) in its plenary session of 7-10 November, 2006

This report does not necessarily reflect the view of the European Commission and in no way anticipates the Commission's future policy in this area.

SUMMARY

This working group took place from the 11th to the 14th July 2006. The group consisted of six participants, from UK, Ireland and Norway. In addition, three observers attended the meeting, two representing the fishing industry and one representing the conservation movement. The deepwater gillnet fisheries that take place in Europe were identified. Fisheries catching the following species were considered ; hake, monkfish, deepwater sharks and deepwater crabs. The fisheries were defined according to gear characteristics, spatial and bathymetric distributions. The available information on each fishery is presented. Available information on selectivity and soak time experiments are presented. All relevant legislation is summarised and the management measures relevant to each fishery, presented in each case. The report contains recommendations on how these fisheries should be managed.

1 INTRODUCTION

1.1 TERMS OF REFERENCE

The Working Group was asked to:

1) Identify the fisheries that use trammel nets, entangling nets and bottom-set gillnets in waters in the ICES statistical areas that have a charted depth of greater than 200 metres, describing their seasonal and spatial distribution, the characteristics and selectivity of the gears used, the species targeted, the major by-catch species, and estimates of discard rates.

2) Suggest appropriate descriptors that would allow the different fisheries to be reliably delimited, with a view to applying appropriate management measures to each of them.

3) Recommend measures to regulate each of the fisheries identified, taking into account the difficulties of monitoring and control, notably to ensure good selectivity, to avoid excessive soak-times and to ensure that lost or abandoned nets can be quickly retrieved.

4) To assess the possible consequences of introducing the new regulatory measures, such as the diversion of effort to other fisheries.

1.2 PARTICIPANTS

Tom Blasdale	JNCC, UK
Maurice Clarke (Chair)	Marine Institute, Ireland
Nils-Roar Hareide	Independent Consultant, Norway
Phil Large	CEFAS, UK
Philip MacMullen	Seafish, UK
Dominic Rihan	Irish Sea Fisheries Board (BIM), Ireland
Doug Beare	DG JRC, EC
Peter Hopkins	DG Fish, EC

In addition, the following observers attended the meeting:

Juan Carlos Corras	Observer representing fishing industry
Javier Lizaur	Observer representing fishing industry
Carol Phua	Observer representing the WWF

1.3 RATIONALE FOR THE MEETING

Deepwater fisheries developed in Community waters in the late 1980s and early 1990s. Research work focused on description of fisheries, biology of the species caught and assessments of the state of these stocks. Most of this work took place in the mid and late 1990s. In addition there were a number of studies investigating the effects of lost and abandoned gillnets in European fisheries, though these did not specifically cover deepwater fisheries. It became clear that no information existed on gillnet fisheries for deep-water species. In response to this, a research consortium from UK, Ireland and Norway conducted a study called DEEPNET to investigate fixed net fisheries for deepwater species in the NE Atlantic.

Based, largely, on the results of DEEPNET, Council Regulation 51/2006 Annex III, Paragraph 8 introduced a ban on gillnetting in waters deeper than 200 m in 2006. This regulation stipulated that Community vessels should not deploy gillnets, entangling nets or trammel nets at any position where the charted depth is greater than 200 m in ICES Divisions VIa, VIb, VIIb, VIIc, VIIj and VIIk and ICES Sub-area XII east of 27^0 W. This ban only applies until the end of 2006. NEAFC also introduced these measures on a complimentary basis in the NEAFC Regulatory Area. The NEAFC ban is indefinite, pending adoption of agreed management measures.

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This meeting was convened by the Commission in order to review the information available on gillnet fisheries in depths of more than 200 m, to define these fisheries and to propose management measures.

1.4 CONFIDENTIALITY

The Commission asked the Working Group to respect confidentiality on the basis of Article 10 of Commission Decision 93/619/EC. It was stressed to the participants that, although they could talk about the outcome of the meeting, it could not be considered as STECF advice until the results had been properly scrutinised by STECF.

It was noted that no sections of the report should be made public before the report had been evaluated by STECF in plenary session.

2 THE FISHERIES

The Working Group considered all gillnet fisheries in the ICES area, in waters of depths greater than 200 m. The following fisheries were identified:

- Hake gillnet
- Monkfish (monkfish) tangle net
- Shark gillnet/tangle net
- Deepwater crab
- Greenland halibut gillnet IIa and IVa

- Saithe gillnet IIa and Iva

Of these fisheries, only the first 4 are prosecuted by Community vessels. The Greenland halibut and saithe fisheries are prosecuted entirely by Norway, though both extend to Community waters of IVa. Therefore, for the purposes of this report, only the Community fisheries are considered. Descriptions of these fisheries are presented below. Given the importance for future management, available information on Illegal, Unreported and Unregulated Fishing (IUU) fishing is presented below in section 2.5.

2.1 HAKE GILLNET FISHERY

Information in this section has been drawn from:

- 2005 log-book data from the Spanish-registered gillnet fleet
- Interviews with industry representatives by Mulligan (2006, WD)
- The ICES Working Group on Hake Monk and Megrim (Anon., 2005)
- Limited French information from recent observer trips (Anon., 2006 WD)
- A submission from the NWWRAC
- Fantared II report (MacMullen et al., 2002)
- Working document from IEO Spain (Costas et al., 2006 WD).
- Gillnet Deterrent Trials from Ireland (Cosgrove et al, 2005)

2.1.1 Fishery description

The fishery for hake is conducted along the continental slope from north of the British Isles to as far as the south of Portugaland maybe even extending to the coast off west Africa.

At least 61 European vessels fish gillnets in depths greater than 200m. Around half of these are French, with the remainder registered in Spain, the UK, Ireland and Portugal (NWWRAC, 2006 WD). Table 2.1.1 below is based on information provided by the NWWRAC and describes the country of registration of many of these vessels.

According to Costas et al (WD) a total of 38 vessels from the Spanish gillnet fleet operate in ICES div. VIIIa,b,d and Sub-areas VI and VII during 2005. According to Industry representatives present at this meeting, the French and Spanish fleets have similar fishing patterns and the gears are likely to be the same.

There is also a small Portuguese hake gillnet fishery off the west and south coasts of Portugal that involves about 3 vessels (MacMullen & al 2002).

Table 2.1.1. Hake gillnet fishery. Number of vessels and country of registration of vessels fishing for hake (NWWRAC, 2006 WD).

National fleet	Hake gill netting	Hake gill netting + monkfish tangle netting	Total
France	17	16	33
Spain	20	1	21
UK	2	1	3
Ireland	1	0	1
Portugal	3	0	3
Total	43	18	61

2.1.2 Seasonal and spatial distribution

The fishery is conducted all year round. The main fishing areas are ICES areas VI, VII (excluding VIIa), VIII and IXa. The depth ranges between 200-700m. French vessels fish throughout the year in sub-areas VI (10% of vessels) and VII (90% of vessels) as well as, between January and April, in sub-area VIII (50% of vessels fishing in VII). The pattern in landings of the Spanish fishery is shown in Figure 2.1.1.

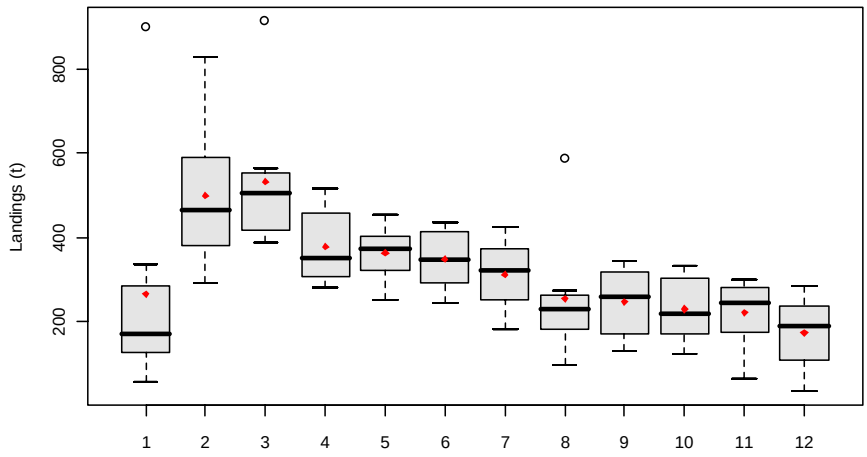

Figure 2.1.1. Hake gillnet fishery. Box plot of landings (t) by month from Spanish hake gillnet fishery (Costas et al., 2006 WD).

2.1.3 Gear characteristics and fishery practice

Spanish hake nets are known as 'volanta'. They are made up of sheets of monofilament netting, dimensions 0.45mmØ x 100mm or 120mm mesh size (depending on area) x 100 meshes deep and 100 metres in length mounted on Polysteel frameropes to fish at 50m length x 12m height. The Hanging ratio (E_r) is 0.5. Floats are spaced at 1.5m intervals, with around 32 floats per mounted net. (Mulligan, 2006 WD). Irish and UK hake nets are slightly different typically made up from sheet monofilament netting of 120mm mesh size and about 50 meshes deep. They are rigged onto a floated headrope and lead-cored footrope. Two sheets are joined to make up nets of 235m rigged length . Generally 15-20 nets are joined into fleets of 3.5 – 4.7 km) length. Up to six fleets are generally fished with a total length of 25km. (Cosgrove et al, 2005).

No information is available on the specification of French hake gill nets but it is thought to be similar to the Spanish rigged gear..

Data were also presented to the group on the mesh size of quantities of gillnets receovered by Irish vessels working in the Porcupine Bank area during 2006 and brought ashore for disposal (Table 2.1.2).

Table 2.1.2. Hake gillnet fishery. Mesh size (mm) in 14 samples of hake gillnets dumped ashore in Ireland during 2006, as measured by BIM Irish Sea Fisheries Board.

Mesh size (mm)	N
90-94	1
95-99	1
100-104	1
105-110	
110-115	2
115-120	8
120-125	1
Total	14

Based on information from Mulligan (2006, WD) and from industry representatives (this meeting) total length of hake gear per vessel is calculated to 25-27 km. Some vessels also work 300 tangle nets for monkfish (equivalent to 15 km).

The gear is shot at about 0400hrs. At 7 knots the shooting process takes approximately 2 hours (Mulligan, 2006 WD). The fishermen's opinion based on sounder readings and experience is that the gear starts to fish at around 0800hrs. The monk nets are then hauled at 1500hrs and the hauling process terminates at approximately 0100hrs if there have been no problems. Based on this information average soak time is estimated to be 16 hours.

According to Mulligan (2006, WD), however, nets may be left at sea for up to 48 hours while landing. It has been suggested by industry sources and also based on evidence from the Irish Naval Service, that a reason for leaving the gear in the water while landing fish, is to avoid being caught with illegal mesh netting aboard.

According to Mulligan (2006, WD) anecdotal industry sources confirmed that a practice that is commonplace is to deploy 100 mm mesh size at the ends of fleets, with the middle sections having the legal 120mm mesh size. This was observed during a detention of a hake vessel made by the Irish Naval services in 2005 (Irish Naval Service, pers. comm).

2.1.4 Landings

Annual hake catch data for the Spanish gillnet fleet in ICES divisions VIIIabd and Sub areas VI, VII for the period 1998 to 2005 are given in Table 2.1.3. Catch composition data are given in table 2.1.4. These data are as provided to ICES (Anon., 2006) and were presented by Costas et al. (2006).

Landings data from the French fleet were not available for this meeting and no data were available to the subgroup on discards.

Table 2.1.3. Hake gillnet fishery. Total hake landings (t) for Spanish gillnet fleet, 1998-2005 (Costas et al., 2006 WD).

Year	Landings (t)
1998	2 783
1999	3 525
2000	3 619
2001	2 989
2002	3 922
2003	4 162
2004	4 733
2005	4 856

Table 2.1.4 Hake gillnet fishery. Percentage landings composition from Spanish gill-netters for 2005 from log book data (Costas et al., 2006 WD).

Species	Total %
Merluccius merluccius	70
Beryx spp	6
Molva spp	6
Ommastrephidae	3
Phycis spp	2
Helicolenus dactylopterus	2
Lophius spp	2
Pollachius pollachius	1
Merlangius merlangus	1
Osteichthyes	1
Mullus spp	1
Scorpaenidae	1
Trisopterus spp	1
Others	5

CPUE in the Spanish gillnet fishery was calculated as hake catch by fishing days. Figure 2.1.2 shows spatial distribution of CPUE for 2005, it is to be noted high hake CPUE in ICES divisions VIIIabd along the shelf edge. Data for the area west of Ireland are not presented in this Figure.

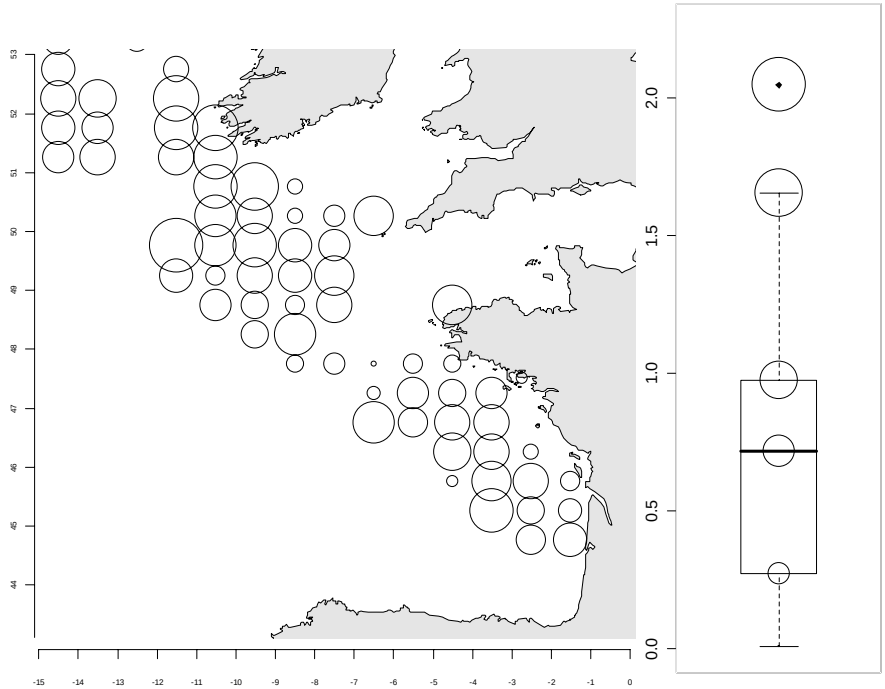

Figure 2.1.2. Spatial distribution of CPUE for part of the Spanish gillnet fleet for 2005 (Costas et al., 2006 WD).

2.1.5 Length distribution

The length range of hake landed by this fleet during 2005 was 24-100 cm. The mean length was 62 cm. The length distribution from 1998 to 2005 are shown in Figure 2.1.3.

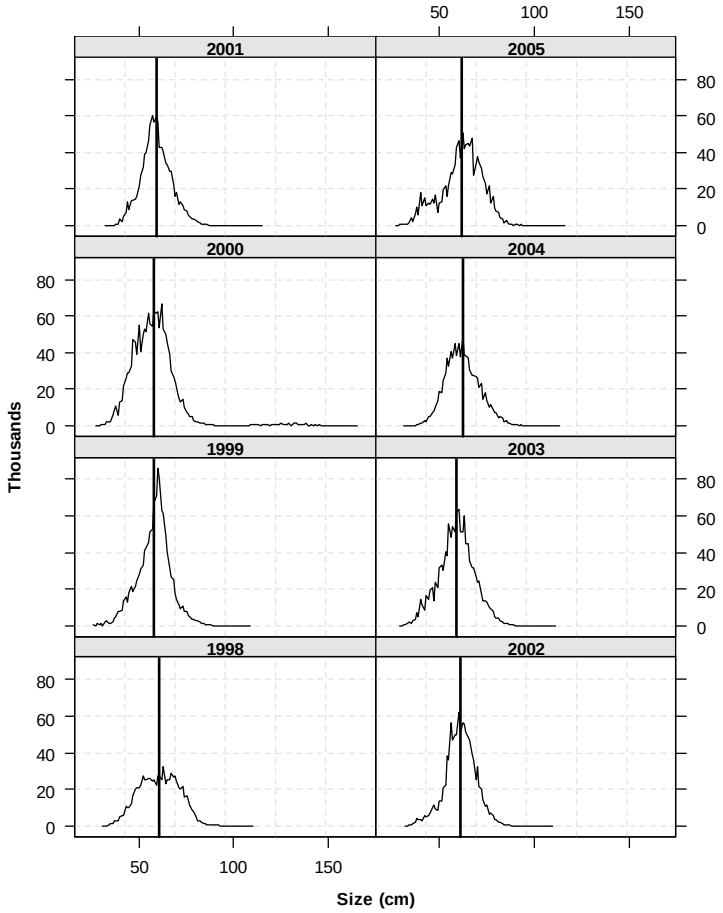

Figure 2.1.3. Hake gillnet fishery. Length distributions of hake landings (thousands) from 1998 to 2005 from the Spanish fishery (Costas et al., 2006 WD).

2.1.6 Discards

Only limited information on discards is available for gill net fisheries. Irish fishing trials (Anon. 1995) showed discard levels by number of all fish taken ranging from 2-80% with a mean of ~30%.

2.1.7 Technical measures

The minimum mesh size for hake in Areas IV, VI VII, XII and including the North Sea is 120mm under Regulation 850/1998. There is a derogation to use 110mm in Sub-areas VIIe and VId. In Sub-areas VIII and IX the minimum mesh size is 100mm, with a derogation to use 80mm in Sub-areas VIIIc and IXa.

2.1.8 Relevant scientific advice and TACs applicable

ICES provides management advice for two stocks of hake. Annual TACs for these stocks are as set out in Council Regulation 51/2006. ICES considers two stocks of hake. The northern stock comprises IIa, IIIa-d, Vb, VIIIabde and Sub-areas IV, VI, VII, XII & XIV.

The sum of TACs for the northern stock is 42 577 t. The ICES advice for the northern stock for 2006 is that to be consistent with the agreed management plan (F=0.25) landings in 2006 should not exceed 44 000 t.

The southern stock comprises Divisions VIIIc, IX a and X. The TAC for this stock is 6 661 t. The ICES advice for the southern stock is for zero catch and a recovery plan to bring the stock back within precautionary limits

2.2 MONKFISH TANGLE NET FISHERY

This section is based on information from the following sources;

- UK fisheries official landings data
- UK (England and Wales) Observer trips (CEFAS)
- French observer data. Comité National des Pêches Maritimes et des Elevages Marins (Anon. 2006 WD)
- Institut fur Seefischerei, Hamburg
- Scottish Fishery Protection Agency
- FRS Marine Laboratory, Aberdeen
- Norwegian Coastguard inspections of two vessels operating in the Norwegian zone
- UK retrieval survey (Large et al, 2005)
- WD on UK observer tripsin the monkfish fishery, submitted to meeting (Large et al, 2006)
- Deepnet report (Hareide & al 2004).
- Irish gillnet retrieval survey (Rihan & al 2005)
- Contributions from industry observers attending the meeting.
- Irish Naval Service information

2.2.1 Fisheries description

This fishery started in the late 1980s in ICES Sub areas VIIb-k. It 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 about 50 vessels involved in the fishery, including some that also fished for hake. As fishing effort increased, catch rates declined to unprofitable levels and in 2000/01 approximately one third of the fleet moved to Brazil under private agreements between the Spanish owners and the Brazilian Government.

It is difficult to define the fleet participating in this fishery as many vessels are able to move between targeting monkfish and hake. In 2003 there were around 16 European vessels participating in the monkfish fishery, 12 registered in the UK and four in Germany. In addition there were a further 2-3 registered in Panama or Togo.

In the first 2-3 years of the fishery, vessels of 20-30 m length were used, with the catch landed fresh. In the period 1996-1999 vessel size increased to typically 30-40 m in length and most also installed freezing facilities on board to allow increased trip length. These developments made it possible to work and carry more nets and to work more days at sea. 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 operates throughout the year with individual vessels typically working about 300 days per year.

2.2.2 Spatial and seasonal distribution

Logbook information from Scottish Fishery Protection Agency shows that the main fishing areas for the vessels landing into Scotland is ICES division IVa and VIb (Hareide & al 2004). Information from the industry (this meeting) suggest that ICES area IVa is the most important in the months between January and June after which the fleet moves southward. From June to December these vessels fish in Sub-areas VI and Divisions VII b,c,j,k.

French vessels fish for monkfish in Sub-area VI and Divisions VIIbcjk, principally between October and March .

Figures 2.2.1 and 2.2.2 show the spatial and temporal distribution of UK (England and Wales) official landings of monkfish taken by all types of gillnet in 2005. Provisional data indicate that 7 UK (England and Wales) vessels made at least one trip in 2005 where monkfish landings exceeded 10t. There are no strong seasonal trends evident in these data.

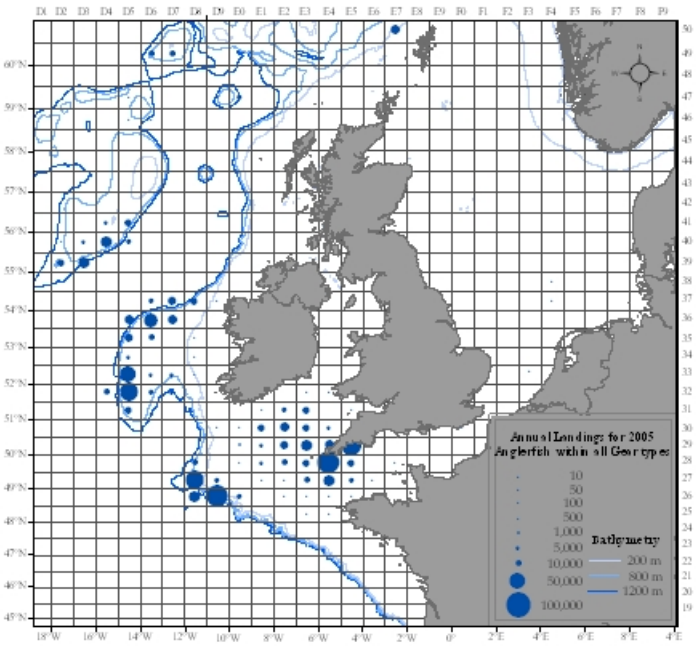

Figure 2.2.1. Monkfish tanglenet fishery. Official landings (kg live weight) of monkfish taken by all types of UK (England and wales) gillnetters in 2005 by ICES rectangle. The 200 m, 800 m and 1200 m depth contours are also shown.

The spatial distribution of fishing on the two scientific observer trips carried out in May/June 2006 on the UK vessels *Brosme* and the *Mar Azul* is shown in Figure 2.2.3. Each vessel fished for monkfish on two different grounds, making a total of four grounds fished in all. Depth of fishing ranged from 174 m to the northwest and west of Rockall to 944 m at Rosemary Bank (Table 2.2.1).

Table 2.2.1. Depth of fishing by fishing ground: hauls sampled on UK observer trips. Haul sampling rates ranged from 67% of hauls at George Bligh Bank to 90% of hauls at Lousy Bank.

Fishing ground	Depth range (m)	Mean depth (m)
George Bligh Bank	448 - 735	584
NW and W of Rockall[1]	174 - 808	689
Rosemary Bank	479 - 944	724

[1] Only four sampled hauls were made at depths of less than 580 m

Lousy Bank	622 - 781	704

The skipper of the *Mar Azul* reported that the best time of the year for this fishery is from January to March and that the ship had catches of 300 kg to 600 kg of monkfish tails per gillnet fleet at Rockall during January. The winter fishery mainly takes place in depths of 550 to 730 m.

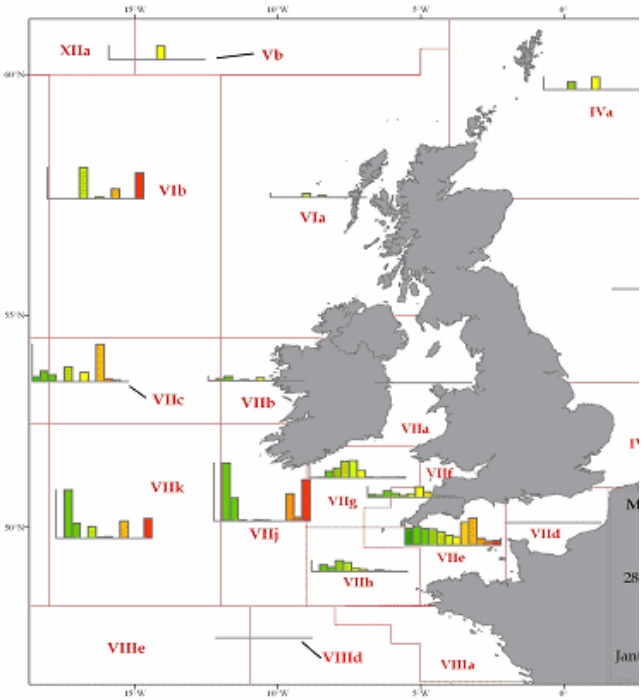

Figure 2.2.2. Monthly patterns, by ICES Division, of UK (England and Wales) landings (kg live weight) of monkfish taken by all types of gillnet in 2005.

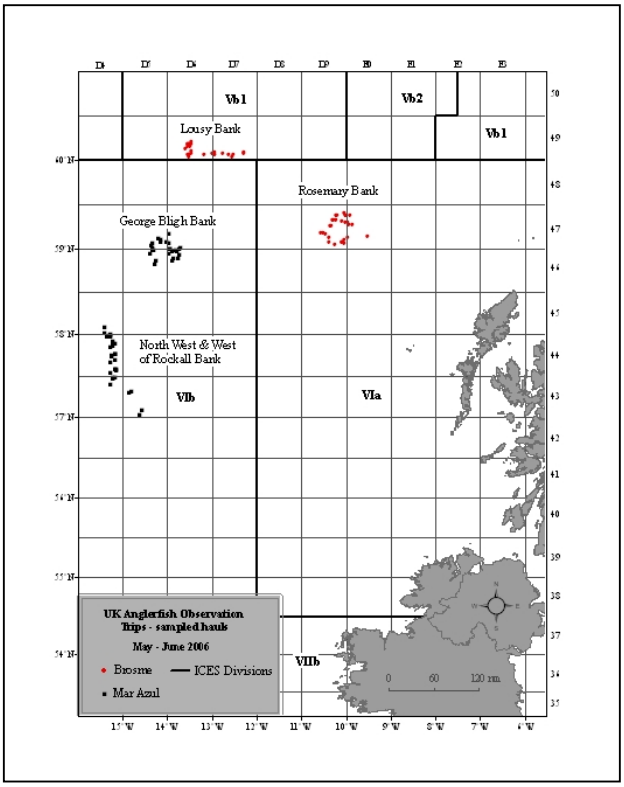

Figure 2.2.3 Shooting positions for hauls sampled on scientific observer trips on the *Brosme* and the *Mar Azul*.

2.2.3 Gear characteristics and fishing practices

Spanish monkfish nets are known as 'Rasco'. Specifications are provided by Mulligan (2006 WD). They are made up of a sheet of monofilament netting, dimensions 0.60mmØ x 280mm mesh size x 13 meshes deep and 150 metres in length, mounted on Polysteel frameropes to fish at 50 m length x 3.64 m height. The hanging ratio, E_r is 0.33. There are no floats on the headrope. The weight of one of these sheets is 44 kg in air.

Information on fleet length is available from one vessel inspected by the Norwegian coastguard. The fleets varied between 310 and 450 nets. Each net was 50 m, thus the total fleet length was between 15.5 and 22.5 km. The average length of fleets was 19.4 km. In total, 2 710 nets (135.5 km) were deployed in the Norwegian zone by this vessel. The vessel had also deployed nets in EU waters, but how many is not known.

Preliminary information is available from one French observer trip (Anon, 2006 WD). Average length of gillnet fleets used was 11 km.

The information on gear characteristics and fishing practices collected on two scientific observer trips on UK vessels described above is summarised in Table 2.2.2. Aspects of the gear configuration during these trips are shown in Plates 1 to 4.

A UK retrieval survey was carried out in 2005 on and around the Rosemary Bank. No fleets of gill nets were retrieved; only small fragments of gillnets and other gear (long-lines, trawl wire and a single crab pot) were found. The only ghost catch recorded was a single deep-water red crab in a crab pot (Large et al. 2005).

Table 2.2.2. Monkfish tanglenet fishery. Summary of main gear characteristics and fishing practises observed on two scientific observer trips on UK vessels.

Name of vessel	Number of fleets	Length of each fleet	Panel length and height	Mesh size	Maximum total length of nets in the water	Typical soak time
Brosme (31 day trip)	9	Mean 10.9km (range 8.9 to 12.4 km)	Length 50m Depth 3.6m	280mm	100 km	Mean 81hrs (range 46 to 109hrs)
Mar Azul (30 day trip)	14	Mean 9.8 km (range 7.1 to 11.5 km)	Length 50m Depth 3.6m	280mm	145 km	Mean 86 hrs (range 48 to 119 hrs)

For both observed vessels, each end of every fleet was attached to a surface marker comprising a dahn buoy and 3 or 4 coloured bladders labelled with vessel name, port licence number and radio call sign (see Plates 1-4). Terminal dahn buoys carried a conventional radar reflector with flashing yellow light(s) and yellow flag(s). Plastic labels showing ship name, port licence number and radio call sign were attached to terminal dahns and along the float line of each fleet at intervals. For the *Mar Azul*, each fleet was labelled so that it could be identified.

Plate 1. *Mar Azul*- bladders showing markings.

Plate 2. *Mar Azul* – dahn gear in water.

Plate 3. Monkfish tanglenet fishery. *Mar Azul* – label on dahn buoy.

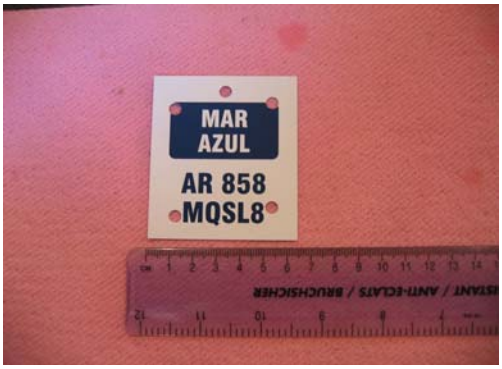

Plate 3. Monkfish tanglenet fishery. *Mar Azul* – label attached at intervals along floatline.

Both vessels fished two different grounds (see Figure 2.2.3). When each vessel changed grounds approximately half of the fleets fished were hauled and then shot at the new ground. The remaining fleets at the first ground were then hauled and then shot at the new ground. The *Mar Azul* could haul and re-shoot around 3.5 fleets per day i.e. all 14 fleets were shot and hauled in approximately a four day cycle.

No fishing gear was lost on either trip. On the *Brosme*, during one haul a fleet was cut and buoyed off due to the presence of a French trawler. This net was recovered without loss. The *Mar Azul* had creeping gear to facilitate the retrieval of lost nets.

For the *Brosme*, all damaged nets were landed at Ullapool. On the *Mar Azul*, the length of each fleet gradually diminished as worn out damaged nets were removed and not replaced. Disposal of netting was achieved by burning in an oil drum on deck. Ship's agents were exploring other means of disposal e.g. shredding machines for compact storage before disposal ashore, enclosed incineration at sea etc.

On the vessels sampled by French observer, 0.5 - 1% of the nets were changed each day and, during the period observed to date, no nets have been lost (Anon., 2006 WD).

2.2.4 Landings

Information on species composition of catches is available from the preliminary data from a single French observer trip which began in May 2006 and is still ongoing (Figure 2.2.4). This is outside the normal high season for this fishery and results may therefore be atypical.

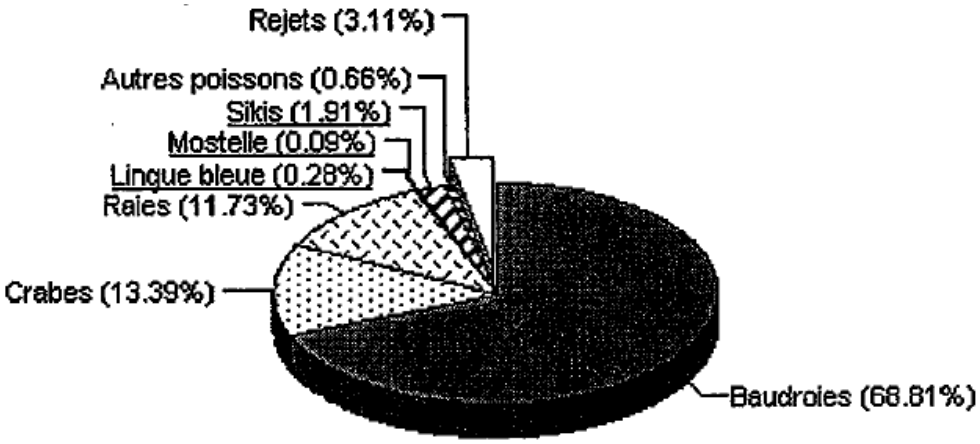

Figure 2.2.4. **Species composition of landings on a single French observer trip. Baudroie = monkfish, Crabes = crab, Raies = rays, Lingue bleue = blue ling, Mostelle = greater forkbeard, Sikis = deepwater sharks, Autres poisons = other fish, Rejets = dicards.**

Composition of catches from two fleets of abandoned monkfish nets retrieved from the SW slope of Rockall in the Irish retrieval survey (Rihan et al. 2005) is shown in Table 2.2.3. The total catch of monkfish in these nets was 2,338 kg. In one fleet, set between 650-800m, monkfish amounted to 94 % of the total catch of fish. In the other fleet, set between 400-500m, very few monkfish were caught and this may indicate that these nets may have been left for a considerable period of time.Length distributions of catches of monkfish caught on single French observer trip and in nets retrieved on the Irish retrieval survey are presented in Figures 2.2.5 and 2.2.6. The length frequency modes and ranges are similar between the French observer and Irish survey data.

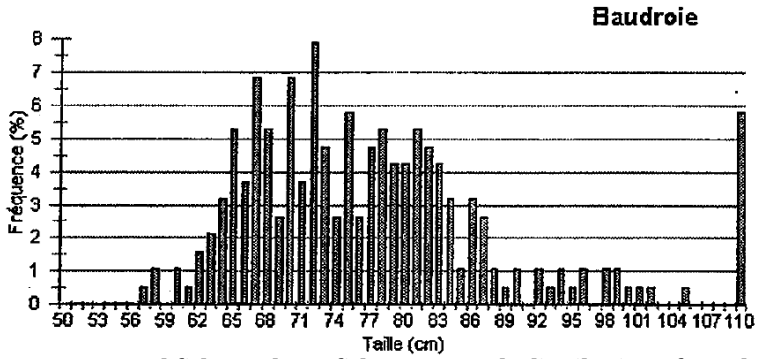

Figure 2.2.5. Monkfish tanglenet fishery. Length distribution of monkfish measured on a French observer trip.

Table 2.2.3 Monkfish tanglenet fishery. Catch (kg live weight) from the two monkfish gillnet fleets retrieved in the Irish retrieval survey in the SE slope of Rockall 2005 (Rihan & al 2005).

Area		SE Rockall		South Porcupine	Both Areas
Depth range		650-800m	400-500m	1000-1100m	400-1100m
Nets (n)		350	130	150	630
Species		Haul 12	Haul 16	Haul 48	Total
Leafscale gulpershark	*Centrophorus squamosus*	7		6209	6216
Monkfish	*Lophius piscatoris*	2318	20		2338
GreenlandShark	*Somniosus microcephalus*			1000	1000
Smoothead	*Alepocephalus bairdii*			552	552
Shovelnose dogfish	*Deania calceus*	7		384	391
Portuguese dogfish	*Centroscymnus coelolepis*			240	240
Norwegian skate	*Raja nidarosensis*	36			36
Mora	*Mora moro*	13		19	32
Sixgill shark	*Hexanchius griseus*			32	32
Black scabbard	*Aphanopus carbo*			31	31
Common scate	*Raja batis*	27			27
Rabbitfish	*Chimaera monstrosa*	22			22
Kitefin Shark	*Dalatias licha*	9.0			9.0
Sandy ray	*Raja circularis*	8.1			8.1
Greater Forkbeard	*Phiycis blennoides*	6.5			6.5
Blue ling	*Molva dyptrerigya*	1.4		3.2	4.6
Large-eyed rabbitfish	*Hydrolagus mirabilis*	2.7			2.7
Total fish		2457	20	8470	10947
Toothed rock crab	*Cancer bellianus*		864		864
Deep water crab	*Chaecon affinnis*	271			271
Box Crab	*Paramola cuvieri*	205	2052		2257
Total Crustaceans		475	2916	0	3391
Total Crustaceans and Fish		2932	2936	8470	14339

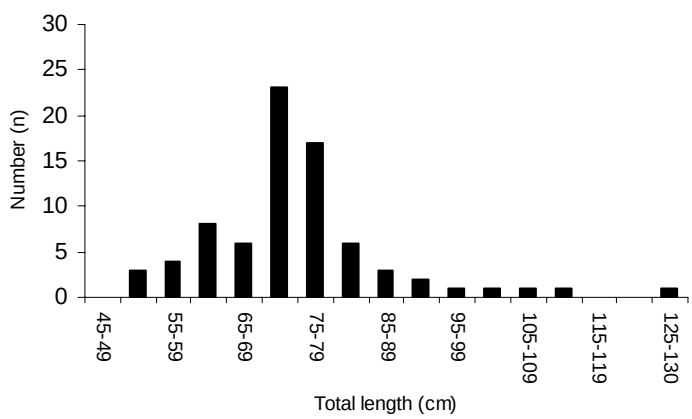

Figure 2.2.6. Monkfish tanglenet fishery. Length frequency distributions for monkfish (*Lophius* spp) at Rockall from Irish retrieval survey (Rihan et al., 2005).

2.2.5 Discards

The subgroup identified that discarding in this fishery could be:

- size-based,
- species-based, or
- because of spoilage or intrinsic quality rendering the catch unmarketable.

The main species found in sampled retained and discarded catches at each of the four grounds fished on UK observer trips are shown in Figure 2.2.7.

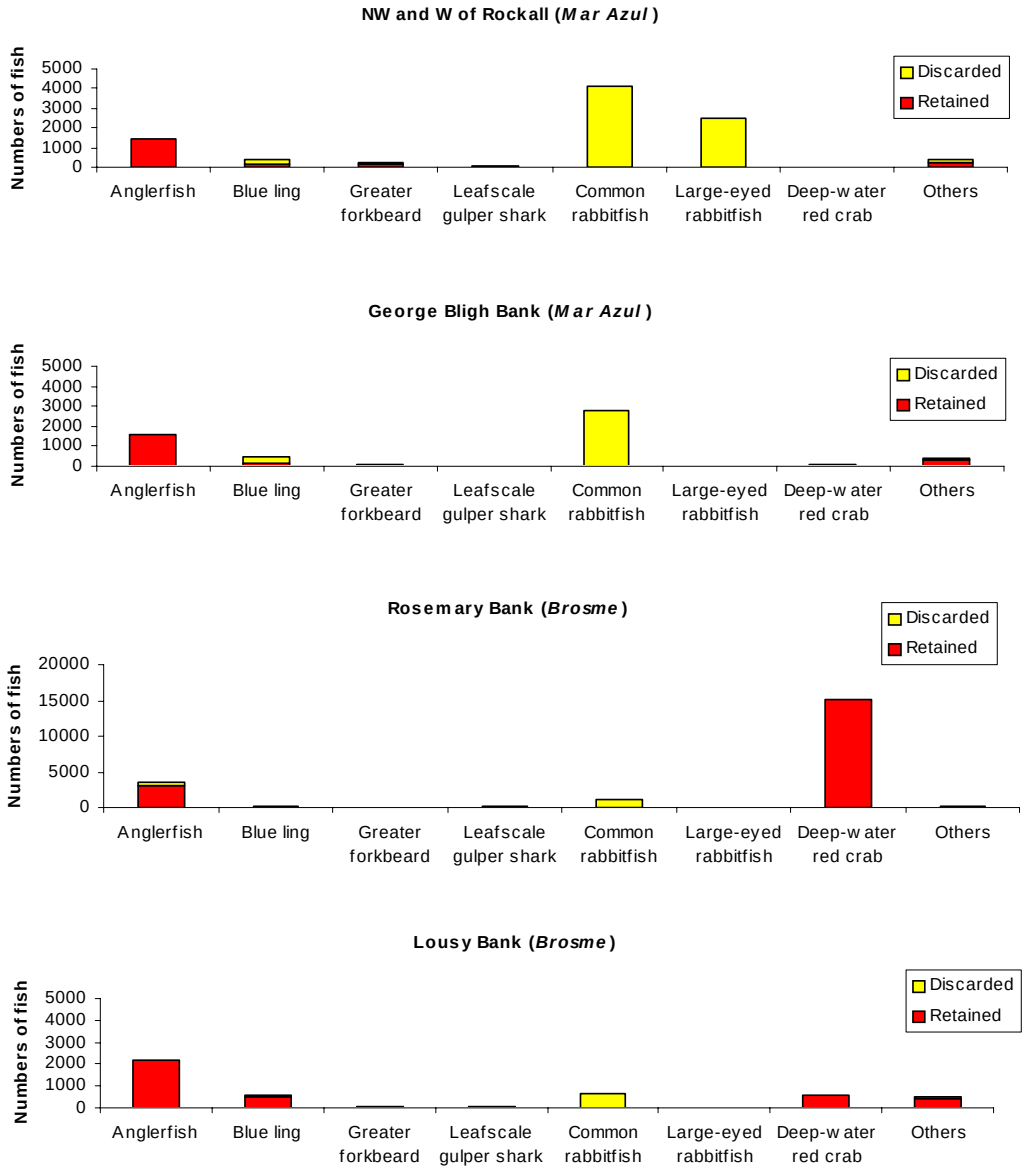

Figure 2.2.7. Monkfish tanglenet fishery. The main species found in sampled retained and discarded catches by fishing ground (note difference in scale of y axis for Rosemary Bank). Data from observer trips 2006.

To the northwest and west of Rockall (*Mar Azul*), monkfish (*Lophius piscatorius*) comprised 16% of the total sampled catch by number and only 0.2% of these were discarded. Blue ling (*Molva dipterygia*) comprised 5% of catches but over 60% of these fish were discarded because of spoilage (blue ling are very soft-fleshed and can deteriorate very quickly even with comparatively short soak-times). Greater forkbeard featured in catches in small numbers (2%) and around 84% of these were retained. Very few deep-water sharks were taken (1% of total catch) and these comprised mainly the leafscale gulper shark (*Centrophorus squamosus*), of which only 6% were discarded. The common rabbitfish (*Chimaera monstrosa*) and large-eyed rabbitfish (*Hydrolagus mirabilis*) were the most common species in catches. These species accounted for 45% and 27%, respectively, of the total sampled catch from this ground, and all were discarded.

At George Bligh Bank (*Mar Azul*), monkfish comprised around 30% of the total catch by number. Of these, only two fish were discarded. Blue ling accounted for around 8% of the total catch and around 60% of these were discarded. Deep-water sharks were present in very small numbers (20 fish in total) and all but six leafscale gulper sharks were discarded. The common rabbitfish was the most common species in catches, accounting for around 50% of the total sampled catch from this ground. All were discarded.

At Rosemary Bank (*Brosme*), monkfish comprised around 17% of the total catch by number, and of these monkfish only 9% were discarded. This was on the basis of size. Blue ling accounted for around 1% of the total catch and around 40% of these were discarded. Deep-water sharks comprised less than 1% of total catches and 11% of leafscale gulper sharks and almost all birdbeak dogfish (*Daenia calceus*) were discarded. The common rabbitfish accounted for 6% of catches and all were discarded. Deep-water red crab (*Chaceon affinis*) was the most common species in catches, comprising around 75% of the total sampled catch from this ground. All but 1% were retained.

At Lousy Bank (*Brosme*), monkfish accounted for 47% of the total catch by number, and of these less than 2% were discarded. Blue ling accounted for 12% of the total catch and 12% of these were discarded. Deep-water sharks were present in very small numbers (65 fish in total) and comprised leafscale gulper sharks (all retained) and the birdbeak dogfish (*Daenia calceus*), most of which were discarded. The common rabbitfish accounted for around 15% of the total sampled catch from this ground. All were discarded. Deep-water red crab comprised around 13% of catches and all but four specimens were retained.

In summary, discard rates of monkfish across the four grounds were generally very low (with the exception of Rosemary Bank accounting for less than 1% of the total catches of this species at each ground). The only catch component in poor condition on hauling was blue ling and this explains why discard rates were generally high for this species. The monkfish survived well in the nets and none were discarded because of spoilage.

Length compositions of sampled retained and discarded catches of monkfish, blue ling and deep-water red crab are shown by fishing ground in Figures 2.2.8 and 2.2.9. These data were obtained from the UK observer trips.

Preliminary discard data are available for a single French observer trip. 3.11% of the total catch was discarded (Figure 2.2.10). 1.82% of the discarded component of the catch was monkfish which equates to a discarding rate for monkfish of 0.08%. The majority of the discards were of rabbit fish. The ling included in these discard figures were actually utilised for consumption on board. It should be bourn in mind that this trip took place outside the usual high season for this fishery and results may therefore be un-representative.

Composition of catches from two fleets of abandoned monkfish nets retrieved from the SW slope of Rockall in the Irish retrieval survey (Rihan et al. 2005) is shown in Table 2.2.3. The total catch of monkfish in these nets was 2,338 kg. In one fleet, set between 650-800m, monkfish amounted to 94 % of the total catch of fish. In the other fleet, set between 400-500m, very few monkfish were caught and this may indicate that these nets may have been left for a considerable period of time.

Excessive soak times are known to result in high discarding rates. A Norwegian Coastguard inspection showed 54-71% discard rate per fleet. The average fleet length was 19 km. The average discard rate for monkfish was 65%. The soak times were reported as 96-240 hours.

Abandoned nets taken on the Irish retrieval survey (Rihan et al. 2005) were found to contain 2.3 t of monkfish, of which 50% was unfit for human consumption. The proportion of discards in the catch is presented in Table 2.2.4. The vessel to which this gear belonged was also inspected by the Irish Naval Service, while it was hauling its gear. A vessel working in the vicinty in which these nets were recovered was also inspected by the Irish Naval Service, while it was hauling its gear. This inspection yielded a similar 50% rate of fish unfit for human consumption .

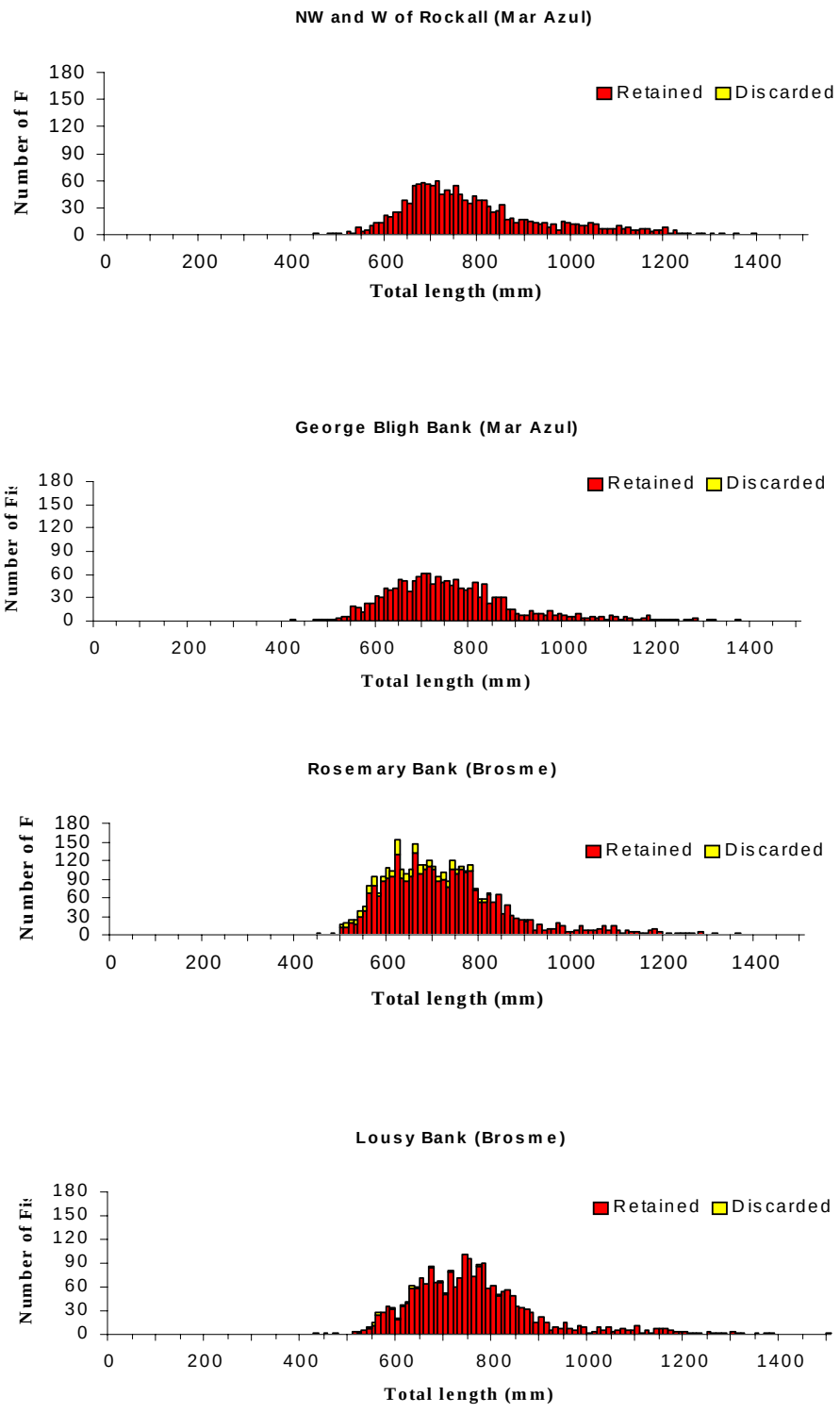

Figure 2.2.8. Monkfish tanglenet fishery. Length composition of retained and discarded monkfish by fishing ground. For presentation purpose all lengths are shown in mm but all fish were measured to the lowest whole cm. Data from observer trips 2006.

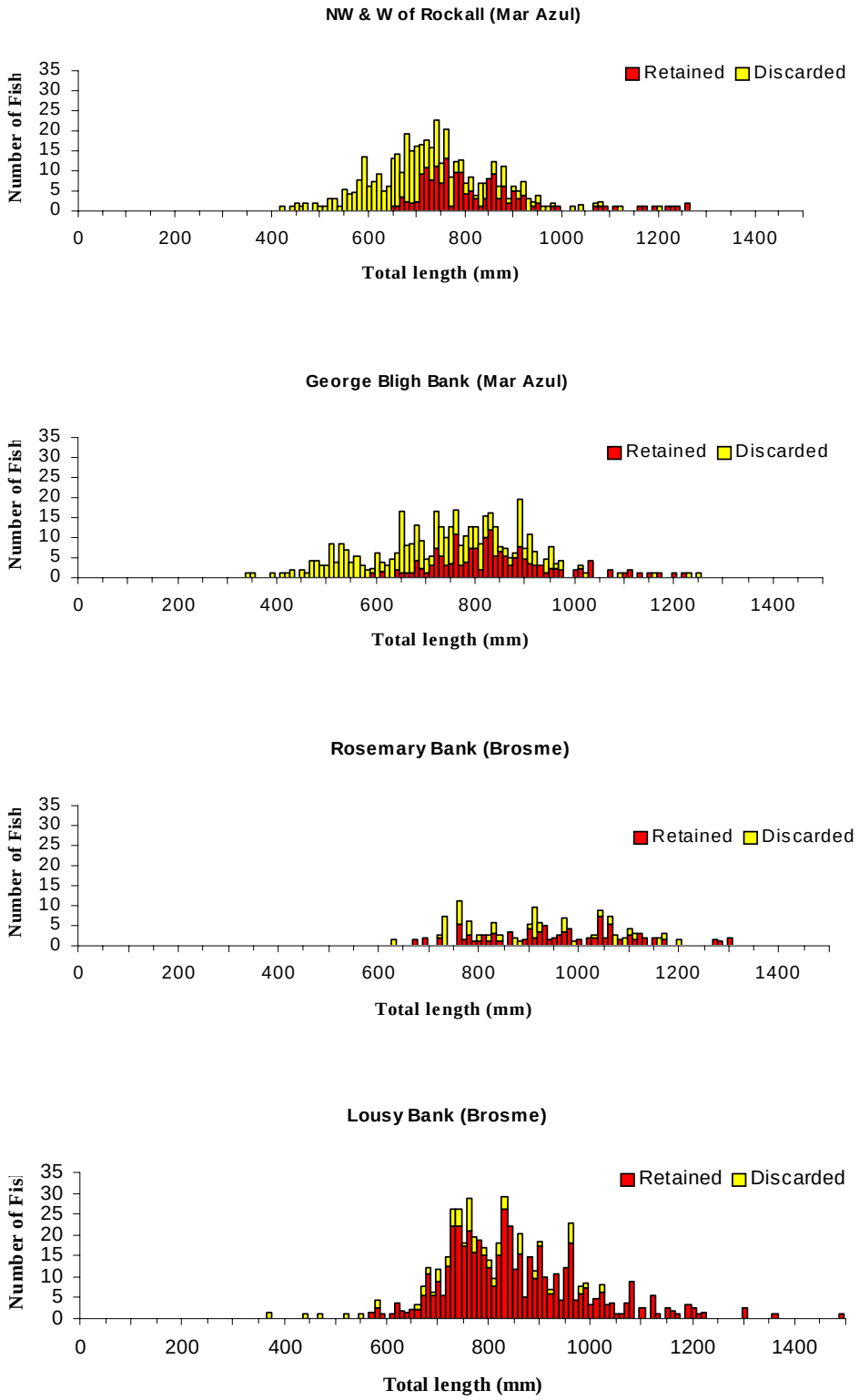

Figure 1.2.9 Length composition of retained and discarded blue ling by fishing ground. For presentation purpose all lengths are shown in mm but all fish were measured to the lowest whole cm. Data from observer trips 2006.

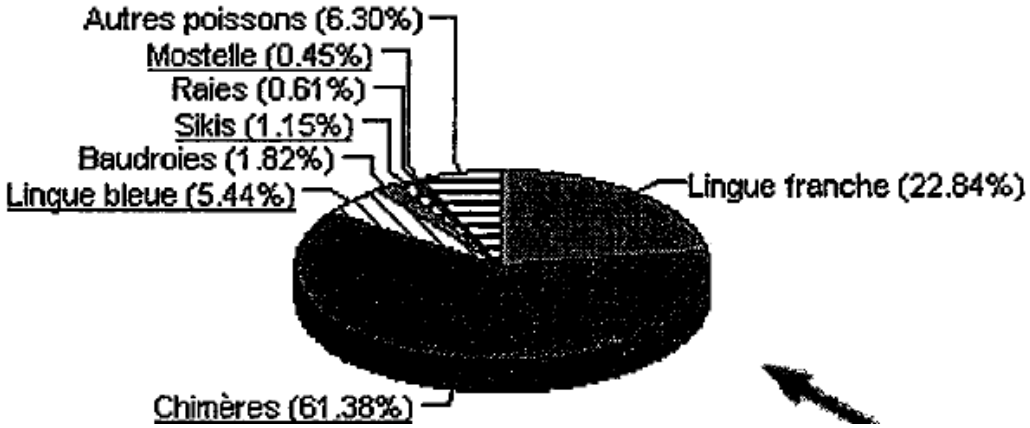

Figure 2.2.10. **Species composition of discards from a single observer trip on a French vessel. Lingue franche = Ling, Chimeres = rabbit fish, Lingue bleue = blue ling, Baudroies = monkfish, Sikis = siki sharks, Raies = rays, Mostelle = greater forkbeard, Autres poisons = other fish.**

Table 2.2.4. Proportion of discards in the Irish retrieval survey (Rihan et al. 2005).

Area	SE Rockall				South Porcupine	
Depth range	650-800m		400-500m		1000-1100m	
Species	Haul 12		Haul 16		Haul 48	
	Live Weight (kg)	% Discards	% Live Weight (kg)	% Discards	% Live Weight (kg)	% Discards
Leafscale gulpershark	7	0	-	-	6209	70
Monkfish	2318	48	20	50	-	-
Greenland Shark	-	-	-	-	1000	0
Smoothead	-	-	-	-	552	4
Shovelnose dogfish	7	0	-	-	384	63
Portuguese dogfish	-	-	-	-	240	20
Norwegian skate	36	0	-	-	-	-
Mora	13	100	-	-	19	100
Sixgill shark	-	-	-	-	32	0
Black scabbard	-	-	-	-	31	67
Common skate	27	0	-	-	-	-
Rabbitfish	22	25	-	-	-	-
Kitefin Shark	9	100	-	-	-	-
Sandy ray	8	0	-	-	-	-
Greater Forkbeard	6.5	0	-	-	-	-
Blue ling	1.4	0	-	-	3.2	100
Toothed rock crab	-	-	864	0	-	-
Deep water crab	271	0	-	-	-	-
Box Crab	205	0	2052	0	-	-

2.2.6 Technical conservation measures

The minimum mesh size for monkfish in Areas IV, VI, VII and XII under Regulation 850/1998 is 250mm if more than 30% by weight of the catch on board is monkfish. In Areas VIII and IX a minimum mesh size of 220mm is required if more than 30% by weight of the catch on board is monkfish.

2.2.7 Relevant scientific advice and TACs applicable

ICES provides management advice for stocks of monkfish in this area. Annual TACs for these stocks are as set out in Council Regulation 51/2006. Three separate stock units of monkfish are considered by ICES viz:

- II a, III a, IV, VI
- VIIb-k, VIIIa,b
- VIIIc, IXa

The combined TACs for the monkfish in II a, III a, IV and VI are 6 436 t in 2006. The ICES advice for monkfish in II a, III a, IV and VI is that effort in the fishery should not be allowed to increase.

The combined TACs for VIIb-k and VIIIa,b,d,e is 33 918 t in 2006. The ICES advice for these stocks is that fishing at F_{pa} for *L. piscatorius* (=0.23) would result in landings of 25 000 t. The corresponding fishing mortality of *L. budegassa* (F=0.22) would result in catches of 8 300 t. Thus the overall advice is for landings of 33 700 t in 2006.

The TAC for VIIIc, IX, X and CECAF 34.1.1 the TAC for 2006 is 1 955 t. The ICES advice is for F=0, to recover the stock to above F_{msy}.

2.3 DEEPWATER SHARK FISHERY

Information contained in this section was drawn from the following sources:

- The Scottish Fisheries Protection Agency
- The Irish Naval Service
- FRS Aberdeen
- Institut fur Seefischerei
- UK retrieval survey (Large et al 2005)
- UK (England and Wales) Deep Water Observer Scheme (UKDWOS)
- Industry sources
- World Wide Fund for Nature (WWF)
- Irish Sea Fisheries Board (BIM)

2.3.1 Description of fishery

The deepwater fishery targets mainly the leafscale gulper shark (*Centrophorus squamosus*) and Portuguese dogfish (*Centroscymnus coelolepis*).

Gillnetting for these species started in 1992 in ICES Sub area VII, although some of the vessels involved previously targeted sharks using longlines. 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. Utilization of meat for human consumption gradually increased until, in 1999, all the catch of these two species was being retained for human consumption. This was initially into the French market but now the Spanish market for frozen shark backs predominates. All the vessels are now freezers and normal trip length is around three months, or until the liver tanks or the fish hold is full. Vessels generally work at least 300 days per

year. The number of participating vessels reached about 15 in 2000 but half the fleet (7-8 boats) left in the fishery by 2000-2001. The resultant reduction in landings then had a positive effect on the market and the fishery became profitable so that the fleet in 2003-2005 comprised 10-12 vessels, 11 registered in the UK and 1 in Germany (SFPA, FRS Aberdeen, Irish Naval Service, ISH Germany unpublished data; industry sources).

Some of the vessels that left the fishery moved to West Africa around 2000. In 2005 two vessels were fishing off Mauritania. Two more vessels moved away to this area in 2006 following the EU closure (Industry observers pers. com.).

Two British and one German vessel previously targeting sharks have now changed to target the deepwater crab *Chaceon affinis* with pots. They are supplying a strong market for frozen, part-butchered crab. The remaining vessels targeting sharks have benefited as the reduction in volume of their target species has strengthened prices.

2.3.2 Seasonal and spatial distribution

The fishery is carried on a year-round with no known seasonality. The main depths range from 800-1200 m, though fishing is recorded as taking place down to 2 000 m. The fishery has covered ICES sub areas IVa, Vb, VI, VII, VIII, IX, X and XII. In sub area IVa the fishery is only conducted to the west of the Wyville-Thompson Ridge. Industry and WWF sources (this meeting) suggest that after the fishery closure in February 2006, vessels withdrew from VIa, VIb, VIIb, VIIc, VIIj, VIIk and XII east of 27^0 W and consolidated in Vb, VIII, IX and X.

Figures 2.3.1 and 2.3.2 below show the spatial and temporal distribution of UK (England and Wales) landings of deep-water sharks (all species) taken by all types of gillnet in 2005.

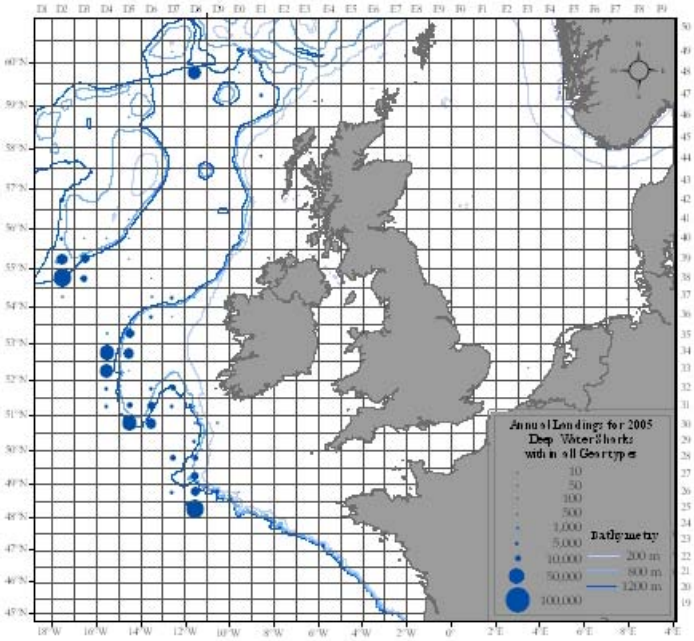

Figure 2.3.1. Deepwater shark fishery. Official landings (kg live weight) of deep-water sharks taken by all types of UK(E+W) gillnetters in 2005 by ICES rectangle. The 200, 800 and 1200 m depth contours are also shown.

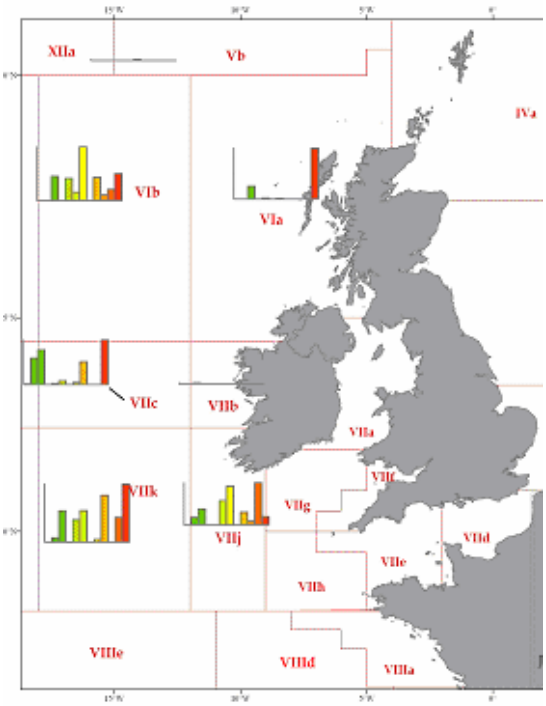

Figure 2.3.2. Deepwater shark fishery. Monthly patterns, by ICES Division, of UK(E+W) landings (kg live weight) of deep-water sharks taken by all types of gillnet in 2005.

2.3.3 Gear characteristics and fishing practices

The most commonly used net for sharks is a gill net known in Spanish as 'Jata'. It comprises a single sheet of monofilament netting, dimensions 0.70mmØ x 160mm mesh size x 40 meshes deep and 112 metres in length mounted on Polysteel frameropes to fish at 50m length and 6.4m height. This is equivalent to a hanging ratio E_r of 0.45. No floats are used (Mulligan 2006, WD).

Information on gear characteristics and fishing practices were collected on two scientific observer trips on UK vessels described below. The information is summarised in Table 2.3.1.

Table 2.3.1. Summary of main gear characteristics and fishing practices observed on two scientific observer trips on UK(E+W) vessels.

Year and season	Depth (m)	Number of fleets	Length of each fleet	Mesh size	Maximum total length of nets in the water	Typical soak time
Spring 2004	931 – 1 222	4	6.4 km	220mm	26 km	40-50 hrs
Summer 2005	1001 – 1982*	3	7.2 km	220mm	22 km	84-96 hrs

* 95% hauls 1001-1581m

An observation of one fleet of retrieved nets in SW Porcupine was found to comprise 168 nets with a total length of 8.4km (Rihan et al. 2005) and unpublished Irish Navy data from an inspection in 2004 show one vessel working 8 fleets, each of approximately 15 km.

Little information is available about net loss in this fishery. Information from the UKDWOS revealed that poor weather and problems with a net hauler during fishing resulted in the loss of 3 km of nets during a trip in Spring 2004. The vessel would normally have tried to recover these nets but did not on this occasion because of continuing bad weather. On the second trip, two separate attempts were made to retrieve previously lost nets. No nets were found.

A UK retrieval survey was carried out in 2005 on and around the Rosemary Bank. No fleets of gill nets were retrieved; only small fragments of gillnets and other gear (long-lines, trawl wire and a single crab pot) were found. The only ghost catch recorded was a single deep-water red crab in a crab pot (Large et al. 2005).

Members of the Subgroup received information from the fishing industry on gillnets lost on south-west Porcupine and Rosemary Banks between:

- 57˚ 18 N; 11˚ 00 W and 57˚ 18 N; 11˚ 12 W
- 51˚ 22 N; 13˚ 12 W and 51˚ 26 N; 13˚ 09 W
- 54˚ 06 N; 11˚ 58 W and 54˚ 27 N; 11˚ 18 W .

2.3.4 Landings

The only detailed information available on catch composition is shown in Table 3.3.1 below. This was obtained from a part-fleet of lost nets retrieved during the Irish retrieval survey in 2005 but, because of drop-out, predation and other factors, may not be typical of normal commercial catch composition.

The main bycatch species in this fishery is the deep water crab (*Chaecion affinis*) but landings data for this species are incomplete.

Table 3.3.1. Deepwater shark fishery. Species composition from one gillnet fleet retrieved in ICES area VII in 2005 (Rihan & al 2005).

Area		South Porcupine
Depth range		1000-1100m
Nets (n)		150
Species		Catch wt (kg)
Leafscale gulpershark	*Centrophorus squamosus*	6209
Greenland Shark	*Somniosus microcephalus*	1000
Smoothead	*Alepocephalus bairdii*	552
Shovelnose dogfish	*Deania calceus*	384
Portuguese dogfish	*Centroscymnus coelolepis*	240
Mora	*Mora moro*	19
Sixgill shark	*Hexanchius griseus*	32
Black scabbard	*Aphanopus carbo*	31
Blue ling	*Molva dyptrerigya*	3.2
Total fish		8470
Total Crustaceans		0
Total		8470

2.3.5 Discards

The subgroup identified that discarding in this fishery could be:

- size-based,
- species-based, or
- because of spoilage or intrinsic quality rendering an animal unmarketable.

There is no evidence of discarding of the target species of this fishery purely on the basis of size. Very few small individuals are retained by the gears used in the areas fished.

Poor data on the total catch composition mean that no firm conclusions can be drawn regarding discarding of other elasmobranch species. The species identified by Rihan et al (2005) however are known to be found on the same grounds as the main target species. Of these at least some would normally be discarded (industry sources, pers. com.) so species-based discarding is very likely to occur to some extent but no judgement can be made as to its significance.

Discarding of the target species may take place if quality has been compromised to the point where they are not marketable. Three main causes have been identified for this phenomenon, mechanical damage from the hauling process, excessive soak time – whether or not the gear remains under the control of the owner – and damage caused by scavengers. Of these only one is amenable to control by operators or managers – the intended soak time of the gear. No data are available to describe likely or relative levels of discarding arising from each of these causes but observations have been made that yield some relevant information.

The only other observed and potentially significant cause of discarding of marketable catch is of red crabs that are soft shelled.

The UKDWOS has produced discard figures under normal fishing conditions. On the trip in spring 2004 at Rosemary and Rockall Banks, discards of targeted sharks were very low at around 1% and these were due to damage sustained on hauling. Very few monkfish were taken and these were all retained. There were high discards of deep-water red crab at Rosemary Bank; almost all were soft-shelled.

On the trip in summer 2005, discards of targeted sharks were low at SW Ireland (< 5%) and up to 20% at Porcupine. The latter was due to the damage from amphipods, and as a consequence only four hauls were carried out at this ground. All monkfish were retained. Other discards comprised non-commercial species.

Of the catches of deepwater sharks in 2005 from abandoned shark nets retrieved on the Porcupine bank discard rates due to spoilage were 70% (Rihan et al. 2005).

2.3.6 Technical conservation measures

The minimum mesh size for deepwater shark in Areas IV, VI, VII and XII under Regulation 850/1998 is 220mm, given that deepwater shark species are included in the species category "*All other marine organisms*". In Areas VIII and IX a minimum mesh size of 100 mm is required, again given shark are included under "*All other marine organisms*".

2.3.7 Relevant scientific advice and TACs applicable

TACs for 2005 and 2006 for deepwater sharks were first established by Council Regulation 2270/2004. ICES considers that deepwater sharks (mainly leafscale gulper shark and Portuguese dogfish) comprise single stocks in the ICES area. For kitefin shark, ICES considers that the stock mainly comprises Sub-area X.

The TAC for V, VI, VII, VIII and IX is 6 763 t. In Sub-area X the TAC is 120 t, for a bycatch in the black scabbard fishery only. In Sub-area XII the TAC is 243 t.

The ICES advice for 2006 for deepwater sharks in all areas (mainly leafscale gulper shark and Portuguese dogfish) is that they are depleted and that there should be zero catch of these species in the ICES area. For kitefin shark in Sub-area X, ICES recommends that fishing should not proceed unless accompanied by programmes to evaluate stock dynamics.

2.4 DEEPWATER CRAB

Information in this section is drawn from the following sources:-

- WD on UK observer trips in aglerfish fishery, submitted to meeting (Large et al., 2006).

- Defra official landings statistics (from logbooks)
- Irish retrieval survey at Rockall Bank

2.4.1 Fisheries description

This fishery is believed to have commenced in the early to mid-1990s and is reported to be of high commercial value. Notwithstanding, fisheries information and data are sparse. The collation of these is beyond the scope of this report, so information presented here should be regarded as provisional. Available data suggests that red crab can be taken as a bycatch in the tangle net fishery for monkfish and deepwater shark but there is also some evidence of directed fishing in some areas for this species. There are also directed fisheries using pots and traps. There is some evidence that catches can comprise small quantities of other species of deep-water crabs such as the box crab (*Paramola cuvieri*) and the toothed rock crab (*Cancer bellianus*).

Crustacean fisheries prosecuted by nets usually fall into one of two categories. Most are based on setting nets across the migration routes of the target species. The animals presumably have no perception of the nets and readily become entangled. This occurs even when the netting is made up from relatively thick twines with a degree of visibility that would severely limit catches of most fin fish species. Examples of this type of fishery include that for the spider crab *Maia squinado* off the south coast of England, and for the crawfish *Palinurus epinephalus* in Brittany and on the west coasts of the British Isles.

High catches of scavenging crustaceans (including red crab) are also found in nets that have been abandoned or deployed with excessive soak times (Rihan et al, 2004). There is some evidence (MacMullen, 2002, Hareide et al, 2004) of the strategic use of long soak times in order to capture fish species that will then attract scavenging target species.

The mechanisms which may make the deep-water red crab fishery effective are not fully known. Data presented elsewhere in this report show that the shark and monk fishery can have a relatively high bycatch of *Chaceon*. It is reasonable to speculate, therefore, that developing a net-based fishery for *Chaceon* may involve significant bycatch levels of sharks. Whilst this is not demonstrable on the basis of the limited data available it is known that targeted fishing for *Chaceon* using traps and pots has no by-catch of shark species. Further information is therefore required before endorsing netting as a strategy for exploiting stocks of *Chaceon*.

Available data suggests that red crab can be taken as a bycatch in the tangle net fishery for monkfish but there is also some evidence that a directed fishing might take place in some areas. Provisional Defra data indicate that 8 UK(E+W) registered vessels made at least one trip where more than 10t of red crab was landed in 2005.

2.4.2 Spatial and seasonal distribution

The majority of UK (England and Wales) landings of deep-water red crab in 2005 were taken at Rosemary Bank, south of Porcupine Bank, south-west of Rockall Bank, to the west of Ireland and to the west of the Shetlands (Figure 2.4.1). The highest landings in most areas were taken mainly in summer months (Figure 2.4.2).

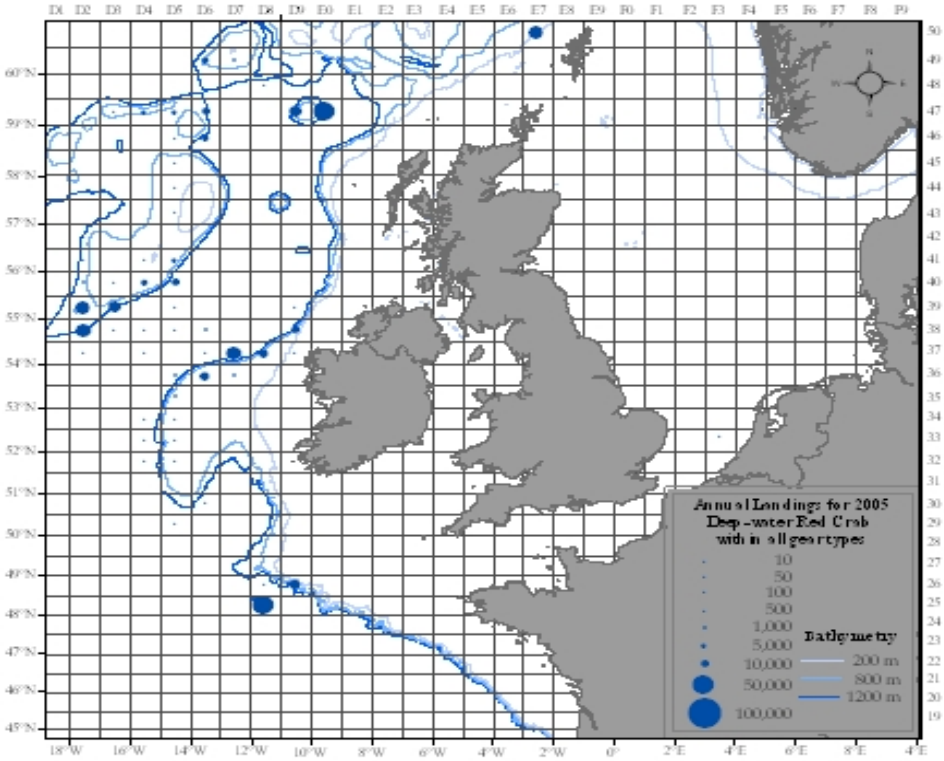

Figure 2.4.1. Deepwater crabs. Official landings (kgs live weight) of deep-water red crab taken by all types of UK(E+W) gill netters in 2005 by ICES rectangle. The 200, 800 and 1200 m depth contours are also shown.

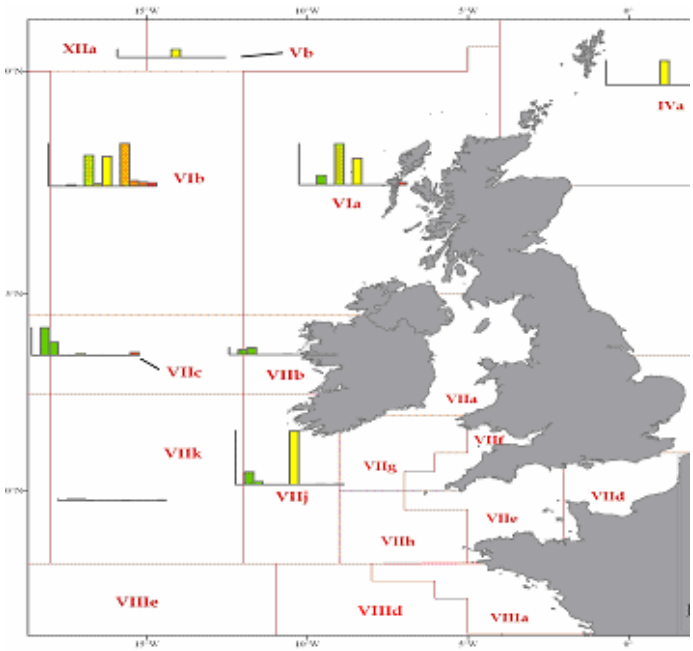

Figure 2.4.2. Deepwater crabs. Monthly patterns, by ICES Division, of UK(E+W) landings (kgs live weight) of deep-water red crab taken by all types of gillnet in 2005.

2.4.3 Gear characteristics and fishing practices

Information on gear characteristics and fishing practises are available from a scientific observer trip on a UK vessel (Brosme) fishing at RosemaryBank in May/June 2006 (Table 2.4.1). Depth of fishing ranged from 479 to 944m (mean 724m). This trip was targeted at monkfish but the industry representatives present at the meeting indicated that the data collected are similar to those that would have been observed on a trip targeted at red crab. Given that data on this fishery are sparse, it seemed sensible to include them as indicative of current practise in this fishery.

Table 2.4.1. Deepwater crabs. Summary of main gear characteristics and fishing practises observed on the scientific observer trip on the *Brosme*..

Name of vessel	Brosme. 31 day trip
Number of fleets	9
Length of each fleet	Mean 10.9 km. Range 8.9-12.4 km)
Panel length and height	Length 50 m, depth 3.6 m
Mesh size	280 mm
Total length of nets in water	100 km
Typical soak time	Mean 81 h. Range 46-109 h

Previously, it has been reported that soak times may be very long (weeks/months) in this fishery, however there are no fisheries data available to confirm this. The soak times reported on the UK observer trip add little to validate these findings but they do show that high catches of red crab can be taken with soak times of around four days i.e similar to the soak times observed in the monkfish fishery.

2.4.4 Landings

Landings data were not available to the Working Group but they are available for some countries and require collation. The only information presented here is the species and length composition of the retained catch from the above trip are this given in the discards section below.

2.4.5 Discards

No information is available other than that observer at Rosemary Bank the UK scientific observer trip described above. The main species found in sampled retained and discarded catches at Rosemary Bank are shown in Figure 2.4.3.

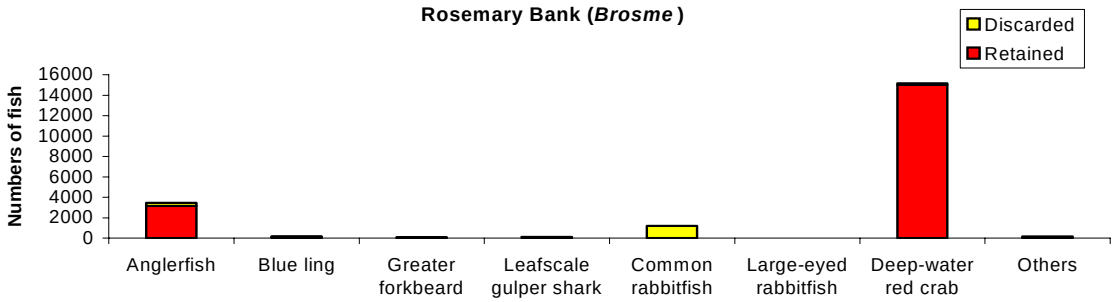

Figure 2.4.3. Deepwater crabs. The main species found in sampled retained and discarded catches at Rosemary Bank.

Deep-water red crab was the most common species in catches, comprising around 75% of the total sampled catch from this ground. All but 1% was retained. Monkfish comprised around 17% of the total catch by number, and, of these monkfish, only 9% ws discarded and this was due to small size of fish.. Blue ling accounted for around 1% of the total catch and around 40% of these were discarded. Deep-water sharks comprised less than 1% of total catches of these 11% of leafscale gulper sharks and almost all birdbeak dogfish (*Daenia calceus*) were discarded. The common rabbitfish accounted for 6% of catches and all were discarded.

Length compositions of sampled retained and discarded catches of deep-water red crab are shown in Figure 2.4.4.

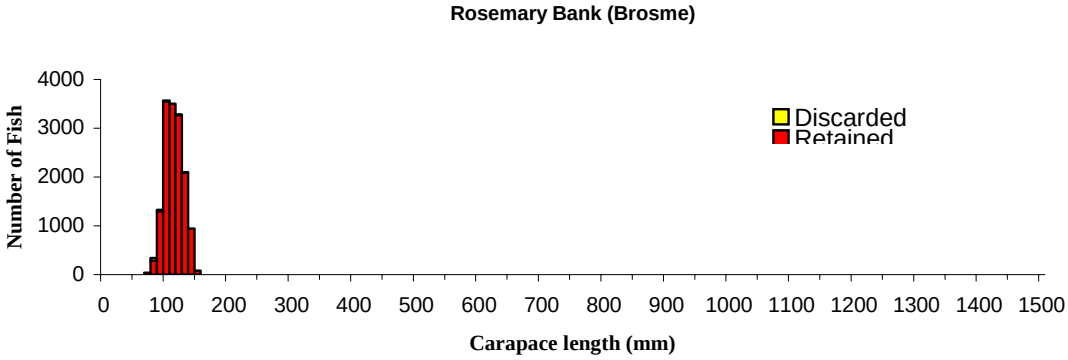

Figure 2.4.4. Deepwater crabs. Length composition of retained and discarded deep-water red crab by the *Brosme*.

Deep-water crabs were recorded in retained catches from abandoned gillnets taken in an Irish gill retrieval survey in 2005 at Rockall Bank (Rihan et al. 2005). Deep water crab (*Chaecon affinnis)* was only found in one retrieved fleet from 650 to 800 m. The total catch was 270 kg. Due to the small numbers caught no biological sampling was carried out. The toothed rock crab (*Cancer bellianus)* was only caught

in one fleet retrieved from 500-500 m. The total catch was 864 kg recovered from 130 nets. Of the 36 crabs that were measured (Figure 2.4.5), 34 of them were males, with 2 females. There appears to be two distinct cohorts, one with a modal size of 7cm carapace length and the other with a modal length of 17cm carapace length. The average length was calculated at 9.8cm.

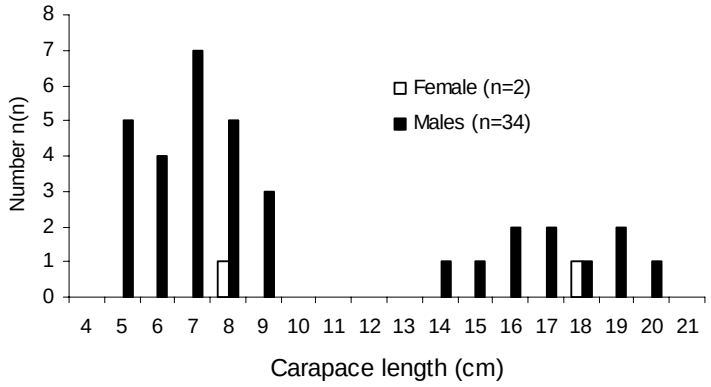

Figure 2.4.5. Deepwater crabs. Length frequency distributions for toothed rock crab (*Cancer bellianus*).

Box Crab (*Paramola cuvieri)* was caught in two fleets in depths between 500 and 800 m. It was the most abundant crab species encountered in one fleet and amounted to 2,250 kg. Of 57 specimens measured (Figure 2.4.6), 17 of them were males and 40 were female. The modal carapace length was 9cm carapace length with an average length of 9.2cm.

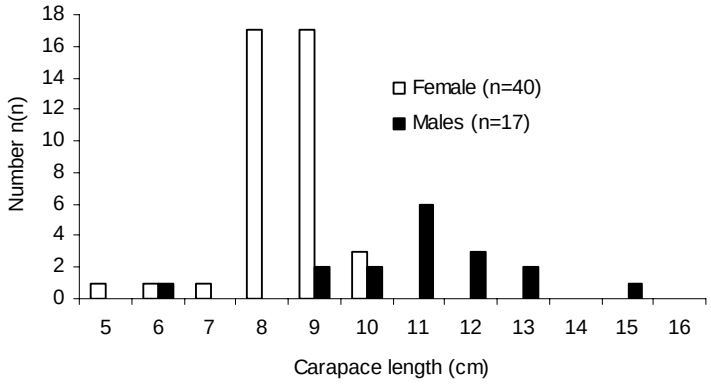

Figure 2.4.6 Deepwater crabs. Length frequency distributions for box crab (*Paramola cuvieri*).

It is not known if the toothed rock crab and the box crab are of commercial value.

2.4.6 Technical Conservation Measures

The minimum mesh size for red crab in Areas IV, VI, VII and XII under Regulation 850/1998 is 220mm, given that red crab is included in the species category "*All other marine organisms*". In Areas VIII and IX a minimum mesh size of 100 mm is required, again given red crab are included under "*All other marine organisms*".

2.4.7 Relevant scientific advice and TACs applicable

ICES does not currently give advice for stock(s) of deep-water crabs in the NE Atlantic and there are no TACs and quotas for these species. Red crab is not a licensed species under EC Deep-water Licensing Regulation No.2347 (2002) but it is included in Annex II of this Regulation, which requires the collection of fisheries and other data.

2.5 IUU FISHERIES USING GILLNETS

In international waters there is evidence of suspected Illegal, Unreported and Unregulated fishing (IUU) by gillnet vessels registered in Third Countries, notably Panama, the Dominican Republic and Togo. Annex III Paragraph 13 and Appendix 4 of Regulation 51/2006, contains a list of 18 vessels confirmed by NEAFC of such IUU activities. Many of these vessels are reportedly engaged in deepwater gillnetting. The extent, numbers of vessels involved and the impact on stocks remain unknown. The regulations specify a number of measures applying to these vessels, including an outright ban on them fishing in Community waters and landing or trans-shipping fish, inspection requirements by the competent authorities when in port and the banning port authorities from supplying provisions, fuel or other services to IUU vessels. NEAFC also have made a commitment to update this list on a regular basis.

There are specific examples of IUU activity associated with the deepwater gillnet fisheries. The DEEPNET report (*Hareide et al, 2004)* refers to information given by the Greenpeace vessel MV *Eeperenza* between October and November 2004, of two vessels suspected of IUU, *Badminton* and *Fontenova* fishing in international waters to the west of Rockall (Greenpeace, pers.comm). No catch or effort data exist from these vessels and at least one of these vessels, *Fontenova* appears on the NEAFC list. In 2004 the Irish Naval Service arrested a Portuguese registered vessel *Ilha Brava* fishing inside the EU 200 mile limit to the west of Rockall. This vessel had been observed by VMS by both the Irish authorities and NEAFC inspectors entering and exiting EU waters in Area VIb. It had no entitlements to fish in this area and was finally arrested, having been caught hauling gillnets in VIb and having a sizeable catch of monkfish retained on board (Irish Naval Service, pers. comm. ; NEAFC pers. comm.).

Industry sources have also reported that IUU vessels, fishing illegally inside EU waters, have marked their gear with the name of vessels legally fishing in the area. The markings used are very detailed, including the plastic labels showing ship name, port licence number and radio call sign attached to terminal dahns.

According to industry sources, there are seven vessels from NEAFC non-contracting parties fishing in international waters, using *Rasco* for monkfish and/or sharks, in 2006. Two are registered in Togo. A further three are registered in Panama, one of which has been reportedly fishing shark, wreckfish and deepwater red crab on seamounts around the Azores (WWF, pers comm). This vessel has been noted as landing fish to the Azores. One vessel is registered in Belize. The flag state of the remaining vessel is either unknown or it does not belong to any flag state. Three of these vessels, have been listed on the NEAFC list of IUU vessels active in the ICES area in 2006. Two listed vessels are Panamanian and one Belize registered.

3 LEGAL INSTRUMENTS

3.1 TECHNICAL CONSERVATION MEASURES

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 set out catch composition limits for vessels using gill, tangle and trammel nets. Table 3.1 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 including the North Sea) and Region 3 (Areas VIII and IX) are given for comparative purposes.

Table 3.1. Legal instruments. Mesh size and catch composition regulations as specified by Council Regulation 850/1998.

Target Species	Minimum Mesh Size (mm)[1]	
	Region 1 & 2	Region 3
Hake	120mm	≥100mm[2]
Deepwater Shark & other Deepwater Species	≥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. There is also a derogation to use 110 mm mmesh size in in VIIe and VIId.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.*
3. *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 or construction. In 1994 the need for regulation of these parameters 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 no additional measures have been introduced. Recent regulations brought in for the Baltic Sea, The Belts and The Sound under Council Regulation No. 2187/2005, however, contain provisions regarding the dimensions and immersion times for gillnets.

New regulations for the marking and identification of gillnets for vessels fishing in Community waters are contained in Commission Regulation No. 356/2005 as amended by Commission Regulation No. 1805/2005, which came into force from 1st October 2005.

3.2 MONITORING OF FISHING OPERATIONS

General provisions for vessels operating in the fisheries including access to waters, observer schemes 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 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 (Biologically Sensitive Area). 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. There is also a specific requirement contained in Regulation 2807/83, for vessels over 15m (10m in the BSA) using static gears to record in the logbook, date and time gear is shot and the date and time of completion of the fishing operation. In addition, Regulation 2847/83, as amended most recently by 1804/2005, sets out effort reporting requirements for vessels targeting demersal species, scallop or brown and spider crab, which would include vessels gillnetting for monkfish or hake. For hake, specific provisions are set out in Regulation 811/2004 relating to designated ports, prior notification of landing, recording and reporting requirements and also specific tolerances levels for completing the logbook.

For 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. Regulation 2347/2002 requires Member States vessels to:

- Issue Fishing Permits for vessels which caught more than 10 tonnes of deepwater species in any of the years 1998-2000;
- Cap effort at the aggregated capacity of the vessels referred to in point (a);

- 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;
- Vessels to land quantities of deepwater species in excess of 100kg, only into designated ports;
- Member States to submit Sampling Plans covering the deployment of scientific observers on licensed vessels and sampling at ports.

TACs for a specified group of deepwater sharks were introduced for 2005 and 2006 under Regulation 2270/2004 at a level of 50% of the recent reported catch levels. For Sub-areas V, VI, VII, VIII and IX this meant a TAC of 6,763 tonnes, in Sub-area X, a TAC of 120 tonnes and in Sub-area XII 243 tonnes.

3.3 CETACEAN BY-CATCH

One other regulation that should be noted in relation to gillnet 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. 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 to monitor cetacean by-catch levels. In deepwater gillnet fisheries it is expected that the by-catch of cetaceans will be low.

3.4 INTERNATIONAL WATERS

In international waters of ICES area, management and regulation of fisheries are the responsibility of NEAFC. No specific technical conservation measures, other than existing EU legislation in international waters are in place for gillnet fisheries. There are, requirements under Article 6 of the NEAFC Scheme of Control and Enforcement specifying marking of static gears. Of particular relevance, with respect to deepwater species is a recommendation for *ad hoc* and temporary conservation management measures for deep-sea species, These were agreed in 2003 at the NEAFC Annual Meeting, and effective from March 2004. These measures included a commitment that :

- 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;
- Effort should not exceed 70% of the highest level put into deep-sea fishing in previous years for a list of species, which includes deepwater shark species;
- Effort should be calculated as aggregate power, tonnage, fishing days at sea or numbers of vessels participating in the fishery.

Also NEAFC has specified a number of areas in international waters which fishing with static gears including bottom set gill-nets and longlines as well as bottom trawling is prohibited. These areas are also included in Annex III Paragraph 11 of EU Regulation 51/2006.

3.5 MARPOL CONVENTION

One international convention that has relevance to the management of deepwater gillnet fisheries, especially lost or deliberate dumping, is Annex V of the MARPOL Convention. This convention covers the prevention of pollution of the marine environment by ships from operational or accidental causes. It is a combination of two treaties adopted in 1973 and 1978 and updated by amendments through the years. Annex V specifically deals with different types of garbage and specifies the distances from land and the manner in which they may be disposed of. The requirements are much stricter in a number of special areas. An important feature of the Annex is the complete ban imposed on the dumping into the sea of all forms of plastic, which therefore includes discarded gillnets.

It should also be noted that the FAO Code of Conduct for Responsible Fisheries recognizes the impact of lost gears, stating that States should take appropriate measures to minimize catch by lost or abandoned gear (Articles 7.2 and 7.6.9). (*IEEP, 2005).*

3.6 INTERNATIONAL CONVENTIONS AND PLANS OF ACTION

UN Fish Stocks Agreement

The United Nations Agreement on the conservation and management of straddling fish stocks and highly migratory fish stocks entered into force in 2001, and was ratified by the EC and MS in December 2003. The Agreement aims to ensure the conservation and sustainable use of straddling and highly migratory fish stocks, by elaborating certain provisions of the 1982 UN Convention on the Law of the Sea. It also requires the application of the precautionary approach, the protection of marine biodiversity, and measures to be taken to prevent or eliminate overfishing and excess fishing capacity and to keep levels of fishing effort within the limits of fisheries resources.

The Agreement is relevant to the management and conservation of deepwater stocks as several of the deepwater fish stocks straddle international and Community waters.

EU IPOA-Sharks

International plans of action (IPOAs) are voluntary and are a product of the Food and Agriculture Organisation (FAO) Code of Conduct for Responsible Fisheries. Two such IPOAs are relevant, on sharks (including deepwater sharks) and on IUU fishing, see below.

In 1999 Committee on Fisheries (COFI) of the FAO adopted a voluntary International Plan of Action for the Conservation and Management of Sharks in response to concern about the global state of shark stocks.

The IPOA-Sharks applies to FAO member countries that contribute to the fishing mortality of sharks, rays, skates and chimaeras, which are caught either as target or non-target species. It applies to States in the waters in which sharks are caught and those whose vessels catch sharks on the high seas.

The overall aim is to develop management and conservation strategies to keep total fishing mortality for each stock within sustainable levels by applying a precautionary approach. Countries should adopt national shark plans of action by 2001. In addition, states should regularly assess the status of shark stocks subject to fishing in order to determine whether a new shark plan is needed. Implementation of shark plans should be reviewed at least every four years to identify cost-effective strategies for improving their effectiveness.

The EU has signed up to the IPOA-Sharks on behalf of Member States but has yet to develop and adopt a shark plan of action or shark management plan. Some efforts were made in 2000 and a draft was circulated in the 2001 at COFI, but due to failure to meet the IPOA-Sharks requirements, this proposal was then withdrawn. A formal plan from the EC has yet to be proposed (Fowler *et al*, 2004).

EU IPOA-IUU

FAO Committee on Fisheries (COFI) adopted the IPOA on –IUU fishing in March 2001. This was due to increasing awareness that IUU fishing poses a threat to effective conservation and management of many fish stocks.

The EC has signed up to the IPOA on IUU. An EC Action Plan (COM (2002)180), was forwarded as part of the 2002 Common Fisheries Policy reform, and set out the necessary measures for the EC to comply with the IPOA-IUU. It identified 15 new measures or initiatives to be undertaken by the Community itself, or to be pursued through regional fisheries organisations and/or international organisations. These measures include the identification and monitoring of IUU vessels, the promotion of uniform action plans to curb illegal fishing, the development of framework plans for control and inspection within each regional fisheries management organisation and the alerting of fishing industry, consumers and the public in general to the need to control IUU fishing. IPOA-IUU also includes measures relating to flag States, coastal States and port States. It also encourages the use of

internationally agreed market related measures, research and regional fisheries management organisations. However, a timeframe for delivery for the EU IPOA-IUU has yet to be specified.

4 DESCRIPTORS OF THE FISHERY

There are number of potential descriptors to define the different fisheries as follows:

- Gear Type
- Mesh Size
- Net Height
- Hanging Ratio (E_r)
- Gear Length
- Soak Time
- Net construction
- Depth
- Area
- Catch Composition
- Vessel characteristics
- No of Vessels

Table 4.1 summarises these main descriptors by fishery. The red crab fishery has been included, even though the gear used in this fishery is poorly described. It has been assumed that the gear being used in this fishery is the same as for monkfish. For mesh size both the legal minimum mesh size and the observed mesh size used in the fishery are included.

For gear length it was felt better to define the gear by length of fleet or numbers of nets in an individual fleet and number of fleets deployed rather than overall length of gear, given that this seems to vary between vessels. The soak time indicated is based upon industry sources and practices observed during observer trips. Net construction refers simply to whether the nets are rigged with or without floats on the headline.

Catch comparison is also included in the table as it could be a good descriptor of the available information, although limited suggests the fisheries are quite directed in nature. Catch comparison limits are already included in Regulation 850/1998 for gillnet fisheries.

The table suggests that simple gear parameters can be used to delimit the hake fishery from the other fisheries. It is more difficult to delimit the monkfish, deepwater shark and red crab by gear type solely, given the similarities and depth should also be included even though there is an overlap in the depth range for shark, monkfish and red crab between 600-800m. It can also be inferred from the table that ICES Sub-area is not a good delimiter as the different fisheries cover wide areas and overlap.

Table 4.1 Descriptors of the fishery. This table is based on the Working Group's judgment of the characteristics of these fisheries.

Fishery	Hake (*Merluccius merluccius)*	Monkfish (*Lophius spp.)*	Deepwater Shark (*Centrophorus squamosus & Centroscymnus coelolepis)*	Crab (*Chaceon affinis)*
Gear Type	Gillnet	Tangle Net	Gillnet/Tanglenet Hybrid	Tangle Net
Regulation Mesh Size (mm)	120mm	250mm	220mm	220mm
Observed Mesh Size (mm)	100mm/120mm	280mm	160mm	280mm
No. of Vessels	43 (18 both monkfish & hake)	9 (18 both monkfish & hake)	2 (4 both monkfish and shark)	??
Net Height (no. of meshes deep)	100 (12m)	13 (3.64m)	40 (6.4m)	13 (3.64m)
Hanging Ratio (E_r)	0.5	0.33	0.45	0.33
Fleet Lengths (No of Nets x length of Fleets per vessel	25-50 nets (1.5-2.5km) 6-10 fleets	150-450 nets (7-22.5km) 9-14 fleets	130-180 nets (6.5-9km) 3-10 fleets	??
Approximate Total Gear Length per vessel	(~20-25km)	(~100-200km)	(~25-100km)	??
Soak Time (hours)	12-24	72-96	72-96	??
Net Construction (Floatation)	Floats placed at 1.5m spacings (32 floats per net)	No floats on headline	No floats on headline	No floats on headline
Depth Range (m)	100-600	100-800	800-1600	600-1200
ICES Sub-area	IVa, VII, VIII, IXa	IIa, IVa,b, VI, VII, VIII	VI, VII, VIII, IX, X, XII	IVa, Vb, VI, VII, VIII, XII
Catch Composition	~70% hake	~70% Monkfish	~90% shark	~75% crab

Taking the information presented in Table 4.1, the fisheries can be defined by gear as follows:

Hake

- Gillnet;
- Mesh size of 120mm;
- No more than 100 meshes deep;
- Hanging ratio of not less than 0.5;
- Rigged with floats;
- Fleets of a maximum of 2.5km in length;
- Total length 25 km
- Soak time of no more than 24 hours;
- Depths< 600m.

Monkfish

- Tangle net;
- Mesh size of 280mm;
- No more than 13 meshes deep;
- Hanging ratio of no less than 0.33;
- No floatation;
- Fleets of no more than 15km in length;
- Soak time of no more than 96 hours;
- Depths < 800m.

Deepwater Shark

- Tangle/Gillnet hybrid;
- Mesh size of 220mm;
- No more than 40 meshes deep;
- Hanging ratio of no less than 0.45;
- No floatation;
- Fleets of no more than 10km in length;
- Soak time of no more than 96 hours;
- Depths > 600m.

Based on the available information it was not possible to delineate a separate fishery for crabs using gillnets.

5 SELECTIVITY AND SOAK TIME EXPERIMENTS

5.1 SELECTIVITY

There have been comparatively few fixed net size-selectivity studies carried out within the EU. This reflects the perceived good size-selectivity of fixed nets, lesser use of these gears and the difficulty in accurately measuring their selectivity. There are, however, a few studies that have provided selectivity data for hake gillnets of varying mesh sizes. All of these studies indicate that gillnets even of a mesh size of 80mm are size-selective for hake and give indicative l_{50}s in excess of the current minimum landing size of 27cm.

Anon. (1993) reports of selectivity experiments carried out to determine selectivity parameters for hake of a range of monofilament gillnets of differing mesh sizes on board an Irish commercial vessel. Gillnets of 94mm, 106mm, 115mm, 155mm mesh size were compared to standard 126mm mesh size gillnets. The effects of the different mesh sizes on hake catches and net selectivity were clearly demonstrated. Estimates of l_{50} were determined using the SELECT model assuming a Gaussian retention curve. The results of these experiments were as follows:

- 155 cm 108.6 cm
- 126 mm (control) 88.3 cm
- 115 mm 80.6 cm
- 106 mm 74.3 cm
- 94 mm 65.9 cm

A further experiment carried out as part of the same study assessed the selectivity and fishing efficiencies of monofilament gillnets of 106mm and 126mm mesh size against multi-monofilament gillnets of 110mm and 127mm mesh size. Estimates of l_{50} were obtained using the SELECT model assuming a Gaussian retention curves. These results were:

- 106 mm monofilament 75.8 cm
- 126 mm control monofilament 57.8 cm
- 110 mm multi-monofilament 78.7 cm
- 127 mm multi-monofilament 58.3 cm

No differences in the relative efficiency of the two gear constructions were found.

A similar study by Dos Santos et al. (2003) on the selectivity of hake gillnets in the fishery off southern Portugal provided mean selection lengths as follows :

- 80 mm 46.7 cm (± 2.4cm)
- 90 mm 51.1 cm (±3.1cm)

Another study conducted by Revill et al. (2005) was undertaken aboard a commercial gillnetter off the coast of Cornwall to estimate the selectivity parameters of hake gillnets of 80mm, 100mm, 120mm (control) and 140mm mesh sizes. Various methods were used to estimate selectivity including the SELECT, Jensen, Holt and McCrombie and Fry methods. All four of the methods used produced selectivity values for gillnets, which were closely comparable and gave l_{50} as follows :

- 100 mm 68 cm
- 120 mm (control) 81 cm
- 140 mm 95 cm

Revill et al. (2005) showed that the selectivity parameters estimated after excluding hake entangled by their teeth is reduced by 2-6cm compared to the results for gilled and entangled fish combined reported above.

For monkfish, deepwater sharks and red crab no experiments to measure selectivity have been carried out to date in EU waters. Length-frequency data from the Irish retrieval survey (Rihan et al. 2005) and the observer trips carried out by the UK and France, suggest that no monkfish of les than 45 cm were caught in these tangle nets. Although this maybe due to the fact that there are few small monkfish on these grounds rather than the selective properties of the gear. Similarly for deepwater sharks, length frequency data from the Irish survey showed only leafscale gulper shark in excess of 85cm retained in retrieved nets with 160mm mesh size.

5.2 SOAK TIME

Soak time has an important influence on effort, catch quality and discard rates. Within limits, increased soak times will result in increased catches, although for each gear type i.e. gill or tangle nets, there is a maximum quantity of fish which can be retained so that extending soak time beyond these limits does not result in appreciable increase in catch. The gear tends to approach saturation over time with retained fish, other organisms such as crustacea and debris, the presence of which may deter contact with the gear by other fish. Alternatively or additionally the quantity of catch retained may be such that the headline height of the gear and hence the efficiency decreases, potentially to the point at which the

gear becomes ineffective. This happens particularly with gillnet gear and is less of an issue for low standing tangle nets.

If soak time is extended, the initial catch may deteriorate in the net as a result of simply rotting or through the action of scavengers, in particular small crustaceans. As a rule, excessive soak time makes it impossible to market an increasing portion of the catch, and therefore leads to an increase in discards. In some fisheries this becomes apparent after 24 hours, whereas in others soak times can be longer without causing problems. Therefore the optimal soak time should be matched to the target species and also take into account quantities both landed and discarded of each species retained by the particular gear type.

Despite its importance, there have been very few studies specifically designed to measure the relationship between soak time and discarding. A study carried out by Sancho et al. (2003) was designed to simulate the fishing patterns of lost tangle nets, commonly used for monkfish in the Cantabrian Sea. A number of fleets of tangle nets were deployed for these experiments and recovered at intervals of 1-12 months with the catch composition, abundance, size, catch quantity and preservation state recorded. A fleet of tangle nets was deployed following normal commercial fishing practices next to the abandoned nets, providing simultaneous estimates of commercial catch rates. These experiments were carried out in depths of between 117-135 m. According to commercial fishermen that participated in these experiments, monkfish tangled in the nets start to rot and lose their commercial value after approximately 4 days. The results from the trials suggested that a 4-day soak time is reasonable to keep discard to a minimum, in this fishery in the Cantabrian Sea.These results cannot be applied to other fisheries/areas where depths or temperatures are different. It should be noted that depth and sea temperature are important parameters in interpreting results of such experiments.

6 RECOMMENDED MANAGEMENT MEASURES

The Working Group considered all available information and also proposals received from the NWWRAC. The recommendations are split into specific measures by fishery, general provisions that cover all of the fisheries and also comments on IUU fishing.

6.1 RECOMMENDATIONS SPECIFIC TO THE FISHERIES

Hake Fishery

The delimiters derived in Chapter 4 show that the gears used in the hake gillnet fishery are suitably different to the other fisheries to allow definition of management measures based on the following parameters as follows:

- Gillnet;
- Mesh size of 120 mm;
- No more than 100 meshes deep;
- Hanging ratio of not less than 0.5;
- Rigged with floats or equivalent floatation;
- Fleets of a maximum of 2.5km in length;
- A limit of 25km total gear length;
- Soak time of no more than 24 hours;
- Depths 200-600m.

To improve control and enforcement in this fishery it is also recommended that the minimum mesh size used for hake in Areas IV, VI, VII and XII be harmonized with the mesh size in Area VIII. This will help alleviate the alleged practice of vessels fishing with sheets of undersize mesh in between sheets of legal mesh nets. The current regulations allow vessels to carry on board but not deploy nets of different mesh sizes (i.e. 100mm and 120mm) but in practice it has been very difficult to enforce.

Monkfish Fishery

Any management measures in this fishery must address the fundamental problem that there is currently limited control with respect to quantities of gear being fished, soak times and regulation of effort. It was noted that the Working Group found it difficult to reach a full consensus on measures relating to the limitation of gear length and soak time. The industry observers attending the meeting also expressed reservations regarding the proposed gear length limitations, soak time and depth limits on the basis that the proposed measures would make the fishery uneconomic for vessels. The recommendations made, therefore are based on the best available information and also taking into consideration the precautionary approach. It is recommended that attempts be made through experimentation and observer trips to provide better estimates of optimal gear lengths and soak times for proper management of the fishery.

The delimiters derived in Chapter 4 defined the gear used in this fishery but also showed that it is quite similar to the gear used in the deepwater shark and crab fisheries. Thus it is recommended that depth be also included in management measures for this fishery but there should be a provision taking account the overlap in depth range fished with the deepwater shark fishery. Management provisions should allow for a small by-catch of shark in the fishery to take account of this overlap. (Data from the French and UK observer trip suggest that this by-catch should be no more than 5%). Specific management measures recommended for the monkfish gillnet are as follows:

- Tangle net;
- Mesh size > 250mm;
- No more than 15 meshes deep;
- Hanging ratio of no less than 0.33;
- No floats;
- Fleets of no more than 10km in length;
- A limit of 100km total gear length but subject to verification by research and observer trip data;
- Soak time of no more than 72 hours but subject to verification by research and observer data;
- Depths 200-600m;
- Shark By-catch < 5% by weight.

Deepwater Shark

Given the scientific advice from ACFM with respect to deepwater shark it is recommended by the Working Group that there should be no targeted gillnet fishery for these species and the current ban should remain. As stated, if this fishery is closed, it is important to recognise the overlap in depths fished in the monkfish fishery with a by-catch provision for deepwater shark included in the management measures for monkfish.

If the stocks of deepwater sharks recover to the extent that they are able to support a sustainable fishery in the future then fisheries managers may wish to re-open the fishery. In that event Chapter 4 defines delimiters for the deepwater shark fishing that should form the basis of management measures.

6.3 Deepwater Crab

From the available information the Working Group found it difficult to establish whether a directed fishery for deepwater crab can be identified unambiguously. It is recommended by the Working Group that there should be no targeted gillnet fishery for these species and the current ban should remain. The Working Group recommends that directed fishing for crabs be restricted to pots and traps to avoid the possibility that crab fishing would proceed by attracting the crabs predating on enmeshed fish. However, it is accepted that there will be a by-catch of crab in the monkfish fishery.

Note on specific recommendations

In conclusion it can be seen that the hake and monkfish fisheries should be limited by a maximum of 600 m and the deepwater shark similarly deliminated with a minimum of 600 m depth. This was seen as best compromise to be practical and to avoid the main part of the sharks' depth range. This depth limit means that the monkfish fishery cannot proceed in depths down to 800 m. It is recognised that some smaller shark species are mainly distributed in this range (600-800 m). It is also recognised that the two species to which the ICES advice mainly applies, Portuguese dogfish and leafscale gulper shark have very low abundance in depths shallower than 600 m. It should be noted that pregnant Portuguese dogfish do tend to occur in the shallower part of its bathymetric distribution, from 500 –1 000 m. The overall distribution of the species is from 500 – 2 900 m (Clarke, 2000 ; Clarke et al. 2001).

6.2 GENERAL RECOMMENDATIONS

The following are general provisions that are recommended to be included in a management regime for the gillnet fisheries. These measures are designed to improve control and enforcement in the fisheries and also to restrict effort levels in the fisheries.

Permit system

All vessels using gillnets landing more than 10 tones of hake and monkfish in a calendar year must hold a special fixed net permit issued by the flag MS.

It should be prohibited for any vessel using gillnets to catch and retain on board any aggregate quantity of these species in excess of 100 kg in any trip, unless the vessel holds a fixed net permit.

Any vessel holding a fixed net permit should record in the logbook or on a form provided by the MS the following information:

- The mesh size
- The nominal length of one net
- The number of nets in a fleet
- The total number of fleets deployed
- Position of each fleet deployed
- The soak time by fleet
- The depth
- Position and amount of any gear lost

Vessels with fixed net permits should only be permitted to land into designated ports. (This already exists under the Hake Recovery Regulation).

Certification of Gears

The competent authorities should certify the length of gear carried by a vessel before leaving port to ensure that the vessel only has on board the legal limit of gears.

Vessels should be allowed to carry on board a limited amount of reserve nets in case of loss or damage.

All gears should be marked with unique identification tags provided by the competent authorities in the flag MS. (This is based on experiences in Canada and US).

Discarding and Loss of Gear

Vessel where practical should remain in attendance of their gear at all times. Attendance is defined as being within 10 nautical miles of the vessel's gear.

Vessels must comply with Annex V of the MARPOL Convention regarding the dumping of unwanted or damaged gear at sea.

Vessels should not be allowed to enter port without the same amount of gear on board as recorded in their logbook when leaving port. Any discrepancy should be recorded showing the date, position and amount of any lost gear.

MS should ensure that facilities are provided at ports for fishermen to dump discarded or damaged nets.

Research should be carried out into ways of management of damaged gear on board vessels at sea.

Identification of Abandoned Gear

The Naval Services or other competent authorities should have the right to deem unattended gear as being abandoned if the gear is not properly marked as required under current EU Regulations or if there is no vessel in the vicinity and the buoy markings indicate that the owner has not been in the vicinity of the gear for more than 240 hours as verified by VMS data.

The Naval Services or other competent authorities should be able to charter an appropriate commercial fishing vessel to remove any such gear.

6.3 IUU

The Working Group expresses the concern that the effectiveness of their recommendations would be diminished if IUU fishing continues. The Working Group recommends that while the NEAFC/EU Regulations are welcomed, real deterrents, properly enforced are required in order to make engaging in IUU fishing less attractive. NEAFC and the Member States should ensure that any sanctions placed on IUU vessels are of a sufficient magnitude to be effective in stopping their activities. The recent Environmental Justice Foundation (2005) also alludes to the use of ports such as Las Palmas de Gran Canaria and Gibraltar as ports of convenience, which openly provide services to IUU fleets and hosting companies that operate illegal vessels. These ports also serve as gateways for IUU vessels to the EU market and again it would appear that such ports needed to be monitored more closely to eliminate landings by IUU vessels.

7 CONSEQUENCES OF NEW MANAGEMENT MEASURES

The introduction of any management measures can be expected to result in changes in fishermen's behaviour. Fishermen may adapt their behaviour to new regulations by, amongst other things, changing or modifying gear, moving to new geographical areas and fishing different depths. Such changes are very difficult to predict and may have unintended consequences, particularly if the changes result in exploitation of previously unexploited areas or increased conflicts with other gears.

The introduction of the ban on gillnetting in depths greater than 200m in sub-areas VI and VII in 2006 could be expected to have resulted in diversion of fishing effort into other Sub-areas and to shallower depths within sub-areas VI, VII and XII and change of fishing gear to long-lining and potting. Information from industry sources and from the WWF indicates that several shark vessels have moved to sub-areas VIII, IX and X and to West Africa.

A socio-economic report undertaken by the fishing industry (Franquesa and Mourelo, 2006 WD) on the impact of the ban on the community bottom-gillnet fishing vessel concluded that, of the 69 vessels involved in the fisheries, 54 could feasibly change to other gears. It was considered unlikely that vessels targeting monkfish would be able to change to any alternative gear, however, those currently targeting sharks or hake could change to longlining. Conversion to other gear would have economic cost in terms of fixed costs of converting vessels and buying new gear as well as variable costs such as bait.

Table 7.1 shows the numbers of UK vessels participating in a range of fishing activities in 2005 and February to June 2006. Vessels included in this table are the 16 UK vessels that are known to have been involved in deep-water gillnet fisheries. Vessels were considered to have participated in a particular activity if they landed more than 20 tonnes of the target species within the specified time period. Due to the length of time vessels can remain at sea, it is likely that some of the landings recorded in 2006 may have resulted from fishing activities that occurred before the ban came into force. Several vessels have participated in more than one activity within each of the periods.

Table 7.1. Estimated numbers of UK vessels landing, hake, monkfish, shark or crab before and after the introduction of the current regulations on deep water gill-netting. Data provided by UK Government.

	Numbers of vessels	
Activity	**2005**	**2006 February to June**
Monkfish tangle netting, Sub-areas VI and VII	11	5
Monkfish tangle netting, Sub-area IVa	4	6
Shark Gillnetting	5	0
Crab netting	2	0
Hake gillnetting	2	1
Hake long-lining	1	2
crab potting	0	1
no activity	1	5

The Working Group's assessment of the known and likely effects of the current ban on gill netting in depths greater than 200m is that;

There has been a small increase in gillnetting for monkfish in Division IVa since the introduction of the new management measures.

Some shark gill netters have moved to Sub-areas VIII, IX and X and to West Africa.

There has been no recorded fishing for deep-water shark or deep-water red crab by UK vessels since the ban came into force. It is not known whether crab netting has continued elsewhere.

There have been limited increases in long lining for hake and potting for deep-water red crab.

For IUU vessels fishing in international waters, the current NEAFC ban does not seem to be effective.

Changes in the geographical distribution of fishing effort have occurred as a result of the current regulations, however, the available evidence suggests that changes of fishing method have not occurred on the same scale. Due to the temporary nature of the current ban, it is likely that fishermen have been reluctant to invest in new fishing gear until they know the long-term management. The Working Group recognises that structural funds may be available to mitigate the financial costs of changing gear.

8 RECOMMENDATIONS FOR RESEARCH

1 The extent of ghost netting in gillnet fisheries in waters deeper than 200 m, needs to be known. The impacts of ghost netting are potentially serious. But these cannot be quantified without the introduction of recommendations 2 and 3 below.

2 The effectiveness of targeted retrieval exercises is hampered by not having accurate positional data on lost nets. Therefore, the provisions in Section 6.4 regarding reporting of net loss should become an integral part of planning retrieval surveys.

3 In the light of recommendations in Section 6.4, it is recommended that targeted retrieval surveys continue.

4 Research should be carried out into ways of handling of damaged gear on board vessels at sea.

5 Experiments and observer coverage to investigate soak time for monkfish and hake are required. It is necessary to identify the optimum level of profitability whilst minimising discards. This should be conducted in cooperation with the Industry. Experiments could also yield valuable information on gillnet catch composition, by depth.

6 A pilot project on investigating soak time could be recommended to the NWWRAC.

7 Given that information on these fisheries is still very limited, observer schemes should continue and be developed further. These should investigate fishing practices, catch composition, discarding and impacts on benthos. This should be considered along with point 3 and 4 above.

8 Deepwater red crab is a poorly understood species. Research is required on the biology, fishing practices, landings and discard data and catch rates.

9 GLOSSARY

By catch

That portion of the retained catch that can best be described as 'incidental catch', that is to say the species that the fishing operations are not specifically designed to capture.

Catch

Total catch = landings + discards.

Conflict

Spatially-based conflict, whether deliberate or incidental, that results from the presence on a fishing area of more than one fishing operation. Gear conflicts, particularly between towed and static gears, can result in gear loss leading to the possibility of ghost fishing and other unintended impacts.

Discards

That portion of the total catch which is thrown away or dumped at sea for whatever reason. It does not include plant material or offal and the discards may be dead or alive.

Fixed net

A general term for any simple net when it is held in fishing trim by anchors, sinkers and/or stakes (Anon. 19878).

Fleets or tiers

Any number of nets, joined end to end and operated as a complete outfit (Anon, 1987)

Ghost fishing

The capacity of lost nets, or netting, to cause some mortality of marine organisms. This capacity may be affected by a wide range of factors including the initial circumstances of the loss and the environment in which the lost gear then exists.

Gill net

A net, usually rectangular in shape, made of thin twine, which catches fish by holding them in the meshes (Anon, 1987). This is a generic term that includes sub-types such as tangle net and drift net. These sub-types are difficult to define precisely because of the wide variations in their construction. The size selectivity of gill nets generally decreases with reduction of E_r because a decreasing proportion of fish are caught by gilling. Note that there are species that do not exibit size selection in their capture because, for example, of factors such as body shape or the presence of spines.

Hanging ratio (E_r)

The ratio between the stretched length of a sheet of netting and the frame ropes upon which it is mounted. An E_r of 1 would result in the netting being completely closed horizontally, an E_r of 0.5-0.7 results in the meshes being held relatively wide open. At values of less than 0.5 the meshes tend to hang loosely and are more likely to entangle marine organisms.

IUU

Illegal, unreported and unregulated fisheries.

Landings

The retained portion of the catch.

Lost nets

'Lost' is taken to mean permanently loss from the control of the owner. In the context of gill nets this may then come to mean the permanent loss of some part of a fleet of nets, usually as a result of some human or natural impact upon the fleet. A distinction must be drawn between this phenomenon and the deliberate and illegal dumping of sheet netting.

Net/s

A fishing implement, comprised mainly of netting (Anon, 1987). In the context of this report a fully mounted and operational gill net comprising sheet netting, frame ropes and, usually, other appendages such as weights and floats.

Netting

A meshed structure of indefinite shape and size (Anon. 1987). The sheet material that takes shape through being mounted onto frame ropes or some other device. The material, when worn, may be stripped from the frame ropes and discarded so that the frame ropes can be re-used. The bulk of this material can be substantial so that vessels working for long periods at sea can potentially accumulate large volumes as a result of gear maintenance.

Soak time

Also 'immersion time': the period of time between first deploying nets in the water to the point at which they are fully recovered on board of the fishing vessel.

Tangle net

A type of gill net in which the hanging ratio (E_r) is usually significantly less than 0.5. In comparison to a net designed to catch fish by gilling this results in relatively more netting being mounted on a given length of frame rope and a higher likelihood of marine organisms becoming entangled.

Target species

The species (one or more) against which a fishing operation is primarily directed.

Frameropes

The ropes to which sheet netting is attached in order make a gill net. All nets have at least a headrope to which floats may be attached. Most nets also have a footrope which usually carries weights of some kind. Two or more vertical strengthening lines are also usually incorporated into the structure to stop the sheet netting from tearing when the footrope becomes entangled with some seabed feature.

Retrieval survey

An exercise to recover lost nets by towing retrieval devices. The survey is usually structured in some way, often on the basis of anecdotal information, so that the likelihood of success is greater than would be achieved by completely random activities.

Targeted retrieval

An exercise to recover lost nets based upon positional information supplied by the owners of the nets. Retrieval devices are towed along transects based upon this positional information.

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